"Are Canada's Business R&D Incentives Working?"
The Sixth Annual RE$EARCH MONEY Conference
8 March 2007, National Arts Centre, Ottawa, Ontario

Conference Proceedings

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Opening Remarks
Jeffrey Crelinsten, co-publisher, RE$EARCH MONEY
Mark Henderson, managing editor, RE$EARCH MONEY

Crelinsten dubbed the global economic background to the conference as "interesting times", with its ironic implications. "We're watching over our shoulders as the BRIC countries — Brazil, Russia, India, and China — are growing at a torrid pace. Our resource-based economy is keeping us propped up, especially in the west, but I for one worry whether our high-tech industries are going to grow fast enough to compete in the future."

By way of introducing the conference theme, he noted that Canada's business expenditures on R&D as a proportion of GDP (BERD) is low compared with other OECD countries. Governments at all levels have felt obliged to compensate for this lack by introducing programs to encourage private sector firms to participate more actively in R&D undertakings, i.e. hire more dedicated research staff, take risks in the search for new, disruptive technologies, and to work more closely with university researchers to help commercialize their research. "Despite all these programs and interventions, Canada's BERD remains low."

> "As Einstein once remarked, not everything that counts can be counted, and not everything that can be counted, counts."— Jeffrey Crelinsten, Impact Group

Crelinsten suggested that we may get a more accurate picture by looking beyond the simple measure of BERD, such as the number of R&D-intensive firms in Canada, their revenue, their R&D expenditures and employee counts. We find that the number of successful examples is small. "Interviews with CEOs show that industry awareness of government support programs is low," he said, adding that even when they are aware of these options, the need to meet a regular payroll predominates, and government programs are often regarded as being unhelpful or onerous. For just this reason, then, the conference brought together experienced business executives, policy analysts, and policy makers to discuss these points and assess Canada's business incentives for R&D. Participants also were asked to compare these incentives with the approach taken by other countries around the world, as well as to discuss efforts within Canada to keep R&D-intensive firms here.

Henderson noted that each year's RE$EARCH MONEY conference travels a bit further "up the food chain" in an examination of what it takes to build a knowledge-based economy. He noted that this reflects some progress in our understanding of the different facets of this issue, but also a growing appreciation of need to look beyond Canadian borders, to countries that have social and economic agendas very similar to our own. Some of these countries are developing novel approaches to this process, which can serve as instructive examples to us.
He pointed out that in the near future we can look forward to formal science and technology strategies at the federal level as well as in Ontario. More immediately, he argued that the upcoming federal budget could contain some indication of such strategy, although just how much of an indication is not clear. Of specific interest, he said, is the Scientific Research and Experimental Development Tax Incentive Program (known as SR&ED or "shred"), the largest single R&D incentive initiative in the country, with a budget of $2.6 billion. The government has indicated that it will be examining this program, with the potential for enhancing it.

"It makes sense that the program works in concert with the business needs, rather than at cross-purposes."— Mark Henderson, RE$EARCH MONEY

Opening Keynote: Market Insight, Key to Business Success
Kirk Mandy, President and CEO, Zarlink Semiconductor

Mandy subtitled his talk "Where's the money?" and "How do I get it into my bank account?", and he premised his remarks on the experience he has had in a wide range of activities over the last 30 years. The list includes hands-on engineering work such as factory labour, building and testing products, and designing a wide range of processes and system, for manufacturing, product development, project and program management, quality control, and field service. The list also includes administrative functions such as running marketing or sales and R&D functions, designing compensation schemes, negotiating IP licensing deals, and buying or selling whole firms. Above all, he carried out this work as the CEO of a public firm, in companies big and small, dealing with shareholders, boards of directors, bankers, and the many crises that cropped up on a regular basis.

He recalled that he initially turned down the invitation to address this conference, not because he lacked the time, energy, or interest, but because he was not sure that it was worth trying to influence policy setters in this country.

"After all, this is Canada, land of the supreme academic lobby, where research is king!"— Kirk Mandy, Zarlink Semiconductor

He explained in detail what he meant by this reference to the dominance of an academic perspective. "Canada has a basic policy model that suggests that research leads to development, leads to commercialization, and ultimately wealth creation. As a result, we are the envy of a great deal of nations in terms of the research and development incentives and capabilities that are available in Canada. We do research in government labs, we support research in our universities,

we subsidize research in our companies, and as a result, we have a lot of researchers and a lot of technology.

“But have we created wealth, for anybody other than the researchers and the institutions that support them? Where are the growing companies, the growing industrial sectors of our economy which we can point to and say ‘thank God we spent all that money on research or we wouldn’t have all these wonderful companies and industries providing quality jobs for all these Canadians!’”

“I can honestly say that I have never had a customer say to me, ‘jeez, I got to have that research, where can I buy it?’ I contend that this basic philosophical model under which we develop policy to support R&D, under the assumption it will lead to wealth creation, is not only wrong but backwards.”— Kirk Mandy, Zarlink Semiconductor

Mandy argued that wealth creation follows from an understanding of where wealth originates. This is not a question of drafting an easy map showing where to dig for treasure, but instead a matter of creating value for customers. “You must start with a very clear idea of where the money that you want to put in your company’s bank account is going to come from, and why your customer would allow you to have it.”

This is what he referred to as market insight, an understanding of what drives financial transactions between you and your clientele. The result is an algorithm that can help you decide what do to next, setting the stage for plans that include such measures as research, product development, building manufacturing or distribution capability, or marketing. By acting on this insight, successful execution of such plans will result in wealth creation. “Said a different way: market insight leads to execution leads to wealth creation.”

He therefore described it as peculiar that government programs support R&D, but not the creation of market insight. “In my experience, these are skills that do not exist, nor are taught in Canada as a general rule. I can’t tell you why this is the case, but I can tell you that the best business development people I have met — and in many cases, hired — did not learn the trade in Canada.”

He pointed out how rare it was to find people who could see the money and develop the plans that make the financial process move forward. In fact, he offered a gallery of expat Brits — including Dick Foss, Terry Matthews, Michael Cowpland, Des Cunningham, and Colin Patterson — who demonstrated just such abilities on the Canadian scene, building companies from scratch. Mandy concluded that the people he has known who possess these skills have come from elsewhere, such as Brazil, India, China, the UK, and especially the US. Meanwhile, the best technology people he has known have been home-grown Canadian talent.

“We encourage the development of technology, we get technology and technocrats. I wonder what would happen if we were to encourage the development of business

with the same vigour that we support R&D?"— Kirk Mandy, Zarlink Semiconductor

He contrasted this situation to the US, where a significant number of "benchmark" companies — including giants like Procter and Gamble, Intel, Coca-Cola, Microsoft, General Electric, and Cisco — serve as comprehensive training grounds in commerce and business development. Many Canadians have learned the secrets of successful market insight generation by living and working in the United States, people who often move back to this country for social or personal, rather than economic, reasons.

Mandy outlined a couple of revealing examples of market insight generation. The first was the origin of the accessible modem, a device pioneered by Gandalf Data Communications in the late 1970s when people in the company (founders Cunningham and Patterson, two of the expat Brits mentioned earlier) realized the need for a new product that could enable individuals to exchange large amounts of electronic data without having to lease expensive systems monopolized by Bell Canada. The financial outcome was clear, he explains, as Gandalf's sales grew from $6 million to $80 million between 1978 and 1983. Thus did market insight lead to product and technology development, the growth of manufacturing and distribution capability, and a great deal of wealth for everyone involved.

A second example he offered was Mitel's realization that it could substantially lower a small business's telecommunications cost by reducing the number of lines it had to lease from the phone company. The technology and regulatory changes that made this possible enabled Mitel to gain a 20 per cent share of the small business telephone market less than decade after the firm was created, yielding some $350 million in sales.

"Again the insight into the market, or how can I save this customer money and have him share the savings with me, preceded the technology development — not the other way around."— Kirk Mandy

Mandy insisted that market insight is about identifying areas in the market where costs can be reduced or profits increased for a target customer segment, while earning a reasonable profit for your company. The notion of a "reasonable profit" is the driver behind the execution, as all the other elements in the plan — such as technology, distribution, credibility, or working capital — must be synchronized with this goal. For this reason, many of these processes must occur in parallel.

"Spending a ton of money developing a technology or product without having a clearly defined market insight is a recipe for financial ruin, and this town is littered with examples."— Kirk Mandy, Zarlink Semiconductor

He conceded the need to focus on R&D incentives because that is where taxpayer money is being spent. These incentives do generate R&D, along with the occasional successful company. He then set this in the context of his own firm, Zarlink, which works on developing market

insight for itself. “This of course is to ensure that we do not commit to R&D without a clear understanding as to how it will generate a return for our shareholders.”

> “Spend the money on defining insight; translate to an execution plan, clearly highlighting everything that must be done in order to realize the insight, before you go on a spending spree. And if you want to see what happens if you don’t do that right, just drive through Kanata. Two billion dollars in venture capital and what do we get? A bunch of new buildings.”— Kirk Mandy, Zarlink Semiconductor

Mandy then put this concept of market insight into the context of globalization and the prospects for Canadian prosperity. He described how 30 years ago, the relatively new field of electronics was vertically integrated, with individual companies taking on all aspects of the business. Today, small numbers of highly skilled people can generate the market insight and essentially outsource all other business functions. As various parts of the world have made significant advances in the relevant technologies, and those technologies have become highly standardized, it is feasible to use the best resources from the most cost effective parts of the world, regardless of where they may be.

“In a world where all of the execution capabilities can effectively be outsourced, I would argue that the only thing left that is core to a company is its ability to identify opportunities in the marketplace and to successfully execute whatever programs are necessary to cause a financial transaction to occur between the company and its customers.” He maintained that this outsourcing, to places like China, India, and the former Eastern Bloc, will continue unabated. For just that reason, Canada must cultivate a much more commerce-oriented culture to complement our established, outstanding R&D capability, a combination that would be very powerful. And indeed, our future prosperity and standard of living will be a function of how well we adapt to this emerging world where everyone, everywhere can compete for everything at any time.

“The genie is out of the bottle, and there’s no stuffing her back in. We must become commercially savvy on a global basis, or we truly will be relegated to haulers of water and hewers of wood. Be afraid, be very, very afraid. The world as we know it is forever changed as a result of the deployment of low-cost computing, communications, and collaboration technology on a global scale. This isn’t something that is going to happen; this is something that has happened. Don’t think Canada, think the world.”

A questioner subsequently asked if it were possible to teach a commerce oriented culture, or if it is only possible to learn these skills by working in a company built on such skills. If those companies do not exist in Canada, the query concluded, how do we prime the pump in this country? Mandy acknowledged that the problem is a complex one, but argued that a culture of commerce could be taught. “It’s not something that we teach in universities,” he said. “It’s something that we teach as parents raising children.” He suggested looking around at much of the world, which consists of people filled with rising expectations, whose lives have nowhere to go but up. And with the Internet revolution over the past decade, some three billion of those people are now aware of markets that are available to them. Recalling how his personal needs

were met by his parents until he was a teenager and was told to work to buy things for himself, he observed that people have to be taught to be hungry. “People have to be taught that they can achieve way beyond what they may reasonably expect to achieve, way beyond what they may have observed in their families, in their neighbourhoods, but it’s hard work.” Finally, Mandy referred to what Ontario Premier Dalton McGuinty has dubbed as an “ambition deficit”. He suggested that Canada, in contrast to other places he goes as part of his working life, is a country full of “fat and happy people”.

A second questioner asked for a comparison of the “creative destruction” that has buoyed the fortunes of Silicon Valley with the prospects of the Ottawa region’s further high tech possibilities. Mandy did express optimism, but qualified that optimism by insisting that Canadians have to get past the notion that entrepreneurs here are only competing against other Canadians.

“This issue isn’t how do I develop a company that can effectively compete with my peers in Quebec or British Columbia. The issue isn’t how do I develop policies at the federal level that are going to outsmart my counterparts at the provincial level. The issue is how are we going to employ people over the next 30, 40, 50 years when every transactional job on the planet is up for grabs?”— Kirk Mandy, Zarlink Semiconductor

The days of simply setting up a plant and hiring people to staff it are gone, said Mandy explaining how he is using highly skilled people on the other side of the world for his work, beaming them all the requisite information electronically. “Files get beamed over to Asia, chips get sent to customers. I don’t even see the stuff. All I see is the money going into the bank.”

A final questioner broached the question of marketing, which needs to be supported but may not be by either the public or private sector. Mandy considered this to be a moot point, offering an example that demonstrated how companies could find eminently suitable market niches without the need for marketing at all. UPS, he noted, takes in laptop computers for repair. However, the company does not send these to any third party, but in fact set up its own factory to do nothing but computer repairs. Rather than seeing people wait for someone else to market such a service, he concludes, UPS demonstrated an ability to think way beyond its traditional core business into something new and promising.He would like to promote that kind of thinking in Canada, which should define what it can do well and then do that.

Featured Speaker: Searching for a balanced system of innovation incentives: An International Perspective
Jacek Warda, Managing Principal, JPW Innovation Associates Inc.

Warda began by describing the subject of these incentives as a wide and unexplored area that is constantly changing; his own interest lies with the daunting task of striking a balance between two key tools to promote innovation: tax incentives and direct support. “Looking for an optimal policy mix is next to impossible. The balance needs to reflect country context — with its

economic and social needs — natural endowments, cultural values, and of course the global marketplace. So the balance is changing as we speak, because all these factors are changing."

He added that policies tend to follow the trends that are put in place by these different factors, making it all the more difficult to change them once they are put in place. By way of example he offered Canada's R&D tax incentive system, which is going on 20 years old even though much has altered.

With his first slide, Warda showed an international ranking of federal support for Business Expenditures on R&D (BERD) in a group of OECD nations, which puts the US at the top and Canada in second place. And we would be almost tied for first place if these figures incorporated provincial support, which is worth about $1 billion annually. "We are really very heavily supporting R&D, and the main channel is tax incentives."

That said, Warda pointed out that our very substantial support is not yielding higher business R&D intensity. In fact, our growth in this area is due to public sector R&D work., with higher education institutions leading the way. We have been able to raise that proportion to almost 2 per cent, mainly by building up public research organizations of one sort or another; at the same time, the business sector's research efforts were losing steam. High tech industries in particular have had a hard time restoring their R&D to pre-2001 levels.

By way of contrast, he discussed figures for Austria, which has seen outstanding growth in its business R&D intensity. "Stable and growing — hopefully faster than GDP — business R&D spending is key to achieving higher R&D intensity in the future."

He also noted a strong trend to improve R&D tax treatment over the last 5-6 years, especially in Europe and Asia. In measures of this change Canada tends to look stagnant, simply because our incentives are already among the most generous to be found anywhere. This is especially true for small firms, but we are almost as generous for large firms. In a listing of countries that take this approach, the top performers are those with relatively low research intensity, such as Spain, Portugal, Mexico, and the Czech Republic. On the other hand, countries with the highest research intensities — such as Germany and Sweden — are near the bottom of this list. Others, such as Japan and the US, wind up in the middle of the pack.

Canada's system stands out as effective because it is enhanced with provincial subsidies of one sort or another, which is the icing on the cake of federal support. Yet within the larger context of OECD members, many nations are mounting tax incentives that go beyond simple R&D, to include activities such as enterprise formation, technology transfer, training, and collaboration between the public and private sector. A review of direct versus tax support among 17 EU countries reveals a major shift from the former to the latter, bringing tax incentives into fashion. Where there is direct support, too, it is not seen to be displacing the role of tax incentives. And the examples of Finland, Sweden, and Germany are especially instructive, as they have little in the way of direct support or tax incentives, yet maintain the highest level of research intensity. How they do so is a topic of intense inquiry.

The answer to this question may lie with the setting of national goals. Those goals fall into two broad sets of policy options: to increase the output of risky inventions over the long term, which could be done through a grant system, or to stimulate the general uptake of scientific knowledge in the private sector, which could be best achieved through a tax credit based on the volume of R&D conducted.

Looking to the future, he suggested that the pressure to address business innovation will continue to influence the policy mix in various countries. “Direct support will keep getting more attention, simply because it will be fiscally difficult to carve more funding for incentives out of the tax system. Tax credits will definitely survive, but in a more balanced policy mix fashion.”

In this regard, some countries are already engaged in policy experiments of one sort or another. With specific reference to Canada, Warda argued that it is time for us to do a comprehensive evaluation of our policy mix, especially the effectiveness of SR&ED tax credits. And we need to look at the overall business tax regime, since the burden of taxes on Canadian enterprises is still high compared with most other jurisdictions. “This doesn’t bode well for investing in knowledge.”

He added that the impact of business R&D incentives can likewise be muted if it appears that what government is giving with one hand is being taken away with the other. A quick fix might not be the best long-term solution, but it can address immediate problems. “This would work best with ongoing evaluations and monitoring, including sunset clauses.” Some countries do this often and well, such as Japan, making changes for no more than two or three year.

“The art of explaining tax expenditures lies in knowing where to stop.”— Roger Heath, Senior Analyst, Industrial Innovation, Industry and Science Policy, Industry Canada

A questioner noted that Warda had looked at how Canada was implementing tax incentives, but not why we are implementing them, or why we may not be doing them. Comparing such incentives with the motherhood virtues of vitamins, he asked why countries feel the need to engage in this activity. Warda suggested that the rates of return on R&D are so substantial that governments feel obliged not just to seek out these benefits through public expenditures, but to encourage the private sector to do so as well. “To get business interested, you have to increase the private rate of return somehow,” he said, arguing that governments are convinced of the need to do so, even if they cannot say exactly how these benefits are acquired.

Panel 1: Incentives for Start-up Firms
Panelist: Lisa Crossley, President & CEO, Nysa Membrane Technologies
Panelist: Molly Shoichet, President & Founder, Matregen Corp; Professor, University of Toronto
Panelist: Dan Trépanier, Strategy Officer, AMCC
Moderator: Mark Romoff, President and CEO, Ontario Centres of Excellence

Romoff set the tone for the panel by asking whether or not incentives helpful to entrepreneurs at the early stage of development of their companies can help firms grow to the next level. He

suggested that the panelists' experiences should be instructive in this regard, and asked each of them to describe their interaction with incentives and what they did for their respective firms.

Shoichet briefly outlined the establishment of Matregen Corp., a company dedicated to drug delivery technology that spun off in 2002 from her work in biomedical engineering at the University of Toronto. Seed funding of $1 million from Genesis Capital Corp. was critical to getting this business off the ground and hiring a team, which now consists of five employees. They also worked through the Ontario Centres of Excellence, as well as the NRC Industrial Research Assistance Program, both of which helped them move ahead in determining the strategic focus of the company. They also worked with NSERC and CIHR, which enabled them to find support for hiring skilled employees and begin to address intellectual property issues. She continues to work with NRC-IRAP, which she said is distinguished from these other organizations by the fact that it will direct funds to the company, rather than the affiliated research institutions. For small companies, this represents a key advantage.

Crossley contrasted her perspective on incentives from that of Shoichet, noting that the university research she spun into her current biotech startup, Nysa Membrane Technologies, actually came from a department other than the one where she was working. With the commercial potential of that work identified, she drew up a business plan and was able to quickly raise $2 million in seed financing from MDF Capital and BDC in 2005. They are now closing in on a $12 million series A round of financing.

> "I've only used research incentives for the same reason people climb mountains — because they're there."— Lisa Crossley, Nysa Membrane Technologies

She therefore leveraged some of these incentives in order to keep potential investors on side, but she does not include them in her budget, nor does she count on them in any way to move products toward commercialization. "Certainly we take advantage of SR&ED," she said, "because it's nice to get a couple of hundred thousand back at the end of the year." They also took advantage of NRC-IRAP to help hire a starting employee, as well as to support work on a higher risk project. However, most of their money comes from venture capital, which she regards as the easiest and fastest way to get money, and the best way to guarantee a shared goal with the people paying you, i.e. full commercialization of the technology as quickly as possible. She even turned down a particular NSERC grant because it would have required them to work in an academic setting, which would have slowed down this progress too much by limiting her control over the research. She concluded that while she enjoys the tax credits, she would not pursue any of the other programs except that potential investors expected her to do so.

Trépanier recalled his first interaction with a government business incentive, $2000 the Ontario government provided for him to start a business when he was 15. This initial taste of entrepreneurship lasted for life. Later, working for Quake Technologies during the peak of the tech boom in the 1990s, he did not worry about having to find funding in this way. With the collapse of that boom, he admitted, government incentives suddenly became interesting again and they enabled them to withstand the collapse and retain a good position in the market. Although they did have some positive experiences with the Ontario Centres of Excellence and

NSERC, he found NRC-IRAP to be too slow a process, since by the time they were done filling out the application, the market would have shifted and their business case would be different.

Romoff found these widely varying views and experiences to be remarkable. He asked the panelists to state what might account for these differences.

Shoichet acknowledged that she tends to view most things in a positive light, but added that she did find working with NRC-IRAP to be a highly bureaucratic experience. By way of comparison, her first million dollars of venture capital funding took six months, and it took nine months to close on $150,000 from NRC-IRAP. Nevertheless, the program has been beneficial to them.

Trépanier echoed this view, with private funding far overshadowing the time-frame and amount of any NRC-IRAP contribution. Crossley also agreed, suggesting a similar shortcoming was responsible for her turning down NSERC support. Crossley also pointed out that Shoichet's company was at an earlier stage of development when it was making the most of NRC-IRAP funding, and it was also heavily integrated into academic activities. "When you're really intensively trying to get to market, when you've already defined your product, and timing is a really big issue, it's just not worth the time lag."

Romoff then asked the panelists to discuss how they perceive the challenges of growing a company in Canada and keeping it here, as well as the role that incentives could play in this process.

Crossley recalled how she found most of her investor funding in the US, and that several of the companies she was considering would have required her to move operations to that country. Fortunately, they were able to resist pressure to move or sell because they also had Canadian-based BDC on their side, which she described as being more altruistic and patient than many venture capital firms, "and is really interested in making something out of a Canadian company." The more serious challenge she identified is a lack of management skills, finding someone at the senior level to run a company who has both the experience and the market insight. You need someone who can take your company all the way into the market, but sometimes this proves difficult enough that it is tempting just to sell the firm once the product is ready for market.

Romoff asked if universities could meet the challenge of providing this kind of talent, training the next generation of senior managers. Crossley noted that in her dealings with Waterloo, she found the university to be very efficient and "company friendly", as opposed to places like McMaster and University of Toronto, which have difficulty in doing things like providing a day-long turnaround on contracts or letting the company retain IP rights. It should not be that difficult, with stipulations such as having a university representative on the company board.

"What universities can do, rather than training people to become business leaders, is to nurture the transition of technologies from the university to the private sector."— Lisa Crossley, Nysa Membrane Technologies

Trépanier had a specific perspective on this issue, since he just six months ago sold his company Quake to a US firm. He regards this issue as being very complicated. He knew a good number of gifted Canadian business people, but he learned what he knows now by working in the US. Having said that, though, he insisted that RIM, Newbridge, Mitel, and Nortel are not flukes. Moreover, these successes were built on having ready access to the markets they were serving here in Canada, not travelling elsewhere to do so.

"It's about ecosystems. It's about more than just R&D grants. It's about building the whole food chain of suppliers and customers near your business, and you need that critical mass to build that virtuous circle."— Dan Trépanier, AMCC

In this context, Trépanier concluded that R&D grants can help, but what helps even more is to keep looking for the most sizeable markets to serve.

Shoichet has considered how she will continue growing the company in Canada, with a specific understanding that what most people look for in biotechnology is an exit strategy, and that often that strategy is considered successful if it means selling to an American firm. Nevertheless, she suggested that there are many things that could be done here in Canada, such as taking advantage of the higher salaries that can be paid to research staff in the private sector in order to keep those researchers in Canada, as opposed to the lower salaries they would have in academia. Moreover, she points to incentives in the US that encourage physical construction and expansion, something that is substantially different from the simple tax credits and which results in room for growth.

As a final point for the panel to weigh, Romoff asked what Canada could do to increase research intensity and attract more R&D intensive firms into Canada.

Crossley suggested that intensity alone is insufficient, but rather a question of better targeting the current intensity. Instead of just funding projects that look interesting — fundamental research that already garners a great deal of support — she argued that we should be more selective about the projects that we fund in order to take new technology to the marketplace, carefully vetting the commercial value of this technology, the size of its market, and the nature of any existing competition. Then and only then could projects come up for funding, rather than everything and anything heading to market getting a little bit of funding. The latter is a huge waste of time and money, meaning this could be a way of getting more value out of the public dollars invested in R&D.

Shoichet noted that there are now a number of programs that allow university researchers to do directed work in conjunction with a firm. She suggested that this translates into the kind of focused effort Crossley is suggesting, although it would be hard to imagine Canada having the resources to conduct the broad array of commercialization efforts that is found in the US. Although a major part of the difference is money, she argued that another leading factor was a culture in the US that reconciled itself with failure, allowing good people to bounce back from mistakes or untoward circumstances.

"Until recently, a lot of the venture capital community in Canada hasn't really been venture capital. Not like it is in the United States, where they do take a lot more shots on goal. Part of the reason they take a lot more shots on goal is probably because they have more money, and then also it's just a different culture of willingness to make mistakes and not being afraid of making those mistakes."—Molly Shoichet, Matregen Corp

Trépanier agreed with the virtue of research intensity, but added that this intensity has to start somewhere. That means nurturing small companies, with all their problems, and helping them to grow.

In light of all the comments about the need for agile companies and skilled managers, a questioner asked if there were anything the business schools could do to help out this situation.

According to Crossley, who herself takes business school courses, such education is worthwhile but it will not necessarily reach every future leader. The real solution will likely come from the private sector, which has to create a culture of innovation, a culture of entrepreneurship, a culture of business skills and acumen. Nor is this an easy thing to do, but one way to start is to examine the success enjoyed by places like San Francisco, Boston, or Research Triangle Park in creatuing just such a culture. "Just look at what they've done and see if there's a way we can mimic that model in Canada. But I just can't see that coming from the universities, even from the business schools."

Trépanier pointed to programs such as Junior Achievers, which brings together groups of high school students to start business, as many as 20 or 30 of them and gets them to measure their performance. Carleton and Ottawa U also have programs to promote entrepreneurship amongst business students. Any one of these things may be small, but together they are helping to build that culture of entrepreneurship.

Shoichet agreed, noting that Queen's had similar programs as part of its MBA. She also suggested incentives could encourage large companies to embrace small companies, which could open up markets to the entry of new, promising market.

Romoff also suggested that business schools could do more, pointing to programs at McMaster and Waterloo that are graduating students with master's degrees who have been required to start up a company. The Ontario Centres of Excellence is therefore investing in these companies, providing them with seed money. Even so, this kind of approach has to become far more common if it is to make a difference.

A second questioner asked how we cope with the relatively small number of entrepreneurs and entrepreneurial firms, how can we accelerate the process of moving past this limitation.

Crossley noted that she sits on the board of the Canadian Advanced Technology Alliance's Women in Technology initiative, which has taken on a mentoring mandate, linking up recent

graduates with more senior entrepreneurs. She regards this kind of mentoring as being critical to the success of these individuals and their ventures.

Trépanier stated that he was not qualified to make policy pronouncements, but pointed to the Province of Ontario's position as one of the world's single largest purchaser of medical equipment. Since health care costs are a concern around the world, he recommended a commitment to making the province's medical infrastructure the most modern in the world, with the best administrative organization to be found anywhere. Once the model is up and running and proven, he said, sell it worldwide. Likewise with Kyoto, we can drive innovation to help meet the goals of this agreement.

Shoichet said that the idea of picking winners was antithetical to the traditional Canadian approach of spreading the support around. Romoff looked ahead to the afternoon session with Alastair Glass, suggesting that because Ontario is currently drafting its own innovation strategy, it would be useful to revisit this question with him at that time. From his own perspective, however, Romoff cited $46 million set aside in the last Ontario budget for a Market Readiness Program, which asked Ontario Centres of Excellence and the Medical and Related Sciences (MaRS) Centre to take responsibility for delivering this program. The funding had two components, one aimed at start-up firms and the other aimed at mentorship and business development.

Shoichet added that while we do a good job at starting companies, we do not do so well when it comes to growing them. This is a matter of considering what will become of these firms once they get large enough and have used up their seed funding, and helping them to proceed to the next level.

A third questioner asked for further clarification about exactly what could be done to nurture business talent in this country. Shoichet replied that in the US, business schools admit students who already have a good track record in business, whose skills will actually be improved by the university experience.
Crossley agreed that this kind of strategy speaks to an outlook that does not reflect the realities of the business community. Instead of hoping that everything can succeed at once, you must in fact pick those things that you expect to succeed.

Trépanier suggested that different business schools have different tiers of people, with different types of talent and experience. Moreover, referring back to Shoichet's comment about the US tolerance for failure, he suggested that the calibre of our own business community would improve if such a tolerance could be cultivated here. "We need to change that mind set," he said. "Failure is okay."

A final questioner raised the question about picking the best paths for particular enterprises, but also noted that entrepreneurs are themselves following specific passions. By singling out these passions, we might do better. If we are to pick paths, though, how would we do so?

Shoichet suggested that you have to create an environment where the winners will in fact be able to succeed. And in addition, you do not need to narrow down the area of interest, which might be quite broad in scope. However, it is crucial to promote the success of the participants.

Trépanier said the best way of picking and choosing was to figure out where the biggest economic gains could be made — "follow the money". Unfortunately, as he recalled with Quake, that meant flying back and forth constantly to California, when he would rather have been driving somewhere nearby from Toronto.

Crossley insisted that you need to look to the leaders in specific industries to determine what should be chosen.

"It's great to have thought leaders set priorities for fundamental R&D, but if you're really looking to set the paths you're going to go on, you need to look at people who have gotten to the other end of the path and been successful, and let them advise the government on where we should be going."— Lisa Crossley, Nysa Membrane Technologies

Crelinsten, in wrapping up the panel, pointed out that we have a number of government sponsored incentive programs to get young people interested in science and technology. Entrepreneurs like the panelists could likewise be brought in to provide similar incentives to encourage the next generation of business leaders in this country.

Panel 2: Incentives for Established Firms
Panelist: Garth Issett, VP, Manufacturing Development Operations, IBM Canada Ltd.
Panelist: Dave Jaworsky, Director, Government and University Relations, Research in Motion
Panelist: John Wood, Senior Advisor, Science and Technology, General Motors Canada
Moderator: Lynda Leonard, Senior VP, ITAC

Leonard began by noting that while the companies the panelists represent are quite well known, the depth and scope of the research activities each of these firms has committed to Canada is less known. She invited each of them outline their respective work in this regard.

Issett explained that IBM has invested $3 billion in R&D in Canada over the course of the last decade, and amount that grew year by year. IBM is in fact the sixth largest R&D enterprise in Canada, and second in terms of foreign-owned subsidiaries. Most of this work deals with software development for commercial products sold everywhere, and the number of people employed in this work has doubled over the last 25 years, with the main operation in Markham, Ontario being the company's third largest lab in the world. The other major investment the company has is its semiconductor packaging facility in Bromont, Quebec, which is more than 20 years old, an investment of more than $1 billion that is among the top five plants of its kind owned by any company. Interestingly, it may also be the only plant that builds chips for all three of the major gaming consoles. Last year IBM spent $25 million to move a mission from New York State into Quebec.

Jaworsky provided some history of RIM's development since it was created in 1984. Early on RIM received some assistance from the Ontario government, from NRC-IRAP, and from Technology Partnerships Canada. Now RIM has three locations in Ontario, in Waterloo, Ottawa, and Mississauga, about 5,000 employees worldwide, some 1,500 of them researchers.

"The comment was made earlier that the R&D tax credits could be looked at as a nice cheque at the end of the year. But it could also be looked at as an incentive to stay local, to stay in town and work with universities. Through OCE and NSERC and programs that foster those relationships, that's something that I would highlight as being a key to RIM's future growth."— Dave Jaworsky, Research in Motion

Wood said that people are regularly surprised by the fact that a company like GM, which is almost 100 years old, continues to evolve. In particular, he pointed to the most recent evolution from a multinational firm into one that is truly global in scope, setting up shop in places around the world where it makes the most sense to do so. In this respect, Canada brings a considerable array of resources to the company, so that now the engineering centre in Oshawa is doing complete vehicle design. Another major change has been the design cycle, which has shrunk from five years to about 18 months, and promises to become even shorter. This kind of progress means they have to be similarly dedicated to bringing this work to Canada, to keep plants operating and turning out new products. According to Wood, the company settled on a public-private partnership to make this happen, taking advantage of Ontario and federal government support to introduce new features like flexible manufacturing in the Oshawa facility. He reminded the audience that competition also exists within GM, so that business cases must regularly be put forward to keep these operations in Canada. The latest move in this regard has been to incorporate changes in the supply chain into improving the overall process, drawing on the ideas of people working at companies outside of GM itself. The company also worked with public partners such as OCE and NSERC to bring in these suppliers as partners as well. Similarly, they have become directly involved with several universities in their engineering design programs, encouraging the education and training of highly qualified people who will help to keep this work in Canada, rather than see it go offshore.

Leonard then asked specifically about why each of these firms has focused so significantly on Canada, and what role incentives have played in that decision.

Wood observed that while the auto industry may not be changing at the frenetic pace of consumer electronics, the current rate of change has been unprecedented. In such an environment, other countries are moving equally quickly to position themselves in the marketplace; he offered the example of India, which is launching its own version of SR&ED tax credits. That puts the pressure on people like him to keep this work in Canada. In fact, while we talk about scrapping such incentives here, he suggests it is crucial to giving Canada a competitive advantage. Analysing projects on a strictly scientific basis will undercut that advantage, reducing productivity and the potential for growth in Canada.

Issett compared IBM's situation to the one Wood described.

"We talked earlier about Friedman and the world is flat. Inside a globally integrated enterprise like ourselves, it's flat and it's frictionless. We could be out of business with a keystroke on a Blackberry, that's how fragile the missions are in a global business like ourselves."— Garth Issett, IBM

Issett cited four factors that have allowed the company to maintain the growth of its investment in R&D in Canada. By far the most important of these is human capital. A relatively small operation started some 20 years ago has consistently attracted high calibre people, which combined with good management has allowed them to compete effectively on the world stage and achieve the critical mass they enjoy today. For this reason, this facility might be somewhat more protected from the vagaries of the changing world economy than company operations elsewhere. Issett also credited the low dollar with providing some advantage, an advantage that is now all but gone. What has continued, however, is the company's robust relationship with universities, especially in the software laboratory. There IBM has a highly successful internship program for graduate students and professors; the result has not only been a good deal of collaborative work, but a pipeline to emerging talent. Finally, a fourth factor has been the support of local governments, specifically from the town of Markham and the province of Quebec, and to a lesser extent from NSERC and other organizations associated with the internship program. Interestingly enough the highly touted SR&ED, which might be valuable to others, is not relevant to IBM, since domestic tax benefits are wiped out by foreign tax credit calculations.

In contrast, Jaworsky portrayed the SR&ED credit as being absolutely vital to RIM. "Every dollar of that is a real dollar to us — that justifies everything," he said. And given how fast the company is growing right now, he added, it is vital to keep in touch with all parts of the company in real time, which means a high degree of geographic proximity. They have acquired some companies in other countries, but this remains a small — but expanding — portion of their overall activity. "It's a home-grown company, and a home-grown mentality that we'd like to keep." With specific reference to management expertise, he also indicated that they do look worldwide for such talent, and many of their executives are in fact from the US.

Leonard asked Jaworsky what is working and not working within Canada, whether the economic environment here is capable of spawning next RIM-like innovative enterprise.

Jaworsky noted that while many investors emphasize the availability of an exit strategy, some government programs, such as Technology Partnerships Canada, forced the company to draft a growth strategy, a much more useful exercise. He credits this for at least some of RIM's success, as well as the success of many smaller companies that have been brought into the RIM fold and thus kept in Canada. "Flying to California all the time in not an option; looking locally, and growing your company locally is a heck of a lot more appealing."

Wood suggested that there are actually far too many incentive programs available to a company like GM — 192 by one count. In some cases, the process posed by these programs takes far too

long, including such elements as two-year request for proposal cycles. Likewise, fundamental research programs are worthwhile, but they are entirely distinct from any kind of commercialization effort.

"You get what you measure and you get what you reward. If we really want commercialization, we really have to start thinking about looking at programs that can actually help support some of those engineering activities up front. Product development, tied with the research in Canada, can create the manufacturing opportunities when it's all localized. Without that, not only will you manufacture it overseas, you will design it overseas as well."— John Wood, General Motors

For Issett, when IBM looks to jurisdictions elsewhere, what is missing from the Canadian environment is a focus. He was referring to an articulation of this country's defined strengths, and a description of where we want to take ourselves economically. More specifically, he recommended changing the SR&ED credit to make it more applicable to a firm like his. In addition, he endorsed the conclusions of the Standing Committee on Industry, Science and Technology, which were articulated in a report issued in February, entitled "Manufacturing: Moving Forward – Rising to the Challenge". In particular he pointed to the educational trend away from engineering and math-oriented disciplines, which will be where they will hope to draw the new talent necessary to keep their R&D investment in Canada. Further to that observation, he noted a decline in multi-disciplinary skills, which are going to be the most promising base for keeping work from migrating to lower-cost regimes elsewhere. "The work that will stay is the work that's tied to innovation and problem solving," he said, suggesting that IBM would be eager to help universities cultivate those skills here. Moreover, a significant proportion of the jobs in Canada — especially new jobs — lie in the service sector, leading him to call for studies that consider "service science". Finally, he would like to see government support collaborative, consortium-based research projects that contribute to economic development and growth of our strategic objectives. By way of example, he offered IBM's participation in the National Centre for Medical Device Development, which is to bring the first National Research Council laboratory into the Greater Toronto Area, where it would collaborate with York University, University of Waterloo, and the University of Western Ontario, as well as small medical device manufacturers in the region. "We think we can unlock just fantastic value for those companies, giving them access to university and NRC research in a more comprehensive fashion and unlock that value for the economy."

Before opening up the floor to questions, Leonard asked each of the panelists to comment on the role of major enterprises like theirs in Canada's economic landscape and the prospect if external forces required them to change their commitment to this country.

Wood was blunt: "It's not a pretty picture," he admitted, referring to the possibility that if GM alters the amount of work it does in Canada, the effects are felt throughout the far-flung chain of suppliers to the company, and even competitors who also rely on the well-being of those same suppliers.

"It's not investment. We're talking about the development of highly qualified people, the development of the tacit skills of managing technology ventures, managing R&D activity. That goes away as well."— Lynda Leonard, ITAC

Jaworsky conceded that as celebrated as RIM has been in Canada, on the larger world stage the company remains generally small and unknown, which creates some uncertainty about its ultimate prospects.

"As a start-up, as a growing company, as a multinational — the policies must be in place to nurture companies along the way, so that the good things stay. I've had that happen to me before, with a good government programs in Ontario that we enjoyed and that went away because the government thought they weren't doing what they were intended. RIM was a great beneficiary of that program, it had great incentives for us, unfortunately, we forgot to thank the government for the good work that they were doing."— Dave Jaworsky, Research in Motion

Jaworsky underscored the importance of making sure that policymakers understand what is in fact working and who benefits from these programs, so that successful strategies are not discarded. As for RIM, if the company were to change its emphasis in Canada, the effects might be felt in places like universities, where RIM works closely to promote an interest in engineering. There may be other companies doing similar work, he said, but there are actually few major enterprises in this country in a position to do so.

For his part, Issett noted that while IBM Canada was not set up to serve as a type of business school, where people learn how to create their own enterprises, it is a place to nurture some of the skills essential to that ambition. He also said that the flattening of the world economy has meant that the risk of Canada losing even large-scale operations like his to other countries has never been higher. And if such an operation were ever to leave, he estimated that it would take no less than two decades to replace it. Such replacement is also more difficult than it has ever been before, since there is so much new investment taking place elsewhere, in countries that are far better placed to compete with Canada in this regard. Above all, he foresaw a "trade surplus" in talented graduates from our universities, who would be unable to find work matching their abilities here.

By way of setting the stage for questions, Leonard asked each panelist to suggestion one thing for the forthcoming federal budget and science and technology strategy.

Wood recommended a better commercialization focus, and not just more research funding, but in fact both. Issett recommended that over the long term, there should be an articulation of Canada's core strengths and a commitment to excellence in those areas; he also suggested revising SR&ED to encourage global companies to bring R&D to Canada, as well as implementing the report of the Standing Committee on Industry, Science and Technology. Jaworsky recommended continuing investment in encouraging Canadian companies to work closely with universities and researchers.

A questioner from public works noted how frustrating it could be for companies to develop technology that has no market, and asked the panel for their perception of the role of public procurement as a demand management tool.

Wood noted that this very issue came up in GM's discussions with the Conference Board of Canada's Leaders' Roundtable on Commercialization, which in April 2006 resulted in the report, *Picking a Path to Prosperity: A Strategy for Global-Best Commerce*. GM needs to buy extremely large volumes of commodities, making it difficult for them to work with small-scale start-ups, although such firms may be able to help others within the various tiers of their suppliers. He noted that strategic government procurement could help some of these smaller firms get that first essential contract.

Issett reiterated this point, suggesting that the degree of outsourcing by provincial and federal government departments tends to be quite low. That means there is good potential for precisely this kind of encouragement to firms with valuable goods or services to provide.

Another questioner asked about how Canadians should change their attitudes in order to strengthen the country's ability to compete.

Jaworsky suggested that Canadians appear to enjoy witnessing failures or difficulties, while successes are only rarely being highlighted. Wood extended this observation by saying we are too risk averse, and Issett further noted that we tend not to celebrate our heroes. Issett added that we tend to overlook our strong ability to collaborate, suggesting a valuable government policy might be to find ways of bringing together pockets of promising talent and resources that might otherwise remain isolated.

A final questioner asked Issett specifically about the health care sector. Issett responded that this is the leading area of opportunity for transformation over the next decade. "Health care, if you look at the percentage of the GDP in any of the G8 nations, is approaching a crisis point in terms of spending and budgets." We are so close to the tipping point for a major calamity, he added, that this signals a major change that needs to happen, which can be assisted by information technology among other technical innovations and administrative changes.

Luncheon Speaker: Stewart Beck: The International Commercialization of Canadian business R&D

Assistant Deputy Minister, Investment, Innovation and Sectors, Foreign Affairs and International Trade Canada

Beck began by describing what is most exciting about his job – being at the intersection of investment and innovation. By way of example, he noted that Canada's share of the world's R&D activity was only about 2.5 per cent, meaning that knowledge gleaned the other 97.5 per cent must come through foreign investment in this country. Further to this point, he referred to the Department of Finance document Advantage Canada, which points out that Canada is drafting a global commerce strategy with a focus on where the country wants to position itself

internationally. As an organization, then, DFAIT is vast, with 140 missions around the world, with people on the ground doing work for Canadian companies and Canadian institutions of all kinds. “The Global Commerce Strategy is focused on what we can do to promote Canadian competitiveness and productivity, and it’s focused on where we’re going to go in the future to be a much more productive and influential global player.”

“If you take a look at where our value-added is in the process, and if you take a look at innovation in particular, we consider our first priority to be a catalyst, to connect Canadian business clients and world-class technology opportunities and key international research partners.”— Stewart Beck, Foreign Affairs and International Trade Canada

Their international network at posts abroad therefore emphasizes S&T partnerships and research collaborations. Toward this end, they are trying to introduce partners abroad to key players in the Canadian sector, including researchers in academia and the private sector, with the ultimate goal of adapting world-class technology. “These linkages will give Canadian businesses and researchers a competitive edge. That’s our goal.”

DFAIT is also considering new models for these partnerships, by way of encouraging research and commercialization. Beck pointed to the Canada-California Strategic Innovation Partnership, which brings together universities, businesses and governments to develop new ideas and innovations, as well as matching the efforts of competitors to adopt advanced technology, and to take the results of these R&D efforts to the marketplace. In fact, the Canada-California relationship, which has developed through posts in San Francisco and Los Angeles, has proven to be quite dynamic, working closely with the University of California system and the state government. They have been paired with four Canadian universities and researchers in specific areas: stem cell research, high speed broadband access, infectious diseases, and energy.

One could ask why DFAIT is taking part in this kind of initiative, Beck acknowledged. He suggested that it is part of an overall strategy to bring Canadian technology to a level that would make companies in this country more competitive. He added that such work is complicated by the unique approaches that universities and businesses already take to this process. Nevertheless, it is seen by his organization as a high priority.

“It’s more than just Canada-California. Canada-California is a model. How do we operationalize that on a much broader basis? That’s part of the challenge we face today.”— Stewart Beck, Foreign Affairs and International Trade Canada

Beck also offered the Going Global Science and Technology Program as another example of what DFAIT can bring to the Canadian R&D community. This program brings researchers from private companies, universities, and non-government research centres into collaborative R&D partnerships with key players elsewhere in the world. He noted that the program was turning out to be extremely productive, perhaps even overspending its budget, which is a problem he regards as better than seeing that budget underutilized. In the specific case of the Canada-California

Strategic Innovation Partnership, Going Global is supporting workshops in fields such as stem cells, energy, and infectious diseases.

Similarly, the International Science and Technology Partnerships Program represents an even more ambitious effort directed at emerging economies. A five-year, $20 million undertaking, the ISTPP is aimed at increasing bilateral research projects with good commercial potential between Canada and Israel, India, China, and eventually, Brazil.

Beck explained that the Israel portion of this program is being delivered through the Canada-Israel Industrial Research and Development Foundation, and new agreements for India and China were signed the morning of this talk, with a new organization — International Science and Technology Partnerships Canada — being put in place to administer these agreements.

Besides supporting projects proposed by various private sector and academic organizations, ISTPP emphasizes partnerships between industries and between universities in order to accelerate technology transfer and commercialization. Beck also introduced Henri Rothschild and Paul Thoppil as two people at the heart of these activities, inviting participants in the conference to approach them for more information about these programs.

Beck noted that these programs are dedicated to providing access to the world's best facilities, equipment, talent, and knowledge, as well as fostering the global networks that are critical to the commercialization process. He observed that in his recent visit to Ottawa, none other than Microsoft founder Bill Gates used the term "productization", which Beck found to be an appealing one.

> "If I were to say 'Stewart Beck, what's your goal in the role that you're in right now?' It's to see investment and innovation working to build a new Canadian company that will grow and expand in Canada and become a global player. That would be my goal as an assistant deputy minister."— Stewart Beck, Foreign Affairs and International Trade Canada

Another important aspect of this work is what Beck called "aftercare", or follow-up on commercialization efforts. He gave the example of an American venture capital firm that approached their New York office in a search for Canadian firms with novel cardio technology, primarily on monitoring and imaging, as well as therapeutic applications. The DFAIT network of regional offices and some other contacts were provided with this query, and within three days they had provided information on at least 12 Canadian medical device developers, two technologies that are still being handled by university technology transfer offices, and four Canadian VCs who were interested in striking syndication deals with their American counterparts.

DFAIT is likewise active within its consulates in Boston and San Francisco, organizing financing forums across the US in conjunction with the Ottawa Centre for Research and Innovation and the Ottawa Life Sciences Council. A number of different companies took part in these events, including winners of such competitions as Canada's Top 10 Life Sciences and

Canada's Top Bioproduct/Energy/Environmental Technology. As a result of this initiative, Gatineau-based Variation Biotechnologies, one of the Top 10 prize winners, recently announced a $41.6 million financing deal with US-based Clarus Ventures, ARCH Venture Partners, and 5AM Ventures. "A good example of how, at the front end, we can add value to the process of what is going on."

Beck also described the Enhanced Representation Initiative, a formal partnership with federal departments in the US market, which is also called the North American platform. "There's an active engagement of science-based departments and agencies, research universities, and their offices of technology transfer, and provinces who are important partners in this process as well — these are our core clients."

DFAIT has also deployed specialized Technology Partnering Officers in selected US markets like Boston or California, Beck explained. These build on existing research clusters and venture capital funding pools, a tactic that often raises questions from observers who question why the department would want anything to do with venture capital firms. Yet he maintained the work of ISTPP should rightly be integrated with that of venture capital, since the latter is one of the major drivers of any innovation agenda.

"There's three pillars to the Global Commerce Strategy," Beck said. "One is making Canada a partner of choice globally. One is the whole market access agenda. And the third is harnessing the network that we have."

With regard to the first pillar, DFAIT field officers listen to what people say about investing in Canada, both those who have done so and those who are thinking about doing so. "There's a long list of things that we need to change," he said, referring to feedback they have been receiving from investors contacted through their offices in places like Boston, New York, San Francisco, and Los Angeles.

"We've got to do some changes to our tax system when it comes to venture capital. Their view is that venture capitalists are looking for an exit. And it's very difficult from a Canadian perspective to exit gracefully, without having what they feel is their pockets being picked."— Stewart Beck, Foreign Affairs and International Trade Canada

Likewise in the critical area of skilled labour, Canada may have to consider changes to the way immigration programs are administered. DFAIT is also linking its regional offices with the NRC's Industrial Research Assistance Program, improving support to business clients who need technology and international connections. This work has most recently extended to a highly active program in Spain, along with open houses in the Netherlands and Denmark.
"We are looking forward to building a collaborative, responsive international innovation network, together with business, academia, and federal and provincial partners, building on Canada's strong domestic S&T base, but to focus on performance by our firms and clients worldwide."

Beck concluded by emphasizing the importance of the views expressed by people attending the conference, especially in terms of raising Canada's international profile.

"Canada has lost its visibility on the world stage when it comes to investment. So how do we raise that visibility? If you benchmark us against our competition, we spend about one-tenth what UK Trade and Investment spends on marketing and promoting their country. We spend about a tenth of what the Swedes spend. About an eight of what the Australians spend, about a fifth of what the French spend."—Stewart Beck, Foreign Affairs and International Trade Canada

The Global Commerce Strategy is aimed at correcting this shortfall, as well as using the existing DFAIT network to influence people who may be in a position to bring business to Canada. He regards their role as finding out what these people need and want in order to do so.

After the talk, Beck was asked for his view of the SR&ED tax credit. He suggested it has been highly productive, recalling a meeting of an SME advisory group in which this same question arose. It turned out that every participant in the meeting used SR&ED, and every one of them thought it was a good program. Nor does he regard it as ideal at this point, suggesting that accountability and the emphasis on results could be improved.

Meanwhile, SR&ED is less important to foreign investors, because it is overshadowed by other issues. This is a matter of some concern for DFAIT, since nearly 40 per cent of Canada's business R&D is carried out by foreign-owned firms. In fact, reviews of foreign systems reveal that many other nations have drafted more balanced approaches to the use of grants and tax support, achieving a better synergy among various programs that connect researchers with entrepreneurs and end-users of technology.

Beck cited the Economic and Fiscal Update from last November, which called for the government to ensure a business environment that encourages its private sector to translate research into economic opportunity, and encourage deeper linking between research and markets. This policy commitment extends to improving the accountability to demonstrate the results achieved from the annual expenditures on R&D, as well as supporting strong and enduring partnerships among universities, government and business to accelerate the translation of knowledge into practical applications.

Beck also wondered whether Canada's excessive reliance on SR&ED and other forms of tax support — generally the highest among OECD nations — is actually the most effective means of promoting business R&D. Scandinavian countries, in contrast, clearly regard such programs as expensive and ineffective, an observation that he maintains Canadian officials should take into consideration. "Our basic view is that any changes should be results-driven," he said.

Another questioner asked whether the scope of the Canada-California project could be expanded beyond research to include people who are trying to commercialize that research. "That's basically why we're in it; that's what we would like to see," Beck replied, acknowledging that it

was more challenging to bring some of these commercializers into the process. “It’s a bit of a conflict for them, and we’re coming to grips with that and how we manage it,” he said, noting that the University of California system has a tradition of working with the private sector to move technology into the marketplace, and he would like to see Canadian universities become equally comfortable with these activities. DFAIT is even paying for a study on the management of cross-border IP, and how we can manage the process.

In addition to verbal responses, Beck also provided background information in question-and-answer form. Those points included the following:

Why do you talk about technology acquisition and adoption, rather than international research collaborations?
Beck replied that such collaborations are important, but DFAIT is not a science department. Instead, their innovation network is science-based in order to support Canada’s research enterprise. “Our partners have made it clear they drive international research projects, so they want DFAIT to focus on our value-added — the international dimension.”

In this context, then, the ultimate objective of any research collaboration is technology transfer or commercialization, which is where DFAIT concentrates its services and where its innovation network can make the best contribution. By maintaining a base of science and technology partners supporting Canadian firms and researchers — partners who will identify and establish new collaborative research and development initiatives with foreign partners — DFAIT is dedicated to finding global technologies to bring new S&T ideas and market intelligence into Canada, along with making Canadian firms aware of their international competition by highlighting best practices from abroad.

How can trade commissioners help?
Trade commissioners identify market opportunities for firms and their technologies, working with them to promote commercialization by identifying contacts, introducing them to key contacts and potential partners, outlining local laws and government policies on everything from intellectual property to investment regulations. DFAIT commissioners also provide market research, advocate with government officials on business developments, and follow up on corporate partnering, project development, and following up on various promotional efforts conducted through trade missions or other special events.

Beck noted that over the next five years, DFAIT will be working with business clients, and partners in universities, provincial governments, and the federal government to identify innovative foreign firms and organizations seeking to partner with Canadian capabilities or source our technologies. They will also be launching new bilateral research projects funded with major S&T partners, supporting new links between clients, NRC-IRAP, and various foreign partners, as well as similar projects with private and public sector organizations. In this way the DFAIT network will help identify opportunities for technology adoption or commercialization, making initial calls and following up when innovation teams visit regional offices across the country, and reporting on those opportunities, as well as other economic developments and market intelligence for the benefit of Canadian clients.

Other US success stories

In addition to the examples Beck mentioned in his talk, he also noted these efforts:

- photonics networks with partners in New York and New England are leading to wider partnerships, as are similar efforts in nanotechnology.
- seven Canadian firms promoted by the Consulate General in Los Angeles, which were chosen to showcase their medical device technologies at a major 2006 venture forum hosted by the Larta Institute, an independent, private, nonprofit California corporation.
- a multi-phased partnering program for Canadian firms created by Canada's Consulates General in New York city and Buffalo to address the Northeast US Homeland Security technology market.
- formal presentations by 58 Canadian technology organizations to multinational giant 3M, an event that was coordinated through the Canadian Consulate in Minneapolis. The result was no fewer than five subsequent projects with 3M, and DFAIT is now looking at ways of extending this model to other Fortune 500 companies.

Featured Speaker, Iain Gillespie, International Trends in Industry Research Incentives

Head, Biotechnology Division, OECD

Gillespie summarized his talk as having four main goals: an assessment of what is happening with private sector R&D in OECD countries; the key elements that foster these investments by the business community; the structure of the incentives provided for these investments, and how they develop as the business environment develops; and finally, some take-home messages for people looking at innovation policies.

Portraying the OECD as a "rich man's club", he pointed out that with the exception of Mexico, all OECD members are truly developed countries. Much of the organization's new work, he added, is looking at emerging markets in places such as Brazil, Russia, India and China. With specific reference to science and innovation, one of the oldest committees in the OECD deals with this subject, carrying out various forms of analysis, trying to give advice to member governments that could help them with innovation strategies. "We try to provide a relatively safe and secure platform," he said, "for exchange of views, analysis, data, and peer review."

Looking at graphs of trends in R&D intensity in the OECD, it is clear that in most of these countries, intensity is growing. Nevertheless, most of this growth falls short of the targets countries are setting for themselves. It also turns out that most of this growth is coming from business, rather than public sector contributions, although these are important. And the volume of this business R&D is driven by the size of firms and the particular composition of industries within the country. This information should be carefully regarded, because countries like Finland that are highly specialized in their fields of strength score highly, but may likewise be vulnerable to disruptive changes in technology. An even more complex graph outlined the specific contribution of various industries within each country to that country's overall R&D intensity. A final graph also considered how open each national economy is to foreign investment, and what contribution that made to business R&D. This description also raises the question of whether such openness is an important factor in driving technological competitiveness.

Gillespie then put forward the leading policy issue, how to foster greater private investment in R&D. Before addressing that question, though, he underscored the point that R&D intensity is not innovation, but merely a proxy for innovation.

> "Innovation is a good idea which you develop, which you turn into a product, which you put on the market, which you sell, which you have money in the bank for, and which you're not being sued for."— Iain Gillespie, OECD

In this context, then, Gillespie offered familiar examples of how business investment in R&D could be encouraged, including framework conditions such as labour market flexibility, tax policy, availability of a skilled work force, and good infrastructure, both in the "hard" sense (e.g. bricks and mortar installations) and the "soft" sense (e.g. coherent intellectual property regulations). Each of these elements affects overall R&D intensity in different ways, as Gillespie showed in another graph, but the leading drive is still business investment in R&D. Public expenditures do not have anywhere near as substantial or consistent an effect, nor do regulatory measures, although they do have the ability to build investor confidence in any given market.

According to Gillespie, the framework conditions that are the most important determinants of business R&D include the reduction of anti-competitive product market regulations, lowering restrictions on foreign direct investment, maintaining stable macroeconomic conditions and stable interest rates, and availability of external financing. Innovation policies matter too, however, particularly an openness to foreign knowledge. This is a problem for Japan, which exports a great deal of knowledge but has a much harder time importing it. And because the pool of human resources available for research is invariably limited, expanding public research efforts to complement business research efforts will increase the competition for talent. This limitation is in fact becoming an increasingly critical issue for OECD countries, as heavily populated nations such as China, India, and Brazil become more prominent in the global economy. And finally, Gillespie noted that the argument for simply strengthening national IP policy does not hold up, since it can actually reduce product market competition. Instead, he argued, IP must become more flexible and adaptable to local conditions, which will then foster innovation.

Gillespie returned to the subject of support measures, noting that there is significant change afoot in this area. That change includes a reduction and focusing of effort, especially on the basis of merit or competition, in order to obtain maximum value for this investment. Likewise, there is more of an emphasis on R&D, which is not revenue generating, than on innovation, which has commercial implications. Not surprisingly, another perennial goal is to build dynamic networks and clusters. And tax credits, which are a laudable part of policy, turn out to be not as effective as providing tax relief for employees, especially in smaller companies, so that salaries can be boosted instead.

"We like to think that we see some smarter approaches to supporting innovation," he said. "And we would like to think that these smarter approaches to supporting innovation were widespread across the OECD countries. The short answer is that at the moment, they're not." Tax credits, for example, are still very popular. Direct support for business R&D is also popular.

For Gillespie, the larger question is how one adapts such incentives to meet the demands of a changing business environment. Those demands include shorter time-to-market, expanding technological opportunities, increased cost and risk, globalization of markets, increased labour mobility, and more demand from users. Within OECD, therefore, the outlook is shifting from a old model of "closed" innovation — driven by firms identifying necessary technological advances and conducting the relevant R&D to achieve those advances — to an emerging model of "open"innovation, characterized by new funding models, more diverse innovation drivers, acquisition of technology from elsewhere, licensing of research results.

"This is tracking what successful companies are doing anyway," he observed. "They're spinning out, they're externalizing R&D, they're globalizing R&D, they're looking at a diversity of markets, a diversity of technologies. They're trying to bring technologies together. They're not sitting still on a stagnant business model, but they're developing a business model to innovate, to continue to get good products into the marketplace that sell and don't get sued for."

This shift has a whole range of implications for innovation policies in various countries. Public sector research organizations, for instance, are hearing a call to do more of the basic research, and to make that research achieve new standards of excellence and relevance. >From the government side, there is a change from direct support to shaping the entire innovation environment. So too, is the role of IP being re-assessed and policies surrounding IP now seeking a better balance between protecting innovations and stimulating diffusion of those innovations.

As the OECD has looked for examples of the distinction between these close and open innovation strategies, they have found some countries that are on the cutting edge of this development, while others still have much to do. The lessons are clear: a growing need for connectivity, new models for handling IP and capital, networks of cooperation. In particular, he noted that although many countries are making a high priority of leveraging financing, few are looking at where that financing is supposed to be going. "If you can focus resources, if you can leverage the resources and spend them where it's going to make the difference, you can succeed in innovation terms."

That said, there are problems that go along with these changes. The definition of success becomes somewhat more elusive, as organizations tout measures ranging from amount of capital to the number of jobs created. "We still have a lack of clarity in trying to change the innovation system and the outcomes that we're trying to deliver. The specifics often are lacking." Another question is whether the policy environment is going to sustain investment. He refers back to the earlier description of a "virtuous cycle of innovation", which is exactly what the OECD is seeking. "It's a dynamic, evolving, living system, and it's not the way most policies address innovation. We're still stuck largely in this linear progression, and it just doesn't reflect the reality of the way the business world goes about doing their work."

For Gillespie, this leaves us with some open questions about policy frameworks, the creation of knowledge markets, and where the vision and leadership reside in the country. He praises Canada's ability to punch above its weight, which bodes well for the prospect of leveraging innovation in the marketplace. Nevertheless, such potential has to harnessed, directed,

concentrated, and focused. Meanwhile, at the OECD level, the organization can help countries think about these issues in larger terms, and use that thinking to promote change. The reality, though is that everyone believes that innovation is going to be a key driver of growth, and can help deal with other challenges, such as climate change or the delivery of health care. And yet, government actions anywhere based on such a progressive outlook are few and far between. Given the complexities of trying to determine such actions, then, the OECD is drafting a generic innovation policy for its members, which will provide a base for individual countries to assess how they should move forward.

> "But it doesn't mean anything without the input and the foresight from governments and colleagues and countries. Don't sit there — innovate."— Iain Gillespie, OECD

A questioner asked for some clarification about the role of the IP system, and in particular what disruptive effects the US IP system might be having in the marketplace. Gillespie says the US system does not have the relevance it once did, since it is largely devoted to protect a great deal of IP that has little utility. If the IP system is not aimed at getting IP into the marketplace, the policy question is how to overcome this dilemma, and whether patenting can work in other ways.

Another questioner characterized the OECD countries as representative of the "old economy", whose proportion of the global GDP is going down, and asked what they should do to address that. Gillespie responded by noting that the way in which these new, non-OECD countries are going to behave in the way the OECD countries have done in the past. Without attempting to answer the very difficult question of how to re-shape the international economic order, he simply noted that OECD members had to remain fleet-footed, so they can cope with the new approaches that are bound to define the emerging global economy.

Panel 3: The Future of Incentives for Knowledge-based Business
Panelist: Bob Fessenden, Deputy Minister, Alberta Advanced Education and Technology
Panelist: Alastair Glass, Deputy Minister, Ontario Ministry of Innovation and Research
Panelist: Geneviève Tanguay, Assistant Deputy Minister, Ministère de développement économique, innovation et exportation, Québec
Moderator: Peter Calamai, Science Writer, *The Toronto Star*

Calamai set the stage by referring to Gillespie's comments about Canada's characteristically decentralized decision-making process, which was well represented by the makeup of this panel, and the prime directive of that process being the fostering of business innovation. He then asked Fessenden what that process means, what we are trying to do and who we are trying to do it with.
Fessenden suggested that what we should be doing is fostering the growth of knowledge-based companies, because they're the companies that create wealth from knowledge. This contrasts with Canada's traditional strengths in technology premised on resource development. He therefore maintained that we should be creating a policy and program environment directed toward nurturing these knowledge-based enterprises. And this could in fact be measured in terms of gross sales or employment by these enterprises. Yet another measurable would be the

proportion of world trade in technology-based products and services that we capture. Currently we have a deficit in this form of trade.

Glass highlighted the need to focus on outcomes, to understand where we're going and what we need to do to get there. He does regard technology as an important component of that, but he says business and social sciences are likewise important. That said, the technology-based aspects of the economy are undoubtedly those that are growing the fastest, so the outcomes will likely reflect this fact.

Tanguay suggested that there are many ways of approaching this issue, with direct measures from industry and indirect tax measures, as well as creating an environment for these enterprises to flourish. Just a few months ago the Quebec government introduced tools to implement some of these strategies. Those tools include tax credits as well as direct contributions to technology-based companies, even if those companies are contained within a university setting. And further to Glass's point about the increasing value of the social sciences, Quebec is also investing in social innovation, enabling research to be integrated into the province's social fabric. They are also investing directly in university research, with close attention to specific fields they have identified as important; this is complemented by a focus on highly qualified people, and much like NSERC, scholarships directed at young people to further their careers.

"It's multifactorial, much like growing a plant. You can water a plant but if you don't add nitrogen, it still won't grow. And if we look at all of the factors that need to be there, if we're not being successful, it's not clear necessarily what's missing. It's only when you get all of the factors together that you have a better idea."—Bob Fessenden, Alberta Advanced Education and Technology

Fessenden then suggested that a major emphasis should be placed on the development of highly qualified personnel, all the way from entrepreneurs to skilled technical people, trades people, and even those in the humanities. He also argued that various types of physical and institutional infrastructure need to be addressed. Access to capital is another important factor, especially in terms of mid- to late-stage investment. "As a country, we're doing some of those things very well, and there's some of the things we're not doing so well. In Alberta in particular I think we've done a fairly good job in terms of infrastructure, both physical and institutional. Where we haven't done a good job is in terms of tax and fiscal policy, and in terms of access to capital." He noted that for the past 14 years, the Alberta government has been non-interventionist, preferring a low overall tax environment that lets the market take care of itself. The industrial structure that has emerged reflects this outlook, which yields a robust resource-based economy but not a knowledge-based economy.

Glass noted that as part of public consultations his Ministry has done leading up to the drafting of a strategic plan on research and innovation, they were told that research and innovation activities must take place in a strategic context, i.e. considering how Ontario will benefit from the knowledge that is created. Ministry officials are looking at mechanisms for moving research activities into the marketplace, including entrepreneurial training programs, business support programs, funds for development as well as research, and investing in early stage companies

through a venture capital program in collaboration with the private sector. They also wish to brand Ontario, telling the world about the province's strengths, some of which are unknown to people. Another important feature is measuring the progress toward these goals, and sustaining the innovation agenda over the long term. "All of those issues are addressed in the plan, and we have a number of vehicles for sponsoring programs behind that."

Calamai acknowledged that he was initially thinking of incentives in terms of money, while the talk amongst the panelists reveals that incentives take many different, non-monetary forms.

Glass agreed with this observation, suggesting that the real driving force is the culture of commerce (to use Doug Barber's expression).

"Once we get the culture right, the a lot of the rest follows. The relationship between universities and industry, the market awareness of researchers when they do their research — all that has to improve, and when we get there, the research is actually a lot more fun. When you can see value being derived out of your research, it's a much more fun, creative environment."— Alastair Glass, Ontario Ministry of Innovation and Research

Fessenden confessed that there were no clear answers about how to change this culture in the desired ways. "The notion of trying to get closer connections between our universities and our businesses, the notion of trying to coach our business schools to get involved, programs that start to put technology and business graduates into companies that are creating technology products and going to market — we're not doing terribly well in Alberta on this, but we are doing some things." By way of example, he offered the Alberta Ingenuity Foundation, which has an industrial associates program to fund recent graduates in companies. "There's a lot of things we can do. But if we ask the right question, which is 'how do we do that?', then I think we can start to get at the right answer. If we focus back on how to increase business expenditure on R&D, then I think we ask the wrong question."

Calamai recalled from his own experience in the late 1960s and early 1970s that there were a number of government agencies established to deal with some of these same issues, but today there are few traces of these organizations or their activities. He challenged the panel to suggest that today's efforts would yield any better results.

Tanguay responded by describing her work with the Centre québécois de valorisation des biotechnologies, which is dedicated to technology transfer, where they bring together people from industry and academic circles, with each side expressing its needs as well as what they can offer. As these groups began to work together, they began to coalesce in a productive way that she regards as typical of the success of Québec's biotechnology industry. In much the same way, she added, Quebec has changed the way in which it funds such work. "We are bringing these people together from many institutions and from many different fields at the same time." She cited a similar strategy by CRIAQ (Consortium de recherche et d'innovation en aérospatiale au

Québec), where industry leaders tell them what kind of research this organization should be pursuing.

> "Twenty years ago you couldn't talk to university researchers about this. They weren't willing to sit at the same table. But with money, we did bring them together at the same table, and things are happening. So I think we can change culture."— Geneviève Tanguay, Ministère de développement économique, innovation et exportation, Québec

Glass concurred, suggesting that this perspective was becoming unanimous across the country, with people appreciating the need for change, based on statistics and indicators that are hard to dispute. Collaborations and convergence that might have been difficult even a few years ago are now eagerly embraced in light of observations about such factors as productivity and global competition.

Fessenden asked if the culture is changing, then changing to where? He acknowledged that the political culture in Alberta has changed over the last decade as the Alberta Science and Research Authority has had more opportunity to influence them. Now premier Ed Stelmach was once chair of the Alberta Agriculture Research Institute, where he became much more comfortable with the concept of the role of innovation. In fact, this has been part of a systematic strategy within the province, which has five institutes — i.e. strategic advisory structures — each co-chaired by a back-bench MLA, some of whom go on to become ministers. Most recently, for example, the chair of the Alberta Energy Research Institute Mel Knight is currently the Minister of Energy. If the political culture can be changed, then, Fessenden observed, one could consider changing that the culture of citizenry at large is a much more challenging task, but not an impossible one. He suggested that this process follows from celebrating successes and having big ideas that could capture the public's imagination.

> "The US has been very good about getting their innovation done around big ideas — put a man on the moon by the end of the decade, Star Wars, pick your big vision. Compare that to what we do here in Canada, which is that our universities go forward and say 'please may we have more?' Where's the passion and the vision in 'please may we have more'?"— Bob Fessenden, Alberta Advanced Education and Technology

Calamai then asked the panelists if their respective provincial efforts to effect change and action are being matched in any way at the federal level. And if those efforts are not being matched, he added, can you make it work through the provinces alone?

Glass responded that the federal government has been remarkably silent on this subject, but recent moves to focus the activities of the NRC and concentrate on climate change and biotechnology do represent some steps in the right direction. "But we're all holding our breath. We're waiting for what's going to happen next."

"The Chancellor of Germany is a physicist who can't stop talking about science. Do you remember the prime minister ever making a speech in which the words "innovation", "research", and "development" were mentioned?"— Peter Calamai, Toronto Star

Tanguay pointed out that Quebec is waiting to see what might happen at the federal level, but they have spurred some movement of their own through organizations such as Genome Québec, starting their own suite of genomics programs with private firms in the province. Those firms have responded enthusiastically, so these efforts are actually succeeding with private funding.

Fessenden responded to this point by insisting that their partnership with the federal government at the level of the public service is very good. He offered the collaboration on the National Institute for Nanotechnology as an outstanding instance of this positive relationship. "We all know that at the political level there are tougher issues that the politicians at the federal level are dealing with, and the issue of the science and technology agenda just hasn't been in the top five." Nevertheless, he insisted that this situation is starting to change and if stability can be achieved at the federal level, there will be lots of action.

Calamai suggested that money was one of the key drivers in prompting such action, and he asked what might be the best way of getting it into the system.

Glass portrayed the need for venture capital as urgent, nor is Canada the most business-friendly environment in the world. In Ireland, he recalled, he saw a much greater emphasis on inward investment and strong support for bringing innovative companies into the country. "They go after them," he said. "They don't just sit and wait for them. They say 'who do we want?' and they put money behind it. They'll do whatever it takes."

Tanguay explained that Quebec is putting $400 million in new funding over the next three years into research and innovation, plus another $82 million to increase the spread of the R&D tax credit, and $420 million for essential infrastructure. Some $221 million of this total is going directly into public research and developing strategic technologies such as genomics and photonics. Other funding is meant to encourage R&D activities in enterprises that have not traditionally had this as a component of their work, encouraging innovation in places like pulp mills, where it has not taken place before. All this plus another $100 million to transfer research findings, with $10 million of that dedicated to communicating science to youth and entice them into science, technology, and innovation. And after three years, she noted, they hope to be able to convince their treasury board to invest even more.

Fessenden agreed that funding is an important determinant, but it is only part of the answer. Much more critical, he argued, is finding agreement on shared objectives between the federal and provincial governments, then aligning their programmatic approaches to those objectives. "If you look collectively, we've got far too many programs operating at all levels of government. Simplification of what we're doing would go a long way toward making a big impact. And that doesn't necessarily cost money; in fact, it could save you money." He offered the province's nanotechnology strategy as an example of focusing on what is expected to be a highly disruptive

technology that is bound to revolutionize many industries and find a substantial global market. A partnership with the federal government in this field, he concluded, should be logical.

> "I don't see why we couldn't come together and agree upon a national nanotechnology strategy. That would then have us thinking in terms of growth of that industrial sector, companies that supply nano-enabled products into the marketplace, and it would start us into thinking about things like participating in global standards-setting. And there's no reason we can't unite behind that. It would get us thinking about what we need to do in terms of building manpower through our post-secondary systems. There's a whole variety of thought processes that would come out of a big national objective like that."— Bob Fessenden, Alberta Advanced Education and Technology

Tanguay admitted that as a Quebecker, she brings a different perspective to questions of national perspective. "We do not have to agree on everything," she said, indicating the province's plan for moving forward will not be dramatically altered to suit any federal initiatives that might come along. Nevertheless, broad objectives such as raising GERD or BERD will be more likely to find this kind of general agreement than the specific areas where Quebec has chosen to specialize, such as genomics, optics, nanotechnology, energy and environment, which have implications for older, established industries such as forestry and mining.

Calamai then asked Tanguay if these efforts extend beyond winning over policymakers, to win support directly from the general public.

Tanguay described the risk of alienating public opinion by rushing to adopt novel technologies of unknown scope and implications, and so the provincial granting agencies retain a branch devoted to ethics in science and technology, which now works closely with NanoQuebec, a non-profit organization jointly funded by the governments of Québec and Canada. "They're all working together to bring together social scientists, people in communications, to really show us how to best bridge the gap between the public and what these new technologies can offer to us." Glass maintained that the public will be involved in any such process. The leadership follows from a picking of the particular races you want to run. "Everyone would welcome leadership at the broader scale. People are waiting for climate change policy, waiting for energy policy, waiting for a focus on health activities. It's just a matter of engagement."

Fessenden concluded that this engagement must move past discussions of science and research per se, which are already heavily promoted. "What we haven't talked about is the importance of entrepreneurism, the importance of creating wealth. I could imagine much more effort to celebrate our successes." He suggested profiling successful enterprises to inspire the public and especially young people; but until this takes the form of a national objective, it will not happen.

A questioner endorsed this point, suggesting that business should be taught in high schools so that it no longer has a taint for Canadians who regard this as an unpleasant way of making ones way through life. And with respect to the idea of using the provincial government to leverage

venture capital, this same questioner reminded Glass of the former Idea Corporation, a similar undertaking that was fraught with problems. In fact, he insisted that there is no real shortage of venture capital in Canada. “It’s probably the other way around. We’ve got a venture capital overhang. We’ve had too much money chasing too few good deals. There’s a shortage of good business ideas, and it all comes back to the fact we have a paucity of good strong business people in this country, and that’s what we’ve got to address. This is not a secret.”

Glass disputed this claim about venture capital, suggesting that it was reaching an all-time low in Ontario, but he readily conceded the necessity of encouraging an improved attitude toward business as a career.

Molly Shoichet, speaking in her capacity as an academic, disputed Fessenden’s assertion about the lack of passion in university circles. “Certainly at the University of Toronto and the field that I work in in regenerative medicine, tissue engineering, nanotechnology, stem cells — there’s a lot of passion and there’s a lot of big ideas.” She then asked for a more formal definition of what a knowledge-based company is, suggesting that it is something different for everyone.

Fessenden responded by recalling his own difficulties in using the term “knowledge based”, especially in the reaction it garnered from traditional resource industries that nevertheless see themselves as utilizing knowledge. By way of distinguishing this approach to knowledge, he pointed out that companies engaged in resource extraction might be highly technologically literate, but they acquire their technology in a turnkey fashion, rather than developing it for themselves (although some do). “On the whole, resource companies tend to be very conservative. They tend to compete on the basis of commodity. They compete by dropping their input costs, and they do that by acquiring technology. But they’re not technology developers, they’re not R&D-intensive.” Knowledge-based companies, by contrast, make their money off knowledge capital, with little or nothing in the way of natural resources or physical capital.

Calamai extended this point by noting that the technology our resource-based companies acquire has in fact been developed in countries where resource companies do in fact pursue innovation to this extent.

> “The national tragedy for Canada is that we’ve never had an integrated industrial strategy.”— Bob Fessenden, Alberta Advanced Education and Technology

Another questioner asked for a description of the importance of cultivating entrepreneurial science as part of addressing these issues.

Glass acknowledged that such programs have been put in place, in order to try and cultivate this awareness in people who begin by doing research. Tanguay pointed out that you actually need different types of people at different phases of the growth of an enterprise. For this reason she returned to the earlier stated notion about celebrating failure to a more significant extent. “People who have failed usually do better the next time,” she said. “And we have to use these people a lot more than we have.” She suggested that part of the momentum of Quebec’s biotechnology industry came from the increasing use of such people, who are more and more successful each

time around. And universities are also exploring these qualities more seriously, through programs devoted to the management of technology and identifying what makes for a good entrepreneur.

Fessenden pointed out that this particular discussion revealed the virtue of asking the right question, rather than dwelling just on raising BERD or mounting R&D incentives, but instead expanding the topic to consider more fundamental issues such as cultivating essential talent and experience.

Another questioner referred to a 2006 paper issued by the Council of Canadian Academies, called the State of Science and Technology in Canada, which identified the country's greatest strengths, the country's areas of greatest growth, and where the country should proceed. The questioner wanted to know if this paper's observations could form the basis for uniting public and private sector interests in R&D.

Fessenden agreed that this could be the case, suggesting that our own sectors could serve as domestic markets for testing new products which then go global. Such a model could be stimulated through strategies such as procurement policy, which could be another way of building on our strengths.

Glass echoed that view, insisting that we should formally stake out areas where we can and will distinguish ourselves on a global stage, inspiring the Canadian public in the process.

Finally, Ron Freedman asked each panelist how he or she would spend an extra $100 million a year over the next five years, betting their pension on the outcome.

Tanguay replied that she would bet on helping industry to innovate, getting it out as seamlessly as possible to build R&D capacity. More specifically, she would put engineers in companies that do not traditionally hire engineers, ensuring that new highly qualified people make their way into the system. Nor does her interest stop at Quebec's border, since they also look to European practices as a guide.

Glass bluntly suggested that given a 20 year return on investment, he would sink the money into biorefining, which promises to add extremely high value and even transform existing industries such as polymer manufacturing.

Fessenden agreed with Glass that this is not an overly huge amount of money and should therefore be targeted narrowly into a proven area, topping up a program like NSERC or CFI. At a provincial level, he would put it into the nanotechnology strategy.

Crelinsten praised the value of this final round of answers, suggesting that these choices became lenses through which to look forward. "By picking one area like you were just forced to do, be it environment or health or communications, everything else fits into that. Your advice to try to pick one area where we could be a buyer, and as Canadians have procurement, where we can help our own country and then sell worldwide, I think that's the only way it's going to work."

Panel 4: Wrap-up
Panelist: Jim Roche, Acting President & CEO, Canadian Microelectronics Corporation, Retired President & CEO, Tundra Semiconductor Corporation
Panelist: Janet Walden, VP, Research Partnerships Programs, NSERC
Panelist: Clive Willis, Consultant
Moderator: Paul Johnston, President, Precarn Incorporated

Johnston confessed that the morning sessions left him somewhat confused, because he heard conflicting opinions about the role of universities, incentives, and government programs. But he expressed some satisfaction with the convergence of ideas that emerged in the afternoon. What emerged, he concluded, was a concept premised on the importance of the need to focus. He therefore asked the panel to comment on the need to focus and what it means for taking action.

Roche began by pointing out that focus is critical to survival in the private sector, where it would be hard to overestimate this virtue.

"One of my board members once told me, 'I have yet to see a company fail for attempting to do too little'."— Jim Roche, Canadian Microelectronics Corporation

Roche added that the same could well be true for countries, as demonstrated by nations that have chosen to do so. Canada could well benefit to the same extent as places like Taiwan, which has become the undisputed leader in semiconductor manufacturing. However, it will be important for Canadians to limit their scope, not choosing eight or nine fields but just one or two, and subsequently limiting our investments to those areas. What this requires is leadership, he insisted. "My experience over the last couple of decades is that we've been talking about focus, we've been talking about 'picking the winners' for a long time, but we haven't actually acted on that talk. We continue to consult with people." He maintained that we have enough information and qualified people now, and require the political will to make decisions and stick by them.

Walden responded to this point by arguing that the government's role is that of enabling, specifically the building and sustaining of innovative enterprises. Much of this activity will involve micro- and macroeconomic policies and support mechanisms designed to support a broad base of activities. This is how NSERC approaches the issue, ensuring a broad spectrum of research areas across the country. However, she agreed that to achieve truly world class excellence, it will be necessary to preferentially invest. Yet because of the diversity of governments within the country, preferences cannot be defined in a top-down manner by the federal government.

"When I look at what's happening in the provinces now, you see a lot more activity not only in research investment, but in the support infrastructure for business to grow and develop. If that's not aligned, federally and provincially, then I don't think we're going to be a success."— Janet Walden, NSERC

Walden acknowledged the value of looking at other countries that have focused successfully, such as Ireland, but she warned against overlaying simple models on Canada without an appreciation of the context. “We take the lessons from those examples, but then we have to look at the context in which we live and apply them to the culture of our research and business community.”

Willis argued that there is no magic bullet to direct at what is in fact a very complex, dynamic situation. He noted that the day’s deliberations had not done justice to the genuine value reflected in the country’s universities, referring to them as sources of technology or human resources. That is true, he maintained, but their real strength lies in an unrivalled knowledge of the state of the art. They are the ultimate authority for advice.

> “If you want to know something about nanotechnology, you don’t ask a bureaucrat, you don’t ask someone from NSERC, you go to a university. And that’s what firms have to do. They don’t have to go and get results from a university, they have to talk to them.”— Clive Willis, Consultant

Willis added that the issue of national labs was likewise overlooked. But remarking on the question of focus, he suggested that provincial governments have in fact taken this outlook to heart. For example, in 1999 Quebec identified five technology thrusts it would support, and made it clear to the universities that it was supporting these areas, yielding a strong cohesion around genomics, nanotechnology, and information and communications technology. A similar cohesion has been emerging in Alberta around the resource sector, as well as British Columbia and Saskatchewan. And, he concluded, the real question underlying focus and making choices must take into account the “real” economy, meaning such things as forestry, mining, or agriculture. “It’s not the high tech sector, in isolation, that is going to drive the economy.” This real economy manifests itself much more profoundly at the provincial level, meaning the federal government cannot effectively drive change in the absence of a consensus with the provinces. What the federal government can do, however, as has already been suggested, is to simplify the types of support systems it provides to businesses.

Johnston returned to the question of focus by referring to the virtue of setting forth big goals as an incentive. He recalled when he was with Precarn’s Institute for Robotics and Intelligent Systems, he toyed with the idea of asking researchers to design a robotic goaltender, a project that would inspire on many different levels.

A questioner pointed out that matters of focus are not new, and most parts of the country have conducted such exercises. Almost by definition, he said, people do not want to exclude others, especially if those others are doing good work.

Roche responded by observing that applying focused choices is far from being an easy exercise, but companies are successful precisely because they do make difficult decisions to exclude good, promising work in favour of concentrating their efforts. He insisted that we as a country would reap significant benefits if we did the same.

Walden disputed the point, however, arguing that the government has a very different role from the managers of a company. Just as universities have a mandate for education, they must be careful to focus their efforts only to a certain extent. You run the risk of guiding people into areas that can quickly become either useful or useless.

"The role of the universities is not just about producing the next widget or the next idea for industry, it's producing the people and the thinking and the learning and the understanding that's going to be part of our sustainable growth in future. And you want to have a flexible enough workforce that you can actually achieve that."— Janet Walden, NSERC

Willis recalled a cluster study that indicated Winnipeg had something like nine major clusters of activity and upward of 36 sub-clusters. Economic progress will only be premised on picking one or at most two of these options, and then moving forward. Instead, you wind up with far too many sectors being highlighted.

"If we go back 20, 30 years ago, we as a country could afford to have a broad-based investment strategy, because 20, 30 years ago we didn't have India, China, Brazil, Russia and many other countries nipping at our heels. We are incapable now of having a broad-based strategy and succeeding."— Jim Roche, Canadian Microelectronics Corporation

Roche added that the last company he ran had development centres in Shanghai and Bangalore, where he found attitudes that contrasted starkly with the attitudes he found in Canada. "There was no concept of work-life balance in Shanghai. It was work, work, work. They were hungry, passionate; they wanted to eat our lunch." Such observations have convinced him of the need for Canada to focus.

Another questioner raised the notion that objectively concentrating effort in key areas has a salutary effect on areas that appear to have been overlooked or dismissed. For example, an economically healthy Toronto sustains an economically healthy rural Ontario at the same time by sustaining supply chains and value chains. [Bob Fessenden later offered an even more political interpretation, "A healthy oil sands is a healthy Toronto."] When the Conference Board of Canada's Leaders' Roundtable on Commercialization suggested points of focus, however, it may have no pre-existing bias about doing so, but it has no authority to enforce its recommendations.

Walden responded to this point by indicating that matching objectivity and enforcement is not just a question of balance, but a question of definition. When NSERC took part in that roundtable exercise, she recalled, it was unclear what had to be done. "We walked away after a full day of discussion still undecided. What does that mean to pick an area? Are you picking a business sector, are you picking an underlying technology, are you picking a series of research themes and challenges that might go along with them?"

Willis insisted that even if you get through the difficult task of choosing and standing by your decision, you must then confront the important role of cities. “There is absolutely no doubt in my mind that you start with the cities.” The resulting choices are not made by government, then, but in the context of geography, the local, regional economy.

Roche described a dilemma facing anyone assigned the task of making decisions to focus our economic effort, namely that they are striving toward certainty. In other words, we must pick exactly the right area of focus, running the risk of picking one that disappoints or even fails, while excluding others that would have succeeded.

> “I believe that the country and the world is sufficiently complex that it’s not so much about certainty as it is about clarity. The important thing to do here is not to make sure we pick the number one, two and three of the world hit-list of areas to focus on, but we pick the ones that are good enough for the country such that when we focus, we’re going to get great results.”— Jim Roche, Canadian Microelectronics Corporation

Bob Fessenden maintained that the term “focus” is dangerous to use. He suggested the language of enhancing existing strengths or accelerating an ongoing trend in a catalytic fashion. “This question of focus should be enabling, not constraining, and it should be building on strength. If you want to talk about focusing at an outcome level, we want to talk about focusing at the level of trying to accelerate the development of a particular industrial sector, and let the marketplace look after the company issues.” If, on the other hand, we are proposing specific interventions to develop a specific technology, you need skilled people and educational support, and what looked like a simple matter of infrastructure becomes a much more involved undertaking. By way of example, he offered the development of the oil sands as a specific industrial sector in Alberta over the last few decades.

Willis agreed entirely with this interpretation, but added that it is necessary to look downstream, at the economic impact and wealth generating effects of the resulting choices. Some choices will yield much greater returns than others.

Walden also agreed, and further suggested that even a seemingly straightforward emphasis on natural resource sectors like the oil sands can wind up being more complex than they appear at first glance. Above all, you will need the talent to ensure that you can address the many different needs that will be posed by the development of such sectors.

Roche agreed with the notion of building on strengths, but insisted that the reality is that we will have to say “no” to some prospects, and this fact must be kept uppermost in everyone’s mind. Fessenden, for his part, replied: “Focus means never having to say no; just saying yes preferentially.”

Walden pointed out that NSERC has taken a catalytic approach to areas that are regarded as significant, but they remain cognizant of the need to accept surprises, to expect the significance of areas they know nothing about right now.
Ron Freedman argued that you cannot make a mistake in focusing, if you take certain steps. "You can do anything in this world and succeed, provided you're one of the best in the world at it." That principle applies to any product or service, from the obscure to the prominent, so long as we can mount a critical mass in the field.

"Critical mass doesn't necessarily mean that you have to be the biggest in the world. It may mean that you have to muster your resources better than anyone in the world in a very tiny area."— Ron Freedman, Impact Group

Referring to his current project on NRC's clusters strategy, which he approached by wondering about how particular types of research enterprises wind up in specific centres — nanotechnology in Edmonton, for example, or nutraceuticals in Charlottetown. "You can make these strategic decisions at a national level, but they're only going to work if conditions are right at the local level." Such success follows when municipal forces align with the forces mustered by universities, provinces, NGOs, private firms to make something happen in their community.

Johnston noted that the panel's comments had in fact avoided the question of whether business incentives are working, but in fact looked at the underlying premise behind such incentives, which would be the focus you are taking on R&D activities as a whole.

Willis reiterated Freedman's point that local conditions are paramount, including the mustering of local commitment and local resources.

Walden referred to the reinterpretation of critical mass, suggesting that this is also being reflected in the way we regard clustering. She suggested new models are emerging, but barriers such as intellectual properties remain, and we still have to learn how to deal with them if we are going to move quickly enough to compete internationally.

Roche suggested that Canada has been developing an appetite for complacency and shying away from risk, as evidenced by a growing use of the term "accountability". As laudable as this notion might be to check incompetent or illegal behaviour, it can have a generally dampening effect that actually contributes to our inability to focus, because focusing is a matter of taking a risk.

"Accountability is a good thing in concept. But the word is actually being used more and more in government programs that I see to slow the program down. We're penalizing the majority for the behaviours of the minority, by increasing our scrutiny of everyone's behaviour through these accountability practices. It slows things down and it further reduces our tolerance for risk as a culture."— Jim Roche, Canadian Microelectronics Corporation

He then suggested that this problem is one of cultural change, even to the point of it being unclear that the challenge is one of agreeing to make that change in order to set higher priorities. Nor is cultural change comfortable, he added, and people will feel we are making huge changes even if the actual effects are small and incremental.

Prior to Freedman offering a round of thanks to all participants and sponsors, Crelinsten offered two closing thoughts, first praising Fessenden's remarks on asking the right question as a superb coalescence of the entire day's proceedings, then quoting Einstein: "We can't solve problems by using the same kind of thinking we used when we created them."