**"Commercialization: What's Working, What's Not"**
**The Fourth Annual RE$EARCH MONEY Conference**
**9 November 2004, Ottawa Congress Centre, Ottawa, Ontario**

## Conference Proceedings

Tim Lougheed

The event was hosted by RE$EARCH MONEY co-publisher Jeffrey Crelinsten who pointed out that the theme commercialization was at the top of the list of topics suggested by participants at last year's conference. He noted that the subject is "not without controversy." He cited a private sector colleague who does not like the word "commercialization" because it "implies there's something non-commercial that needs to transform magically into something that is. If it didn't start off being commercially viable, forget it." The group who put the conference program together selected experienced "commercializers" as well as academic and policy experts who interact regularly with "commercializers" in order to bring a more realistic view of the topic. Crelinsten then introduced RE$EARCH MONEY managing editor Mark Henderson, who put conference theme into perspective.

"Commercialization has really started to come to the fore over the last couple of years," he said. "There are a lot of other issues in the science and technology portfolio that require attention — there's northern science, there's international linkages, there's regulatory reform, big science projects, rusting federal laboratories, sunsetting networks of centres of excellence. But the issue that looms over all of them, and impacts on every hot button issue in the S&T portfolio is commercialization."

He added that many pages in RE$EARCH MONEY have been filled with news and comments on commercialization, a complex and daunting term that has come to be known as the "c word". He pointed out that many questions swirl around this concept:
— how to get value from investments in basic research?
— what is required to get innovative products to market?
— how do we create successful start-ups?
— how do we grow large firms from small ones?
— how do we keep offshoring from constraining our ability to innovate?
— are we training people with the proper skill sets for the economy?
— what is the best way to meet the needs of the client, connecting those clients with the people who are managing the innovation process?

"When it comes to successful commercialization, there is no magic bullet," he concluded. "It's hard work determining what works, ensuring adequate funding and skills support, and topping it off with a healthy dose of written litigation. To do a proper job we need effective foresight, dynamic linkages between the policy and political arenas, and a wider appreciation of the role S&T plays in our nation's future well being and prosperity."

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Keynote speech: “Commercialization: Why Basic Research Matters”
Mike Lazaridis, President, Research in Motion

Lazaridis began his presentation with what he described as the conclusion, “what happens when it all comes together”. That consisted of a video clip showing Oprah Winfrey enthusiastically touting the Blackberry on her show.

He explained that he had learned many things during RIM’s 20-year history, particularly about how technology is commercialized and the major role universities play in that process. He pointed to the participation of government as well, through such initiatives as the National Research Council’s Industrial Research Assistance Program and grants from Industry Canada’s Technology Partnerships Canada program.
“What happened over this time is we saw how all the pieces fit together,” he said. “There’s been a lot of talk about commercialization in this town. It’s a buzzword, from what I’ve seen. And I’m worried, because it implies that there’s something wrong with the system. This is a system that’s been working for a long time, and it’s a system that works behind the scenes in a lot of cases.”

He offered the example of the part played by universities in commercialization. Their most obvious activity is that of conducting research and educating highly skilled people, but he added a third function: that of developing new knowledge and passing accumulated knowledge to the next generation. He compared the value of universities with that of electricity — something that we take for granted until it is absent. The educational equivalent of a power blackout would not have immediately noticeable effects, but within a few years we would find ourselves short of engineers, doctors, writers, and a variety of other professionals who contribute to our high standard of living. If we did shut down post-secondary education in this way, restoring or rebuilding such a system would not happen easily or quickly.

In actuality, he said, Canada has a robust university system, with results that are obvious to anyone who cares to look. “We’ve just gone through an enlightened 10 years of government support of the research and university environment in this country. We’ve had CFI, we’ve had Millennium Scholarships, we’ve had Canada Research Chairs, we’ve had support of indirect costs, we’ve had all these programs. We’ve even had the Premier’s Research Awards in Ontario. We just had that for 10 years; inspired leadership, inspired investment because we understood the value of universities, university research, and an education. And what was the outcome of that? An $8 billion surplus. One of the strongest economies in the world. A very strong Canadian dollar. Very high hopes; that’s what the outcome is.”

Lazaridis is bothered by the suggestion that something is wrong with this system, that it requires a special emphasis on commercialization. Universities do not carry out this process directly, he insisted, adding that he has licensed only two technologies from universities during RIM’s entire 20-year history. “In that same 20 years, I’ve hired over 5,000 students,” he said, including Waterloo Co-operative Education Program students, interns, undergraduate and graduate students, and post-doctoral students. In fact, he recalled that two such students recommended that RIM license technology based on the work of researchers under whom each of them had studied. In this way, the opportunities he has offered to students have resulted in opportunities

for his company, which is exactly how commercialization is supposed to operate. Few of those opportunities will be tied directly to a university through a formal mechanism such as a licensing agreement, but the participation of students in the process remains crucial.

“Commercialization happens when we educate the next generation of students with the latest cutting-edge technology, the latest cutting-edge tools, the latest cutting-edge techniques and processes. We inspire them by having them study under and do projects with the very best researchers. And then when those students graduate and go help build the industry and the society of the country, that is commercialization. That happens every year.”

When one argues for commercializing technology at universities, he said, it is like placing a bet in a casino. “But if you really want to take the power of commercialization to new heights, invest in the casino. You always make money there. Somehow we’ve forgotten the value of a university education and university research.”

He also warned that imposing a culture of commercialization on university researchers would have the adverse effect of muting discussion and debate on technical issues. He described an annual gala where RIM celebrates its employees who collect patents for the company, but he also observed that university researcher may never patent anything, nor should they be judged on that basis. Patents foster secrecy, and secrecy runs counter to any scientific venture.

“Science is so advanced and complex today that it requires multinational effort, across the globe, co-ordinated through the scientific method, through peer review, through published papers, through collaborative work, at places like the Perimeter Institute or places like CERN, in Geneva — a €2 billion a year program, funded by over a dozen countries around the world, collaborating and openly publishing the results because no one person can figure the whole thing out on their own. That’s how advanced science has become, that is how science progresses: through openness, through published papers.”

RIM is actively supporting this process by investing $133 million into the Perimeter Institute for Theoretical Physics and the Institute for Quantum Computing at the University of Waterloo. And he pointed to similar research clusters across the country, in areas such as genomics, nanotechnology, superconductivity, advanced nuclear power.

“We’re attracting the best,” he said. “As long as we do that and we invest in these clusters across Canada, we keep investing in the universities, what we’re going to find is that our students will do the rest of the work for us. These exceptional students — who are going to be trained with the best equipment, the best techniques, inspired and taught by the best researchers, the best professors — they are going to generate wealth for this country like you’ve never seen it before.”

At the same time, he reiterated his concern that if we misunderstand how commercialization works, if we begin to support universities by counting the patents they create, it could be a long time before we realize the damage we have done and even longer before we can repair it.

“We’re cutting back funding in ways that aren’t visible to all of us, but for those of us on

granting councils we see it," he said, responding to a question after his presentation. "But more importantly, what I'm concerned about is this belief that somehow there's something wrong with the system and that we need to divert funds from basic research to more commercialization. My whole thesis is that that commercialization mechanism has never been better."

And he outlined an imperative for Canada to maintain the quality of basic research, because that will be our only chance of competing in global markets dominated by much larger players. The largest of those competitors will be China, which in a decade's time is expected to be graduating some 20 million students a year.

"That's like more than the effective population of Canada," he said. "This is what we're up against. The only way for us to really protect our sovereignty, protect our future is to invest in quality. The only way we can compete is quality, period."

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"Commercialization in the Austin, Texas Cluster"
Laura Kilcrease, Managing Director, Triton Ventures

Her organization played a crucial role in transforming central Texas from a region that was economically devastated by plummeting oil prices in the early 1980s into a national hotbed of entrepreneurial activity and innovation. When the original crisis set in, she recalls, almost every financial institution in the city of Austin was taken over by the federal government and homes were being foreclosed at a rate of about 1,000 a month. The solution, she explains, came through major developments in the existing education and research infrastructure. The central city of Austin, with a population of only about 400,000, went from a no-name centre on the map to a model of economic growth and diversification.

"When we looked around our community, even though that community was small, we said 'what do we have?" she recalled. There were six higher education institutions — the flagship being the University of Texas, with some 53,000 students — and a collection of good firms with significant research bases, such as IBM and Motorola. Nevertheless, she observed, these economic resources were somewhat disparate. Although Austin's academic foundation was considerable — the University of Texas alone was spending some $400 million annually on research — they saw a need to expand it in order to attract truly outstanding researchers.

They did just that by bidding successfully against 57 other cities to become home to the Microelectronics and Computer Consortium (MCC), a research collaboration financed by 12 major corporations, which would bring 350 of the world's top researchers into the region. In order to attract MCC, Austin had to meet a requirement imposed by the consortium, which wanted the university to create four $1 million endowed chairs in certain engineering fields. The university, in response, found matching money from its own alumni and endowment funds. By the time all the available support had been pooled, they had created 32 $1-million chairs.

Pulling in such consortia proved successful, but they were also eager to create connectivity

between such enterprises, which would create an even larger economic base. This led them to look closely at community infrastructure.

“Very few of us decide to build our houses in the middle of a field with no electricity, no water, and no telephone lines,” she said. “So why should we expect in our communities that people are going to build businesses and commercialize technologies if there’s no talent, no technology, no capital, no know how or expertise in many areas of the businesses that you’re going to need beyond the technology. Our challenge was to connect our academic groups with our business groups with the policies that our government needed to put in place in order to enable the talent, technology, capital, and know-how to actually be successful in forming firms.”

The process was divided into three stages: gathering the information and identifying technologies they wanted to emphasize; learning what the market opportunities were for that particular technology; then deciding if the outcome would be a specific product, a company, or a specific technological innovation. As part of their thinking, she described a distinction between strong and weak markets, rather than large or small. The difference is important because a large market might also be a weak one (i.e. demand is shrinking), while entirely new products (disruptive technologies like the Blackberry) create small markets that grow quickly and steadily, becoming strong.

People in Austin were most interested in getting in on the ground floor of revolutionary new markets. As business, government, and academia were brought together, the emphasis was placed squarely on the cultivation of entrepreneurial undertakings.

“Technology is often pushed out of organizations, but it reaches market more successfully when pulled by entrepreneurs,” she said. “These might not even be individuals who think of themselves as entrepreneurs, such as students or professors, but the pull does take place.”

In addition, she pointed out, the extent of the local economic crisis was so sudden and so severe that they simply could not afford to wait very long for results. They wanted the speed and impact of entrepreneurial success. Promoting that success included adding an entrepreneurial stream to the university’s MBA program, founding an incubator where students could work in conjunction with existing businesses, and hosting a business competition, which evolved from simple documents to videos and manufacturing prototypes. Austin mounted conferences to raise awareness of entrepreneurial prospects, as well as profiling successful examples.

“Celebrate that success; accept failure,” she said. “This is a cultural issue that you’ll have to understand. We accept failure knowing that not everyone will succeed, but like Mr. Hershey if they try and try again — the Hershey Kiss happened on the fifth time — at some point, whether it’s the second or third time, your entrepreneur will be successful. And every failure will bring knowledge that they need to use for the next opportunity.”

The payoff for these efforts has been profound. The University of Texas suggests that the economic impact of these activities has been in excess of $1.4 billion. The Austin Technology Incubator, established in 1989, has created some 3,000 jobs since then, and the companies that

have been created there have revenues of about $1.5 billion a year. Looking at all the investment capital available in Texas between 1996 and 2003, some 40 per cent of it went to Austin, which has grown from 400,000 people to about 1.2 million. She credits such growth to entrepreneurial businesses.

“It doesn’t matter what size you are, it’s what you can enhance and work together on,” she said, though she cautioned that it is necessary to pick and choose carefully. “We can’t commercialize everything, we can’t create businesses out of everything. Leverage your resources, leverage the power of the community, and measure your results.”

She underlined that last point. “If you don’t know where you started, you won’t know where you’ve got to if you don’t measure.” In Austin, measurement has provided valuable insights, such as an astonishing 5000 per cent return on investments made by the community. And measurement also puts any downturn into perspective. Although 300,000 new jobs were created in Austin during the 1990s, a decline of about 21,000 jobs followed the technology industry’s shakeout in the early 2000s. Although this drop prompted some gloom and doom commentary, she maintains that one bad year out of 10 is acceptable.

“I think of commercialization as a body contact sport, and it’s that body contact that makes commercialization happen,” she concluded, adding a quote from her late colleague George Kozmetsky, who founded Teledyne, was on the board of Dell, and served as Dean of the University of Texas Business school for 16 years.

“Economic security requires competitive advantages that are realized by applying technology to transform basic and advanced industries, as well as accelerating growth in emerging industries and starting new industries,” he said. And Kilcrease noted that he said this 10 years ago, as a reminder that these activities continue to benefit existing businesses as much as new ones.

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Panel discussion: How industry views commercialization

Panelist: Mark Chamberlain, former CEO, Wescam; President, Pictorvision
Panelist: Frank Maw, President, Motorola Canada
Panelist: Brian McFadden, Chief Technology Officer, Nortel Networks
Moderator: Janet Walden, VP Industry-University Programs, NSERC

Walden began by noting that it is only in the marketplace that businesses will find the revenue to keep going, regardless of how much R&D is being conducted and how many highly qualified people are being trained. She then asked each of the panelists to identify the strategies they have adopted to stay ahead in the marketplace.

Maw noted that longstanding international barriers to collaboration, licensing, and merging have been broken down. “It wasn’t so many years ago that our philosophy was that if it wasn’t invented here, we won’t do it,” he said, indicating that firms like Motorola are looking for a

balance between market/customer driven R&D work and the basic push of technology research. "We pretty much have gone to the opposite extreme over the last 10 or 15 years. Any one company's ability to develop total solutions is pretty limited, so partnerships are of the essence. It's a great time for young innovative Canadian companies to approach larger ones, because the doors are open. We're back in the mode of perhaps taking higher risks, we're looking for good IP that fits in with end solutions."

McFadden added that getting close to your customers is the top priority, and customers want solutions that can be readily implemented. He criticized a tendency to undervalue execution, the ability to demonstrate for a client exactly what you have done and asking them what the next step should be. And sometimes companies can also influence that next step, by mounting awards or events to showcase their technology, or by working with others in the industry to define standards and shape the environment for products.

Chamberlain explained that commercialization has always been a definitive priority for Wescam, which produces camera systems for specific applications, such as sporting events and military use. "We think of commercialization as many things," he said. "It's not just technology, it's not just technology development." Since the company's competition was made up of firms no less daunting than Lockheed-Martin, Raytheon, and Boeing, they survived initially by selling almost exclusively outside of North America. These early sales supported the R&D activity that made it possible to hone the product into a truly disruptive technology capable of winning contracts and awards.

Such a strategy makes it necessary to introduce customers to innovations that they do not yet realize have some value for them. In order to do so successfully, McFadden argued, you must understand the pace of change at which those customers would like to proceed, a pace that is tied to their existing methods. "It's got to be implementable, it's got to match where your customer is on their life cycle of business, and it's got to perform," he said. "If you get that mix right then you're successful; if you don't, you go try again."

By way of example, one rapidly expanding field that Motorola monitors closely is automotive electronics. New products currently take upward of five years to enter this market, a period that Maw said manufacturers are keen to shorten because they anticipate growing competition from China. Maw said that means industry, academia, and government need to see this issue from the same perspective and come up with shared approaches, before competitors from elsewhere dominate this market.

In this context, Walden observed that private investment in R&D has decreased even as public investment has increased. McFadden, whose company is Canada's leading R&D spender, suggested both public and private sector investment in this area should be higher. Maw echoed that call, suggesting that Canada should tout itself as home to innovation, with incentives to make the country attractive for this activity.

Chamberlain applauded this goal, but cautioned that institutions such as universities have not proven to be the best place to carry out this work. His firm seeks cash flow in the short term,

while academic R&D efforts tend to operate on much longer time scale. He admitted that measures such as hiring co-op education students and obtaining IRAP grants have proven to be been beneficial for his business, but added that what it really needs is to be left alone to innovate, given a truly level playing field and ready access to markets abroad.

Returning to the initial point about collaborations and partnerships, Maw indicated that many firms are acquiring research carried out elsewhere, making it look as though companies are doing less R&D, when in fact these activities are simply more dispersed. Chamberlain pursued this observation by contrasting two distinct approaches toward R&D: sustainable development versus disruptive innovations. The difference amounts to making better mousetraps versus coming up with completely new techniques for handling mice.

Chamberlain added that employees themselves can undermine the innovation process, as a company's most productive engineers frequently anticipate moving into management as a key step forward in their careers. By retaining these individuals as engineers with management-level salary and recognition, their value as innovators is confirmed and the organization's innovative capacity can be maintained.

Such insights were echoed by McFadden, who argued for the necessity of asking why an organization does things one way rather than another. For this reason, he expressed skepticism about the value of partnerships with government or universities that are too prescriptive, since such collaboration does not challenge the mind. "Let's not blow it," he said, pointing to many economic advantages Canada is currently enjoying. "Let's continue the innovation culture that we've developed here."

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Panel Discussion: The investor's view of commercialization

Panelist: Catherine Eckenswiller, Associate, Smart & Biggar
Panelist: Robert Inglese, VP Technology Seed Investments, BDC
Panelist: Jim Murray, Senior Advisor, WestLink
Moderator: Shawn Gervais, Corporate Development Manager, Alberta Research Council

Gervais began by asking about the defining characteristics of the process that turns a technology into a commercial enterprise. Eckenswiller insisted that while entrepreneurs might put a lot into hard assets such as a manufacturing facility or an office, what really brings a technology into the market and gives it value is intellectual property. Agreements and collaborations should secure this value early, otherwise it can be lost.

Inglese suggested he had not encountered any systematic means of determining successful commercialization. Nevertheless, he described relationships as an integral factor in any success, nurturing an environment in which entrepreneurs can work hard and work effectively. "This is our biggest challenge," he said. "It's not about technology, it's not about markets; it's about people."

Murray insisted that the ability to take an invention from laboratory to market is extremely limited. If a market cannot be demonstrated, he argued, it cannot simply be created. He added that it is also necessary for founders to accept the need to step aside as their enterprise matures, so that people with the necessary skills to carry on can ensure growth. Eckenswiller echoed that point, suggesting that entrepreneurs who try to cover too much ground alone can make such growth more cumbersome and expensive than it should be.

The point at which an individual elects to hand over control in this way can vary from one situation to another. Inglese said his company's willingness to invest in a company depended directly on how sincerely the entrepreneur assessed his or her capacity, which will determine an ability to step aside when new talent is required. He noted that members of the research community are much more realistic about this aspect of their ventures than they were 10 or 15 years ago.

Another change in entrepreneurs' attitudes, according to Eckenswiller, is attaching importance to the notion of selling something in order to proceed. They see their technology as something that can be turned into a product for sale, and they appreciate the need to do so quickly. Some of her clients even carry out product development in parallel with R&D, so that they have revenue to put toward the latter activity.

Murray also confirmed that the financial community is seeking shorter timelines for returns than ever before — 3-4 years as opposed to a 7-year standard a decade ago. The size of a prospect is also a key determinant. "If you don't have a product that has a potential market of at least $100 million," he noted, "you're not going to go very far at getting your financing."

In light of this observation, Eckenswiller recalled an earlier description of the "valley of death", that period in the life of an enterprise when it becomes too big to qualify for start-up financing but has not begun to generate its own revenues. Public policy can address part of this problem, but it must do so carefully, Murray argued. He pointed out that Canada has about 395 biotechnology companies, and there is not enough public or private funding for all of them. If 50 of the most promising could be funded, however, revolutionary new developments could follow.

Inglese suggested that there is actually a lot of venture capital available, but the costs associated with investing it are too high. Investors therefore overlook smaller companies, no matter how promising they might be, and that could be a mistake. Low-key, unassuming innovations can evolve into something quite different if they have the resources to do so.

"We have many examples of businesses that got their success from a very different product, a different market, different from the initial plan," he said. Moreover, he advised investors not to focus too closely on business cycles determined by particular technologies, but instead at trends driven by technology, which will yield a much greater return.

Eckenswiller concluded by advising start-up entrepreneurs to set clear goals, allocating resources according to those goals and with an emphasis on quality. Murray offered even more pointed

advice: “If you want to build a successful business, it’s important to integrate management, marketing, financing, along with technology production.”

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Luncheon address: “Commercializing Canadian research results: opportunities and challenges”
Arthur J. Carty, National Science Advisor to the Prime Minister

Carty introduced himself as Canada’s National Science Advisor, charged by the Prime Minister to work with the Minister of Industry in developing a plan for Canada to emerge as a world leader in turning ideas into wealth and social benefits for the nation. With specific reference to the participants in this conference, then, he considered what it will take for the country to build a world-class commercialization system.

He reviewed some pertinent economic features of the last decade, which include balanced budgets and a paying down of debt, along with injecting some $13 billion into Canada’s scientific infrastructure over the past 7 years. In addition, he noted that in 2002-2003, the country’s per capita R&D spending in universities and research institutes was the highest in the G8. Moreover, Canada now offers one of the highest rates of tax credits for R&D in the world — five times higher than the US.

In spite of such substantial, concrete gains, he asked whether these were enough to ensure our ability to cope with the demands of an increasingly competitive, global knowledge-based economy. In this context, Canada remains a small, highly trade-dependent nation, confronted by forces that challenge our continued success in historic areas of strength.

Among those forces, he pointed out, is China’s emergence as a major economic power. Besides dominating low-cost goods and services, this country is becoming more prominent in science and technology, last year surpassing Canada’s output of scientific publications in the natural sciences and engineering. Some 200,000 engineers graduate in China every year, three times as many as in the US.

Not surprisingly, then, the Canadian Manufacturers and Exporters Association identified the economic and industrial emergence of China as its top issue of concern facing manufacturers today. The list of such concerns now contrasts sharply with that of 10 years ago, when taxes, access to the US market, and exchange rates were the leading issues.

Nor is China alone the cause for concern. The global economy will also find India, Brazil, and South Africa at the cutting edge of new technologies. According to Carty, Canada can and must be both competitor and partner if we are going to continue to prosper.

Another confrontational factor is the ongoing decline in the value of commodities, which have long sustained the Canadian economy. Innovation can offer us a competitive advantage in producing traditional sources of wealth taken from minerals, forests, oceans or agriculture, but we will have to be well organized in order to do so.

"It is absolutely vital that Canada have the capacity to not only perform leading-edge R&D, but a world-class system for getting the ideas and discoveries to market," he said. "In other words, commercialization of this R&D."

He added that our competitors around the world will undoubtedly be doing the same thing. By way of example, he pointed to the UK's 10-year science strategy [UK Treasury, *Productivity in the UK: The Evidence and the Government's Approach*, November 2000], which reviews the factors necessary to increase that country's innovation performance and productivity. The Lambert Report on Business-University Collaboration assigns this responsibility to business, asking companies to boost their participation in R&D, rather than relying on universities for ideas and services. Representatives of British industry have responded quickly and positively to this call, putting hundreds of millions of pounds into new R&D investments.

Carty offered Australia as another example of balancing investments in public research with mechanisms to foster technology transfer and nurture internationally competitive start-up enterprises. That country recently expanded its Commercializing Emerging Technologies program, which included a "Commercial Ready" initiative.[Australian Institute for Commercialization, *The economic impact of the Commercialization of publicly funded R&D in Australia*, 2003]

"We need to do the same and better," Carty insisted, adding that a focus on commercialization does not mean a neglect of basic research. "Rather we must create the conditions for science to flourish and create an environment for companies to innovate. Leading edge research is the feedstock from which advances in science and technology and new innovations flow."

Carty outlined the kind of commercialization system that would best suit Canada, based on his exchanges with hundreds of leaders from industry, government and academia on the topic. He listed a number of common themes that could define such as system, as follows:

— a competitive business environment, encouraging firms to innovate as they develop and market their products;
— a solid research base, especially in key enabling technologies such as biotechnology, information and communications, and advanced materials;
— strong linkages between researchers and industry, allowing ideas to move seamlessly back and forth between the marketplace and the laboratory bench;
— a global-focused economy, drawing on the best sources of people, knowledge, capital and markets;
— a constant supply of talented graduates and highly skilled people;
— an internationally competitive risk-financing system, encouraging the emergence of new ideas through the building of strong companies;
— an up-to-date, internationally compatible regulatory system, protecting public safety and the environment while ensuring trade and investment.

According to Carty, the first step in realizing such a system is a fundamental change in attitude.

"All of us, whether we are engaged in firms, learning institutions, markets, networks or government, have to realize that commercialization is about markets and customers."

He insisted that government does have a key role to play in fostering such a change in outlook, through market-driven initiatives enabling innovative firms to grow as viable businesses. More specifically, he pointed to these steps which could be taken:
— moving beyond subsidies for new technology development; instead, government would provide incentives to stimulate private sector investment and eliminate disincentives to investment and growth;
— building on current efforts to supply the workforce with highly qualified scientists and engineers, but also the managers and business leaders who know how to turn new ideas into commercially successful products;
— evolving policies away from principles of lowest cost-based purchasing and risk avoidance; instead, government could promote early adoption incentives, procurement, and shared risk management.

"Let me stress that what is not required is another centralized big government program," he said, describing these efforts as a series of cohesive activities carried out by all the interested parties. "Our rule of thumb should be to build on our strengths, to invest strategically in initiatives that will deliver real value to Canada, and to use partnerships to make the most effective use of our resources and energies."

Some steps have already been taken in this direction, as Carty explained. In the federal budget last March, the Business Development Bank of Canada announced $270 million for risk financing — $100 million for a fund of funds, $150 million for direct investments, and $20 million through the Farm Credit program. In a report published in July, the Prime Minister's Advisory Council on Science and Technology recommended investing the $100 million fund of funds in 2004, specifically in seed and pre-seed innovation. This amount would then be increased by $140 million in the 2005 budget , with another $65 million for training and mentoring.

"In total, these investments are expected to generate $ 1 billion in new venture capital," he said.

That budget also assigned $5 million annually to the National Research Council's Industrial Research Assistance Program, which strengthens the innovation capacity of smaller businesses and ensures their potential to grow into larger, more viable enterprises. Two new funds, of $50 million and $25 million, have also been created to improve the commercialization capacity of universities, hospitals and federal science-based departments and agencies.

The External Advisory Committee on Smart Regulation has reported on how to bring Canada's regulatory system up to international standards. At the same time, a private sector Task Force on Early Stage financing is offering federal and provincial officials its own recommendations on how to improve the risk-financing ecosystem in Canada. These recommendations include harmonizing scientific research and experimental development rules, using tax credits to entice angel investors to become mentors, simplifying "Qualified Limited Partnership" rules to

encourage pension fund participation, and clarifying Federal Income Tax Act provisions that discourage foreign investment.

Carty concluded with five key points to summarize his perspective on commercialization:
— the commercialization process is market-driven; technology pull from firms and the market is more important than technology push from labs, but both are needed.
— it is crucial to build a dynamic and productive interface between these two groups through collaboration and partnerships;
— we are not looking for a single commercialization program, but rather a comprehensive series of solutions that will improve the entire system;
— these solutions need to be coordinated, coherent and kept relevant to Canada's changing needs;
— we need to build on our strengths and invest strategically in areas of discovery and activities that will deliver real value to Canada.

"I am aware of the growing expectation and anxiousness on the part of both industry and the scientific community around the issue of commercialization," he said, noting that initial progress would likely be incremental. He suggested that the 2005 budget would represent a move forward, but there are many other matters competing for the government's attention and resources.

"I see the need for a measured and staged plan that will build on improvements, correct market failures and adjust to new emerging realities in the market and among Canadian firms," he said. "We have to recognize that playing at the top of our game all the time will not always be easy – nor will it necessarily be comfortable. However, Canada's future prosperity and quality of life will depend on our willingness to continually challenge ourselves and to innovate."

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Panel discussion: "The role of universities in supporting successful commercialization"
Panelist: Lorne Babiuk, Director, Vaccine and Infectious Disease Organization (VIDO)
Panelist: Hany Moustapha, Manager Technology Development, Pratt & Whitney Canada
Panelist: Howard Alper, Vice-Rector, Research, University of Ottawa
Moderator: David Brener, Director of Research Translation Programs, CIHR

When asked about whether the role of a university in commercialization was that of a contracting organization, rather than a more comprehensive collaborator, Babiuk responded that this approach does not represent the best use of resources available through such an institution.

Moustapha suggested that the prospect of contracting would vary from sector to sector, as well as project to project. He pointed out that research conducted by the aerospace industry is generally a matter of making incremental improvements to existing technology, rather than more sweeping, fundamental investigation. Nevertheless, university researchers have played a part in the success enjoyed by this industry.

“We are almost like the jewel of industries in Canada, by market share, by commercialization,” he said. “The input of universities went into all those products, be it an engine, or an aircraft or a simulator.”

Alper noted that he has collaborated with companies in five countries, as well as conducting a formal study in the UK on why universities and industry collaborate. Such ventures are not necessarily premised on technology, but on the training and education of highly qualified individuals, who may eventually end up working for an industry partner.

With respect to technology, he added, industry may have two motivations for working with a university: an offensive strategy and a defensive strategy. The former amounts to the creation of new products, while the latter is a matter of helping a company retain its capabilities by protecting proprietary resources. Both approaches may be inspired by specialized facilities that are only to be found on a university campus. He offered the example of his own campus, the University of Ottawa, where there is a significant concentration of highly skilled people in the field of catalysis, along with state-of-the-art high-throughput chemical equipment, which has captured the attention of many manufacturers.

Brener asked the panelists how to strike the right balance between idea “pushers” from universities and technology “pullers” from industry. Moustapha characterized the challenge as that of incorporating the innovation that thrives on campus, “as long as these things are toward a final product, which will come in as market share.”

Babiuk acknowledged that there will always be distinctions between university and industry, but the two need not become “two solitudes”. Industry has a great deal to gain from their interaction, as he illustrated with a story about a livestock vaccine developed by VIDO that would prevent the occurrence of e.coli bacteria in meat. When such a vaccine was being developed, industrial observers maintained there was no market for it, because it did not solve a problem that was costing them any money, nor would it increase their current revenues. However, regulatory agencies welcomed it, and food marketers could envision making certification of such vaccination a condition for the sale of any meat.

“So I don’t think we should say that industry knows exactly what needs to be marketed or that universities don’t know,” he said. “I think it’s communication between all those and understanding of each of their needs that’s going to ensure appropriate commercialization.”

Alper further insisted that the notion of “two solitudes” is an absolute myth. He recounted how his students could spend a matter of months working for a company, while those same companies might send their own people to work in a university lab for weeks on end. “It’s a partnership, it’s working together, it’s a team, and as a consequence of that, one can achieve remarkable success,” he said. “I have to tell you bluntly that I wouldn’t be where I am today if it wasn’t for the input from industry.”

And he added that industries in other parts of the world often do a better job of fostering such partnerships, something he has learned through his own international collaborations. “In some

industrial sectors in Canada it works just as well or better than in other countries in the world, but in some sectors we're way behind."

Brener posed a Technology Readiness Level scale used by Pratt & Whitney, which begins with "research" and heads toward "development", asking panelists if this conception is a useful way of addressing commercialization. They each confirmed that such an approach is widely used, but perhaps applied differently in different fields. Moustapha argued that universities did best at precompetitive, basic research, while government labs were better suited to work that is further along the path to development into products; and the company itself must tackle the final stages of that development, since much of the work would be very specific and proprietary in nature.

At the same time, Alper cautioned against packaging research too definitively in this fashion. He cited the case of a company that ran into technical barriers while trying to commercialize some technology, but rather than shut down the project, offered it up to a university in order to pursue some necessary basic research. The outcome included publications in top journals in the field, as well as the completion of the commercialization process and a great deal of profit for the company.

"That 'basic' doesn't mean it's only involved in the beginning," concluded Alper. "It can be involved much later on in the process."

Babiuk agreed, recounting his own varied experience with the commercialization process, which yields basic as well as applied knowledge. And he has seen students who took part in such projects become valued employees of the industrial partners, who required the understanding these individuals had of the forthcoming new products.

"There isn't one way of commercializing, and we all have a role to play," he said. "And one role is not more important than another."

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Panel discussion: "The role of governments"
Panelist: Gilbert Drouin, President, Valorisation Recherche Québec
Panelist: David Fransen, ADM, Policy, Industry Canada
Panelist: Andrew Woodsworth, Vice-President (Acting), Research (Life Sciences and Information Technology), NRC
Moderator: Jeffrey Parker, Canadian Consul General, Seattle, Washington

Woodsworth began by suggesting that Canadian governments have pursued policies of commercialization for decades, though perhaps they were referred to as "helping business" or something similar. By way of example he offered the National Research Council's Industrial Research Assistance Program, as well as collaborative work and licensing agreements conducted through the NRC itself. More recent undertakings have included cluster strategies in key technology sectors, the major example being biotechnology in Montreal, as well as public/private partnerships aimed at founding even more sophisticated research enterprises.

Fransen referred to a well known speech given by then-Finance Minister Paul Martin to the Montreal Board of Trade, where he asked if the federal government was maximizing the return on its considerable investment in research and development. Fransen then noted that this investment represents some 155 programs promoting commercialization, worth about $1.5 billion, to which can be added to another $1.5 billion of indirect spending on R&D activities. He later recalled the even larger amounts mentioned in Arthur Carty's luncheon speech.

"Are we foolish enough to believe that $13 billion worth of public investment should be returned on a dollar for dollar basis?" he asked. "I don't think so. But how do you make that assessment?"

In light of this significant stake, then, he suggested that the question of return is an interesting one that calls for an assessment of increases in intellectual capital, human capital, risk capital, and whether the resulting market is as competitive as it should be. In light of the redundancy, overlap and daunting array of government programs, he noted, perhaps the most appropriate way forward would be looking at ways of helping the country's entrepreneurs simply navigate through this complex maze.

"We have to make things simpler and make things much more user friendly, and I'm not sure that we're heading in the right direction," said Parker. "We're going to have to be far more effective and far more efficient in being able to reach out and provide the kind of information and the kind of guidance that will make an entrepreneur's life a whole lot easier than it is now."

Drouin agreed, stating that government guidelines can easily isolate one program from another, so that participants have trouble seeing the path they must follow as their commercialization activities proceed. He explained that Valorisation Research Quebec was created following a study by the Montreal Stock Exchange that looked into what was needed to improve commercialization in that province. Operating at arm's length from government, the organization has created four university-owned corporations to manage seed funding for commercial development.

He noted that this strategy was successfully encouraging companies to take a closer look at research going on in the province's universities, determining what technologies exist there and how they could be packaged to attract investment capital. Woodsworth described Quebec's approach as well advanced, comparing it with initiatives such as the Markham Synergy Centre, which attempts to focus support based on the stated needs of entrepreneurs in the densely populated Toronto market. In each case, the goal is not one of dictating a commercialization process to these entrepreneurs, but developing a process that everyone agrees on.

Government can help emerging companies acquire the skills and resources necessary for them to succeed, Woodsworth insisted, but the process need not be restricted to government. Fransen cited the major challenge posed in "growing" an enterprise beyond a modest start-up size, a challenge that often boils down to a demand for specific skills of one sort or another. The people possessing those skills will increasingly come from outside Canada, making it imperative that the country position itself to attract them here. For Fransen, that objective means ensuring that

Canadian enterprises meet the rigorous standards of global competition.

“There’s a certain amount of collaboration and coordination that’s required here,” he said. “But in the end what you’re trying to do to be really successful, for there to be real excellence in this country, there’s got to be outright competition.”

Questions afterward underlined this same point with respect to government regulations, prompting Fransen to add that anything that the more that could be done to open up Canada to the world — such as reviewing limits on foreign investment — the better. “One of the most important things you can do is eliminate barriers to trade, barriers to investment, and make it as open a marketplace as you possibly can.”

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Wrap-up

Panelist: David Crane, Columnist, Toronto Star
Panelist: Brian Guthrie, Director, Innovation and Knowledge Management, Conference Board of Canada
Panelist: Claire Morris, President & CEO, AUCC
Moderator: Bob de Wit, Director of Licensing, Flintbox

Guthrie began with an overall observation that the conference participants had demonstrated a eager willingness to seek a strategy for moving Canada forward in its efforts to commercialize technology. That willingness should now begin to manifest itself through the leadership necessary to act upon such a strategy.

“We’re ripe for a national vision,” he said. “This is more than just platitudes and nice discussion about how to do things. It’s about more than just doing things right, it’s about doing the right things. It’s about choosing, picking, and finding Canadian niches. That comes quickly to allocation of resources, to which big science projects we want to get involved with, to where the PM spends his or her time, to choosing programs that we might want to dismantle, regulations that we might want to dismantle.”

Morris expressed her own observations of this same energy and excitement, as well as the inspiring example provided by Kilcrease’s account of the transformation of Austin.

Crane, for his part, suggested that the day’s activities did not answer the difficult question of whether we are getting adequate return on our investment in R&D. As we come to terms with the overall place Canada occupies in the dynamic global economy, debating this question will become all the more important. And the result would be all the more meaningful if the call for a debate on industrial strategy came from representatives of industry, demanding that government take on this issue.

In this respect, Morris noted, Lazaridis’ keynote presentation put forth the crucial point to be

considered in such a strategy.

“Commercializations depends first and foremost on having the outstanding researchers and the outstanding students that can then go out in the world and create innovation,” she said. “When we look at the investments that other countries are making and are making in very significant sums, we know that it won’t take long to be outpaced completely.”

Guthrie also reiterated Lazaridis’ call to let universities get on with their original mandate, rather than assigning them a very different mandate revolving around commercialization.

“The university doesn’t produce businesses, it doesn’t produce products, it produces knowledge,” he said. “Let’s leave it there, let’s not try to turn scientists into business people. Business has a role, universities have a role, they can work together very very well. Let’s be clear about the roles.”

Some of those roles have been defined by the discussion surrounding the relative importance of technology push versus market pull. Guthrie insisted that companies actively pursuing commercialization will concede that both factors are essential for success. But Crane argued that the distinction between these two factors can lead to a misleading perception that universities should take on the primary responsibility for commercialization. The ultimate danger, he adds, is a misallocation of valuable resources.

He added that government policy can help many firms through the difficult stages of early design and proof of concept for innovative technologies, using initiatives such as procurement programs to provide such firms with a ready market of first customers. Nevertheless, the US government does even more, sponsoring a formal competition for small companies to offer their solutions to problems presented by the various government departments themselves. And if government could be doing more to help these fledgling enterprises, argued Crane, so too could more established enterprises.

“One of the things we didn’t hear today was how much companies themselves are doing to help the innovation process along in this country, by strengthening their supply networks, by investing in small start-ups, and doing things like that on their own initiative,” he said.

Subsequent comments from the conference participants made similar points, including the importance of appreciating the potential contribution of business students to the success of commercialization, rather than just the contribution of engineers. Guthrie extended this observation to include the hard-won expertise that already exists in the business community. Rather than focusing exclusively on the transfer of technology to start-up enterprises, established ones might be able to do just as much, if not more. “There’s mature firms out there who have business skills,” he said. “Why aren’t we using them?”

Another comment brought up the underestimated value of cluster dynamics, especially organizations that can cultivate social capital and trust between various groups in areas where innovation is being promoted. Such organizations already exist in Calgary, Waterloo, Ottawa,

forging linkages that might be hard to establish in any other way.

Morris responded that she recently witnessed just these sorts of linkages in Saskatoon, where she attended the opening of Canada's first synchrotron. This major scientific installation stemmed from a remarkable coalition of several levels of government, universities and companies, forming an awareness of the project so sweeping that her cab drivers could tell her about its economic impact on the region. "The ownership in the community was palpable," she said.

When the panelists were asked by an expatriate American why Canadian enterprises cannot seem to find the same venture capital as they could in the United States, Crane observed that this country lacks the same base of industrial interests large enough to acquire an interest in those enterprises. Instead, even the most promising prospects can languish in the "valley of death".

"If we're not able to test out these ideas and pluck those that have value out of that process, we're going to lose out on a lot of opportunities in this country," he said. "Our big challenge in Canada is to create a next generation of companies with the scale and scope for international competition. And we're not going to do that if every time a company reaches a certain size, its only option is to be sold to somebody in another country."

And despite calls by entrepreneurs to be "left alone", added Crane, government has a role to play in solving this problem. In highly competitive sectors such as the automotive, aerospace, or life sciences industries, many people expect governments to come up with transparent solutions. Politically, however, it will be even more important to move from a "zero sum" mentality to a "positive sum" mentality.

"We have this attitude through all parts of the country that anything good that happens in one part somehow has to be at the expense of the other parts," concluded Crane. "As opposed to a recognition that anything that happens that's good in any part of the country actually benefits the entire country."

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Final word
Ron Freedman, co-publisher, RE$EARCH MONEY

Freedman began by admitting how remarkable it was to learn that Canada has 155 publicly funded innovation programs worth upward of $1.5 billion.

"I saw it as being akin to having 155 car parts, but the problem is at the end of the day we don't have a car," he said. "Our challenge in the commercialization game is to turn these car parts into a working car."

He added that it is equally remarkable that members of the business community remain largely unaware of what government is doing, though there are some outstanding successes to be found.

"We have really a lot of world-leading examples of technology commercialization — things that we've done before anyone else and done better than anyone else," he said, referring to initiatives such as the National Research Council's Industrial Research Assistance Program, Precarn, and provincial as well as federal networks of centres of excellence. "We have done a lot of things right in Canada; the problem is we still have not found a way of packaging the whole thing."

He noted that as part of a project reviewing how many companies in Canada actually do research, he has learned that although the period from 1994 to 2000 saw new technology adopted with unprecedented speed and scope, the number of Canadian companies doing research actually went down at the same time. Only in Quebec did that number go up, because that province had mounted a slate of programs to promote research and development. What existed there was political will, a government committed to innovation.

"We need some political leadership in these areas," concluded Freedman. "Our political leaders are fixated on how are we going to divide the pie, how are we going to spend it. But nobody is asking the question of where is the pie going to come from in the future."