Restoring Our Economy: Great Expectations for R&D

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Anticipating recovery from this recession, Canadian leaders are seeking ways to support research and innovation that will lift Canada's rank in world trade as our economy improves.

Our present outlook worries informed leaders. Here is Bell Business Markets' president, Stéphane Boisvert, in a speech prepared for the Telecom Summit (June, 2009): "The greatest test of our leadership is how successful we are at promoting technology advancement for enterprise… Technology is a strong and durable guarantee of Canada's long-term prosperity… So when this conference talks about 'Embracing Transformation'… it's about our national prosperity and our international competitiveness.

"Economists predict that innovation is going to be more important than ever to continued economic and competitive success…" In that respect "the U.S. ranks number one in the world. We're number eight."

Boisvert's office updated me later. In September, Canada ranked 15th. By October 2nd, delegates to IBM Canada's Science and Innovation Summit were challenging that figure as optimistic.

Our present mixture of policies supporting R&D is unfit for purpose. Canada needs more comprehensive support and funding policies.

"I've been doing R&D in Canada for over 25 years," says Gino Palumbo, President and CEO of Integran Technologies Inc. Integran, which won the Royal Bank Innovative Business of the Year Award in 2007, produces high performance nanocrystalline metals for industry, aerospace, defence and transportation parts. "The big promise is that R&D really will lead to new products and technologies." Unfortunately, "We appreciate the support we've received in Canada, but over the years Integran's had much more support from the U.S. Department of Defense – and it's hard for Americans to go outside their jurisdiction. Even so, it's quicker and easier, very focused, with more dollars available." Recently, a consortium from the European Community approached Palumbo, easily obtaining EC matching funds "to adapt our technology."

By contrast, "Canada's scientific tax credit program actually excludes items necessary to market a product: for example, you can't claim costs relating to patenting technology or business development central to bringing your product to market.

"I'd like to hire more graduates and expand faster here in Canada," Palumbo adds, "but we can't get the support we need, so most of our expansion is currently in the US."

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"THE CONCEPT OF R&D AS A CATALYST for recovery and growth has gone in and out of favour since the Second World War," says Steven Liss, Associate VP for Research at the University of Guelph. "Our private sector supplies 50 to 60 percent of R&D funding, but it comes from a few large companies." The decline of Nortel – Canada's R&D funding leader for more than a decade – will precipitate changing sources for investment dollars. "The question is: Can investment move small and medium enterprises? We will see more emphasis on what happens in S&MEs, getting them to recognize the value their R&D can have in building relationships with universities and vice-versa.

"Guelph's history of achievement ranks it among global leaders in food, agriculture, environment, animal health and life sciences. That didn't happen overnight. I'm concerned that R&D funding pressures will demand short term returns and fast gains. How will this affect longer research cycles?"

"We've been thinking acutely about the economic and recovery roles of research," says Rob Steiner, Assistant VP Strategic Communications at the University of Toronto. "We publish more peer-reviewed research than any other university except Harvard and the University of Tokyo. We are figuring out optimal use and the strongest structures with the MaRS innovation centre.

"We want more commercialization, more industry partnerships, but we must ensure our commercialization model supports real success."

"Commercialization *per se* is not the name of the game," Peter J. M. Nicholson, CEO of the Council of Canadian Academies, told the IBM Summit. "Mike Lazaridis licensed just two technologies for RIM in twenty years, but he hired 5,000 students. It's the brains that attract a virtuous circle."

Research in Motion's model suggests a key interface between business and universities. RIM's Tenille Kennedy enlarged this point: "Michael founded RIM as a co-op student at the University of Waterloo, alternating four-month cycles of school and work. RIM has always employed co-op students. [Michael] understands how important they are to a company. We take 2,000 each year."

"Our economy is evolving to let universities and businesses work well and work together," says Steiner. "What has to change is the interface between industry and universities, without distracting what a university should be."

"Research is a major priority at McMaster," says Mo Elbestawi, McMaster's VP Research and International Affairs. But, "McMaster, a university with a global reputation, also helps regional economic development…. Taxpayers demand accountability for their investment. Creating wealth and new jobs, high-paying jobs: This is part of the university's future role, being socially responsive and progressive."

The Université de Montréal, with affiliated hospitals, institutes, HEC Montréal Business School and École Polytechnique, represent $400 million research annually. "All these people generate research and innovations!" Gilles Noel is director of technology transfer at the university; Marc Leroux, managing director of Univalor, the commercial arm of the university and its schools.

They agree that "Developing a commercially appetizing technology can take up to six years; these are the ones that can lead to licensing. We have 200 projects in the works, and about 60 licences. When we get a good prospect, we search through thousands of companies worldwide." Leroux and Noel stress that Univalor works in a pull mode, not push. "We engage industry at a very early stage and we keep engaging it!"

Still, universities face a stiff challenge. Jai Menon, an IBM Fellow whose job titles include "VP and Global Leader of University Programs," reports that IBM asked 765 CEOs and public sector leaders "who they relied on most for their innovative ideas." Employees came first; business partners, second; customers, third. Universities as sources for innovation came ninth.

DIFFERENT SECTORS, DIFFERENT PROSPECTS: Pfizer Canada's president, Paul Lévesque, asked the Canadian Club of Montreal, "How can a major research-intense industry continue creating wealth and innovation during a 'perfect storm'?" Lévesque listed factors confronting his company and 'big pharma': a 25% drop in revenues as patents expire; a "difficult, costly" transition into researching new biologic medicines and gene-based therapies; intense competition for investors and from global manufacturers and – "The whole world wants in on life sciences." Then came Canada's attitude to innovation: "Our health system is fighting it."

Pharmaceutical companies invest "more than one billion dollars in Canada each year." Any reduction would hit biotech firms and academia.

Lévesque finds hope in the first report by Canada's Science, Technology and Innovation Council (May, 2009). He quotes Council member Heather Munroe-Blum, McGill's principal: "We need to work together to nurture the capacity to create, apply new ideas and finance their translation into commercial success in the global marketplace."

In the I.T. sector, "Companies are under pressure to do more," says Ericsson Canada's Chief Technology Officer, Dragan Neradzic. "Our solutions must give customers more efficiencies and more capabilities at stable prices. That drives our R&D spending which increases our market share, so we can maintain R&D at higher levels. Products become more efficient and effective, making a virtuous circle."

(My prediction: The next economic recovery will replay the 1990s, when businesses adopted technology rapidly, boosting productivity while restraining costs.)

Neradzic reports rapidly rising volumes of digital data. "We must make sure our customers' investments in I.T. don't rise along that same line as data growth," he says. "Our products must give customers exponential growth efficiency at a stable business cost despite the fact that their traffic is growing."

TELUS spent 147% more on research in 2008 than in 2007. "Telecom may be the most competitive industry on the planet," says TELUS's Jim Johannsson. "We're ensuring we remain on the leading edge of technological innovation, which feeds our success as a business. Products improve every quarter, creating incremental demands on networks to provide service. Our big research increase is about preparing our Next Generation wireless network for launch in 2010. Pushing limits drives R&D investment as well."

"Does the improvement in technology reflect increased employment?" I ask.

"In the first place it reflects productivity. Any industry can now handle at least five times more data per day than 25 years ago." TELUS itself has taken on 10,000 employees in nine years.

For EnCana, the industry leader in extracting 'unconventional' natural gas, R&D brings extensive new leverage. "It's now economically feasible to extract new gas from old holes with new technology," says EnCana's Rhona Delfrari. "We can *now* say we have enough natural gas in North America to last more than a hundred years." R&D made that possible. One expectation is a more predictable energy supply in which businesses can locate, plan expansion, and generate jobs.

We have many success stories. In national terms, just not enough!

FUTURES, TAKING SHAPE: Stan Shapson, VP Research and Innovation, has watched York University grow from farmland – albeit near IBM Canada and sanofi pasteur. The Markham cluster supports more than 40% of medical devices companies. "When new companies need access to ideas and infrastructure, we do that at York. When they need entrepreneurship, we involve students from the Schulich School of Business. Working across sectors, small and large companies, universities and business schools, research and business, that's our model. It's a powerful delivery of research for the new economy."

Close to York University sits sanofi pasteur, the largest company in the world devoted entirely to human vaccines. Its president, J. Mark Lievonen, remarks, "We started laying the groundwork for future growth in 2000, with our first new building in 25 years." He adds, "We've spent over $350 million in capital investments since.

"In this economy people are moving away from manufacturing. We are expanding manufacturing. These are high-tech jobs, high-tech manufacturing. The vaccine business is globally competitive. If you're not among the best in the world the work won't be done here." Lievonen continues, "We are building on our successes and strengths to become a growth site and a centre of excellence for biopharma-ceutical research and development and manufacturing."

IBM Canada's Public Sector Team is also bullish in forecasting I.T. applications. Like Ericsson's Neradzic, IBM's Don Aldridge predicts, "The next layer of technology will generate massive amounts of 'streaming' data" (data analyzed on the fly, not stored). Never mind economic *recovery*. With IBM the fifth largest corporate R&D spender in Canada, Aldridge boasts technology-based *revolutions* in many fields. But he detects a challenge: "Can we train enough people to carry this into future years?"

"Training must extend to technology transfer administrators," says John Hepburn, VP Research and International at the University of British Columbia's industry liaison office (ILO). "We must build up administrative expertise commensurate with our research expertise. If you develop a drug and it doesn't get commercialized, you might as well not have developed it!"

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At the University of Saskatchewan, the provincial government challenged Glen Schuler's ILO to show benefit from licensing products to companies outside Saskatchewan. Schuler reports: "We were able to show that licence revenue returning to the province brought additional research dollars – and helped starting companies here. We can show $4 in economic value created for every dollar a government agency put in our ILO."

"WEEK AFTER WEEK, HEADLINES in this newspaper raise unsettling questions about Canada's international competitiveness," University of Toronto President David Naylor wrote in the Globe and Mail (July 24, 2008) after returning from fact-finding in Israel with the presidents of UBC and the Canada Foundation for Innovation. Seeking an R&D star in the east, the three presidents discovered how Israel had "flipped its economy" from 70% agricultural in the 1950s to one of high-tech exports from home-grown research. Naylor wrote: "First, Israel's research institutions, government, industries and venture capital sector collaborate to nurture innovation." Second, its research institutes "share 50 per cent of revenues with researchers and students." Third, Israeli researchers are "heavily rewarded for innovation, but seldom asked to change hats and help run companies." And, "Fourth, Israelis recognize that the private sector does commercialization, not universities or governments."

Yes, commercialization belongs in the private sector, says Vicky Sharpe, President and CEO of Sustainable Development Technology Canada (SDTC). "Getting an idea to market requires an ecosystem of innovation and financing specialists. New companies must scale fast to the point of making revenue that attracts capital from the global market. Players must see an improved appetite for risk linked to reward, ensuring that good ideas move to market." Among other roles, Sharpe sees SDTC's mission as "bridging the pre-commercial funding gap." Finding private sector investors demands "extremely extensive due diligence.

"Of the 171 projects we have, 31 companies have attracted money that goes straight to moving them to market. Public investment by SDTC into these 31 companies has been "some $80 million. Follow-on private sector funding has been $902 million, forty percent from offshore. We are attracting foreign capital into Canada for wealth and job creation."

Sharpe believes that university tech-transfer offices should involve the business "ecosystem" sooner and more thoroughly. "When you accept a technology you have to scale it up to prove it. We try to fund a demonstration – it's expensive – hosted by the first user of that technology. That gets us real life performance by a first adopter. The risk to others is minimal, because we tested it."

WHERE SHOULD CANADA GO FROM HERE? In the first place, to a total bottom-to-top analysis of research grants and tax credit program effectiveness, followed by broad-spectrum repair. Speakers at conference after conference make cogent arguments for reforming the existing structure. Even mature companies with managers experienced in research *and* administration – i.e. Integran Technologies – can't make the system work.

What would work better? Ron Freedman, the CEO of RE$EARCH Infosource Inc., suggested a model (Toronto Star, August 26): shifting resources to companies "that have identified a market opportunity and need help to pay universities to develop their ideas"; that gives intellectual property rights to companies performing government research; that consolidates "the alphabet soup of federal and provincial funding programs" – while allowing patent and marketing costs; and, that substitute "business engagement strategies" for "commercialization strategies." Such a program would be easier to create and finesse if Canada had a national software strategy, Freedman argues.

Meanwhile, IBM's global survey suggests that, when "CEOs and public sector leaders" consult "top sources of new ideas and innovation," input from universities ranks ninth. Jeffrey Crelinsten, President of The Impact Group, responds: "Our universities and policy makers still intone the mantra 'Ideas to Market,' believing that industry thrives on ideas emerging from universities." It doesn't.

Jai Menon remarked: "IBM changed its internal culture from one where researchers advanced based on the number of peer-reviewed publications they wrote, to the present system which rewards them for the number of research ideas and projects that lead to customer sales. That full intellectual transition took ten years."

"Few universities have set up merit and promotion pathways for researchers working with industry," Crelinsten writes. "I'm not advocating that professors who excel in fundamental research be penalized. We need high-performance researchers on the leading edges of their disciplines to attract other professors and top students. What we also desperately need is top performers in applied research, entrepreneurial learning and support of commerce and wealth creation."

What Canada needs even more is a massive R&D policy fix. That's the groundwork. The economic recovery component will follow.