

R&D and Innovation: Forging the Way Ahead



Robert Fripp
Senior Associate
The Impact Group

LAST YEAR IN THIS SPACE I WROTE about *Restoring Our Economy: Great Expectations for R&D*. A year later, R&D thrives and delivers in many fields. Trouble is, poor international rankings eclipse too many Canadian innovation success stories. For example, regarding innovation the Conference Board of Canada reports: "Canada receives a 'D' grade and ranks 14th out of 17 countries. The Canadian economy remains a below-average performer on its capacity to innovate." Fortunately, many organizations regard negative news as a spur, forging ahead, riding innovation to success, hauling the country along. That's our story here.

Optimistic Signs

"A step forward for science – a step back for Britain's science sector. Cambridge team reveals potential breakthrough for brain-damaged patients – but lack of funding means [the researchers are] moving to Canada." That story in Britain's *Independent* newspaper (September 21, 2010) stated that as many as seven Cambridge researchers may move to the University of Western Ontario. Principal investigator Dr. Adrian Owen calls this a case of "pull, not push." The Canada Excellence Research Chair program aided Owen's move with \$10m worth of "pull."

From medical research to industry: Good news from resurgent Linamar Corporation. Canada's second largest auto parts maker has carved a share in many precision

engineering fields. In 2010, Linamar returned to profitability (\$21 million in the first quarter) after the collapse of the auto sector. CEO Linda Hasenfratz says, "Back from the depths! We have a solid three-part strategy in place around diversifying our business ... globalising, focusing on green technology, tapping into opportunistic markets – powertrains, energy, heavy machining..." while striving for "best fuel efficiency and lowest emissions... We are scaling up vehicle gears, shafts and housings into parts for wind turbines. Electric vehicles! We will be well positioned for vehicles of the future. That's our three-part innovation strategy: Globalize, diversify, go green!" Even so, "To become a \$10 billion company by 2020, our top need is people-development: attracting, retaining, developing and motivating people... We need lots more. We're working with education establishments at all levels."

Industry Meets Education

Looking at "working with education establishments" from the other end, Lakehead University's V.P. of Research, Professor Rui Wang, stresses the need for regional universities to reach out to their local communities and companies. Lakehead has one of four full natural resource and management faculties in Canada, its emphasis on forestry extending to biomass management. When the provincial government closed its coal-fired power plant, the town of Atikokan (pop. 5,000) looked "ready to die," says Wang. The Ministry of Natural Resources enlisted the faculty's help. After a two-year study, Atikokan's plant came back on line, burning wood-waste biomass with "a combustion efficiency of wood at almost 100 percent," Wang adds. "Two years after receiving funding of \$3.8 million, the project returned \$7.5 million. Lakehead has trained 73 students and other specialists to fill the new jobs." Atikokan's web site boasts: "Atikokan is quickly becoming a model town for regeneration."

David Johnston, the former president of Waterloo, would applaud

Lakehead's policies: "Look to your local strengths. Develop your academic strengths around those strengths – like Sudbury for mining engineering; like Victoria and Dalhousie for some of the best marine biology in the world." Johnston relates the story of Ira Needles, who was the CEO of BF Goodrich in 1956. Needles pushed this idea in a speech: "Here's a manufacturing community [Waterloo] that doesn't have an engineering school. Let's start one!"

"Since its early days," Johnston went on, "Waterloo has chosen to specialize, doing just a few things but doing them well. Hence our focus on science, engineering and

"INNOVATION. You can't schedule it, though many have tried, including Novelis. It generally defies the myriad structures devised to corral it... What you can do, and what Novelis has done successfully, is to create an environment that enables – key word, enables – all the aspects of the company to come together in customer-focused teams to solve problems with innovation..."

Charles Belbin, *Harnessing the Elusive Power of Innovation*
© Novelis Inc. 2010

computer science. Today, we have the largest faculty of engineering and computer science, by numbers, in the world, and the largest faculty of engineering in Canada.

"Growing, Waterloo made policy choices. First, 60 percent of our students alternate academic courses with employment and all our engineers do that. Blending theory and practice helps implement technology transfer and make contact with commercial companies.

"Our intellectual property policy is also unusual. We help creators commercialize their IP, but Waterloo takes no ownership. It's complicated enough to transfer technology. The fewer steps, the better. So Waterloo concentrates on serving as the marriage-broker but not being part of the party."

He continued, "We used to think of science development flowing one way, from theory to experiment to prototype to early commercial product. We increasingly see a two-way street where applications inform the experiment and experiment informs the theory. That two-way street will

power the next decade, accentuating the need for talented people, of whom Canada is short."

Johnston cites an example. "The Premier came here. He approved \$50 million invested in the Institute of Quantum Computing at Waterloo; and before that, in the Perimeter Institute of Theoretical Physics. He looked at RIM, at DALSA (specialized imaging devices), at Open Text and at other companies occupying 28 buildings. Then he said: 'I understand what you mean about *continuum* here: Perimeter does the theory; Quantum Computing does the experiments; and the applications come from RIM, from Open Text, and companies like them.'"

Bits and Bytes: Bulky Possibilities

"The good news for science is that everything is getting bigger, better, faster, cheaper," says Don Aldridge, General Manager Research & Life Sciences at IBM Canada. "Processing will not be the issue. The issue is: How do we curate data, filter it, use it, transport it – and *store* it? Big science presents emerging challenges." Might the next trend be: Do we keep data or dump it? "Exactly," Aldridge agrees. "That's the concept underlying data streaming, which says: process it, use it, then save it – or not."

The trend to massive data files is everywhere. The Artemis Project captures and analyzes large amounts of data from babies in the neo-natal care unit at Toronto's Hospital for Sick Children. "It's a relatively low data flow compared to some things, but still beyond what humans can ingest without computational processing. The Artemis system can warn about certain conditions at least 24 hours earlier than trained nurses."

Imagine a future in which computing opportunities extend over all hori-

zons. "We need people with a broad set of skills, experts in public policy with an appreciation of what the technology can do, to fully grasp the opportunities. That's our main need," says Aldridge: "People with skills in science, math *and* the humanities."

Loosening the Oil Tap

"I often refer to Cenovus as a technology company with oil and gas assets," CEO Brian Ferguson told the *Edmonton Journal* (June 17, 2010). Innovation significantly benefits resource industries. Harbir Chhina, Executive V.P. of technology development and reverse engineering at Cenovus Energy, adds: "Our policy is: work on about fifty innovation projects annually, develop those that work, and implement one each year.

One major innovation is recently patented "wedge well" technology, by which Cenovus drills a horizontal well between pairs of existing vertical wells to extract the wedge of bitumen trapped between them. *The Canadian Mining Journal* (April, 2010) applauded this accomplishment with the headline, "Well done!"

Other innovations include fibre optics underground, and electric submersible pumps. "Six years ago, no pump in the world could work at our production rate in an environment of more than 180°C. Through collaboration we now have pumps that can work at 210°C. We think we can go higher" – yielding correspondingly greater production. The list of Cenovus's innovations is too long to fit here.

"The next [innovation] to roll out is low-pressure steam-assisted gravity drainage," says Chhina. "Our intention: to operate at lower temperatures and pressures, lower steam ratios, lower water usage and lower emissions." His metrics on the results: "recovery, profit and environmental conservation will all improve by significant numbers."

Metals: Innovating, Going Green

Similar "Green" economies are catching on. ArcelorMittal Dofasco

announced in September that it had completed its \$100 million "product and process innovation upgrades" while increasing capacity for steel production by 20 percent, adding 50 jobs, and achieving "significant energy-efficient gains and environmental improvements." CEO Juergen Schachler hailed "one of the most productive and energy-efficient advanced steel manufacturing plants in the world." The company's several innovations won it the 2010 Dow Jones Sustainability World Index (DJSI World).

From steel to aluminum – specifically Novelis, best known for recycling 35 billion beverage cans each year, including at its Can Facility in Aurora, Ontario. Ontario hosts Novelis's Global Technology Centre at Kingston, too. Company products and processes are myriad, including panels for BMW cars. I remarked to Mike Thomas, Director of Global R&D: "Few companies I come across publish a booklet about innovation for their staff." Restricted to internal distribution, *Harnessing the Elusive Power of Innovation* contains sections such as: "How to avoid killing a big idea," "Role of innovation in 2010 turnaround" and "Making innovation work." Thomas responded, "Our innovation capability is demonstrated by our position in the market – typically the market leader or number two."

Quantum Valley: Coming Soon

David Johnston, now Canada's Governor General, expects in ten years we might be calling the Technology Triangle around Waterloo University, "Quantum Valley." Johnston talks about Ray Laflamme, his quantum computer, and the Institute for Quantum Computing at Waterloo.

So let's ease up on the gloom! Government agencies, universities and businesses are taking to heart the seemingly intractable challenges of Canada's innovation performance. Many are working hard – collaborating – to revise and adopt appropriate policies, encouragements, taxes and triage that will make innovation, and Canada, fly.