

Colleges: Hidden Gems of the Innovation Ecosystem



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AS GOVERNMENTS AROUND THE WORLD increasingly turn their attention to the economic returns from public investments in research, policymakers are beginning to recognize the value of colleges beyond their traditional training role. While universities focus on basic research to discover new knowledge, colleges work on applied research problems that are user-centric and often bring immediate benefits to society. The two kinds of institutions are complementary, together helping to prepare Canadians for success in the knowledge economy.

“In the spectrum of R&D, curiosity- and discovery-driven basic research is generally the realm of universities,” explains Nobina Robinson. The CEO of Polytechnics Canada describes the differences and complementarities between universities and colleges, and about the different roles for the research they produce. Downstream from universities, businesses frequently approach colleges to help develop aspects of new or improved products. College faculties and students respond, creating a major route for transferring technology into commercialization. “College-based applied research helps to achieve either new outcomes that bring productivity, competitiveness, new products or commercial benefits.”

The college sector has shifted significantly over the last twenty years. “Colleges tended to be purely training institutions,” says Chris Hawkins, Vice President Research at Yukon College. “Most colleges have moved to an applied role in research because they have strong technology programs – and that’s what small and medium-sized businesses need. No matter what they do, businesses look for technical expertise, hence the changing role of colleges.”

Robinson agrees. “That confirms what has always been in colleges’ DNA: solving industry’s problems.” Colleges are now working way beyond their original mandate: on product development, process-testing models, building prototypes and planning marketing. Or, businesses might ask them: “Could you add two more applications to our I.T. software?”

“Commercialization exposes our students to innovation-literacy and gets them job-ready to apply to the real world what they’ve been learning in college.” Companies benefit from colleges’ enhanced courses and revised vision, while students, led by their faculty, do the last-stage tinkering (late stage commercialization) that leads to commercial release.

Colleges assign many business-based problems to their students and faculty: Prototyping, scaling, avoiding costs incurred by poor production. “Not sexy, not profound,” says Robinson. “We’re not going to win a Nobel Prize,” adds James Watzke, Dean of Research at Humber Institute of Technology & Advanced Learning. He adds, “But someone else might, working with something we helped create!”

While college faculty are not paid to do research, like their university colleagues, their research is an important part of their training mandate. “That we do research for industry is a byproduct of what we do one hundred percent of the time, which is to train,” says Robinson.

The college community as a whole offers a powerful latent tool, “an innovation tool kit that governments could harness for the benefit of businesses.” That has been proposed, but the college community

feels that an ancient, enduring paradigm persists: that governments are trying to enforce university standards on colleges; while colleges feel that they should be “downstream,” because “what we do does not compete with universities.”

Biology applies a term, convergent evolution, when different animals adopt similar characteristics. Convergent evolution may also be true of human societies. Colleges across Canada have adopted similar procedures to deliver applied research to the needs of different regional populations. Here we showcase a selection of colleges, their research and their impact:

Centennial College

“Colleges were mandated to teach, to enhance students’ employability,” says Trish Dryden, Associate V. P. Applied Research. Industry and community partners help us understand what employers need in curricula, applied research and innovation. All along, businesses have come to us, asking for help, for our staff, labs and equipment – although that part of our role has been a hidden gem until recently. In a sense we are almost a finishing school for universities: 48% of our students have under-graduate degrees. They come back to college to get the applied industry-based know how.”

And to get leverage! Centennial partnered with “a very small company” which had an electronic controller for large buildings. It eventually won a “Mind to Market” award from the Ontario Centres of Excellence. “That kind of support is what people need. The impact of college applied research is very powerful,” Dryden adds. The Conference Board of Canada will issue a report soon to tell us just how powerful! Meanwhile, one finding is clear: Industries invest much more with colleges than they do with universities, and the number of students who graduate into employment with industries where they worked as students is very high.

novaNAIT – Centre for Applied Research and Technology Transfer

“ ‘NOVA’ is short for Innovation,” says Executive Director Stuart Cullum. “The traditional role of colleges has long been exceeded. I think we are all proceeding in a similar direction in our approach to innovation.”

“Is novaNAIT business oriented?” I ask. Cullum responds, “More outcomes oriented. We look at what the impacts of research are, or could be, to impact society, to generate commercial products or to assist industry. In a sense we are always looking for the return on investment – not always in a monetary sense. We have an outcomes-based approach to everything we do.”

“There are many opportunities for colleges and technical colleges to add value for SMEs – even for entrepreneurs, the early-stage folks who want to build a company. There are those opportunities where we do feel responsible for ensuring that a business case is solid. SMEs often need more than a technical capacity. They need a business solution as well.”

Cullum mentions that Alberta supplies funding for NOVANAIT to support companies “in terms of their product development requirements. Companies leverage our facilities and faculty (complement: 1,000).”

In terms of outstanding projects, NOVANAIT administers the Boreal Research Institute, which its website describes as “a partnership of the private sector, the education system, and the community.” The Boreal reclamation program serves industries in reclaiming up to 40,000 old oil and gas well sites in the Peace River region. “Shell, and native groups, need us to meet immediate and mid-term requirements for reclamation,” says Cullum. “Here’s a good example of how a college can play a really important role.”

Humber Institute of Technology & Advanced Learning

“College-based, or applied, research

serves the needs of small and medium sized companies,” says James Watzke, Dean of Research. You could argue that colleges’ needs are under-served, but they connect well with SMEs. “At Humber we call it solutions-based research, Research for the real world,” he adds. Applied research at a college is “very much about connecting to a business outside the college who says, ‘I have a problem. Can you help?’”

“Innovation literacy helps college grads get jobs quickly. This has economic implications. We try to train them so they are in a position to innovate. We want them skilled for a quickly changing landscape.” Humber offers 160 programs, each with a program advisory committee of industry personnel. The result, as Watzke puts it, is that “thousands and thousands of industry people are in our minds every day.”

Success stories include expandable musical drums, for professionals; the entrepreneur is exploring agreements with major drum manufacturers. Fig Jam, a snowboard and skateboard clothing retailer, was doing a poor job with e-commerce, so Humber brought it in to work with students on “really interesting” open source technology. There are many success stories. Suffice to say, industries and Humber Institute make good friends.

Saskatchewan Institute of Applied Science and Technology (SIAST)

“We are extending our research capacity through our communities and industry centres – thereby supporting economic development in Saskatchewan.” Cristina Holguin-Pando, Director of Applied Research, can’t wait to advance the cause of applied research. “We support many fields, aligning our agenda with national and provincial research strategies. We focus on four key priority areas.”

Those areas are: urban development; natural resources and environment; health education; information technology and communications – “and of course we support scholarly activities in those areas.”

In partnership with two local industries and supported by NSERC-funding, SIAST’s applied research into waste-water management, led by its chemical technology program, may be incorporated into recycling, purification, and sewage treatment.

Another partnership, this time with SaskEnergy, the Salvation Army and others, called Share the Warmth, helps lower-income families capture energy savings. “It’s a basic, grass-roots type of project. Volunteers survey houses, assessing energy consumption to see what modifications have to be done to optimize energy consumption. It’s one of our proud stories.”

SIAST is also exploring partnerships developing alternative energy, possibly extending wind energy work being done by its Technology Division. “Industry really knows that SIAST is into applied research, and that we have the expertise, facilities, and the resources.”

Applied research gives SIAST students on four campuses hands-on experience, better preparing them to become solution providers in the working world, ultimately impacting both social and economic development.

“Industries come to us; we go to them. We work both ways. Industries, agencies, universities, students and teaching staff – We make a good marriage, and the Office of Applied Research and Innovation acts as the match-maker.”

Holland College

“We differ from universities in that we’re not doing discovery work. Our applied research consists of industry problems that they bring to us. They may ask us to fix a problem in beta testing, prototype development, processing issues, or technical enhancement...”

Dr. Audrey Penner, Director of

Applied Research, continues, “So, problems come from industry, solutions from us. Our students benefit because we are closely tied to industry and industrial advisory committees, so students get occupational training, ensuring they are ready to go into industry. That’s often how we discover what industrial problems are, and, in a perfect circle, industry comes back to us for help.

“As a community college our mandate is about community economic development. For example, we research food products in what we call ‘Canada’s Smartest Kitchen.’ An industry asked us for: ‘a better product for the school market, because schools have strict guidelines for vending machines.’ Working with our research chefs, UPEI and the Food Technology Centre of PEI, we made twelve formulations for vegetable-based Maximum Nutrition Snacks. Four fit the school criteria. Others work for diabetes, weight control, etc. There’s an example of multi-party collaboration, government investment, and an industry in need of help. We met an industrial need, and gave it several markets.”

Niagara College

“We approach research from the company side,” says Marti Jurmain, Director, Research and Innovation Division. “It starts when a company or a government department approaches us with a problem, be it an idea, a new product, a process for improvement, marketing strategy... Industries see colleges not just as suppliers of graduates, but also as solution providers.”

“More and more we use course-based projects to support industries that have little cash. If a client-industry can wait, our students can take it on during a course, at no cost. Course-based research involved 700 students this past year. With typically 50 clients a year, we involve multiple faculties and about 40 teaching staff. Afterwards, intellectual property belongs to the client, and often we help them assert it.”

The result is many success stories, including from innovative, supportive Walker Industries. “We are testing their compost. Then we have green roof applications, an irrigation system company, and a firm that makes containers for green roofs. We grow grapes and make wine, of course – package it, label it, design the labels.”

“SMEs are the backbone of Canada’s economy, representing over 65% of the country’s base. They are critical to us as a nation, but they’re challenged on all sides. They often lack resources, so, for SMEs, colleges are a great resource.”

Lethbridge College

Applied research at Lethbridge College started with carp,” says Peter Leclaire, V.P. Academic, and Chief Learning Officer. Alberta has one million acres under irrigation, and it was decided that carp could eat weed in the canals. However, the canals had to be drained every year, so fast-breeding carp proved unsuitable. Lethbridge College then researched and created sterile carp. Applied research was born!

Lethbridge always had a strong environmental program, strengthened by local partnerships with Agriculture Canada’s Research Facility and its provincial equivalent. Applied research abounds, currently occupying 500 students and “we have fifty faculty leveraged on behalf of our community, whether for local or international benefit,” says Peter Leclaire, V.P. Academic and Chief Learning Officer. “Closeness with our community has triggered the bulk of the applied research we do.”

Sterile carp never reached Alberta’s irrigation channels, but the fish became biological controls in ponds and golf course water traps, eliminating chemical herbicides from dugouts, a major water source for agriculture.

Taking that a step further, Lethbridge became one of the first colleges to win a CFI grant and become an aquaculture centre of

excellence. “We produce aquaculture and aquaponics ‘in a box,’ moving fish around in large containers that we can put anywhere.” Farmers can empty a container into a pond to grow carp; the fish eat the weeds, the nutrient-rich waste from the fish is separated, becoming fertilizer, while the cleansed water is recycled – “A source of protein and vegetables, too! People can grow their own fish.”

Fanshawe College

“Applied research at Fanshawe is oriented toward problem-solving,” says Greg Weiler, Dean, Applied Research, Innovation & University Partnerships. “In many cases we work with something already known, bending, applying or adjusting it to solve someone’s business problem. We call that ‘putting knowledge to work.’ We generally use an industry ‘pull’ model, where businesses bring their problems to us rather than us inventing something at the college.

“Government is interested in helping companies, particularly small and medium-sized companies (SMEs), become more innovative. Making those changes can be difficult when a firm’s resources are lean and focused on immediate results. We can help them innovate processes, products and services,” he says.

“Right now, Fanshawe is working on the creation of more efficient solar collectors, improved solar energy storage and management systems, a better small wind turbine and solar powered utility vehicles in our new Centre for Sustainable Energy & Environments, funded by a grant from the NSERC-administered College & Community Innovation program.”

The role that Canadian colleges can play in fostering innovation has now been recognized, Weiler says. “We are finally seeing resources allocated to help mobilize colleges’ potential.”

Yukon College

“Colleges used to be training institutions. Many have moved to an applied research role because they have strong technical programs – and no matter what you’re doing, you need technical expertise, hence industrial partnerships with colleges,” says Dr. Chris Hawkins, V.P. Research. Yukon College has two specialist fields. The first is climate change, (applied research that resembles a traditional university course). Second, we have our Yukon Cold Climate Centre. That comes in conjunction with the Yukon Technical Innovation Centre.

“The first of these focuses on technology for cold climates – in hopes we can sell it around the circum-polar region. The second is about developing knowledge-based technologies we can market anywhere. We’re trying to take advantage of the creative economy we have in the Yukon.

“Because we have a thinly distributed population, Yukon College has a local campus in almost all communities. Eleven in all. People approach us; we try and get their project going, whatever, wherever it is.”

One special project involves generating electricity in water moving under ice. “Rivers and creeks freeze up here,” says Hawkins. Nevertheless, Yukon College is researching generating year-round run-of-river hydro. Diesel-generated electricity in northern communities costs 80-90 cents per kilowatt-hour. Water-generated hydro would cost about 30 cents. “Generating hydro is the easy part,” says Hawkins. “Keeping the ice from destroying things is more difficult.” The big question: “How much depth of water do we need beneath the ice?”

Seneca College

“For us at Seneca, applied research involves solving real world problems. We deal with SMEs and assist charitable associations, but all projects must involve our students, our faculty, and have meaning within

the scope of our curricula. Applied research is happening in virtually all our faculties,” says Laurel Schollen, Dean, Applied Science and Engineering Technology. “Two of them are really busy; Applied Science, and the Faculty of Information, Arts and Technology.”

She describes two projects for which Seneca received CCI grants: The first, \$2.3 million to Seneca’s School of Aviation and Flight Technology to expand research and innovation, and explore simulation technology to advance pilots’ technical and non-technical skills transfer. (The number of Canadian flight schools is declining, while the International Civil Aviation Organization predicts a shortage of pilots.) One major investigation: How can simulation improve such non-technical needs as situational awareness, decision-making, and workload management in a cockpit?

Meanwhile, the Faculty of Information won a grant for its Centre for Development of Open Source Technology. “We are strong in open source. This CCI grant will let us grow that. Working with partners such as Mozilla, IBM and Red Hat, we are developing tools to enhance enterprise-scale use of open source – and help SMEs partner with open source developers.”

Schollen encourages the federal government’s “financial opportunities” for colleges. “Recognizing the importance of colleges is good news for Canada. In fact, since colleges and universities complement each other, it’s good news for them both.”

Bow Valley College

“What we do is about developing the whole person. That’s our core business. We have a leading role in Canada for people on the margins, and our applied research is about finding solutions to help them access education and therefore the workplace.”

A human at work needs nine essential skills, says Sharon Carry, President and CEO: Communication, disciplined thinking, numeracy, using information... “We invented TOWES (Test of Workplace Essential Skills) to measure some of these. Every jurisdiction in Canada uses it to measure and remediate people’s skills. We commercialized it over a decade ago. Industries use it for hiring decisions, or to offer applicants essential skills. We call TOWES the Velcro to which all learning sticks.”

Then there is “Canadian Drug Speak.” Bow Valley teaches a program for pharmacy technicians in which the Canadian Drug Speak tool helps students master the names of prescription drugs. “All sorts of colleges and companies have bought it. Invented here, we took it commercial. It’s an important example of research leading to a commercial opportunity.”

With more than 20 locations, Bow Valley College is growing to offer careers to 20,000 full- and part-time students. “Revenues have grown from \$15 million to \$75 million, substantially through entrepreneurial efforts.”

Colleges Set to Deliver

This focus on research strategies and projects at some of Canada’s colleges vindicates the federal government’s recent decision to support applied research at Canadian colleges. As the college representatives so eloquently put it in this feature article, applied research at colleges is about problem-solving, creating value and helping students, companies and communities succeed. This activity is critical, yet until now it has been below the radar and largely unappreciated. This serious policy gap appears to be closing.