Canadian Colleges: Creating IP and Powering Commercialization

Submission to the House of Commons Standing Committee on Science and Research – Study on the Commercialization of Intellectual Property

April 2023

COLLEGES & INSTITUTES CANADA | COLLÈGES & INSTITUTS CANADA

CICan is the national and international voice of Canada's largest post-secondary education network. It advocates, builds capacity, and drives knowledge to strengthen Canada's publicly supported colleges, institutes, CEGEPs, and polytechnics. With more than **95%** of Canadians living within **50 km** of a member institution, and thanks to its extensive reach around the globe, CICan works to future-proof communities in Canada and abroad.

We respectfully acknowledge that CICan's offices in Ottawa are located on the traditional and unceded territory of the Algonquin Anishinaabe Nation.

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About Colleges and Institutes Canada

Colleges and Institutes Canada (CICan) represents Canada's largest post-secondary education network with over 140 members. Across more than 680 campuses and access centres, our members collaborate with governments, industries and not-for-profits to train millions of diverse learners. With partners around the world, our members scope and practical approach equip colleges to respond to both global challenges and Canadian workforce needs. CICan's members are within 50 km of 95 percent of Canadians and 86 percent of Indigenous peoples. They provide practical and flexible pathways for learners in urban, rural, northern and remote communities to develop the skills needed to grow and adapt as industries change. Colleges' grassroots, ground-level perspective enables partnerships with businesses to train learners for today's jobs and to solve tomorrow's problems, from wherever they are.

Introduction

By way of this submission, Colleges and Institutes Canada (CICan) is pleased to follow up on our appearance before your Committee on March 7th, 2023. CICan was deeply grateful for the opportunity to appear to inform your study on how the commercialization of intellectual property can be better supported by the Government of Canada.

During Dr. Jeffrey Taylor's testimony, CICan offered three recommendations on how the Government of Canada can better support the commercialization of IP through college applied research:

1. Improve support for the generation of intellectual property by enhancing funding for college applied research;
2. Explore funding for colleges to offer education and other wraparound supports on the importance of intellectual property and IP rights to businesses with whom they collaborate; and
3. Consider more broadly the contributions colleges can make to programs oriented at improving commercialization outcomes in the post-secondary sector, like the Government's proposed Lab-to-Market program.

Subsequent to CICan's appearance before the Committee, Budget 2023 announced a significant new investment of $108.6M in support for college applied research over three years, beginning in 2023-2024. CICan strongly supports this investment and is grateful for the continued support of the Government of Canada. This investment will facilitate our network's ability to support thousands of additional SMEs in the next several years.

The pages that follow outline CICan's responses to questions received at Committee, as well as our broader perspectives on other matters of relevance to the Committee's study.

The Value of College Applied Research

College applied research creates significant value for the Canadian economy and for thousands of small and medium-sized businesses across Canada.

In 2019-2020, the college applied research system leveraged total investment by the Government of Canada of $111 million to facilitate:

- Over 6,400 applied research projects conducted with almost 8,000 business and community partners;
- Of these 6,400 projects, 5,500 successfully produced outputs which include:
    - 2,297 prototypes;
    - 1,670 new products;
    - 415 new processes;
    - 351 new service offerings; and
    - 169 derived enterprises. [1]

College applied research is conducted through over 700 laboratories and research centres affiliated with colleges and provided **over 42,000 students** with real-world research experience by facilitating their involvement on an applied research project team. In addition, 85% of all projects undertaken were completed in **under one year –** moving at the speed that businesses need.

Importantly, the Government of Canada's investments are leveraged and matched by other players in the applied research ecosystem. In fact, in 2019-2020, private sector investment in college applied research projects **matched the Government of Canada's investment dollar-for-dollar** at $111 million in both cash

[1] Data via CICan's biennial Applied Research Survey, available here: https://collegesinstitutes.ca/arsurvey

and in-kind support. The system also saw provincial/territorial funding of $68 million for applied research, alongside $61 million invested by colleges themselves. Finally, funding from Indigenous and municipal organizations and governments amounted to $4M, for a total system value of **$354 million** facilitated by the Government of Canada's foundational investments.

College applied research is **demand-driven innovation**. Colleges and college applied research practitioners do not identify their own research questions; research questions are determined by external partners – usually small- and medium-sized businesses – based on their business or operational needs. This means that investing in the college applied research system is ultimately an investment in market-driven innovation, ensuring that the outputs of applied research have a clear use-case and identified opportunity for deployment.

For example, when Autobus Lion (as it was then known), a school bus manufacturer in Saint-Jérôme, QC, saw an opportunity to fill the market's desire for electric vehicle transportation solutions, they partnered with the Institut Vehicule Innovant (IVI) at Cégep de Saint-Jérôme, an applied research centre with expertise in vehicle innovation. Through their partnership, IVI helped Autobus Lion develop the first-ever North American electric school bus prototype.

After road testing, including in extreme winter weather conditions, the project was a success. This started an incredible scale-up journey, supported by the start of manufacturing based on the company's applied research project. Several years after their collaboration, Autobus Lion re-branded to Lion Électrique– an all-electric transport vehicle manufacturer. Now, Lion Électrique is a North American leader in EV transport solutions, boasts multiple Tier 1 clients (Amazon, IKEA, the New York Times), is expanding its presence south of the border, and is listed on both the Toronto Stock Exchange and the New York Stock Exchange.

Applied Research and Intellectual Property

As outlined during CICan's appearance and testimony by Dr. Jeffrey Taylor, colleges take a hands-off approach to intellectual property generated through college-based applied research. This is because colleges' fundamental mandate is to spur and support local economic development. While most Canadians are familiar with this mandate in the context of talent and skills development through our bevy of programs, this mandate also colours our approach to supporting innovation and applied research.

This comes from a core tenet of the college approach to research – that the partner best placed to exploit the intellectual property developed through applied research is the business partner: they have identified the issue they're trying to solve or the product they're trying to create, suggesting they have identified a market opportunity or an opportunity to improve their business practice. Generally speaking, there is a use-case identified by the partner for the output of the applied research project. While colleges could attempt to exploit or take a stake of the intellectual property output of a project, this would be antithetical to their role as engines of local economic development.

However, as indicated in CICan's testimony, wraparound supports involving both pre- and post-project supports could be a key way to leverage and expand colleges' ability to support SME-based innovation across Canada. This type of assistance is critical given that SMEs often lack the capital, knowledge, or time required to consider issues such as a long-term IP strategy. Such supports would include:

- Allowing colleges to support businesses to identify alpha and beta customers
- Tapping into their own networks to support businesses [especially female or BIPOC-led] find partners, funders, customers
- Producing market research and feasibility studies
- **Expanding colleges' onsite IP expertise with a focus on supporting the domestic use and application of IP developed in conjunction with the college**
- Providing legacy support following the completion of a research project to assist partners in capitalizing on alternative uses or markets for innovations
- Supporting SMEs with the process of manufacturability and scaling of products or services

CICan previously advocated for a $25M per year program to provide these supports, along with expanding marketing and outreach for college applied research and providing navigator supports, particularly for financing, to SMEs. Additional details on CICan's 'College Business Boost Program' proposal can be found in Annex A.

Applied Research and Commercialization

College applied research is really about powering Canadian commercialization.

This is because college applied research occupies a space between university-led basic research and industry-led industrial research, focusing on translating our fundamental knowledge base into tangible outcomes – products, services, process improvements, and prototypes. Focusing on Technology Readiness Levels 4 through 8, college applied research helps bridge the gap between basic research and industry needs, as pictured below.

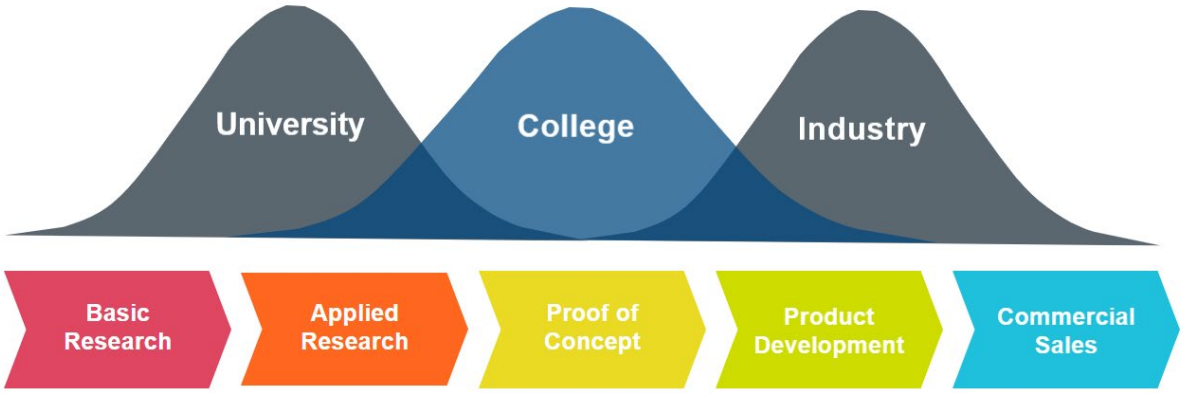

Figure 1: Colleges in the basic <---> industrial research spectrum

Colleges' unique value-add to Canada's innovation ecosystem was most recently identified in the Canada Innovation Corporation Blueprint, which indicates the intention of the Corporation to foster interconnections between SMEs seeking support and institutions who can provide the support SMEs need.

In response to a question from Mr. Williams, please see below several examples of products which have gone on to be commercialized:

Keeping Kegs Tapped to the Last Drop (Mohawk College)

Barventory, a Hamilton-based inventory control company, was frustrated with current methods of measuring beer inventory, which often miscalculate due to the foam of pours.

Barventory approached Mohawk College to design a wifi-connected keg scale, which relays information about beer quantities in stock to a cloud-based inventory management platform. Mohawk worked with the company to design a scale using a function-based design approach and created twelve versions of the initial design. The seventh version proved fruitful. Mohawk subsequently produced four physical prototypes for testing – including through over 600 120 lb drop tests.

The successful prototype has been turned over to Barventory for production and distribution and is now available on the market.

Bringing Digital Humans to Life (Sheridan College)

Digital doubles – recreations of real people in digital environments – have historically cost more than $1M each to develop.

Sensing an opportunity, Toronto-based Cream Productions partnered with Sheridan College to create 'Digital Dynamic Humans' – a workflow and software suite that significantly expedites the creation and animation of digital doubles. Supported by 10 staff and over 20 students across several faculties, Sheridan extensively supported the design and development of the product. Since project completion, Cream has licensed the process and suite to partners in video game development as well as to Meta, Facebook's parent company.

The result is a significantly reduced time and labour investment required to create a realistic digital human: using Cream's tools, a dynamic digital human can now be created in virtual environments using a tool as simple as an iPhone 12.

Keeping a Pulse on the Plant-Based Food Market (Red River College)

Big Mountain Foods, a Vancouver-based plant-based food manufacturing business, sought new ways to diversify their product offerings and grow their business as they expanded their tofu manufacturing capabilities.

Thankfully, the Prairie Research Kitchen at Red River College had already been working with Prairie Fava, a Canadian grower and ingredient supplier of fava beans (a key pulse product grown in Manitoba) for several years to refine, explore, and develop new ways for consumers to use fava beans, including fava flour and how fava could form a tofu product. Thanks to this ongoing partnership, when Big Mountain Foods came calling in 2020 seeking support for product and process validation, the Prairie Research Kitchen was able to connect the two partners and spur collaboration.

Since facilitating the partnership, Big Mountain Foods has begun production of a fava bean tofu at the world's first allergen-free tofu factory. The company aims to produce 15 million units per year – and the soy-free tofu is now available on store shelves, giving Canadians more choice in the growing plant-based foods market.

Applied Research Commercialization Statistics

CICan does not systematically track which applied research projects proceed to commercialization and availability in the market.

This is largely because under the current model, colleges' engagement stops with the finish of an applied research project.

With additional funding to provide wrap-around (pre- and post-project) supports to business partners, colleges would be enabled to better track the outcomes of their applied research projects, as well as provide education and supports related to IP education and the importance of asserting IP rights, facilitate market opportunity assessments, and provide other supports as required by partners. Importantly, this funding could also allow colleges to extend the involvement of students in projects based on the breadth of their programming; for example, many colleges host business administration and marketing programs, the students in which could be involved in providing these sorts of supports as part of a work-integrated learning opportunity.

Taking Innovations from the Laboratory to Market

In Budget 2022, the Government of Canada announced its intention to invest in a national ‘Lab-to-Market’ program, which would support researchers in understanding how to take their own innovations from the laboratory bench to the market shelf.

CICan views it as critical that this program see colleges as a key partner, particularly given their expertise at scaling innovations along the Technology Readiness Level spectrum. In the context of this program, colleges want to ensure that their own researchers and their research-focused students are eligible for supports to ensure that Canada’s largest post-secondary system is effectively leveraged to facilitate growth in research-based entrepreneurship.

The Lab-to-Market program also presents an opportunity to strengthen interconnections in the post-secondary education sector. Given colleges’ business-focused programs of applied research and development, colleges are increasingly hiring research associates separate and apart from faculty to support this growing line of business.

Colleges often also run training programs in business administration, marketing, sales, and other key aspects of entrepreneurship. Given the growing number of research associates at colleges, an interesting option for supporting lab-to-market training and entrepreneurship programming would be to host Lab-to-Market participants from universities at college applied research centres in ‘fellowship’-type posts, whereby the participant could contribute their own expertise to the college’s applied research portfolio while also receiving support to develop their own innovation. This opportunity could be paired with training to ensure the participant’s success.

Aside from boosting research entrepreneurship experience among participants, as well as solving a labour need and deepening participants’ business networks, this approach would also draw the post-secondary sector more closely together, enhancing college-university interconnections and offering the opportunity to develop other collaborations between college and university-based researchers.

ANNEX A: College Business Boost Program (CBBP) – Concept Paper

College based, business-led R&D

Canada has continued to see research and development (R&D) investment, and in particular private sector R&D investment, decline compared to our OECD peers. Innovation and commercialization are key drivers of economic prosperity and good jobs. Particularly troubling for Canada has been the fact that small and medium sized enterprises [SMEs] - who make up by far the greatest share of our employment and businesses – continue to struggle with innovation. SMEs have identified four key barriers: challenges accessing equipment, talent and expertise, government supports and alpha/beta customers. College based, business-led Research and Development has proven to be an effective and highly efficient way to address all four of these barriers.

Canada's college-based applied research system is a unique research process that places a business challenge at the heart of the investigative process. This process has three unique value propositions within the larger Canadian innovation ecosystem: 1) The research question is driven by the business, all research assets are directed at solving the business problem, 2) intellectual property (IP) stays with the business, and 3) solutions are found at the speed of business, with most project completed in less than one year. This approach to research is particularly valuable when it comes to the creation and potential monetization of IP. Since the IP stays with the business, it remains in the hands of the entrepreneur who is most likely to have the interest in commercialization.

Our system focuses on solving problems and creating innovative solutions to real-world challenges. SME partners find these attributes particularly attractive, and SMEs make up roughly 70% of college-based applied research partners. Over the last ten years the college based applied research ecosystem has grown significantly – revenues have doubled, with private sector funding matching dollar for dollar the federal investments.

There is no shortage of innovative ideas in Canada but turning ideas and IP into products and services that will be commercially successful can be tough, especially for SMEs. The process requires support before, during and after the research. Colleges and institutes across Canada have become research partners of choice by helping thousands of businesses, entrepreneurs, and social enterprises. Colleges are also strongly committed an inclusive world-class R&D ecosystem incorporating strong research data management systems, equity, diversity and inclusion principles, research integrity and security, and high regulatory and ethical standards. In 2019-2020 college based applied research offices reported:

- Over 8,000 businesses received supports from the college, including technical expertise, equipment and talented labour as well as local business networks and prospective talent;
- More than 42,000 students participated in applied research, building the talent pipeline; and
- Over 5,500 new processes, products, prototypes and services, 85% completed in under a year.

The Minister of Innovation, Science and Economic Development's mandate letter includes a commitment to establish a new fund to help colleges and universities commercialize leading research, including identifying and securing patent rights for research done within their institutions and connecting researchers with people and businesses to help put these innovations into action and grow our economy. CICan believes that this important promise should be prioritized for Budget 2022 with a particular focus on helping SMEs innovate and thrive in these turbulent times – and this fund can help scale these proven, highly efficient solutions.

College Business Boost Program – Supporting SMEs innovation and commercialization

We know that there is significant unmet business demand for college-based applied research. Additional federal funding would provide valuable support services and draw more players into this ecosystem. We know that only 2% of SMEs access IRAP, for example and only 6% look to their local college or university for help with innovation. We can change that with the College Business Boost program.

This additional funding would mean consistent high quality pre- and post- project support to SMEs, including market analysis, identification of alpha and beta customers, assistance with the manufacturability and production process – all vital pieces of the commercialization process. We also intend to do more to connect SMEs to existing government resources and supports.

CICan is proposing that $25 million a year be dedicated to a new College Business Boost Program (CBBP) – which would allow colleges to scale and expand innovation supports for SMEs both before and after applied research projects. The program would provide funding to colleges to provide commercialization services to SME clients in three broad areas:

1. Expanding marketing and outreach to bring in many more entrepreneurs and businesses.
2. Providing navigator support to SMEs.
    - Support colleges in offering a consistent suite of navigator services to assist business access to existing federal and provincial supports and funding, including those offered by the regional development associations, as well as Business Development Bank of Canada
3. Expanding front-end and back-end support for applied research projects, including:
    - Allowing colleges to support businesses identify alpha and beta customers;
    - Tapping into their own networks to support businesses [especially female or BIPOC-led] find partners, funders, customers;
    - Producing market research and feasibility studies;
    - Expanding colleges' onsite IP expertise with a focus on supporting the domestic use and application of IP developed in conjunction with the college;
    - Providing legacy support following the completion of a research project to assist partners in capitalizing on alternative uses or markets for innovations; and
    - Supporting SMEs with the process of manufacturability and scaling of products or services.

This investment would complement the recent reforms to the College and Community Innovation Program and the post-pandemic investments through the Applied Research and Technology Partnership grants that have allowed colleges to be more flexible in their applied research offerings to business. Colleges are ideally positioned to provide responsive local support to increase productivity and innovation in start-ups and SMEs and encourage new initiatives that advance post-pandemic priorities related to sustainability, public health, social inclusion and making supply chains more resilient. Most importantly, expanding this proven Canadian approach – embedded in colleges and institutes but led by the business - could truly make a difference to Canada's innovation and commercialization goals.