



POLYTECHNIC APPLIED RESEARCH

BUILDING A STRONGER CANADA



POLYTECHNICSCANADA

Canada Needs Polytechnic Applied Research

Innovation drives economic growth and enhances social well-being. It can be incremental—improving efficiencies, experimenting with new technologies or testing theories and concepts. Innovations can also be ground-breaking and globally significant—impacting the food we eat, human health and wellness, and the way we interact with the planet. Applied research at Canada's polytechnics is working at both ends of this spectrum and everywhere in between, supporting non-profit and business enterprises of all sizes to solve today's most pressing challenges.

Polytechnic institutions mobilize state-of-the-art facilities, equipment and expertise to deliver solutions, always in partnership and often with the help of a student talent pool. In most cases, intellectual property is retained by the business partner, creating an environment that amplifies the incentive for creative engagement and supports ongoing collaboration.

Applied research takes many forms, including product development, process design, technology adoption and proof of concept. Though polytechnic institutions develop areas of specialty based on industry in their region, applied research is responsive by nature. Prospective partners identify a business or societal need, then polytechnics pull in faculty expertise and student support to respond to those requirements. The result is an applied research infrastructure that is flexible and agile.

By engaging students, polytechnic institutions provide hands-on opportunities for learners to work alongside employers to solve real-world challenges. This ensures graduates enter the labour market with strong problem-solving skills, employer connections and relevant experience. Employers gain access to a talent pipeline to deal with skills shortages and an aging workforce. More broadly, the lessons learned in applied research are folded back into classroom instruction, creating a virtuous innovation ecosystem that gets stronger with each project. Applied research is about leveraging these benefits for businesses of all sizes and in all sectors, creating and supporting an environment that pushes innovation boundaries and propels us forward as a country.



In the following pages, we highlight how polytechnic applied research is supporting Canada's innovation economy.

Business Development

Leveraging Innovation Know-How to Drive Business Performance

Polytechnics are innovation intermediaries that serve organizations of all sizes and from all industrial and social sectors. They provide support in diverse areas, contributing to growth, allowing for experimentation, solving on-the-ground challenges and nurturing new ideas. Applied research can be the boost partners need to realize greater efficiencies, reduce costs and enter new markets. While organizations of all sizes stand to benefit, small- and mid-sized firms are particularly well-served by having an innovation partner at the ready. Polytechnics support business innovation with modern facilities, future-forward equipment and industry-relevant expertise, a combination that positions partners for long-term success.

Advanced Facilities | **Future-Forward Technology & Equipment** | **Industry-Relevant Expertise**

Social Development

Leveraging Innovation to Improve Life in Canada

Partners come to polytechnics seeking innovative solutions to challenges or obstacles to growth. In many cases, these projects are also supporting significant social advances—building improvements to health and eldercare, agriculture and food production, and environmental sustainability. Applied research is oriented to pragmatic, scalable solutions to some of the biggest social challenges of our time.

Health & Eldercare | **Agriculture & Food Production** | **Environmental Sustainability**

Talent Development

Leveraging Innovation Challenges to Prepare the Next-Generation Workforce

Polytechnic applied research offers a valuable hands-on learning experience to students, exposing them to real-life challenges and providing an opportunity to work with employers in their field of study. At the same time, learning from applied research is folded back into curriculum, providing a feedback loop into the classroom.

Work-Integrated Learning | **Incubators & Accelerators** | **Capstone & In-Class Projects**

Business Development

Advanced Facilities

To ensure institutions stand ready to serve their industry partners, polytechnics invest in research spaces that house world-leading technologies. Facilities are developed to support partners in a range of applied research activities including proof of concept, prototype development, field / lab testing and simulation, as well as business development and enhancement services.



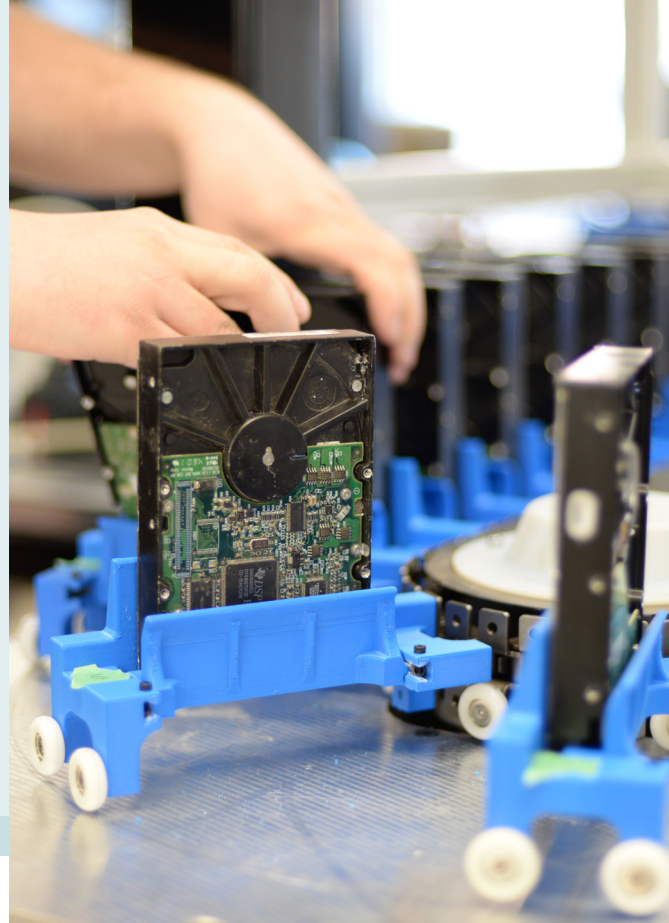
NAIT's Productivity and Innovation Centre (PIC) is one of North America's largest innovation spaces. Home to their Centre for Sensors and System Integration and other emerging research areas, PIC is delivering productivity-boosting innovation services for industry partners of all sizes. For example, a partnership with BioLargo Water Inc. and Sunworks Farms developed, installed and tested a prototype advanced oxidation water treatment system. Over the winter, a shipping container resided at PIC while technologists installed the system, outfitted the container with utility hook-ups and fittings, and put the system through its paces. In the spring, the system was transported to a poultry producer for field testing. The end user stands to save on operating costs while also reducing water use.



Located in RRC Polytech's Skilled Trades and Technology Centre, the Smart Factory is an experiential learning facility and technology demonstration site. It hosts emerging technologies in metal additive manufacturing, collaborative robotics, autonomous factory vehicles, flexible robotic work cells, industrial automation and networking, and high-speed 3D laser metrology. The Smart Factory is home to a current collaboration between RRC Polytech's aerospace and manufacturing researchers, the Composites Innovation Centre (CIC) and National Research Council of Canada scientists to bring a highly specialized composite-forming technique into the hands of industry. Magellan Aerospace, which manufactures aerospace systems and components, will use the initial research to conduct a commercially viable demonstration at their Winnipeg plant using RRC Polytech's equipment. The data from this demonstration will be used by the Smart Factory industrial network.

Future-Forward Technology & Equipment

New technology has the potential to drive growth and improve productivity. However, technology adoption presents risks for business, including upfront costs, uncertain return on investment and concern about acceptance by the current workforce. Polytechnic institutions de-risk new technologies for their applied research partners by exposing them to the practical application and impact of technology. Polytechnics invest in the tools and equipment in use today, as well as cutting-edge equipment being adopted by global leaders. By investing in both, industry partners can experiment with equipment currently available in their workplaces and make informed choices about new investments.



Seeking to understand the potential impact of a new technology, the Ontario Ministry of Transportation (MTO) sought George Brown's expertise with Building Information Modelling (BIM) technologies and processes in the pre-design and construction of the Bowen Road Bridge. The project involved scanning the existing site and creating a BIM model with simulations. As a result, MTO signalled intent to incorporate BIM technologies across the Bowen Road Bridge project and into future initiatives.



CONESTOGA
Connect Life and Learning

Greentec, an electronic waste recycling company, reached out to Conestoga for advice about technologies that could improve their hard drive recycling process. Greentec typically receives eight tonnes of hard drives per month, the majority of which were being manually disassembled to recover valuable materials such as rare earth minerals. Through an applied research partnership with Conestoga, Greentec adopted "Lexi," a robotic cell that can rapidly dismantle a computer hard drive. This innovation allowed Greentec to recover all components more quickly, improving efficiency and enabling the reuse of materials in other products.

Industry-Relevant Expertise

Because of the industry-aligned nature of polytechnic education, institutions are home to staff and faculty made up of leading experts in their respective fields. It is not uncommon for staff to cycle in and out of industry and it is equally common to see professionals in the field working as part-time instructors. The result is faculty with an intimate understanding of the current pressures on and global opportunities available to firms.



A partnership between Humber and Martino Contractors Ltd. led to the development of a unique furnace accessory that saves lives with email notifications. The MB Furnace Minder counts “miles” on a furnace to prevent gas leaks and fires. The Minder taps into home Wi-Fi to send the homeowner an email notification in the event of a weak valve or a faulty line in their furnace. Project lead Georges Livanos had mentored Humber alumni Vlad Porcila since 2013 and student Michael Johansen since 2017 when they collectively developed and improved upon the MB Furnace Minder. Today, the device is almost half the size and half the cost of the 2015 prototype.



An increasing number of homes are using renewable energy to move “off-grid,” often generating more energy than needed for personal use. London Hydro wanted to know how new energy storage technology would impact their ability to purchase excess energy from residents and was interested in developing controls to help off-grid power producers decide when to sell. Recognizing their expertise in sustainable energy production, London Hydro partnered with Fanshawe researchers and co-op students. Working with solar arrays installed on campus buildings, the Fanshawe team developed a system that married fluctuating energy costs and load predictions with climate-prediction data from Environment and Climate Change Canada. The system gives users a holistic understanding of when to save the energy their systems are producing and when to sell it to London Hydro.

Social Development

Health & Eldercare

With an anticipated population of more than 10 million seniors by 2035, Canada is facing significant social consequences associated with demographics. Beyond estimates of job growth approaching 300,000 in healthcare and social assistance, there is a huge need to consider how Canada will care for its elderly. At polytechnics across the country, applied research is taking on this challenge.



Sheridan

Investigators at Sheridan's Centre for Elder Research received a grant to explore the health and well-being benefits of using virtual reality (VR) with long-term care residents. The project brought together collaborators from Owlflx Media, Acclaim Health and Sienna Living to design, develop and film VR components based on survey results from seniors and recreational staff. The goal was to create a recreational VR program that assists with pain management and memory improvement, ultimately creating novel ways to support the health and well-being of seniors. Data collection focused on five Sienna Care locations in North Bay, Barrie, Ingersoll, Elmira and North York.



Urinary incontinence affects 3.5 million Canadians, with significant impacts on quality of life. Roughly half of those affected are men but, until recently, limited treatment options were available. Life360 Innovations Inc. partnered with BCIT's MAKE+ team to change this. After more than eight years of extensive research, including a five-year, multi-site Canadian clinical study, Life360 received Health Canada approval for its Contino® urethral insert, a licensed, self-administered medical device that controls bladder leakage in men.

During the project, the MAKE+ team produced more than 20 variations of the initial design, evaluating, testing and verifying more than 100 different design requirements. This extensive work is the basis of some 45 design patents and 20 utility patents registered in 15 countries. Life360 continued the commercialization process and opened Contino® Authorized Clinics, attributing a major part of their successes to the MAKE+ team.

Agriculture & Food Production

As the global population grows, the ability to produce adequate amounts of food in sustainable ways will become increasingly important. Canada is well-positioned to be a global leader in food production and food security, while innovating to mitigate the environmental impacts of agriculture.



To improve growth and productivity in canola crops, SaskCanola, SaskWheat and the Prairie Agricultural Machine Institute partnered with Saskatchewan Polytechnic to assess different tillage and crop residue treatments on canola crops using an unmanned aerial vehicle. By leveraging new technology in combination with innovative workflows, the project is expected to make significant contributions to the advancement of food production by improving agricultural monitoring.

Researchers at KPU's Institute for Sustainable Horticulture are exploring ways that fungi could open the door to horticultural innovations. Trichoderma are fungi naturally found in the soil, with strains that can help protect crops and other plants from disease. The team at KPU is studying biopesticide with a high-performance liquid chromatography machine to measure and identify molecules and a digital droplet polymerase chain reaction instrument to identify tiny genetic pieces of DNA in soil samples. While this project is looking at protecting plants against disease, related initiatives are developing alternatives to chemical insecticides.

Environmental Sustainability

Polytechnics are innovating alongside industry to develop the talent, tools and technologies needed to address climate change, promote sustainable practices and develop the infrastructure for a more energy-efficient future.



For many Canadians, an old shirt or jeans are destined for donation or the garbage. As the fashion industry comes under fire for use of chemical dyes, exploitative labour practices and high greenhouse gas emissions, it is increasingly important to find a second life for clothing. Researchers at Fanshawe partnered with Goodwill Industries and the Arcane Digital marketing group to develop a re-manufacturing model that is widely replicable at donation centres and training centres across the country. The project reduces the textiles that end up in landfills while providing training to Canadian newcomers with textile-related skills.



While the sale of electric vehicles in Canada has been increasing, limited access to a charging infrastructure remains a significant barrier to continued growth. In dense urban areas, where off-street parking is a luxury, owners often have no space to install charging stations. BCIT's Smart Microgrid Applied Research Team (SMART) partnered with the City of New Westminster to install chargers in existing streetlights on city property. This project will create a blueprint for Canadian municipalities that want to leverage streetlight infrastructure for electric vehicle charging.

Talent Development

Work-Integrated Learning

Work-integrated learning connects students to employers, allowing them to develop the hands-on, applied and soft skills that are in high demand and can be difficult to develop in a classroom environment alone. While polytechnics offer a breadth of work-integrated learning opportunities to students, one of the most compelling is involvement in applied research projects.



Dementia doesn't just affect the elderly: it impacts thousands of men and women at mid-life. In Calgary, YouQuest is filling a services and support gap by providing recreational therapy for Canadians with early-onset dementia. To help gauge the effectiveness of its therapeutic approaches, YouQuest partnered with SAIT's Applied Research and Innovation Services and Centre for Innovative Information Technology Solutions. A group of SAIT students were brought in to develop a web application that gathers data to assess patients and their response to treatments, helping health professionals develop and use the most effective therapies.



CONESTOGA
Connect Life and Learning

Applied research is being used to improve the lives of seniors in long-term care while developing a more reliable talent pipeline of personal support workers and practical nurses. In partnership with Schlegel Villages, a long-term care and retirement living organization, researchers at Conestoga's Schlegel Centre for Advancing Seniors Care developed a new approach to optimize resident-centred care called Neighborhood Team Development (NTD). The NTD approach has resulted in a measured increase in quality of life among residents, as well as higher levels of staff engagement and decreases in staff absences, turnover and terminations.

To solve the talent pipeline challenge, Conestoga researchers partnered with Schlegel Villages and the Schlegel-UW Research Institute for Aging to create the Living Classroom, offering students immersive education in a fully functional long-term care and retirement home. This workforce-education model allows students to interact with faculty, staff, residents and families. As of May 2019, more than 800 students had graduated from the Living Classroom, with 90 per cent going on to work in senior care.

Incubators & Accelerators

Recognizing creativity is inherent in all types of applied education, polytechnics have made significant investments in spaces that nurture and support entrepreneurship. These spaces help students and staff navigate supports available on campus and help budding entrepreneurs leverage external opportunities as their ideas develop.



ALGONQUIN
COLLEGE

The DARE MakerSpace at Algonquin is a hands-on hub for the discovery and exploration of emerging technology. An open-to-all approach offers students, faculty and external partners free and easy access to equipment such as 3D printers, VR stations and a laser engraver. Because the space is open, it fosters creative collisions across programs, faculties and sectors. In its first full year of operation, the MakerSpace has proved to be an invaluable asset to the in-class experience. Projects that would have otherwise been difficult to achieve—like the intricate scale model developed by Architectural Technician student Sophie Lecours—are brought to life with the help of onsite professionals and emerging technologies. According to Sophie, “When I came to the MakerSpace, I had never worked with a 3D printer or even seen one before.”

Seneca
POLYTECHNIC

Within the HELIX incubation space at Seneca’s Centre for Innovation, Technology & Entrepreneurship, budding and experienced entrepreneurs engage mentors and coaches to advance their venture ideas and build scalable businesses, with a focus on innovative health and lifestyle products and services. With the support of HELIX, two students from Seneca’s Sustainable Business Management program co-founded Ripple Farms, an urban agri-tech start-up. Using “aquaponics”—a combination of aquaculture (raising fish) and hydroponics (using water instead of soil), Ripple Farms is improving food security by sustainably growing food in urban areas. Ripple Farms has taken the aquaponics process to another level by making it modular using shipping containers. HELIX provided Ripple Farms with mentorship, space, networking opportunities and workshops that proved invaluable.

Capstone & In-Class Projects

A capstone project, also known as a culminating project or experience, is a research project that allows a student to demonstrate their learning. Capstones and other in-class projects often involve external partners as part of the experiential learning process.



Sheridan

Working in partnership with HP Canada, students in Sheridan's Honours Bachelor of Game Design program completed a capstone project to experiment with and develop new applications for the HP Z VR Backpack. This wearable, wireless PC enables a free-roam VR experience and is used for education and training, as well as design and entertainment. The student team, known as *Hexabyte!*, worked with HP and Hong Kong-based Shadow Factory to improve the device's freedom of movement. The enhanced capabilities were demonstrated in *Booyo Park*, a mixed-reality experience that lets players interact with virtual creatures in the real world.



For their final capstone project, three Information Technology students worked with Element Labs—a software and technology company—to develop a cattle monitoring system to remotely track cattle. SAIT advisory committee member Dean Brennan from Element Labs approached the students with a product idea for a trackable ear tag. The students came up with ways to track an animal's location while monitoring its body temperature. The capstone project provided the students with invaluable real-world experience for their training, something they can feature on their résumés long after graduation.

About Us

Polytechnics Canada is the voice of leading, research-intensive, publicly supported polytechnics, colleges and institutes of technology. Our mission is policy advocacy for federal action on innovation and skills.

Polytechnics Canada members play a critical role in enhancing Canada's productivity and innovation. Through their facilities and networks, our members provide meaningful solutions to industry problems and accelerate knowledge transfer. Graduates are job-ready and armed with the skills employers need across sectors.

Close ties to industry make the polytechnic talent pipeline dynamic and responsive to the challenges of developing the future workforce. Polytechnics work with industry to build programs and design curricula, to conduct applied research that helps firms scale and get products to market. They offer students work-integrated learning opportunities and position graduates for careers. Beyond the traditional student, polytechnics embrace those at mid-career who find themselves displaced from the labour market or simply need short-term retooling to refine and modernize their skillsets.

At Polytechnics Canada, we are proud promoters of the polytechnic education model—applied, hands-on and technical; industry-focused and industry-driven. Learn more at polytechnicscanada.ca.

Polytechnics Canada Members





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