



Applied Artificial Intelligence Research Centres

Concept Paper



POLYTECHNICSCANADA

About

Polytechnics Canada is the voice of leading research-intensive, publicly supported polytechnics and institutes of technology. We advocate for federal action in areas where polytechnics provide solutions for a more innovative, productive and globally competitive country. Polytechnics Canada members play a critical role in addressing some of the country's greatest challenges. Through their facilities and networks, our members provide meaningful solutions to industry problems and accelerate knowledge transfer.



Cover photo courtesy of the British Columbia Institute of Technology (BCIT) and the institution's applied research that leverages AI-powered drone technology to improve forest fire management.

Introduction

In Budget 2024, the federal government dedicated \$2 billion to launch the Canadian AI Sovereign Compute Strategy and AI Compute Access Fund. This funding is intended to develop artificial intelligence (AI) compute infrastructure and offer direct support to Canadian AI researchers and developers.

Polytechnics Canada proposes that the government dedicate 15 per cent of its investment to address the need for compute resources to support applied research designed to translate AI discoveries into market-ready solutions. Over five years, we recommend that government allocate \$60M/year to create and operate three Applied AI Research Centres housed at polytechnic institutions.

Polytechnics are among the largest colleges and institutes of technology in Canada and many are already actively engaged in applied research collaborations focusing on the implementation of AI (see final page for examples of current and recent projects). Polytechnics are well positioned to host applied research hubs that we envision will support the broader community of colleges, institutes and cégeps seeking to access compute power as they engage with and support small- and mid-sized businesses in applied research projects. These centres will accelerate and derisk AI adoption by providing subsidized and centralized resources designed to solve industry challenges, improve AI integration and strengthen partnerships within Canada's AI ecosystem.

We propose the centres be developed around sector expertise, ensuring businesses, non-profit organizations and institutions are empowered to learn from each other as they experiment with AI solutions and integrate new models. To benefit from existing areas of expertise, we recommend the centres focus on Healthcare & Life Sciences, Environment & Energy, and Digital Integration.

Canada as a Leader

Canada has established itself as a global leader in AI. Despite strengths in AI research, Canada's private sector has been slow to adopt and commercialize AI technologies. This poses a risk to the country's leadership in this field and has prevented Canada from benefiting from associated economic growth and productivity gains.

While the [Pan-Canadian Artificial Intelligence Strategy](#) has sought to address these challenges, a key component of the research ecosystem has been overlooked: the polytechnic sector. This omission has stunted adoption and commercialization activity, a space where polytechnic applied research is ideally positioned to address the gap by derisking business experimentation with new technologies. The recent \$2-billion investment in AI compute announced in Budget 2024 can correct this oversight.

While Canada's achievements in AI are commendable, competitors are catching up as global players make large investments. [The gap between Canada's R&D spending and the OECD average continues to widen](#). Part of this challenge stems from the preponderance of small- and medium-sized enterprises (SMEs) in Canada, which make up a considerable share of the private sector. Closing the innovation gap among SMEs must be central to Canada's strategy to accelerate AI adoption.

As AI moves beyond the theoretical, companies and organizations are eager to understand how it can be used to boost their competitiveness, improve their products and services, and help them grow. This is where applied research is well positioned to intercede. Applied research is demand-driven, allowing partners to define the purpose of the research, helping mitigate risks and remove barriers, and putting innovation activity within reach of even the smallest company. Polytechnic applied research makes a distinct and important contribution to addressing Canada's productivity challenge among enterprises of all sizes, a vast majority (85 per cent) of which are SMEs.

As it seeks to position itself as a global AI leader, Canada must prioritize applied research as the next logical step to enabling AI adoption throughout the economy.

Helping Industry Adopt AI

Pillar 1 of the Pan-Canadian Artificial Intelligence Strategy focuses on commercialization, aiming to translate AI research into commercial applications and enhance the ability of companies to adopt these technologies. Since 2021, the Strategy has focused on increasing AI patents filed nationally. While this is commendable, SMEs, which constitute [98 per cent the private sector, tend to rely more on security protocols and non-disclosure agreements than on patent protection](#). As a result, the positive outcomes delivered thus far are unlikely to extend to the broader Canadian economy.

While studies show that Canada's SMEs under-invest in innovation activity, they face a number of [unique barriers](#), including a shortage of technical staff, lack of access to appropriate facilities and capital constraints. For many SMEs, the cost of investing in R&D involves significant risk. When it comes to AI, where the benefits are unproven and the technology poorly understood, adoption is likely to lag. Realistically, SMEs are largely unaware of existing programs in place designed to support them.¹ There is a clear need for more tailored resources to address these challenges.

The national AI strategy would benefit from a stronger emphasis on near-to-commercialization support, enabling businesses to test AI technologies, explore implementation options and grow their bottom line. While the [current AI institutes](#) offer some programming for SMEs, the perceived risks and high costs remain a deterrent. Direct support for companies can be risky given high rates of failure among Canada's smallest businesses. Polytechnics and their college colleagues are uniquely positioned to address these challenges. Close relationships with industry and the ability to

¹ Canadian Federation of Independent Business, CFIB Your Voice Survey, July 6-25, 2023, n = 919

undertake responsive project design stands to put AI adoption into context and within reach. Allocating funds to public higher education institutions ensures they are broadly available over the long term.

The benefits of polytechnic involvement are plentiful. Collaborations with institutions focused on basic research² are often characterized by extended timelines and shared intellectual property. Polytechnics and colleges remove these obstacles by working closely with partners to define the project and operate at the speed of business. Moreover, partners retain IP arising from their collaborations, making commercialization more feasible.

Because applied research also engages thousands of students each year, polytechnic and college applied research is developing an innovation-enabled talent pipeline. In the context of AI, this contributes to Canada's ability to develop and retain a technology-ready workforce.

Applied research has proven effective at supporting technology adoption and commercialization among industry partners. Applied AI Research Centres amplify that impact, developing solutions to challenges identified by industry itself.

What is an Applied AI Research Centre?

While discovery research remains critical to Canada's AI ecosystem, it is increasingly important to ensure Canadians are able to realize the pragmatic benefits of these investments. Applied research bridges the gap between leading-edge research and implementation, patents and productivity. Establishing dedicated Applied AI Research Centres leverages the expertise and industry-focused approach that polytechnics and colleges offer their partners, matching AI capacity with critical challenges in healthcare, climate change and digital integration, to name a few.

We propose the government earmark \$300 million over five years to establish three Applied AI Research Centres. This represents a modest 15 per cent of the federal investment announced in Budget 2024. Yet, we believe these centres offer a crucial opportunity to push AI discovery research into the Canadian economy, ensuring the benefits of the investment are more broadly enjoyed.

We propose these centres operate under the following guiding principles:

Expert Leadership

- Centres should be managed by Canadian polytechnics with pre-existing expertise to enable data-sharing and collaboration across start-ups, researchers and industry
- Leads should embody and fully appreciate research that is applied and industry-focused, with a strong understanding of business imperatives, timelines and resources

² Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. (OECD Frascati Manual)

Focus on Industry

- Projects should address needs and challenges identified by business partners and/or non-profit organizations, ensuring real-world relevance over theoretical research
- Research should enable AI experimentation and innovation, drawing on best practices
- Intellectual property should vest with the project partner, ensuring the economic impact of the government's investment can be commercialized without unnecessary encumbrance
- Partners should be expected to provide in-cash and/or in-kind contributions to ensure they have skin in the game

Sector Collaboration

- Centres should be encouraged to promote and provide resources to polytechnics and colleges to extend broad access to compute resources
- By focusing on important economic sectors (i.e. healthcare and life sciences, environment and energy, digital integration), centres are positioned to engage both companies and researchers with interdisciplinary expertise
- Efforts to coordinate grant funding and compute capacity should be made

The benefits of Applied AI Research Centres include:

Creation of an Innovation Ecosystem

- Partnerships and data-sharing agreements among polytechnics, colleges and industry will foster greater collaboration within Canada's AI ecosystem
- Solutions-focused research ensures relevance to partners and generates insights for replication more broadly
- Implementation hubs ensure Canada remains a desirable destination for cutting-edge AI research and development, with a built-in market for new discoveries
- Subsidized common compute platforms enable pooling of computational resources and expertise
- Joint AI research centres lower costs, enhance compute capacity and advance collaboration

Economic and Talent Development

- Locating centres within public post secondary institutions ensures technology adoption and talent development is equitable
- Research aligned with sector and industry needs fosters economic benefits such as job creation, business growth, commercialization and improved productivity
- Aligning centres with AI talent strategies will increase workforce retention and offer continuous learning opportunities
- Providing compute resources to those seeking pragmatic solutions is likely to attract top AI researchers interested in application and implementation
- A commitment to providing hands-on opportunities to students through work-integrated learning builds an innovation-enabled talent pipeline

Data Sovereignty and Security

- Using Canadian-owned solutions strengthens data security and privacy while reducing reliance on foreign technologies
- Ensuring sensitive data remains within Canada supports adherence to national privacy laws and regulations, enhancing data security and governance

While Canada's polytechnics are already experimenting with AI in the context of their applied research enterprises, the high cost of cloud computing, limited access to compute resources and limited funding for applied research are challenges. Polytechnics rely on a combination of onsite infrastructure and external cloud services for their AI research. While onsite solutions offer better access and security, they are expensive to maintain and upgrade. Cloud platforms, on the other hand, can accelerate research, improve deployment speed and foster global collaboration, but the most readily available options are foreign-based, costly and present security concerns. There's a pressing need for greater compute resources and domestic cloud providers capable of supporting applied AI research that translates AI discoveries into market-ready solutions.

Applied AI Research Centres should prioritize applied research using cloud platforms that offer scalable resources for large-scale AI model training, ensuring both the flexibility and computational power required for advanced AI applications. Initially, these centres will likely rely on foreign cloud providers but a key long-term goal should be the development of sovereign Canadian cloud providers. In addition to benefits to both cybersecurity and autonomy, this capacity stands to reduce the risk of foreign-controlled providers reallocating resources during high-demand periods and reduces physical barriers such as geographic distance.

The Global Incentive

Artificial intelligence is borderless, requiring a comprehensive and ambitious approach. While Canada benefits from AI, we also actively promote its use beyond our borders to drive improvements in global health, gender equity and human development. The International Development Research Centre has invested in the responsible use of AI in [34 countries](#). While this work is important, we must also prioritize domestic R&D and the productivity improvements it stands to foster. Compared to our peers in Europe, Australia and the United States, Canada has limited avenues to connect SMEs to affordable and impactful R&D related to AI adoption.

Polytechnics, which are particularly attuned to industry needs, deliver a strong return on research investment. A [recent report](#) suggests that for every dollar the federal government invests in polytechnic applied research, there is a return between \$8.09 and \$18.49. Further, data from the past three years shows polytechnics have been able to attract matching funds for every dollar invested by the federal government. Yet, these institutions are under-utilized.

Fraunhofer-Gesellschaft, based in Germany, is the world's leading applied research organization. As a University of Applied Sciences – the German version of a polytechnic institution – it is backed

by the German government and has more than [6,200 private sector customers](#), 60 per cent of which are SMEs. The organization's focus on applied research is widely recognized for its substantial contribution to Germany's economy. Its impact is striking: [437,000 new full-time jobs](#) and [over 15.2 billion euros](#) in economic activity.

Canada needs a similar level of ambition for its advanced technical institutions.

Project Examples

Polytechnics are actively engaged in work with AI. **Saskatchewan Polytechnic's** Digital Integration Centre of Excellence (DICE) is partnering with businesses in mining and agriculture to improve practices and sustainability through AI. In partnership with Cameco, DICE has applied AI to improve the waterjet boring system used for safe uranium extraction. They have developed AI models to enhance the predictability of mining recovery and reduce dilution. In a pilot project, these AI models worked alongside human engineers to mine new cavities and identify real-world improvements. The study indicated the potential for increased ore production, reduced waste and lower energy consumption, all by integrating AI.

Sheridan is working with the Ontario Brain Institute, Winterlight Labs and Soul Machines on a project to explore the use of AI for remote monitoring of cognitive function and mental health in older adults. An AI-powered virtual human character engages seniors in conversation, using AI algorithms to analyze speech patterns. Baseline data is generated from initial conversations and then compared over time to detect signs of cognitive decline or changes in mental health. This project combines multiple AI applications to assess the feasibility of remote cognitive testing, which could significantly enhance healthcare accessibility, especially in rural or remote areas, by removing barriers like clinician time and travel.

Algonquin College's Social Innovation Lab co-developed insightScope with clinical researchers from the Children's Hospital of Eastern Ontario. This novel software platform dramatically accelerates the process of systematic reviews for evidence-based medicine using AI and crowdsourcing techniques while maintaining scientific rigour. The production model is utilized by over 1,100 clinicians across Canada and from 40 countries to answer medical questions. During the COVID-19 pandemic, when rapid high-quality medical evidence was required at speed and scale, the platform was able to inform use and reuse of Personal Protective Equipment.

At **BCIT**, researchers are integrating drones with AI-powered computer vision for forest fire prevention and management. This project maps both existing fires and areas at risk, addressing the limitations of ground sensors, aerial surveillance or satellite imagery. In collaboration with industry partner Spexi Geospatial, BCIT developed a proof of concept that leverages computer vision algorithms to identify forest fire risks. The resulting maps enable forestry managers to anticipate where fires might ignite.