



Meeting Canada's Full Potential: *Building on a Strong Foundation*

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UNIVERSITY OF
ALBERTA

Executive Summary

Canada is fortunate to have a strong foundation of talent, innovation and knowledge. Over the previous two decades, the Government of Canada has established a strong record of investing in innovation and competitiveness. Agencies and programs such as the Granting Councils, the Canada Foundation for Innovation, the Canada Research Chairs, the Canada Excellence Research Chairs, the Knowledge Infrastructure Program, the Vanier Scholarships and the Banting Postdoctoral Fellowships Program have positioned Canada well on the global landscape. Further investments to strengthen and secure Canada's knowledge foundation are essential to positioning Canada for economic growth in a highly competitive, shifting global environment.

As the Government of Canada has recognized, Canada's future prosperity and high standard of living will increasingly depend on our ability to increase our productivity, which in turn depends on our ability to innovate. As this submission will detail, both post-industrial states and emerging economies are devoting increasing resources to enhancing their global competitiveness and innovation capacity.

Budget 2012 presents an opportunity for the Government of Canada to make strategic investments that will fortify an already strong foundation for the new challenges and opportunities that lie ahead.

Acknowledging the importance of fiscal restraint and improved government efficiency, the University of Alberta recommends that the Government of Canada make strategic, targeted and fiscally responsible investments in three aspects of advanced education and research: talented people, world-class infrastructure and global partnerships.

The Recommendations

- 1. Enhance Canada's ability to develop, attract and retain talented people by making internationally competitive and strategic investments in the Granting Councils. The investments should reflect the full costs of research including proportional increases to the indirect costs of research.**
- 2. Invest in world-class infrastructure through sustained and strong investments in the Canada Foundation for Innovation that will secure Canada's role as an innovation partner on the global stage.**
- 3. Foster international collaboration by creating a Global Partnerships Fund that will allow Canadian innovators to develop all forms of international partnerships.**

Global Realities

According to UNESCO, in the next thirty years, more people will graduate from higher education than have graduated throughout human history thus far. These highly skilled graduates are and will be more educated, more interconnected and, most importantly, more mobile than any other group in our collective global history.

This increased mobility means that innovation through knowledge production, which is the key of continued economic prosperity, is no longer the domain of any one country, government or region, but rather a truly global phenomenon as people, ideas and capital flow worldwide.

A global economic shift in the geography of knowledge production is taking place. Countries such as China, India, Brazil, Korea and Germany have put investment in education, research and development and innovation at the centre of their political agendas.

Nations worldwide have recognized the critical importance of investing now in order to secure a competitive advantage in the knowledge economy of the future. Indeed, both post-industrial and emerging economies are realigning resources towards knowledge production in recognition of the reality that the nation that best supports innovation now will reap the benefits in the future.

The urgency of this realignment was recently noted by European Union Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn, who characterized the need for investment into innovation fronts as an "emergency."¹

The countries that have understood this urgency, especially in light of recent economic turbulences, are making world-leading investments into education, research and development. Between 1995 and 2008, total research investment grew exponentially. For example:

- In the four most knowledge intensive countries in Asia – Japan, South Korea, Singapore and Taiwan, investment grew by 75%
- In the BRIS countries – Brazil, Russia, India, South-Africa – investment grew by 145%
- In China, investment grew by 855%²

These investments are creating the infrastructure and research environments needed to attract top talent that will advance a nation's position and prominence in the new world order.

Talented people are highly motivated to seek environments that will provide them with the resources that they need to make the discoveries, innovations, and impact that they aspire to make.

These resources include highly qualified students and trainees to advance research, facilities for conducting competitive and groundbreaking research, and innovative international frameworks for leveraging opportunities from around the world.

Fostering, attracting and retaining highly skilled people will be critical as Canada competes with countries that will graduate vast numbers of highly educated students entering the global marketplace in the coming years. In China alone, more than six million students began pursuing an undergraduate degree in 2009; this is more than the number of undergraduates in the EU, United States and Japan combined for that same year.³

Canada has advanced economic growth by solidly investing in both knowledge infrastructure and talent. This foundation must be built upon further with strategic policy and financial decisions that balance the need for fiscal restraint with the imperative need to keep pace with other nations' innovation agendas.

Top talent, leading companies, researchers, and students alike are wholly aware of the investment priorities and government policy of leading and emerging economies and make decisions about where they will work, study and live accordingly. The Organization for Economic Cooperation and Development (OECD) states that the global mobility of talent is an increasingly important factor in a country's competitiveness.⁴ As such, the signals that Canada sends through its foundational investments will be a key factor in determining whether or not highly talented people choose Canada as the destination of choice.

Recommendation 1:

Enhance Canada's ability to develop, attract and retain talented people by making internationally competitive and strategic investments in the Granting Councils. The investments should reflect the full costs of research including proportional increases to the indirect costs of research.

Talent, knowledge, innovation and entrepreneurialism are the new global currency. Canada can capture the market on that currency in strategic areas of national interest by not only investing in our own talent but also by acting as a super-magnet for global talent. The competition for top talent is fierce, coming from both our traditional competitors as well as from new, emerging economic powerhouses.

In China, for example, in an effort to improve research, the government launched the Thousand Talents Program in 2008. The program is meant to recruit 2,000 talented professionals worldwide in five to ten years to help the country achieve its goal of becoming an innovation-oriented nation. Each new recruit receives significant funding from the central government as well as funding from their employer. Academics who

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sign up for the program are also encouraged to bring a small team with them to China.

Canada must compete in a global arena with a comparatively small population. Canada's success relies on the development, attraction and retention of top talent - innovative leaders and visionaries who can compete with the best in the world, positioning Canada as an energetic, entrepreneurial and creative society.

The investments made by the Government of Canada into the Granting Councils over the last two decades have put Canada in good stead. It is critical that those investments not only be maintained but enhanced if Canada is to remain competitive and not risk losing the talent that has been attracted here.

Canada has created visionary programs such as the Canada Research Chairs and the Canada Excellence Research Chairs. In order to retain individuals of this calibre and to attract other top talent to Canada, it is imperative that the foundation which has been built to support their needs is not eroded and remains competitive with other nations.

When compared with other competitor nations, Canada's post-secondary sector already carries a disproportionately heavy research and development load. As a result, university research has become an ever more critical part of Canada's R&D agenda. In fact, universities function as industry's R&D labs in Canada today. Higher education spending on research and development grew from \$5 billion in 1998 to \$8.5 billion in 2008, accounting for over half of the growth of R&D performance during this time period – more than federal and provincial governments and business combined.⁵

Therefore, it is essential that additional investments into the Granting Councils reflect the full costs of research through proportional increases that provide fairness for research-intensive universities.

Much of Canada's success to date in research and development can be attributed to recognizing the importance of the fine balance that exists between intellectual and physical infrastructure. Talent and tools are integrally linked. The operating funding provided by the Granting Councils and other key programs that attract talent and enable those individuals to do their work is supported by the other key component, infrastructure, provided by the Canada Foundation for Innovation.

Recommendation 2:

Invest in world-class infrastructure through sustained and strong investments in the Canada Foundation for Innovation that will secure Canada's role as an innovation partner on the global stage.

Top talent, researchers and graduate students go wherever they see the greatest opportunities for making the biggest impact. These people are acutely aware of the quality of a university's resources, including the quality of facilities, laboratories and equipment.

The Canada Foundation for Innovation has been instrumental in raising Canadian universities to the point that Canada can successfully draw international talent into the country through initiatives such as Canada Research Chairs and the Canadian Excellence Research Chairs program.

The Knowledge Infrastructure Program was a critical program providing key physical infrastructure to Canadian universities. This cannot, however, be confused with the role played by the Canadian Foundation for Innovation, which enables Canada to keep its scientific and innovation infrastructure on par with the rest of the world. It is commonly accepted that scientific infrastructure becomes obsolete in five to seven years. In fast-moving platform sciences and technologies, the infrastructure of 2000 is not the infrastructure that will deliver the next round of breakthroughs and innovations that will advance our society and our quality of life. The Canadian Foundation for Innovation represents a critical federal commitment to ensuring that Canada's scientific infrastructure supports the visionary agendas of its exceptional researchers, innovators, and students.

Further, CFI has been a highly effective mechanism for forging meaningful industry-university partnerships. CFI facilities are one of Canada's key knowledge exchange venues for linking discovery research with sector challenges. In its submission to the Expert Panel on Federal Support for R&D, Research in Motion made the following statement, "[I]n order to create the workforce for a vibrant digital economy in Canada, students and teachers in our country's colleges and universities must have access to cutting edge facilities and equipment in order to reach their greatest potential."⁶

An excellent example of how CFI investment catalyzed significant industrial and international impact can be found at the University of Alberta (U of A). Prior to 2004, CFI contributed \$7.5M to equip several laboratories to support interdisciplinary research in oil sands engineering, nanomaterials, and surface sciences. The superb scientific and analytic capacity created through these facilities subsequently attracted a contribution of \$20M from Imperial Oil, along with \$8M from the

Government of Alberta, to create the Centre for Oil Sands Innovation (COSI). We can trace the creation of this state-of-the-art, cross-disciplinary, industrial-university initiative directly to the infrastructure capacity provided by CFI.

With COSI established, the U of A leveraged CFI's investment further to build a unique international relationship between Canada, through the U of A, and Germany. The U of A has partnered with Germany's largest scientific organization, the Helmholtz Association of German Research Centres, to form the Helmholtz Alberta Initiative, also funded by the Government of Alberta.

Over a five year time frame, the Helmholtz Association has committed 25M euros, the Government of Canada \$2M and the Government

of Alberta \$25M. The project covers research topics such as the environmentally responsible development of the oil sands, carbon capture and storage, geothermal energy and land and water reclamation, opening up new opportunities for technology transfer and collaboration with business and industry.

Intellectual capacity coupled with state of the art facilities is what enables visionary university partnerships with businesses like Imperial Oil and with international organizations like the Helmholtz Association. Through programs such as the Canadian Foundation for Innovation, the Government of Canada ensures that our nation grows as an innovation partner for the industries and nations around the world.

Recommendation 3:

Foster international collaboration by creating a Global Partnerships Fund that will allow Canadian innovators to develop all forms of international partnerships.

Strong international partnerships are at the cutting edge of trends that are driving the global research and innovation marketplace. These partnerships are at the centre of stimulating the exchange of talent, ideas and innovations related to science and technology, and also encouraging greater collaboration and exchange with the private sector. The outcome of these kinds of outstanding partnerships is that Canada's leaders in research, innovation, universities, the not-for-profit sector and industry will be at the centre of decision making and influence in areas of strategic national interest related to commerce, and economic, scientific, public and social policy. This influence will help position Canada and its researchers, innovators, opinion makers, and business leaders, as global leaders and agenda setters.

The importance of forging international strategic partnerships has been highlighted throughout federal strategic documents and has become a focal point for many Parliamentarians and business-leaders alike. "Partnerships are essential to lever

"[I]n order to create the workforce for a vibrant digital economy in Canada, students and teachers in our country's colleges and universities must have access to cutting edge facilities and equipment in order to reach their greatest potential." Research in Motion, February 2011

Canadian efforts into world-class successes and to accelerate the pace of discovery and commercialization in Canada. Through partnerships, the unique capabilities, interests, and resources of various and varied stakeholders can be brought together to deliver better outcomes.”⁷

The Government of Canada, and post-secondary institutions such as the University of Alberta, realize the importance of forging world-class partnerships. In addition to its relationship with the Helmholtz Association of German Research Centres, the U of A has forged some significant partnerships with both China and India. The U of A has memoranda of understanding with top-tier universities, research institutes, government agencies and administrative institutes across China, allowing for a flow of people and knowledge between the two nations. Currently, there are almost 2,000 students from China studying at the U of A.

Joint research labs have been established for nearly a decade between China’s Ministry of Science and Technology (MOST) and select U of A labs. No other foreign university has such an agreement with MOST. Examples of impact span the areas of energy, infectious diseases, and environmental sciences. For example, Dr. Zhenghe Xu holds an Industrial Research Chair in advanced coal cleaning and combustion technology, funded by a number of industry partners and the Natural Sciences and Engineering Research Council of Canada (NSERC). Dr. Xu’s partnership with MOST gives him and his graduate access to two of China’s Key State Laboratories, while at the same time allowing Chinese graduate students an opportunity to conduct research at the U of A.

In the area of infectious diseases, the infusion of \$25M by the Li Ka Shing Foundation into the U of A has led to a multi-year investment by MOST of over \$2.5M, to enable Chinese scientists to work with U of A scientists in the U of A’s Li Ka Shing Institute of Virology. And further discussions are ongoing to develop a China-Alberta Virology Institute.

Another exemplary international partnership with great strategic impact is the \$14 million Hitachi Electron Microscopy Products Development Centre. This venture is a collaboration of the University of Alberta, Hitachi High-Technologies Canada, Inc., the National Research Council (NRC) and the Alberta Innovates – Technology Futures nanoWorks program. The centre houses three electron microscopes, one of which is the only one of its kind located outside of Japan (worth \$7 million) that gives researchers the tools needed to make important discoveries in nanotechnology from oil sands processing and industrial coating to solar energy and diagnostic devices. University of Alberta researchers and Hitachi are collaborating to bring leading-edge research to the marketplace.

This centre, located at the National Institute for Nanotechnology (NINT), is the first project announced under the new Western Economic Partnership Agreements between the Governments of Canada and Alberta. NINT, a partnership itself between the National Research Council of Canada, University of Alberta, and Government of Alberta “[...] combines the strengths of a federal laboratory and a university to position Canada at the forefront of nano-scale discoveries [...]”⁸ and was the magnet that attracted Hitachi to Canada. NINT continues to attract international talent, technology and partners and to act as a catalyst for international networks and partnerships.

Many of the world’s most influential economies have established national funding initiatives with the explicit mandate to support international research partnerships between their universities and others. For example, Brazil, under its ‘Science without Borders’ programme, recently committed \$2 billion dollars to creating a program that will, in part, foster collaborative scientific partnerships between Brazilian scientists and institutions and foreign scientists and institutions.

While the importance of these strategic international partnerships has clearly been recognized, there are further opportunities to be capitalized upon.

The 2011 Global Innovation Index, one of the most comprehensive international assessments on the impact of innovation on competitiveness and growth, cites these types of public/private/academic partnerships as

essential to innovation.⁹ A Global Partnerships Fund would equip Canadian institutions with the tools they need to create these critical linkages. Such a fund would:

- Create a flexible mechanism for rapid deployment of federal funds to facilitate global multi-partner initiatives
- Be in addition to, and separate from, existing budgets of the Granting Councils
- Be administered by the Granting Councils
- Leverage public funds for greater returns on investment by enabling partnerships with world-class organizations
- Build momentum and widespread excitement as Canadian businesses and higher education engage the world with revolutionary partnerships

While Canada’s pre-eminent universities are forging world-class partnerships with international organizations, governments and people, these same institutions are losing out on additional opportunities when they lack appropriate funds to respond in a timely manner to take advantage of opportunities when they arise.

Canada’s ability to capitalize on strategic opportunities and find effective and innovative solutions to challenges will be directly linked to our ability to advantageously partner with global innovators at the highest levels.

By ensuring that universities can nimbly create and sustain international research, training, and innovation partnerships, Canada can extend its own research and innovation capacity beyond its borders and can benefit from the innovation agendas and investments around the world.

Conclusion

Over the last two decades, the Government of Canada has invested in building a strong foundation for research and development, innovation and competitiveness, and has acknowledged the ongoing importance of building on that foundation. Given the current global realities associated with shifting economic influence and emerging economies, Canada can do no less than aim for a position of leadership in knowledge, technology, entrepreneurship and innovation in areas of strategic national interest. To do so, Canada must seize the opportunity to reinforce and strengthen our knowledge foundation through investments in world-class people, infrastructure and partnerships.

¹ Máire Geoghegan-Quinn, “A broader range of participants in EU Research and Innovation programmes” (Speech to the Informal Competitiveness Council, July 21, 2011) <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/11/537 &type=HTML>

² European Commission, Innovation Union Competitiveness report, (Luxembourg: Publications Office of the European Union: 2011), 3.

³ *Ibid.*, 5.

⁴ Organization for Economic Cooperation and Development, *The Global Competition for Talent: Mobility of the Highly Skilled* (September 2008), 9.

⁵ Science, Technology and Innovation Council, *State of the Nation 2010: Canada’s Science, Technology and Innovation System* (Ottawa: 2011), 15.

⁶ Research in Motion, “Input to Expert Panel on Review of Federal Support to Research & Development” (February 2011), 5.

⁷ Government of Canada, *Mobilizing Science and Technology to Canada’s Advantage* (Ottawa: 2007), 11.

⁸ *Ibid.*, 71.

⁹ Soumitra Dutta and Daniela Benavente, “Measuring Innovation Potential and Results: The Best Performing Economies,” *The Global Innovation Index 2011: Accelerating Growth and Development* (INSEAD: 2011), 13.