



Pre-Budget Submission to the House of Commons Standing Committee on Finance for Consultations on the Federal Budget 2012

August 12, 2011

Mitacs, Inc.
University of British Columbia
Suite 301, Technology Enterprise Facility
6190 Agronomy Road
Vancouver, BC V6T 1Z3
604.822.9189
www.mitacs.ca

Executive Summary

Human capital - the combined skills, knowledge, and training of the workforce - is the foundation of modern economies. For too long, Canada has lagged its economic peers in human capital development, and has fallen behind in measures of productivity and innovation. Now, we are faced with a rare and significant opportunity. Through a combination of good fiscal management and historical circumstance, we find ourselves with a robust economy and solid political leadership. This is our opportunity to leverage these advantages to close the innovation gap with our economic peers. Targeted investments to reinvigorate development of human capital will ensure sustainable well-paying jobs for Canadians and place us again at the forefront of the global economy.

Recommendations:

1. **Increase support for industry-partnered R&D skills-training programs for Canadian post-secondary students and graduates;**
2. **Increase support for business and soft skills training, better preparing our Masters and PhD students for non-academic careers; and**
3. **Support programs and policies to attract the best and brightest international students to Canada.**

Outcomes:

- Significantly increase the quality and quantity of highly-skilled, highly-trained individuals in the workforce;
- Equip our graduates with the diverse, non-technical skills necessary for sustainable, high-quality jobs;
- Encourage and support entrepreneurship among our most highly-skilled graduates;
- Increase collaborative R&D between industry and academia, increase business expenditure on R&D (BERD) and increase industry demand for highly-trained Canadian graduates; and
- Increase the number of exceptional international students who choose Canada as a place to study and perform world-class research.

Estimated Costs:

Our recommendations fundamentally transform Canadian human capital development through targeted support for training programs for more than 20,000 students annually at a yearly cost of an estimated \$165 million. The design of suggested programs ensures substantial leveraging of this investment, with an estimated \$400 million in additional support from industry and provincial partners.

Introduction

The relationship between Human Capital and Innovation

Human capital represents the sum of a population's skills, knowledge, and training. Rapid technological change and the evolution of the knowledge economy means there is growing demand for the highly-skilled and highly-trained workers who form the foundations of innovative economies. Development of human capital is therefore a priority concern for countries worldwide, and for good reason:

- Education improves the quality of labour and economic performance, and is associated with better health and happiness and other social benefits like lower crime rates and greater social engagementⁱ;
- Investment in human capital is three times as important to economic growth as investment in physical capital, such as machinery and equipmentⁱⁱ; and
- More than half the differences in economic growth between economies can be explained by differences in the average skill level of their workersⁱⁱⁱ.

Development of a highly-skilled and highly-trained workforce is essential to the growth and long-term sustainability of our economy. Unfortunately, Canada has fallen further behind comparable economies in this area; to keep pace, we will need a significant increase in the number of highly-skilled graduates we currently produce, especially those holding advanced degrees (Masters and PhDs), and we need these to be properly equipped to contribute across the economy:

- Canada has a serious productivity problem. Relative labour productivity in Canada has fallen from more than 90% of US productivity in 1984 to about 76% in 2007, and ranked 15th out of 18 peer countries in the OECD. This productivity slide has been blamed on a “*relatively weak commitment to training and skills development compared to some of its key trading partners*”^{iv};
- In 2003, Canadian firms spent only \$834 per employee on training (1.55% of payroll), while US firms spent \$1,135 per employee (2.34%). And Canadian spending on education relative to the US has fallen from roughly equivalent in 1996 to \$800 less per capita today^{v,vi}; and
- Countries with a high PhD graduation rate also rank highly on business expenditure on R&D (BERD). Countries with a low proportion of BERD – Canada, Netherlands, and Italy for example – have below-average PhD graduate rates. Switzerland, Sweden and Germany, countries that rank high on patents – often a surrogate for innovation – also have a high PhD graduate rate. Canada ranks 14th out of 17 countries on patents by population, and ranks last in PhD graduate rate^{vii}.

The shape of Canadian Human Capital, today and tomorrow

The shortcomings listed above will have serious and severe consequences. Numerous sources decry the coming skilled labour shortage in Canada:

- Canada ranks 23rd among OECD countries in new PhD graduates per capita, ahead of only Japan, Turkey and Mexico, and is producing relatively fewer PhDs in Science, Technology, Engineering, and Mathematics (STEM) disciplines that drive innovation and discovery. OECD countries increased the number of PhDs awarded annually by 40% between 1998 and 2006. Canada increased by only 13% in that time, though there are indications this trend may be reversing^{viii,ix,x,xi};
- There is an increasing mismatch between the supply of unskilled workers and shortage of skilled labour in Canada. A conservative model predicts that by 2016 there will be almost 450,000 unskilled workers who will not qualify for skilled vacancies. The number of skilled vacancies may grow as high as two million by 2031^{xii};
- According to the AUCC, there will be roughly 1.3 million more jobs for university graduates in 2020 than there were in 2010, as well as 700,000 to 900,000 jobs replacing those who retire in the next decade^{xiii}.

Canada faces the additional challenge of an aging population and a declining birth rate. A combination of effective skills training programs must be combined with effective, targeted immigration policies and programs to meet this challenge. International education is an attractive vehicle to accomplish both skills training and recruitment of exceptional international talent. While Canada has many advantages that we can leverage – an immigrant-friendly culture and a high quality of life – we still fall well behind the leaders in attracting these students. Recruitment of the best and brightest students will have enormous benefits to Canada:

- There were 2.8 million international students worldwide in 2007. There are expected to be 7.2 million by 2025, a 5.4% annual growth rate^{xiv};
 - A Canadian study found that international students injected \$6.5 billion into the Canadian economy in 2008, surpassing exports of coniferous lumber and coal in economic value. These students generated \$291 million in government revenues and supported jobs for 83,000 Canadians^{xv};
 - The Canadian Competition Review Panel recommends a goal of doubling the number of international students in Canada within a decade^{xvi};
- By the end of the 1990s, 29% of Silicon Valley companies were run by Chinese and Indian engineers, accounting for \$19.5 billion in sales and more than 70,000 jobs. As well, 25% of technology and engineering companies started in the US between 1995 and 2005 had at least one immigrant as a key founder. These companies grossed \$52 billion in sales and employed 450,000 people in 2006^{xvii,xviii,xix}; and
- Immigrants account for 24% of US patents, but only 12% of the general population. An increase of 1% in college-graduate immigrants is estimated to result in an increase of 6% in patents per capita^{xx}.

Industry partnership in advanced training to boost sustainable, high-quality jobs for Canadians

Industry-academia cooperation in design and delivery of training programs confers numerous benefits: it ensures training programs are relevant and valued while increasing industrial receptor capacity for our best and

brightest graduates. It also increases innovation directly through increased industrial R&D spending, both in the short and long term. This is an important side-effect, since Canadian industry lags its OECD counterparts in business expenditures on R&D, even though Canada leads the pack in several measures of academic productivity. Programs and policies that encourage greater cooperation between industry and academia in skills training should be encouraged:

- Countries are increasingly incorporating internships into graduate training. 68% of PhDs in Netherlands participated in internships during the course of study, 55% in Germany, 30% in Spain, 23% in the UK, and 22% in Italy. At current levels of support, an expected 7% of Canadian PhDs will perform internships ^{xxi,xxii};
- In 2003-04 (the most recent year available), 74% of Canadian PhDs had definite plans following graduation; of these, only 56% had definite employment. This contrasts with 65% of American PhDs who had definite employment. Canadian firms also tend to pay PhD graduates less than their American counterparts. This is an especially worrying trend as the availability of university faculty positions declines: in 2007, Canadian universities awarded 4,800 doctorate degrees but only hired 2,600 new full time faculty ^{xxiii,xxiv,xxv};
- Retention of Canadian graduates requires increased job opportunities post-graduation:
 - Only 1/3 of international students remain in Canada upon completion of their studies, whereas 71% of international students remain in the US after completion (up from 49% in 1989) ^{xxvi,xxvii};
 - 21% of 2005 doctoral graduates intended to leave Canada upon completion of their degree and most of them (57%) planned to move to the United States. Roughly 1/3 of Canadians with PhDs in STEM disciplines lived in the US in 2007 ^{xxviii,xxix}; and
 - 80% of Canadian PhDs in the US intend to return to Canada if they can find appropriate opportunities ^{xxx}.

Recommendations

1. Increase support for industry-partnered R&D skills-training programs for Canadian post-secondary students and graduates.

Given the ever-changing needs of a rapidly evolving innovation economy, skills training programs in Canadian PSEs (universities, colleges and polytechnics) should be designed and delivered with full partnership with industrial partners, who must make real and significant investments in training programs. Programs should be true partnerships that are “win-win” for industry and academia.

An increasing number of countries are developing effective industrial research and management skills through industrial internships. Interns gain on-site training and experience through a collaborative research project between an academic supervisor and an industrial partner. Industrial partners contribute substantially to the program financially, mentor students, and co-supervise the research project with the intern’s academic supervisor. In return, the industrial partner can apply academic expertise to solve a research challenge. Canada’s *Industrial R&D Internship (IRDI)* program, delivered almost exclusively through *Mitacs Accelerate*, has shown the exceptional value of such a program. A federal investment of \$16 million has supported 2,700 internships across Canada since 2008, and has been leveraged by additional investments of \$40 million from industrial partners and \$17.5 million from nine provinces. The program has been an unmitigated success with a 27% increase in retention of graduate students in Canada, and an excess of demand from trainees, academics and industry.

We can build on the success of industrial internships to address the increasing challenges faced by Canadian post-doctoral fellows, our most highly-trained individuals. Canada must establish an “off-ramping” strategy involving industrial partnerships to create opportunities beyond the academic track. Industrial internships should be supported to help these talented and highly-trained individuals transition into non-academic careers in industrial R&D, management, or entrepreneurship, where they will become Canadian innovation leaders.

Finally, industrial-academic cooperation can also help expand entrepreneurship skills training for highly-trained and highly-skilled Canadians. A national entrepreneurship program that involves internships and mentorship by high-growth SMEs will help weave entrepreneurship learning into undergraduate and graduate students’ course of study, ensuring students understand the “ideas to market” pipeline as they become technically proficient.

Outcomes:

- Significantly increase the industry-readiness of highly-qualified graduates, providing skilled workers prepared to meet industrial research and development challenges across all sectors;
- Increase collaboration between industry and academia and support high-quality research at Canadian firms;
- Increase business expenditure on R&D, resulting in an increase in high-quality, sustainable jobs;
- Increase industry demand for highly-trained Canadian graduates; and
- Leverage industry funding for R&D through academic collaboration.

Budget:

- A total investment of \$130 million annually will ensure industrial internships are a cornerstone of Canadian human capital development. The recommended arrangement of these programs ensures this investment will yield significant industry partner and provincial leverage:
 - An expansion of R&D internship opportunities to support 10,000 internships annually will require \$70 million in steady-state funding. This will support a four-fold expansion of current program levels to 7,500 graduate students and an expansion of the program to 2,500 4th year undergraduate students;
 - A program to support off-ramping of 1,000 PhD graduates annually (20% of graduates) through advanced research management internships will require \$50 million annual investment; and
 - Entrepreneurship mentoring for 1,000 students will require an investment of \$10 million annually.

2. Increase support for business and soft skills training, better preparing our Masters and PhD students for non-academic careers.

Advanced study at the Masters and PhD level provides trainees with exceptional technical skills and specialized knowledge that contributes significantly to Canada's innovation capacity. However, according to the Canadian Association for Graduate Studies (CAGS): *"to be competitive, graduate students increasingly need to engage in ongoing development of their skills in areas that complement their academic programs, enhance their employability, and foster linkages with the private, public and not for profit sectors"*.^{xxxii}

A system-wide national program to provide a broad range of business skills alongside the highly-specialized technical skills of a traditional post-secondary education can significantly improve the job-readiness of our graduates and improve business productivity. Such a program would certify students who had completed a set of business skills and soft skills courses in industry-relevant subjects such as project management, communications, critical thinking, and teamwork. These courses would also support entrepreneurship initiatives by providing training in subjects essential for starting a business, covering subjects such as business plans, financing strategies, and intellectual property.

Outcomes:

- Equip our graduates with a suite of non-technical skills to complement their technical training; and
- Encourage and support entrepreneurship among our most highly-skilled graduates.

Budget:

- Business and entrepreneurial skills training programs will involve government investments of \$10 million annually so that 10,000 students are certified each year through a national curriculum.

3. Support programs and policies to attract the best and brightest international students to Canada.

While a significant increase in the production and deployment of domestic skilled workers is a national imperative, it is clear that the overwhelming needs of the future labour market growth will require an expansive immigration policy targeting highly skilled workers. It is essential that Canada implements policies and programs to attract exceptional international students to our universities. The government's investment of \$10-million over two years in the *New International Education Strategy* marks a positive start; building on this initial investment with increased and sustained funding will allow Canada to recruit the world's best and brightest.

An international student recruitment strategy should balance international marketing and education fairs with proactive programs to directly target exceptional students. While increasing the overall number of

international students is clearly necessary, we should focus on programs that attract high-calibre students, as these students will have a disproportionate effect on Canadian innovation. On-the-ground recruiting efforts, summer internship programs for promising international students, and scholarships and incentives for graduate study should all be evaluated for effectiveness and extended where appropriate.

Outcomes:

- Increase the number of exceptional international students who choose Canada as a place to study and perform world-class research;
- Expand the pool of highly-skilled and highly-qualified human capital for Canadian industry, thereby improving Canadian productivity and competitiveness; and
- Improve international networks for Canadian research and Canadian industry.

Budget:

- An estimated total investment of \$25 million annually for marketing, program support, and scholarships, which can be leveraged through pre-existing international linkages and international recruitment programs.

Conclusion

Canada's fiscal rectitude and stable leadership present us with a unique and important opportunity to achieve transformational change in the Canadian workforce. Through wise and targeted investments in proven and effective training programs, Canadian industry will be supported by a world-class workforce, placing Canada in a leadership position among innovative economies. We've outlined here how a targeted annual investment of \$165-million, leveraged with an additional \$400 million in industry and provincial support, will achieve significant and real industry investment in R&D and skills training, and will result in a world-class innovation workforce ready to carry Canada for generations to come.

ⁱ OECD (2011), Skills for Innovation and Research.

ⁱⁱ Canadian Council on Learning (2007), Connecting the Dots: Linking Training Investment to Business Outcomes and the Economy.

ⁱⁱⁱ *ibid.*

^{iv} Expert Panel on Business Innovation (2009), Innovation and business strategy: why Canada falls short.

^v Cooney J and RO Parker (2005) Learning and Development Outlook 2005 Moving Beyond the Plateau—Time to Leverage Learning Investment. Available from the Conference Board of Canada.

^{vi} Institute for Competitiveness and Prosperity (2011) Canada's innovation imperative.

^{vii} Conference Board of Canada (2011), Hot Topic: Advanced Skills and Innovation.

^{viii} Science, Technology, and Innovation Council (2008), State of the Nation 2008, Canada's Science, Technology, and Innovation System.

^{ix} Science, Technology, and Innovation Council (2010), State of the Nation 2010, Canada's Science, Technology, and Innovation System.

^x Auriol, L. (2010), Careers of Doctorate Holders: Employment and Mobility Patterns.

^{xi} Desjardins L and D King (2011), "Expectations and Labour Market Outcomes of Doctoral Graduates from Canadian Universities". Statistics Canada Catalogue no. 81-595-M No. 089.

^{xii} Miner, R (2010). People without jobs, jobs without people: Ontario's Labour Market Future.

^{xiii} Association of Universities and Community Colleges of Canada (2011). Trends in Higher Education: Volume 1 – Enrolment".

^{xiv} Institute for Competitiveness and Prosperity (2011).

^{xv} Kunin, R. (2009). Economic Impact of International Education in Canada.

^{xvi} Competition Policy Review Panel (2008), Compete to Win.

^{xvii} National Academies Press (2007), Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.

^{xviii} Wadhwa, V, A Saxenian, B Rissing, and G Gereffi. (2007) America's New Immigrant Entrepreneurs.

^{xix} Downie, M (2010), Immigrants as Innovators: Boosting Canada's Global Competitiveness. Conference Board of Canada.

^{xx} *ibid.*

^{xxi} Teichler U (2007), "Does Higher Education Matter? Lessons from a Comparative Graduate Survey", Eur. J. Education, 42: 11-34

^{xxii} Advisory Science Council (2009), The Role of PhDs in the Smart Economy.

^{xxiii} Industry Canada (2007), Mobilizing Science and Technology to Canada's Advantage.

^{xxiv} Crawley, A (2010) "A postdoctoral crisis in Canada: From the "Ivory Tower" to the Academic "Parking Lot".

^{xxv} Boothby, D (2011) Recent Doctoral Graduates In Canada And U.S.A: Indicators From Canadian And U.S. Surveys Of Earned Doctorates.

^{xxvi} National Academies Press (2007), Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.

^{xxvii} Science, Technology, and Innovation Council (2008), State of the Nation 2008, Canada's Science, Technology, and Innovation System.

^{xxviii} King, AJC (2008), Educational Portrait of Canada, 2006 Census.

^{xxix} Desjardins L and D King (2011), "Expectations and Labour Market Outcomes of Doctoral Graduates from Canadian Universities". Statistics Canada Catalogue no. 81-595-M No. 089.

^{xxx} *ibid.*

^{xxxi} Canadian Association for Graduate Studies (2010). A Research and Innovation Plan.