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DALHOUSIE UNIVERSITY
UNIVERSITÉ LAVAL
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MCGILL UNIVERSITY
MCMASTER UNIVERSITY
UNIVERSITÉ DE MONTRÉAL
UNIVERSITY OF OTTAWA
QUEEN'S UNIVERSITY
UNIVERSITY OF SASKATCHEWAN
UNIVERSITY OF TORONTO
UNIVERSITY OF WATERLOO
WESTERN UNIVERSITY

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Group of Canadian Research Universities

Regroupement des universités de recherche du Canada

Summary

Research is changing the world – transforming the way we live and work. The countries and societies that make the investments in research are the ones that will gain the jobs, the growth, and the higher quality of life that can accompany those transformations. The countries and societies that don't make those investments will be left behind.

This year, the Fundamental Science Review Report provided the first comprehensive assessment of Canada's scientific research system in 40 years. The Report found that Canada is in danger of becoming one of those countries that is left behind. Between 2007-08 and 2015-16, "the real resources available per active researcher to do investigator-led research declined by about 35 percent." Thus, Canada's global ranking in research output dropped from fourth in 2005-2010 to ninth in 2009-2014.

To begin reversing this trend, the Report recommends a series of reforms and reinvestment in Canada's fundamental research system. In order to maximize the return on research investments, the Fundamental Science Review proposes a phased reinvestment that balances the mutual dependencies of all aspects of fundamental research.

Given the importance of fundamental research to Canada's long-term productivity and prosperity, **The U15 recommends that Budget 2018 begins reinvesting in Canada's research enterprise, as the Fundamental Science Review recommends.**

Introduction

Science and research are among the most powerful, transformative forces in the world. Although research takes various forms, it lies at the core of every knowledge economy, and is central to improvements to our health, quality of life, as well as to public safety. Some research is tightly focused on meeting a clear, immediate need, while other research – fundamental research – focuses on earlier-stage discoveries. Although the path from fundamental research and early stage discoveries to a tangible impact is not always clear or quick, the future of our country, our economy, and our society depends upon performing that research. Sustained investment in early-stage research will ensure that Canada becomes a more productive and competitive nation, and that Canadians are well-equipped not only to address our challenges, but also to seize the immense opportunities available to us.

Talent and productivity

Talent and brain power are the key to that prosperous future. If we foster and nurture a new generation of global research leaders, the benefits to Canada will be immense. Businesses around the world are aggressively pursuing top talent, both by recruiting them to join existing research teams, and by building new R&D centres in the regions where a critical mass of talented individuals live. According to a recent OECD paper, one of the major “pull” factors for multi-national companies making international R&D investments is the research strength of local universities.¹ In recent months, Canada has been the beneficiary of a number of these investments, particularly in areas related to artificial intelligence and the automotive industry. In the months ahead, we expect the federal government’s Innovation Superclusters Initiative to stimulate even more of these investments, creating high-quality jobs.

Building on this success will require a multi-pronged strategy that recognizes the critical importance of attracting and retaining top business and research talent and of training our next generation. Providing researchers with opportunities to undertake cutting-edge research here in Canada, needs to be a key component of that strategy. In the world of scientific research, the best and brightest are attracted to places where excellence thrives. If Canada is to be a place where excellence thrives, we need to make the investments that allow emerging and established researchers to undertake world-class fundamental research. Worryingly, between 2007-08 and 2015-16 “the real resources available per active researcher to do investigator-led research declined by about 35 percent.”² This reality is making it increasingly difficult to attract and retain the talent Canada needs to prosper.

¹ Belderbos, R. et al. (2016), “Where to Locate Innovative Activities in Global Value Chains: Does Co-location Matter?”, OECD Science, Technology and Industry Policy Papers, No. 30, OECD Publishing, Paris. <http://dx.doi.org/10.1787/5jiv8zmp86jg-en>

² Canada’s Fundamental Science Review. Investing in Canada’s Future: Strengthening the Foundations of Canadian Research. 2017.

Our investments in fundamental research are also an important part of how Canadian universities make graduate education accessible to more than 200,000 students from diverse backgrounds. According to the Review, \$655 million of the federal granting councils' investments supports students and trainees. When these graduate students train with the best and brightest researchers, they gain skills and knowledge that create lasting benefits for all Canadians.

Roots of innovation

Former Federal Reserve Chairman Ben Bernanke once noted that “fundamental research is ultimately the source of most innovation, albeit often with long lags.”³

This is as true in Canada as it is in the United States. Canada's investments in fundamental research over the last several decades have turned previously impossible ideas into great opportunities for our country. A few examples of the transformative impact of fundamental research include:

Genomics. In 2000, when Canada's research output in genomics had stalled, the federal government decided to reinvest. This reinvestment ensured that Canada remained one of the top 10 countries in the world for genomics research. Our research strength has resulted in genomic discoveries ranging from biocomposites that make cars safer and more fuel efficient, to microbes that make pipelines safer and from improved cancer treatments to enhanced food safety.

Artificial Intelligence. Although they are currently celebrated, for two decades Canada's AI researchers worked in relative obscurity, relying on fundamental research grants for their support. As a result of that sustained investment, Canada now has the opportunity to lead the world in one of this decade's most important technologies.

Energy storage. In 2016 and 2017, Tesla Motors and Dalhousie announced a major research partnership and created an industrial research chair to investigate ways to make lithium-ion batteries cheaper, longer-lasting, and more powerful. This collaboration builds on a long-term investment in fundamental science. In the late 1970s, the partnership's principal investigator was conducting NSERC-supported research into lithium intercalation.

These and other exciting opportunities for Canada's economy began in universities and research centres. These opportunities continue to develop thanks to public funding. Without scientists chasing big questions over the last several decades, we would never have produced the innovative methods, ideas, and products that benefit Canada and Canadians today. If we are to be global leaders in the coming decades, we will need to start reversing our declining global rank in research output now.⁴

³ Bernanke, B. S. (2011, May 11). Promoting Research and Development: The Government's Role. Retrieved from <https://www.federalreserve.gov/newsevents/speech/bernanke20110516a.htm>

⁴ Canada's global ranking in research output dropped from fourth in 2005-2010 to ninth in 2009-2014, according to the Council of Canadian Academies' Preliminary Data Update on Canadian Research Performance and International Reputation.

Dynamic regions

The geographic centres with the most intensive fundamental research are also the most economically dynamic places in the world. Five of the world's most prosperous regions (London, Silicon Valley, Boston, Los Angeles and Beijing) are home to 9 out of the Top 10 research universities. Looking more broadly, every city that is ranked on all four-key city economic rankings is home to one or more top research universities⁵ (see table). These cities excel across many measures of economic success, ranging from economic growth to R&D activity and from global competitiveness to equity and quality of life. It is clear that these global powerhouse regions succeed not only because of natural endowments but also as a result of using knowledge and creativity to capitalize on those assets and create new ones.

This link between cities with a critical mass of fundamental research and powerful growth and economic strength is multifaceted. It is built on the role of research universities in creating the highly skilled workforce that businesses need today, the expertise and research capability that businesses need to solve challenges for tomorrow, and the knowledge and discoveries that will fuel the region's next wave of economic growth.

City/Region	Top Research Universities (rank)
London, England	Oxford (1) Cambridge (3) University College London (9) Imperial College London (18) LSE (32) King's College London (36)
New York	Cornell (19) Columbia (30) New York University (49)
San Francisco - San Jose (Silicon Valley)	UC Berkley (4) Stanford (5)
Boston	Harvard (2) MIT (8)
Los Angeles	California Institute of Technology (6) UCLA (13) UC Davis (50) University of Southern California (70)
Paris	Ecole Normale Superieure (94)
Sydney	University of Sydney (61) University of New South Wales (73)
Beijing	Tsinghua University (10) Peking University (27)
Stockholm	Karolinska Institute (76)
Shanghai	Jiao Tong University (80)

⁵The city indexes are: Global Power Cities Index; World's Most Economically Powerful Cities, City Momentum Index and Global Innovation Cities Index. Research university rank is based on the Times Higher Education World University Rankings 2017 research scores.

Canada's moment

Canada has a unique opportunity to capitalize on some of our country's most important advantages: our diversity, our openness, and our confidence in the future. These are hallmarks we share with world-class research environments. These advantages attract people from around the world – particularly as other countries close their doors, lower their sights and rein in their ambitions.

We must seize this opportunity and reap the economic and social benefits of our leadership for decades to come. Seizing the opportunity will require us to be welcoming today, and also to build an environment that remains desirable in the future, when the global context changes again. Unfortunately, as was documented in the Fundamental Science Review Report, Canada's research system is beginning to slip. If we are to take advantage of this unique moment in history and attract the people who can fuel our economy and enrich our society, we must take urgent action.

Conclusion and Recommendations for Budget 2018

The Fundamental Science Review demonstrated that Canada's research ecosystem has immediate and pressing needs. Canada's business sector undertakes many forms of research, but fundamental research is not one of them, because it is so early stage. As Eric Schmidt, the executive chairman of Google's parent company Alphabet noted in an op-ed article he co-wrote, "While investing in basic research typically doesn't make sense for a business, it has been a winning strategy for our nation."⁶ Budget 2018 represents an urgent opportunity for the federal government to reinvigorate Canada's research ecosystem through a major reinvestment in this critical foundation of our knowledge economy.

The interconnectedness of the research system means that it is essential that we reinvest in a balanced, comprehensive way. In their recommended phasing of the reinvestment, the Panel carefully considered the mutual dependencies involved. The Report recommended a phased reinvestment that ensures the research ecosystem remains balanced. Advancing only a subset of the Report's financial recommendations will reduce the return on investment and risks unintended consequences.

Accordingly, The U15 recommends that Budget 2018 commits to reinvesting in Canada's fundamental research system in accordance with the plan the Fundamental Science Review Report articulates.

We would like to thank the Committee for this opportunity to provide input to Budget 2018. We would be happy to answer any questions Committee members have.

⁶ Lander, Eric and Schmidt, Eric. America's 'Miracle Machine' is in desperate need of, well, a miracle. *Washington Post*. May 5, 2017