McGill

Equipping Canada with the science and innovation to meet the climate change challenge

Submitted by McGill University
to the House of Commons
Standing Committee on Finance

August 2, 2019

Recommendations

That the Government of Canada:

1. provide sufficient support for fundamental research to preserve the capacity of university researchers to identify and meet the complex social challenges of the future;

2. deliver a long-term funding strategy for climate and sustainability research;

3. provide funding for transformative infrastructure for science and innovation;

4. support the amplification of knowledge mobilization mechanisms by providing additional financial support for environmental innovation.

1. Introduction

McGill University welcomes the Government of Canada's initiative in consulting Canadians on the transition to a low-carbon economy.

Universities are in a unique position to leverage impacts of three kinds that will contribute to the overarching objective of mitigating climate change and adapting to its effects:

- innovation and knowledge mobilization flowing from our research,
- training of the next generation of environmentally aware citizens and solutions-driven researchers, and
- reducing our institutional footprint in our community.

McGill is committed to ambitious goals across the range of initiatives through which research universities can contribute to the transition to a low-carbon economy by, for example:

- supporting sustainability research through the internally funded $10M McGill Sustainability Systems Initiative;
- fostering action by students, staff and faculty through the largest Sustainability Projects Fund in Canada;
- achieving carbon neutrality by 2040;
- investing about $20 million since 2010 to reduce energy related GHG emissions;
- phasing out of the sale of single-use plastic water bottles.

These initiatives have earned McGill international praise: McGill University has recently been awarded "Sustainability Institution of the Year", a UNEP-supported International Green Gown award.

Detailed below are four proposed measures by which the Government of Canada can help universities to fulfill their potential to deliver science, innovation and actionable solutions to the climate challenge for the benefit of Canadians.

2. A Strong Multidisciplinary Foundation

The very notion of 'climate change' is the result of many discoveries that stem from decades of fundamental science. It is because of the curiosity-driven investigations of yesterday's engineers, geologists, biologists, physicists, chemists, space scientists, and other investigators that we are now in a position to track global warming, deforestation, biodiversity, air, water and soil quality. Had governments not supported this science in the 19th and 20th centuries, albeit without knowing its importance for the future, we would not have the data and tools to understand the mechanisms of climate change, predict its trends and foresee its consequences on our modern societies.

Fostering a transition toward sustainability, toward patterns of development that promote human well-being while conserving the life support systems of the planet, is one of the central challenges of the 21st century. Highly complex, multidimensional problems demand sophisticated, cross-disciplinary thinking. Effective solutions will be holistic, encompassing the environmental, social and economic dimensions necessary to ensure meaningful translation and broad adoption. Advances in science and technology offer unprecedented opportunities to develop products and processes that are both clean and profitable. They are, however, insufficient unless they are framed within a societal context, and consider human and environmental health, social and economic well-being and geopolitical implications.

We encourage the Government of Canada to treat investing in university research as a direct response to the climate change and sustainability challenge. Providing sufficient and stable funding to support fundamental science, as well as covering the full costs of research, is essential to preserve the foundation necessary to ensure our capacity to identify and meet the climate and sustainability challenges of the next century.

3. Targeted Research on Climate Change Mitigation and Adaptation

In many ways, the Arctic is the canary in the coalmine for climate change. Canada's presence in the North comes with a great responsibility to monitor and preserve this fragile ecosystem of geostrategic importance.

Accelerating Canada's capacity to collect and analyze the data required for effective solutions to the challenges posed by climate change depends on stable and long-term funding for research in this domain. Fragmented and intermittent targeted funding and shifts in funding mechanisms can destabilize research efforts and impede the ability of Canada's scientists to grasp issues and analyze data over time in consistent and scientifically sound ways.

McGill University therefore recommends that the government adopt a dedicated long-term climate science program, which should include:

- increased funding and a broader range of grants of different sizes that would allow Canada to train, attract and retain highly-qualified personnel;
- a targeted funding supplement for government-academic collaborations;
- specific allocations to maintain shared infrastructure for data collection and analysis; and
- acquisition of the necessary resources (such as ships, satellites and sensors) to reduce Canada's dependency on foreign infrastructure while conducting climate research.

In light of the urgent need to advance knowledge in the areas of climate change mitigation and adaptation, and of the role that Canada should play in international research networks, we support the proposal of the U15 Group of Canadian Research Universities for a Clean Future Research and Innovation Fund.

In order to be consistent with the findings of this very research community, we also recommend allowing a carbon offset of air travel as an eligible expense for Tri-Council funded research, with a dedicated allowance to cover these costs.

4. Transformative Infrastructure for Science and Innovation

There is no simple answer to the challenge of climate change mitigation and environmental sustainability. Finding solutions will require bringing together researchers across a broad range of disciplines including the social sciences, the life sciences, the physical sciences and engineering, to ensure, for example:

- that new materials designed by engineers are tested for potential harm to the environment by environmental toxicologists before production;
- that innovative technical solutions for transportation incorporate psychologists' and sociologists' understanding of behavioural change;
- that financial experts ensure the viability of proposals for energy-efficient buildings designed by architects and urban planners.

While research-intensive universities such as McGill are in a unique position to bring together Canada's best minds and a broad range of expertise to tackle the problems posed by climate change, the reality is that, too often, the buildings in which our outstanding scholars and researchers are housed are not well designed for cross-disciplinary collaboration. University campuses are collections of buildings aggregated over time in more or less coherent ensembles. Departments are often located in separate buildings, preventing fortuitous meetings and conversations among scholars from different disciplines. These 'silos' limit the potential for the serendipity essential to discovery and cross-field applications of new knowledge.

The climate challenge requires us to re-imagine science infrastructure around research themes and expected outcomes, in order to maximize impact. Metaphorically deconstructing disciplinary silos requires literally building research infrastructure that enables collaboration.

The example of Building 76 at MIT

[T]he Koch Institute for Integrative Cancer Research hosts such an interdisciplinary center for cancer research. […] This first shift connected researchers who were formerly disparate in terms of affiliation, and provided funding for research partnerships. In December 2010, the new building was inaugurated, offering specialized equipment and facilities, and serving as a nexus for cross-disciplinary work.

Since its first patent in 2011, Building 76 quickly rose to be the top inventing building. […] [This] analysis hints to a clear success of institutional initiatives in bringing together researchers from different fields.

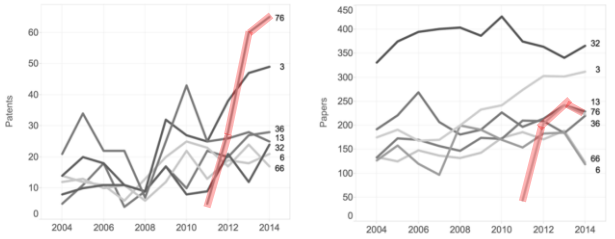


Figure A. Patent and paper output per building per year, from 2004 to 2014. This represents output from faculty during the year they were sited in a particular building – accounting for spatial relocations. Building 76, the Koch Institute, was opened in 2010 and by 2013 had become the top patenting building.

The spectacular potential of collaborative infrastructure has been documented in a study of the impacts of campus proximity on the number of inventions patented at MIT[1] (additional details in text box on previous page). Collision space not only affects the ability to transform single-discipline knowledge into cross-discipline applications, it also provides a dynamic and exemplary learning environment, and fosters collaborative approaches oriented to problem solving at the earliest stages of a researcher's career.

Such a deep transformation in a university's spatial organization would provide external partners, for example cleantech industries, government research departments and non-profit organizations, more salient, sector-relevant entry-points. This would in turn enhance the level of collaboration between universities and public and private partners and ensure a better overall return on investment for research funding.

Our vision for university infrastructure is as ambitious as the climate change challenge is pressing. It cannot be achieved without the help of the Government of Canada.

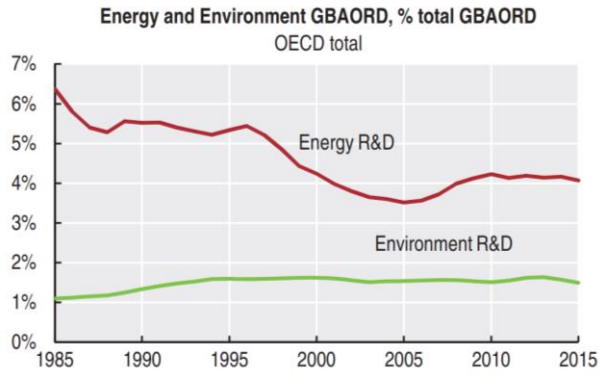
McGill University therefore recommends that the federal government jump-start a transformation of research infrastructure by funding an ambitious infrastructure program that best supports the broad interdisciplinary approaches to research essential to a successful transition to a low-carbon economy. The program should include coordination with the Canada Foundation for Innovation as concerns the administration of funding for shared equipment, platforms and associated "collision space".

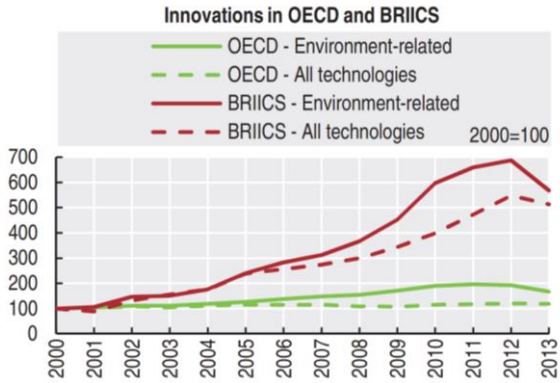
[1] Matthew Claudel, Emanuele Massaro, Paolo Santi, Fiona Murray, Carlo Ratti. "An exploration of collaborative scientific production at MIT through spatial organization and institutional affiliation", PLOS ONE, June 22, 2017.

5. Knowledge Mobilization and Environmental innovation

Knowledge created by scientists and scholars is destined to find its way out of universities and into the hands of those who will transform it into applications, bringing technological breakthroughs to market, adopting evidence-based policies or promoting best practices and behavioural changes. This is especially true of the science and innovation related to climate change mitigation and the transition to a low-carbon economy, where time is of the essence.

The OECD's Green Growth indicators show that while overall investment in R&D has increased since 2000, government budgets for R&D (GBAORD) on environmental and energy objectives have remained stagnant. The result has been a decrease in the proportion of GBAORD dedicated to environmental innovation, and the slowing of invention across all major environment-related technological domains since 2011.





This is especially concerning in Canada, as our share of the global green technology market shrank from 2.2% to 1.3% from 2005 to 2014[2] and environmental-related patents per capita are below the OECD average. Given how fast the share of the green economy in total market capitalization is rising[3], substantial growth gains can be expected in this area if Canada adequately supports environmental innovation.

Support from the Government of Canada could increase the impact of climate change and sustainability sciences by funding the critical early stages of maturation, thus helping bridge the gap between discovery and market readiness.

McGill University recommends that the Government of Canada provide universities with additional funding specifically targeting proof-of-concept, technology transfer, commercialization and entrepreneurship training in relation to technologies to mitigate climate-change.

[2] OECD reference from Analytical Advisors, *2016 Canadian Clean Technology Industry Report*.

[3] According to FTSE Russell, *Investing in the Global Green Economy: Busting Common Myths* (2018), it could represent 7% to 10% of global market capitalization by 2030.

6. Conclusion

As stated at the 2019 G7 Summit of Science Academies, addressing the major challenges of climate change "will only be possible through a systematic understanding of options and consequences, further scientific advances, accelerated technological progress, innovation and the existence of a political will to implement them".[4]

We reaffirm McGill's commitment to creating a research environment in which our scientists and scholars will work to enhance the wellbeing of Canadians, present and future, and to reduce our institutional carbon footprint. In order to help us and other Canadian universities achieve these goals, we encourage the Government of Canada to consider our recommendations:

That the Government of Canada:

1. provide sufficient support for fundamental research to preserve the capacity of university researchers to identify and meet the complex social challenges of the future;

2. deliver a long-term funding strategy for climate and sustainability research;

3. provide funding for Transformative Infrastructure for Science and Innovation;

4. support the amplification of knowledge mobilization mechanisms by providing additional financial support for environmental innovation.

[4] "Science and Trust", Statement from the Summit of the G7 science academies, 2019.