

Canadian Association of Physicists

Responses

1. Economic Recovery and Growth

Given the current climate of federal and global fiscal restraint, what specific federal measures do you feel are needed for a sustained economic recovery and enhanced economic growth in Canada?

The long-term viability of Canada's economy depends on a strong science, technology, and innovation community that (i) responds to industrial demands for knowledge ("market pull", see question 2), (ii) strongly supports basic research and commercializes the knowledge arising from it ("technology push"), and (iii) is able to attract, train, and retain highly qualified people for knowledge-based careers in industry, government, and academia (see question 3). Canada needs to sustain its basic and applied research capacity, which has long-term economic payoffs that could be jeopardized by short-term austerity cuts. Recommendation 1: Enhance and better coordinate funding for basic and applied research at universities. While applied research regularly leads to incremental innovations, basic research provides new insights that sometimes lead to major technological advances. For example, the invention of the World Wide Web flowed from physics research; basic semiconductor studies led to microelectronics essential to computers and cell phones; and spectroscopy studies led to lasers essential in consumer products such as HD and blu-ray players and in the manufacturing, telecommunications and entertainment industries. University research must be strengthened so that it will be better able to respond when industry needs to leverage its expertise, as it often does. Recent cutbacks at NSERC have left no clear means of obtaining funds for purchases of equipment or for operating centralized facilities that support many researchers. Existing facilities now risk cutbacks or closure. Most university researchers rely on Discovery Grants, whose availability and real value, on average, have been dropping steadily over decades. A mechanism is needed, perhaps through re-balancing funding, to support research infrastructure and equipment without negatively impacting the Discovery Grant program. Recommendation 2: Preserve the basic research capabilities currently housed in federal organizations. While the economy will benefit from industry-driven research at AECL and NRC, which are being restructured, these organizations also support basic research and access to large-scale research infrastructure. The basic research capacity at other federal organizations, such as CSA and Environment Canada, is being reduced. Transferring these functions to other organizations may be the best way to preserve them if these functions no longer fit their current organizational mandates.

2. Job Creation

As Canadian companies face pressures resulting from such factors as uncertainty about the U.S. economic recovery, a sovereign debt crisis in Europe, and competition from a number of developed and developing countries, what specific federal actions do you believe should be taken to promote job creation in Canada, including that which occurs as a result of enhanced internal and international trade?

Job growth and continued prosperity depend increasingly on a nation's ability to innovate. Technological innovation accounts for an estimated 50% of economic growth in advanced countries (C. Jones, Sources of U.S Economic Growth in a World of Ideas, American Economic Review. 2002). Complementing recommendations 1 and 2, the government should continue to support innovative approaches to encourage industry to more fully leverage research performed in universities, such as the following two recommendations: Recommendation 3: Extend support for targeted programs such as the Networks of

Centres of Excellence, which link universities and businesses together in research networks.

Recommendation 4: Create vouchers for small and medium-sized businesses to create R&D alliances with university labs. One barrier to such alliances is the highly time-consuming process for a company to establish a relationship with a university, define a joint program, and write a proposal with no certainty that it will be funded. If a company could obtain a voucher for R&D funding in advance, the barrier would be greatly reduced since both parties would be assured that a flexible source of funds is available. This program could be a natural expansion of the vouchers program suggested by the Jenkins report for connecting businesses to providers of commercialization support (Innovation Canada: A Call to Action, 2011). Recommendation 5: Use federal procurement strategically to stimulate business innovation. Canada spends billions of dollars on procurement, which should be leveraged to create jobs through innovation. For example, the USA's Small Business Innovation and Research (SBIR) program helps businesses to grow through granting contracts for proof of principle studies and follow up R&D, and by being the first customer of innovative products and services. The SBIR program is funded by reserving 2.5% of a federal agency's external R&D budget to be used for contracts with small businesses. The SBIR has demonstrated high rates of commercialization of ideas developed under the program, and this success has inspired similar programs in several other developed countries. These measures could greatly assist promising technologies to cross the well-known 'valley of death' between research and commercialization, ultimately creating jobs in Canada.

3. Demographic Change

What specific federal measures do you think should be implemented to help the country address the consequences of, and challenges associated with, the aging of the Canadian population and of skills shortages?

The demographic challenge heightens the importance of attracting, training, and retaining highly trained people, and of transferring knowledge from mature researchers to the next generation, which can be accomplished partly through mentorship programs and financial support. Such people are critical enablers of innovation needed to mitigate specific challenges of aging and achieve sustainable prosperity. Recommendation 6: Encourage people to enter science, technology, engineering, and mathematics programs and support them from undergraduate through graduate school, post-doc fellowships and early career research, by creating Canada Student Grants specifically for students in these fields and increasing the numbers of Postgraduate Scholarships and of Postdoctoral Fellowships. Many studies have shown that persons with more advanced degrees are significantly more likely to innovate and lead to productivity advances. "Well-educated and skilled people make important contributions to business innovation, productivity, and national economic performance. In an interconnected global economy, countries with more highly skilled workers have a distinct competitive advantage." (Conference Board of Canada, 2010). Although recently introduced prestigious scholarships give a lot of support to a few outstanding individuals, better support for a greater number of students is still needed. The demand for regular graduate scholarships and fellowships is great, illustrated by very low success rates for applicants. For example, the success rate for NSERC Postdoctoral Fellowships dropped from 34.9% in 2002 to a shocking 9.3% in 2011. Recommendation 7: Attract and retain scientists, engineers and students with a promise of a bright future by demonstrating commitments to providing large-scale scientific infrastructure and maintaining other federal research programs. For example, begin planning for new world-class research facilities to replace aged infrastructure at Chalk River Laboratories that supports a spectrum of research. Similarly, creating a coherent planning process for life-cycle management of funding for large-scale scientific facilities (including for example, the Canadian Light Source, TRIUMF, the NRU reactor, SNOLAB, Ocean Networks Canada, and Compute Canada) will provide greater stability to retain people than the current patch-work of short term funding cycles. Maintaining other research programs at NRC, CSA, and the science-based departments and

agencies also helps to retain people with needed skills.

4. Productivity

With labour market challenges arising in part as a result of the aging of Canada's population and an ongoing focus on the actions needed for competitiveness, what specific federal initiatives are needed in order to increase productivity in Canada?

Technological advance is a key driver of productivity, and such advances require a large pool of highly qualified people working in knowledge-based careers in industry, government, and academia. In addition to the foregoing recommendations to attract, train, and retain such people, the following recommendation will encourage Canadian students and researchers to gain valuable experience abroad, while foreign students and researchers would bring innovative ideas to Canada. Recommendation 8: Support research exchanges with universities and industries around the world for a limited period of time, such as six months to two years. These exchanges will create international linkages, which can stimulate future interactions and trade opportunities; given attractive opportunities in Canada, some foreign researchers will eventually relocate here. Comparable programs are the Humboldt and Helmholtz-DAAD Fellowship programs in Germany and the Marie Curie Fellowship Program in Europe. New research funds over the past several years have typically been used to add specialized funding programs, but these ultimately create a piecemeal system with gaps and inefficiencies. For example, funds are granted for purchases of equipment or construction of facilities without funds to operate them effectively, or funds are provided for a research program without a means to purchase or repair the equipment needed to perform the research. Consolidation of research funding into more comprehensive programs would directly increase the productivity of the research community by reducing the administrative burden on researchers to secure funding in addition to removing some of these inefficiencies. For example, there should be one federal program that funds both the capital and operating costs of research infrastructure. Recommendations 1 and 7 address these needs. Recommendation 9: Create a Minister of Science, Technology and Innovation (STI). The Jenkins report recommended creating a Minister for Innovation. In fact, Canada needs a Minister that can give full attention to the entire STI spectrum because of the critical importance of STI to productivity, and because technological innovation cannot be separated from the research that makes it possible. Ultimately, these improvements will translate into more research outcomes such as technological advances that increase productivity overall.

5. Other Challenges

With some Canadian individuals, businesses and communities facing particular challenges at this time, in your view, who is facing the most challenges, what are the challenges that are being faced and what specific federal actions are needed to address these challenges?

Canada faces the challenge of ensuring public safety in many areas including water, food, infectious diseases, terrorist threats and major environmental calamities, in an increasingly technologically complex world. Consumers need to be able to trust the products they buy and communities need to be able to trust environmental assessments. Scientific research is an important input in more public policy decisions today than ever before, and a high level of scientific capability within the public sector is required in order to inform these decisions. Recommendation 10: Maintain a high level of capability for "public good" research within federal departments, because public confidence in the research that underpins public policy and government programs is important to the economy and wellbeing of Canadians. There is also a need for public arms-length assessments of the scientific aspects of public policy, which are crucial to building trust and enabling informed public discussion of issues. The Council of Canadian Academies (CCA) was created in 2005 to begin to meet this need, but its mandate is limited

to examining only 5 issues per year. Recommendation 11: More funding should be extended to the Council of Canadian Academies (CCA) to enable it to produce scientific assessments of more issues. Another issue that Canadians face is increasing globalization. Globalization is a reality and those that adapt to this reality will be better positioned for success. In fact, studies have shown that scientists with international experience are more likely to engage in entrepreneurial activity than those with only domestic expertise (Krabel et al. Jena Economic Research Papers, 2009, 3, 26). While there is benefit from many existing programs that seek to encourage research collaborations with domestic companies, there would also be significant benefit from more programs designed specifically to “internationalize” our researchers by supporting internationally collaborative research. Canada would gain from these programs through the exchange of knowledge, which would in turn spark more international trade and job creation. Recommendation 12: Canada should seek to actively participate in major international research partnerships, such as the Framework and Horizon 2020 programs in Europe.