

The Needs of Public Research in Canada

Prepared by:
TRRA Research Working Group
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EXECUTIVE SUMMARY

In today's global knowledge-based economy, Canada's research universities, colleges, institutes and hospitals are the engines of innovation that will ensure our country's prosperity in the 21st century. Canadian researchers understand this responsibility and the need for the transparent and accountable translation of research results into the development and deployment processes so critical to the country's future.

In order to reap the full value of Canadian research, a sustained, balanced and integrated innovation investment strategy is required. Canada's research communities stand ready to work with government and the private sector to tune the innovation eco-system for maximum effectiveness.

Five elements of the innovation eco-system require policy renewal and operational adjustment:

- **Highly Qualified People** – Canada needs to ensure that mechanisms are in place to train, recruit, and retain highly qualified people. Current funding mechanisms for people lack integration. Appropriate and aligned investment strategies that support world leading researchers, new and emerging talent, and highly skilled technical support staff to assist researchers must be developed.
- **Sustained, Predictable Investment** – Grand challenge research programs with the capacity to make real social and economic change require predictable investment over a decade or more. Three-year programs (with no likelihood of renewal) hinder the ground-breaking research needed to drive the development and deployment of world leading new technologies and practices. Similarly, Canada's research institutions require guaranteed long-term investment in the overhead costs related to research in order to sustain the environments in which new ideas can emerge and move forward to market.
- **Solid Research Infrastructure** – Canada's researchers need to know that generic infrastructure in support of research will be available to them. Such infrastructure includes networks that enable communication among teams of researchers - nationally and internationally; computational power required to deal with "big" data science and engineering; data-management tools; access to specialized instrumentation that can only exist at a national or even international level – e.g. telescopes, synchrotrons, and large sensor networks. Today, this infrastructure is uncoordinated and under-supported.
- **Balanced support for basic and strategic research** – Today's basic research will result in commercial and social benefits in 2020 and beyond, while strategic research will allow us to address the problems of today. Equally importantly, we need support for research across the spectrum of human activity – science, engineering, social sciences, the arts and humanities. Successful deployment of innovation requires as much of an understanding of human factors as the development of the technology or practice requires an understanding of the science or the engineering.



- Overarching framework - Canada requires a comprehensive, integrated strategy for engaging innovation through research, development, and deployment. Canada needs to ensure that the mechanisms for support and accountability for each stage are clearly in place, while clearly articulating the role of the public and private sectors and ensuring that there are no gaps in support in the innovation system.

For additional details on each of these five elements, please see the following one-page briefs.

Canada's economic success in the 20th century was a consequence of its ability to realize ever higher value from its natural resources – timber, ore, wheat, fish, labour – the raw materials of the time. In the 21st century, in a global knowledge economy, the raw materials are scientific and social data produced by research and transformed through research into knowledge that can result in new products and new processes that bring transformative value to our economic and social fabric and improve the wealth and health of Canadians.

Canada has begun the transformation from a commodity-based economy. Realizing the full benefits of this transformation, however, will require continual investment and strategic focus.

Canada needs to recognize that its global competitors “get it” and have put in place long-term investment programs to support research, development, and deployment of new knowledge. Canada should sustain the progress it has made and go further to ensure Canadians realize the full benefits of a knowledge based economy.

Canada must become a country renowned for engaging innovation.



HIGHLY QUALIFIED PEOPLE

Canada needs to ensure that mechanisms are in place to train, recruit, and retain highly qualified people. Current funding mechanisms for people lack integration. Appropriate and aligned investment strategies that support world leading researchers, new and emerging talent, and highly skilled technical support staff to assist researchers must be developed. In this regard:

- The formation of highly qualified people is one of the most important outcomes of research in Canadian universities, colleges, and hospitals.
- Canadian innovation in both public and private sectors would be completely frustrated without access to the highly qualified individuals formed in undergraduate, graduate and post-graduate programs.
- Research in Canada not only trains highly qualified people; it requires highly qualified people at all levels.
- Support for highly qualified people needs to address world leading researchers, new and emerging talent, and highly skilled technical support staff.
- Canada has made major strides forward in the training of highly qualified people with the Millennium Scholarship Program and the Canada Research Chair's program.
- Canada lags in providing adequate highly qualified support personnel to our research leaders.
- As research increasingly creates and is dependent upon large data sets and the tools for data ingest, processing, visualization, and integration research leaders increasingly require the support of highly skilled technical staff to assist them in optimizing the use of data and equipment.
- Current funding for such technical support through MFA grants and their ilk is completely unable to meet the need.
- Support for highly qualified people must be at the core of a research and innovation system for Canada.
- The other elements of a research and innovation system must encompass all that highly qualified people require in order to make the optimal contribution
- The highly qualified people in Canada's private and public research organizations will be the country's greatest asset in a knowledge based economy.



SUSTAINED, PREDICTABLE INVESTMENT

Grand challenge research programs with the capacity to make real social and economic change require predictable investment over a decade or more. Three-year programs (with no likelihood of renewal) hinder the ground-breaking research needed to drive the development and deployment of world leading new technologies and practices. Similarly, Canada's research institutions require guaranteed long-term investment in the overhead costs related to research in order to sustain the environments in which new ideas can emerge and move forward to market.

- Grand Challenge research programs with the capacity to make real social and economic change require predictable investment over a decade or more.
- Canada needs a long-term strategy with the commitment of resources to back it.
- Canada must recognize that other competitor jurisdictions are making these long-term commitments. The *Ten Year Research and Innovation Investment Framework 2004-2014* in the United Kingdom is but one example.
- We will not retain highly qualified people in or attract highly qualified people to Canada unless they can feel confident that they will be supported to tackle major research challenges; unless they can be sure that research begun will be research sustained.
- Canada's universities, colleges, and hospitals need assurance that long-term indirect costs of research will be supported. Our research institutions are funded for student instruction/patient care and specific research projects. To accept research contracts, institutions must ensure that facilities including laboratories, libraries, and computer networks exist to support the research. Support services such as co-ordination, grant application, and management of intellectual property must be sustained. Regulation and safety compliance mechanisms must be in place. These supports to research are critical to the institutions' ability to provide high quality people the opportunity to undertake research challenges. These supports have been empirically demonstrated to be at least 40% of the value of the direct funding received to support research projects. Canada's institutions either need assurance on the on-going availability of a 40% overhead on research grants or they need block grants for research infrastructure.



SOLID RESEARCH INFRASTRUCTURE

Research in the 21st century is increasingly dependent upon robust and co-ordinated electronic infrastructure often referred to as cyberinfrastructure. As more and more research across the disciplines is conducted *in silico*, as the use of simulations becomes ever more critical, and as experimentation yields ever larger data sets, researchers require access to new levels of infrastructure beyond their traditional needs in the laboratory and the field.

This infrastructure is not unique to particular areas of research. It is generic to research. It cannot reasonably be provided by the traditional equipment grant process in a competitive peer reviewed process. Rather those successful in the competitive peer reviewed process need to know that such infrastructure will be there.

The Canada Foundation for Innovation's move to create the *National Platforms Fund for High Performance Computing* is a major move towards the provision of this kind of infrastructure.

Such infrastructure includes:

- High Performance Computing
- Data Management and Storage Facilities
- Specialized Instrumentation e.g. synchrotron's, telescopes, sensor networks
- The high bandwidth networks that enable the above elements to work as infrastructure and enable the collaboration among researchers in multiple locations.

Canada today has elements of this infrastructure: significant high performance computing at a regional level; very limited data management facilities, CLS; SNO; Atlas; Neptune; the CANARIE network. But all of these are on three to five year funding cycles with no commitment for long-term support and no co-ordination among them.

Researchers prepared to take on grand challenge questions – the kind of challenges – that can make a real difference may need to rely on such infrastructure for a decade or more. Losing the infrastructure could completely imperil the research in midstream.

Canada needs to commit on an on-going basis to generic infrastructure for 21st century research.



BALANCED SUPPORT FOR BASIC AND STRATEGIC RESEARCH AND ACROSS THE SPECTRUM OF RESEARCH DISCIPLINES

Today's basic research will result in commercial and social benefits in 2020 and beyond, while strategic research will allow us to address the problems of today. Equally importantly, we need support for research across the spectrum of human activity – science, engineering, social sciences, the arts and humanities. Successful deployment of innovation requires as much of an understanding of human factors as the development of the technology or practice requires an understanding of the science or the engineering.

- Many problems in “applied research” require breakthroughs in basic research to proceed. For example, problems in computer science and engineering maybe dependent upon algorithm development in basic mathematics research for progress.
- All research challenges are not within the sciences and engineering.
- Many of the breakthroughs in human practice in multiple fields requires insights from the social sciences and humanities.
- Successful deployment of innovation requires as much of an understanding of human factors as the development of the technology or practice requires an understanding of the science or the engineering.



A POLICY FRAMEWORK FOR INNOVATION

Canada requires a comprehensive, integrated policy framework engaging innovation through research, development, and deployment. Canada's competitor countries have such strategies. Examples include, *Backing Australia's Ability* and the *American Competitiveness Initiative* as well as major programs in Singapore, Korea, Brazil, and the entire European Community.

Such a policy framework must provide for the following:

- A clear understanding of the roles of the public and the private sector completely informed by an understanding of global markets and the policies of Canada's competitor countries.
- Balanced, sustained, predictable support for public research.
- Incentives and tax credit programs to encourage private sector investment in research, development, and deployment.
- Recognition that such incentives and credits are co-investments by government in national prosperity rather than "subsidies" to industry.
- A complete focus on the development of highly qualified people from pre-school to post-doc.
- Programs to facilitate the movement of people between public and private sector research and development.
- Programs to foster the development of an entrepreneurial culture – business for science and science for business.
- Recognition of the role of the humanities and social sciences in the formation of a creative culture essential to building an entrepreneurial culture.
- The creation of national infrastructure for innovation – computation, networks, advanced instrumentation, data repositories, middleware.



TRRA RESEARCH WORKING GROUP MEMBERS

The Toronto Region Research Alliance (TRRA) Working Group is composed of the following representatives from the Toronto Region:

Dr. John Challis
VP, Research &
Associate Provost,
University of Toronto

Mr. Michael Cooke
VP, Academic
Excellence &
Innovation, George
Brown College

Dr. Robert Eagle
Director of Research,
The Sheridan College
Institute of Technology
and Advanced
Learning

Dr. Geoff Fernie
VP, Research,
Toronto Rehabilitation
Institute

Dr. Alan George
VP, Research,
University of Waterloo

Mr. Gordon W. Gow
Chair, Ontario Health
Research Alliance
(OHRA)

Dr. Katharine Janzen
Associate VP,
Research &
Innovation, Seneca
College

Dr. Michael Julius
VP, Research,
Sunnybrook Health
Sciences Centre

Dr. Shitij Kapur
Chief of Research,
Centre for Addiction
and Mental Health

Ms. Mary Catherine
Lindberg, ED,
Council of Academic
Hospitals of Ontario
(CAHO)

Dr. Stephen J. Lye
VP, Research,
Associate Director,
Samuel Lunenfeld
Research Institute,
Mount Sinai Hospital

Dr. Colin Macarthur
VP, Research,
Bloorview Kids Rehab

Mr. Jamie Mackay
VP, Policy and
Analysis, Council of
Ontario Universities

Dr. Heather Maclean
VP, Research & Inter-
Professional
Education, The Centre
for Research in
Women's Health
(CRWH), Women's
College Hospital

Mr. Bill MacLeod
VP, Research and
Corporate
Development,
Hamilton Health
Sciences

Dr. Chris Paige
VP, Research,
University Health
Network

Dr. Ian Rodger
VP, Research and
Academic, Director,
Father Sean
O'Sullivan Research
Centre, St. Joseph's
Hospital

Dr. Janet Rossant
Senior Scientist and
Chief of Research,
Lombard Chair in
Pediatric Research,
Research Institute,
Hospital for Sick
Children Departments
of Medical Genetics
and Microbiology, &
Obstetrics &
Gynecology,
University of Toronto

Ms. Diana Royce
Managing Director,
Ontario Health
Research Alliance

Dr. Allison Sekuler
VP, Research and
International Affairs,
McMaster University

Dr. Stan Shapson
VP, Research and
Innovation,
York University

Dr. Melvin Silverman
VP, Research,
Canadian Institute for
Advanced Research

Dr. Arthur S. Slutsky
VP, Research,
St. Michael's Hospital

Dr. Anastasios
Venetsanopoulos
VP, Research and
Innovation,
Ryerson University

Dr. Alan Wildeman
VP, Research,
University of Guelph

Questions? Contact Walter Stewart, Senior Advisor, Research Capacity Building, TRRA at (416) 673-6678 or wstewart@trra.ca. Learn more about TRRA at www.trra.ca.

