NCDEAS | CCDISA
Report to Engineers Canada

Ishwar K. Puri
Dean, McMaster University
NCDEAS | CCDISA Chair

NCDEAS
CANADIAN ENGINEERING EDUCATION

CCDISA
FORMATION CANADIENNE EN INGÉNIERIE

NCDEAS | CCDISA

ISHWAR K. PURI, MCMASTER UNIVERSITY, CHAIR
JAMES A. NICELL, MCGILL UNIVERSITY, VICE CHAIR
GREG NATERER, MEMORIAL UNIVERSITY OF NEWFOUNDLAND, PAST CHAIR

NCDEAS | CCDISA Committees

- **Education Committee**: Supporting the *Canadian Engineering Education Challenge (CEEC)*, through the *Engineering Change Lab*, to experiment with and measure the effectiveness of various teaching methods
- **Research Committee**: Developed position paper on critical importance of engineering R&D to innovation and productivity in Canada.
- **Deans Liaison Committee**: Continuing to advance the accreditation pilot project

NCDEAS | CCDISA Committees (2)

- **Public Policy Committee**: Worked with Engineers Canada to bring Deans to *Engineers on the Hill*
- **NCDEAS / NSERC Liaison Committee**: Topics of national importance to Canadian engineering research community

Specific Actions

- **Accreditation Pilot**: Lead by a BC institution with financial support and engagement from a dozen universities.
  - Regional discussions ongoing, e.g., APEGBC, PEO
- **Advocacy Committee**: Collaborated with EC to advance engineering education research and engineering design with letters to:
  - MP Chandra Acharya, MP Majid Jowhari, Dr. Mario Pinto, NSERC President

National and Global Leadership

- **NCDEAS–NSERC Liaison Committee**: Established with a mandate from July 1, 2017–June 30, 2020.
- **Global Engineering Deans Council**: Next GEDC meeting to be hosted by McMaster in Niagara Falls, October 2017, expecting 250 global deans – gedc2017mcmaster.ca.

NCDEAS | CCDISA Perspectives

- Prepare for the graduating **Engineer of 2030**.
  - Accreditation, curriculum, emerging technologies
- Integrate learning and research for **innovation**.
  - Develop the next generation of intrapreneurs and entrepreneurs
  - Accreditation, curriculum, emerging technologies
- Address **student mental health**.
  - Workload

NCDEAS | CCDISA Perspectives (2)

- **Advance Educational Innovation**: Study and implement new ways of experiential learning, problem-based learning, project–based learning, design thinking, inquiry, global exchanges and perspectives that augment or substitute for in-classroom instruction
  - Changes in education delivery, input *vs.* output measures and metrics

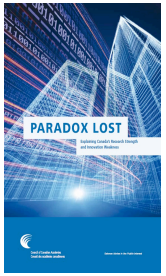
Insert: Excepts of presentation by Dr. James Olson, Associate Dean Research and Industry Partnerships, Faculty of Applied Science, University of British Columbia at April NCDEAS | CCDISA meeting in Ottawa, April, 2017.

THE PIVOT OF ST&I FROM 'DISCOVERY' TOWARD 'ECONOMIC DEVELOPMENT'

James.Olson@ubc
.ca

Paradox Lost

- Council of Canadian Academies (RSC, CAE, CAHS)
  - "Canadian academic research, overall, is strong and well regarded internationally. Canadian business innovation, by contrast, is weak by international standards, and this is the primary cause of Canada's poor productivity growth."
  - "World's sixth highest ARC ratio"
  - "Why has Canada's research excellence not translated into more business innovation?"
- Canada has invested in research aimed at impacting the business of science and medicine while sacrificing research aimed at 'economic development'
- Looking forward:
  - "… innovation policy objectives and business motivation will finally be aligned."



Canada's R&D bibliometric excellence

Field	MAGNITUDE/INTENSITY # of Papers (2005–2010)	Share of World Pubs. (2005–2010) (%)	SI (2005–2010)	QUALITY/IMPACT ARC Score (2005–2010)	ARC Rank (2005–2010)	Share of Top 1% Cited Papers (%)
Agriculture, Fisheries & Forestry	15,880	5.33	1.38	1.25	8	7.90
Biology	18,227	5.23	1.18	1.34	7	5.45
Biomedical Research	31,326	4.96	1.12	1.18	9	4.22
Built Environment & Design	3,152	4.94	1.36	1.17	14	4.81
Chemistry	17,653	2.56	0.63	1.27	7	2.62
Clinical Medicine	88,354	4.09	0.98	1.59	3	6.15
Communication & Textual Studies	2,686	3.16	1.73	1.04	9	1.87
Earth & Environmental Sciences	15,788	5.79	1.23	1.29	9	4.53
Economics & Business	10,161	4.80	1.21	1.11	7	3.96
Enabling & Strategic Technologies	26,896	2.96	0.75	1.36	8	3.77
Engineering	34,927	3.92	1.01	1.37	6	4.44
Historical Studies	3,512	4.76	1.26	1.28	5	3.74
Information & Communication Technologies	40,529	4.35	1.12	1.30	6	4.27
Mathematics & Statistics	8,951	4.18	0.91	1.11	9	3.29
Philosophy & Theology	2,024	5.30	1.04	0.92	8	3.31
Physics & Astronomy	30,890	3.03	0.60	1.42	3	2.57
Psychology & Cognitive Sciences	12,319	7.04	1.96	1.13	5	5.39
Public Health & Health Services	15,298	6.88	1.82	1.24	7	8.00
Social Sciences	12,355	4.69	1.44	1.10	8	4.05
Visual & Performing Arts	286	3.71	1.37	2.09	2	4.55

Clinical Medicine

Physics and Astronomy

Visual and Performing Arts

NCDEAS
CANADIAN ENGINEERING EDUCATION

CCDISA
FORMATION CANADIENNE EN INGÉNIERIE

James.Olson@ubc
.ca

Gross R&D spend: Comparison with OECD

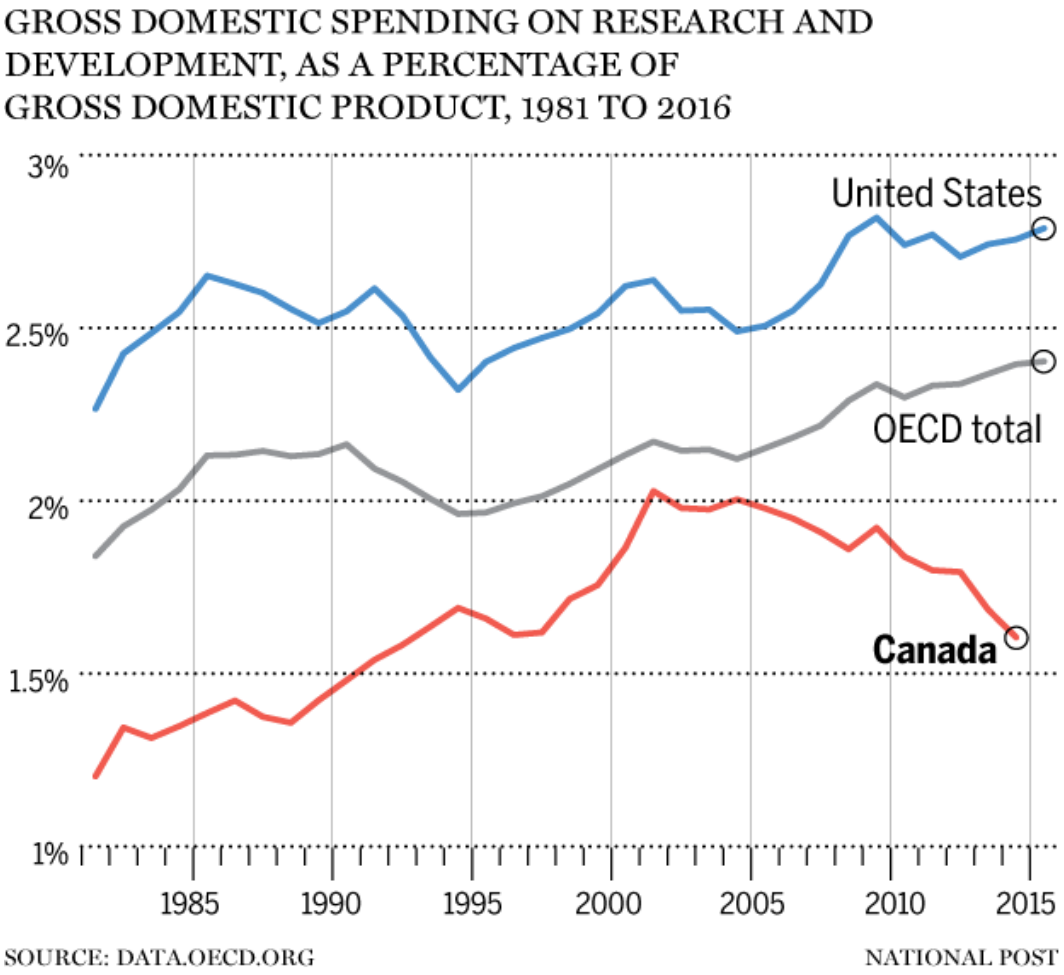
- Canada's GERD spend has been declining for 10 years

  'Decade of Darkness'

- Gross expenditure on R&D (GERD) = Higher Education, Federal & Prov. Gov. + Business + Not for Profit + Foreign

Closing this gap requires $38.2B/y more business R&D spend !

- $78B increase in GERD over 5 years (assuming linear increase to close gap)



How could Canada's Private Sector Fund $38.2 B in New R&D Investment?

- ✓ It must come from increased revenues
  - ✓ Those revenues must come from sales predominately in export markets
    - ✓ Innovative firms spend about 3.5% of revenues on R&D: From Booz + Co
      - ✓ Therefore to fund $38.2 B in new R&D, Canadian Firms would need to increase export sales by an additional $1,091 B (note current Canadian exports total about $623 B)

Conclusion: Canadian export revenues have to increase by 175% to fund an average OECD level of private sector R&D

THEREFORE A "SUSTAINABLE" CANADIAN S&T/ INNOVATION STRATEGY HAS TO BE AN EXPORT STRATEGY!!

David B. Watters, President/CEO
Global Advantage Consulting Group Inc.
Ex-ADM Federal Ministry of Finance - Economic Development

James.Olson@ubc
.ca

Funding growth is not aligned with Economic Development

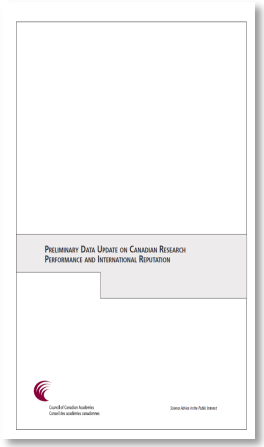
- HERD funding growth in areas with:
  - Strong on bibliometrics
  - Weak on 'economic development'

Data Source: Calculated by Science-Metrix using Scopus database (

Figure 3.3

Growth Index by Field of Research in Canada and the World, 2003–2014

The figure shows the GI scores for Canada by field of research relative to world GI score. The GI score is based on a comparison of growth betwe 2008–2014 and 2003–2008 periods.



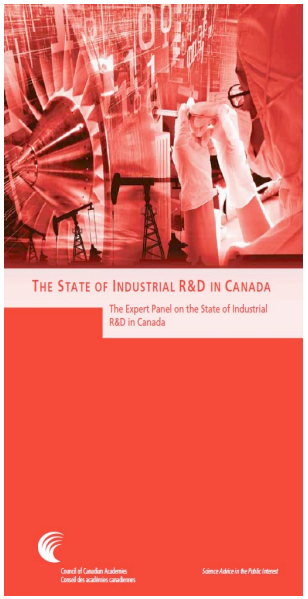
NCDEAS CANADIAN ENGINEERING EDUCATION

CCDISA FORMATION CANADIENNE EN INGÉNIERIE

A "SUSTAINABLE" CANADIAN S&T/INNOVATION STRATEGY HAS TO BE AN EXPORT STRATEGY!!?

David B. Watters, President/ CEO
Global Advantage Consulting Group Inc.
Ex-ADM Federal Ministry of Finance - Economic Development

Paradox lost – Analysis of S&T strengths



S&T Research Strengths	Industrial R&D Strengths	Economic Strengths
1. Clinical Medicine 2. Psychology and Cognitive Science	1. Pharmaceutical and Medicine Manufacturing	
3. Information and Communications Technologies	2. Information and Communications Technologies	
4. Physics and Astronomy		
	3. Aerospace Products and Parts Manufacturing	1. Aerospace
	4. Oil and Gas Extraction	2. Oil and Gas Extraction
		3. Construction
		4. Forestry
		5. Financial, Insurance, and Real Estate
		6. Retail and Wholesale Trade
5. Visual and Performing Arts 6. Historical Studies		

Export industry strengths

NCDEAS CANADIAN ENGINEERING EDUCATION
CCDISA FORMATION CANADIENNE EN INGÉNIERIE