Lessons Learned from the Use of Economic Impact Analysis (EIA) and Partial Benefit-Cost Analysis (PBCA) in Evaluations of S&T Research Grants Program

Presentation to the AEA Conference
October 27, 2012

Natural Sciences and Engineering Research Council of Canada | Conseil de recherches en sciences naturelles et en génie du Canada | Canada

NSERC Key Facts

- Funding agency of the federal government, funds university and college research
- Does not conduct research itself and has no research laboratories
- Governed by an 18 member Council appointed by government with representation from academia, industry and government
- Nearly 400 employees
- Headquarters in Ottawa with five regional offices across Canada

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NSERC Vision and Priorities

Vision: NSERC helps make Canada a country of discoverers and innovators for the benefit of all Canadians

Priorities:

People

Building our human capital in the natural sciences and engineering by supporting more than **29,000** students and postdoctoral fellows.

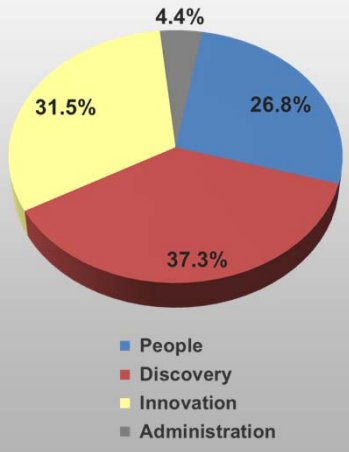
Discovery

Unleashing the creative power of our researchers by funding more than **11,000** professors for their research programs.

Innovation

Connecting and applying the strength of our research capacity to the challenges and needs of industry and society by funding research projects with over **2,000** Canadian companies.

Total Budget 2012-13
$1.08 billion



Economic Impact Analysis (EIA) of Collaborative Research Development (CRD) Grants

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Context

- The Economic Impact Analysis (EIA) was conducted as part of an evaluation of Collaborative Research and Development (CRD) program
  - Evaluation was conducted by Science-Metrix
- The CRD program supports collaborative R&D projects between university researchers and industry
  - Focused research projects; no min. budget; avg. 3 years
  - Direct project costs are shared by NSERC and industry (1:1 NSERC to partner contribution ratio)
  - Key beneficiaries: industry, academic researchers and trainees

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Objectives

- EIA was used to address an evaluation question assessing the economic benefits of the CRD program
  - Conducted by an economist (Professor Hanel, University of Sherbrooke) with assistance from Science-Metrix
  - Analysis informed by admin data, file review and web surveys
- EIA provided an estimation of the program's contribution to Canadian GDP
  - Order-of-magnitude figure on the dynamic and static impacts of a program
  - Dependent on availability and quality of data and factors related to the systems being modeled

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Methodology (1)

- EIA used two main processes: data collection and standardization, and data analysis
- Data collection and standardization
  - Program-specific administrative data was extracted from NSERC's award management information system
  - Administrative data was complemented by data from web surveys of researchers, partners and trainees
  - Detailed budget information from a random sample of 67 grants was used to provide data on expenses
  - Data were standardized to constant 2006 dollars

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Methodology (2)

- Data analysis: Static and Dynamic Impacts
- Analysis of static impacts estimates the economic effects of the program-related expenditures at a point in time
  - Gross static impacts were estimated using an input-output simulation, then adjustments made to calculate the net static impact
- Analysis of dynamic impacts involved top-down and bottom-up approaches
  - Top-down estimates contribution of university education and research activities on GDP
  - Bottom-up estimates program effects based on econometric analysis of micro-data observations of firms and researchers

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Results

- The EIA indicates a positive return on investment on the Canadian GDP when increased human capital included
  - NSERC spent $255 million on the CRD program and leveraged $223 million industrial partner contributions
  - Gross static impact on Canadian GDP: ~$377 million
  - Net static impact: ~$179 million
  - Dynamic impact (top down): Approximately $326 million
    - Average return of $2.7 on GDP for each NSERC dollar spent; return ranges from lower bound of $1.3 to upper bound of $4
  - Dynamic impact (bottom-up): Not possible due data limitations

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Lessons Learned

- EIA is very data intensive and dependent on accessing and/or gathering a wealth of data
- Quality and quantity of data has a direct impact on the types of analysis that can be performed
  - Low response to funded and unfunded partner surveys
  - Inconsistent and incomplete project cost data
- Input-output simulation and systems being modeled are complex and results are approximate
  - EIA adds to the time, cost and data collection activities of an evaluation project

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Utility

- Overall, it was difficult to assess utility of this method to senior management:
  - Results are, necessarily, macro-level, approximate in nature and dependent on the data and parameters
  - No information on the specific impacts of the CRD program
  - Limited applicability to other NSERC programs that do not feature contributions by industrial partners
- Management more interested in impact of projects on firm R&D and performance
  - Unable to complete the “bottom-up” approach to provide micro-level impact of program on firms

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Partial Benefit-Cost Analysis (PBCA) of Strategic Project Grants

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Context and Objectives

- As part of an evaluation of Strategic Project Grants
  - Project grants (3 years) for early-stage research
  - Involves an industrial or government partner
  - In-kind contributions, but cash contributions not required
- Led by Douglas Williams and Dennis Rank, KPMG
- To identify the economic impacts of a program and to determine if it is a drain on economic welfare (i.e., whether the benefits fall short of the costs)
  - Do the benefits of a few, successful projects cover (or are likely to cover) the costs of the program?

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Methodology (1)

- Sampling
  - Long list (~40) – candidates identified based on known success stories, awards, information from program staff, file review, survey results
  - Screening (~20) – candidates selected based on impact size, ability to dollarize, attribution
  - Final selection (~11) – confirmation of suitability
- Data Collection: 5 case studies (2000/01-2005/06)
  - File review; interviews with researchers, partners, students and research staff; industry statistics

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Methodology (2)

- Benefits and costs modeled case-by-case and on an annual basis
  - Benefits were modeled from the known start-date to anticipated end-date (i.e., 5-20 years):
    - Net profits for new products (i.e., marginal profits); sale of firms (profits for Canadian investors); and net cost savings for new processes (i.e., net of costs such as licensing, training, implementation of the new technologies);
  - Costs were modelled in the years they incurred:
    - Early investments (e.g., in start-up firms); and early development costs (i.e., pre-production)

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Results

	Lower Bound ($M)				Upper bound ($M)		
Discount rate	*2%*	*7%*	*8%*		*2%*	*7%*	*8%*
Net benefits (5 "high impact" cases)	367.5	340.1	336.9		584.8	533.1	526.2
Program costs (2000/2001 - 2005/2006)	412.4	557.9	592.1		412.4	557.9	592.1
- Net Present Value	*(44.9)*	*(217.7)*	*(255.2)*		*172.4*	*(24.8)*	*(65.9)*
- Benefit/Cost Ratio	*0.89*	*0.61*	*0.57*		*1.42*	*0.96*	*0.89*

The partial benefit-cost analysis concluded that the net benefits from five Strategic Projects covered between 89% and 140% of NSERC's investment in Strategic Project Grants from fiscal year 2000/01 through 2005/06.

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Lessons Learned

- It has to be possible to identifying sufficient “high impact” cases
- Sufficient raw data must be available at the project level
- Must be possible to quantify benefits in dollars
- Companies must be willing to share information with analysts
- Meet users’ information needs

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Utility

- Useful to have evidence for that the program is not a drain on economic welfare, especially that five projects pay for the whole program
- Interesting to know that it is difficult to predict “benefit to Canada” through the peer-review selection process
- Unfortunate that it does not allow for comparisons with other programs or generalization
- Insufficient as a stand-alone assessment of a program funding early-stage research, but a good complement

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Conclusion

- What approach is most appropriate ultimately depends on intended uses, intended users, availability of required data (or prospects of collecting it)
- Would consider using PBCA again on the program-level, but EIA may be more useful on the organizational level
- EIA and PBCA is heavily dependent on assumptions and somewhat of a black box from a client perspective
- Limited opportunities to build internal capacity to undertake similar studies in the future

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Evaluation Reports: http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/evaluations-evaluations_eng.asp

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