

An Assessment of the Science and Technology Policy Research Capacity in Canada

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Introduction

New agricultural and medical biotechnologies bring both potential and actual benefits to society. Biotechnological advances in the field of medicine, for example, generate drugs and therapies for diseases such as cancer and AIDS.¹ Therapeutic benefits for diseases such as Parkinson's, Alzheimer's and diabetes are expected from ongoing research into stem cell therapies.² Agri-food research, on the other hand, yields or is expected to yield foods that are higher in nutritional content, more resistant to environmental challenges (e.g. heat, cold, drought, diseases) and are more environmentally friendly.³

While clearly beneficial, however, some of these sciences and technologies also give rise to serious controversies. For example, most methods used to generate stem cells necessitate the destruction of human embryos. The opponents of this research thus argue its immorality.⁴ Likewise, the opponents of genetically modified foods (GM foods) raise issues about the lack of knowledge regarding the safety of their consumption and about their impact on the environment.⁵

New life-sciences and technologies (ST), therefore, have the power to impact our society both positively and negatively. In order to achieve an adequate balance between the benefits and the drawbacks, then, establishing a robust ST policy is of paramount importance. Underpinning a robust ST policy, however, is robust ST policy research. The aim of this project is thus to provide an overview of the status of ST policy research in Canada, and to compare it to the ST policy research in other jurisdictions.

II. Scope of the Research

Here the focus is on a comparison of the Canadian ST policy research picture with those of the following jurisdictions:⁶ Australia, New Zealand (NZ), United Kingdom (UK), United States (US), Western Europe⁷ and other countries.⁸ Of interest is the ST policy research focusing on life sciences (that is, agricultural biotechnologies and medical biotechnologies)⁹ that is carried out in the academic settings.¹⁰

III. Methodology

Each ST policy research unit identified was categorised according to the following criteria:

a. Area of Research Focus

Three areas of ST policy research focus were consistently encountered among the research units:

- Medical-only biotechnology policy research focus (e.g. stem cell policy research)
- Agricultural-only biotechnology policy research focus (e.g. GM foods)
- Non-specialised life-science policy research focus (that is, *both* medical and agricultural biotechnology policy issues)

b. Teaching Activities

Teaching activity may be taken as an indirect measure of recognition of the importance of ST policy research, in that it consists (at least in part) of producing further researchers.

Whether a research unit conducts teaching activities was therefore also investigated, and further differentiated into undergraduate and graduate level teaching.

i. Undergraduate teaching

Undergraduate teaching was taken to be occurring if some members of the unit’s research team are undergraduate students, or if the unit offers courses at an undergraduate level.

ii. Graduate teaching

Graduate teaching was taken to be occurring if some of the members of the unit’s research team are graduate students, if the unit offers courses at a graduate level, or if the unit performs dissertation supervision.

c. Conferences/Workshops

Whether a research unit organizes workshops or conferences is an indication that the unit disseminates its research to a greater – usually academic – audience. Thus, information on whether a research unit organises conferences or workshops was also sought out.

d. Consulting/Advising Activities

Consulting or advising activities indicate that the unit disseminates its research to a greater – generally, non-academic – audience. Information about whether the unit engages in such activities was therefore also sought out.¹¹

IV. Research Results

a. General Results

Jurisdiction	Number of univ. examined	Number of ST policy research units located	% of univ. with ST policy research unit
Australia	18	8	44%
Canada	31	18	58%
NZ	7	2	29%
Other	19	0	0%
UK	44	19	43%
US	256	25	10%
Western Europe	99	12	12%
Total	474 univ.	84 research units	----

Figure 1. General Research Results by Jurisdiction

In terms of raw numbers, the largest concentration of ST policy research units is found in the United States (25 units), then the United Kingdom and Canada (at 19 and 18, respectively). Western Europe has 12 research units

and Australia has 8. Countries grouped together as “Other” (namely, Japan, Korea, Turkey and Mexico) and New Zealand have the least number of units located (at 0 and 2, respectively).¹²

In terms of percentages, however, the picture is very different. Canada has the greatest percentage of universities with a unit researching ST policy (58%), followed by Australia and UK (both between 40-50%). United States and Western Europe have 10% and 12%, respectively. While New Zealand’s 29% is higher than the percentage in Europe and the United States, the low number of universities and the low number of research units located there render this number liable to large oscillations with the addition or subtraction of a single unit. Finally, the countries grouped as “Other” have 0% research units devoted to ST policy research. Relative to their respective number of universities, then, Canada, Australia and the UK place the greatest emphasis on ST policy research.

b. Detailed Results

i. Canada

Research units = 18	Area of Research Focus			Teaching		Workshops & Confer - ences	Consultation
	Medical-only	Agri-only	Both	U-grad	Grad		
numbers	5	2	11	5	13	17	15
%	28%	11%	61%	28%	72%	94%	83%

Figure 2. Detailed Research Results – Canada

In Canada, 31 major universities were examined for the existence of ST policy research units. The research yielded 18 ST policy research units. In other words, 58% of the major Canadian universities have an ST policy research unit.

A large majority of research units, 61%, conduct ST policy research focussing on both medical and agricultural biotechnology policy. Where the ST policy research focus is solely on medical biotechnology policy, or on agricultural biotechnology policy, the former occurs at a greater rate (28%) than the latter (11%).

Teaching is emphasized primarily at the graduate, rather than undergraduate, level. Nearly three-quarters (72%) of research units offer graduate level instruction, whereas less than a third (28%) offer undergraduate level instruction.

Research is heavily disseminated. Nearly all, 94%, of the Canadian academic ST policy research units disseminate

their research to other academics (as measured through the incidence of workshops and conferences), and 83% disseminate research to a greater audience (as measured through consulting activities).

ii. Remaining OECD Jurisdictions

Location	Research units	Area of research focus			Teaching		Workshops & Conf.'s	Consultation
		Medical-only	Agri-only	Both	U-grad	Grad		
Australia	8	2	1	5	1	3	7	5
NZ	2	0	1	1	2	2	2	2
UK	19	11	0	8	9	17	18	15
US	25	16	5	4	13	18	22	20
W.Europe	12	3	4	5	2	8	10	3
Other	0	0	0	0	0	0	0	0
Numbers	66	32	11	23	27	48	59	45
%	---	48%	17%	35%	41%	73%	89%	68%

Figure 3. Detailed Research Results – Remaining OECD Jurisdictions

Among the remaining OECD jurisdictions, a total of 443 universities were examined, and 66 academic ST policy research units were identified. In other words, 15% of the universities located have an ST policy research unit.

The largest number of research units, nearly half (48%), focus on human biotechnology ST policy. Just above a third, 35%, focus on both medical and agricultural biotechnology policy. Very few research units (17%) focus solely on agricultural ST policy research.

Teaching activities dominate at graduate rather than undergraduate level: whereas 73% of the research units (or nearly three-quarters) offer graduate level instruction,¹³ only 41% (roughly two in five) do likewise at the undergraduate level.¹⁴

Research is very heavily disseminated to other researchers, and less so to the greater (non-academic) audience. Eighty-nine per cent of units organize conferences and workshops.¹⁵ Only 68%, however, disseminate their research to the greater audience via consulting activities.¹⁶

iii. Comparing Canada to the Remaining OECD Jurisdictions

Research units	Area of Research Focus			Teaching		Workshops & Conferences	Consultation
	Medical-only	Agri-only	Both	U-grad	Grad		
Canada %	28%	11%	61%	28%	72%	94%	83%
OECD %	48%	17%	35%	41%	73%	89%	68%

Figure 4. Status of the Canadian and international ST policy research

How does the ST policy research situation in Canada compare to the rest of the OECD?

In the OECD jurisdictions outside of Canada, 15% of the universities examined have a research unit devoted to the study of ST policy, whereas in Canada, this number is 58%. Percentage-wise, then, Canada has nearly four times as many universities with a dedicated ST policy research unit than does the average non-Canadian OECD jurisdiction.

Canada's research units tend not to be focussed solely on agricultural biotechnology policy research, and in this they're similar to the general OECD picture (Canada's 11% approximates to OECD's 17%). Canada differs from the OECD picture, however, in terms of the split of research focus between medical-only biotechnology policy research and both medical and agricultural biotechnology policy research. The split is fairly close in the general OECD picture (48% for medical only, 35% for both). In Canada, however, the percentage of research units focussing on both medical and agricultural biotechnology policy is more than twice that on medical only biotechnology policy (61% versus 28%, respectively).

Of the Canadian research units, 28% offer undergraduate instruction, and 72% offer instruction at the graduate level. Among the rest of the OECD, these numbers are 41% and 73%, respectively. Internationally, then, there is a greater emphasis on undergraduate education than there is in Canada, although the situation with respect to graduate education is nearly identical.

Canadian emphasis on the dissemination of ST policy research carried out by the research units is very similar to the general OECD picture. In the OECD picture, 89% of the research units conduct workshops and conferences, whereas in Canada, 94% of the research units do so. The Canadian emphasis on the dissemination of knowledge to a greater audience, however, is somewhat greater than the situation in the rest of the OECD. In Canada, 83% of the research units undertake consulting activities, whereas in the international picture, this percentage is 68.

V. Conclusions

Canada, then, emphasizes life-science ST policy research much more than the average OECD jurisdiction: relative to its number of universities, Canada has nearly four times as many academic ST policy research units as the average OECD jurisdiction. Only the Canadian emphasis on undergraduate education is lesser than in the remaining OECD jurisdictions. The situation with respect to



graduate instruction is comparable in Canada and in the remaining jurisdictions, while the dissemination of research — both to academic and non-academic audiences — is more heavily emphasised in Canada than in the other OECD jurisdictions.

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1. Industry Canada, *Mobilizing Science and Technology to Canada's Advantage* (Ottawa: Public Works and Government Services Canada, 2007), online : Industry Canada <<http://ic.gc.ca/cmb/welcomeic.nsf/ICPages/CorporatePublications#s-t>>.
2. American Association for the Advancement of Science (AAAS), *American Association for the Advancement of Science (AAAS) Statement Regarding the President's Veto of the Stem Cell Research Enhancement Act and the New Executive Order* (Washington, D.C.: AAAS, 2007), online: <http://www.aaas.org/news/releases/2007/media/0620aaas_statement.pdf>.
3. Royal Society of New Zealand, *Biotechnology Science Scan* (Wellington: Royal Society of New Zealand, 2004), online: Royal Society of New Zealand <www.rsnz.org/policy/Futurewatch.pdf>.
4. National Institutes of Health, "Stem Cell Information – Federal Policy," online: National Institutes of Health <<http://stemcells.nih.gov/policy/>>.
5. Canadian Labour Congress, "Genetically Modified Foods," online: Canadian Labour Congress <http://canadianlabour.ca/index.php/genetic_foods>.
6. These are members of Organisation for Economic Co-operation and Development (OECD), with the exclusion of its Eastern European members (viz. Czech Republic, Slovak Republic, Hungary, Poland).
7. These include: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. The United Kingdom, which is being treated separately, is excluded here.
8. These include: Japan, Korea, Turkey and Mexico.
9. Physical and applied sciences (e.g. nanotechnologies) were excluded.
10. Various types of research organisations were encountered within academia. These included, for example: Centres, Centres of excellence, Inter-university networks, Institutes, Research groups, etc. The criteria for categorising a research organisation as, for example, a centre rather than an institute, vary across jurisdictions. Thus, for the purpose of this project, all research organisations will be generically referred to as "research units."

11. *Explicit* information regarding consultancy or advising activities was rarely provided by the unit's website. Thus, whether such activities are occurring was determined either via examination of the publication lists (for evidence of position papers or white papers) or via an examination of the "news and events" pages (for indication that the research unit's work was presented to decision-making bodies) (e.g. government departments or ministries), the media, etc.

12. The countries grouped as "Other" do evince a fair amount of academic research activity in various areas of policy research; however, there does not appear to be any research activity conducted that is specifically targeted to *life-science* ST policy, which is the focus here.

13. It is unclear in the case of one (1) research unit whether teaching is conducted at graduate level. The number listed (48 units, which translates into 73%) includes only those research units that were determined to conduct graduate teaching.

14. It is unclear in the case of one (1) research unit whether teaching is conducted at undergraduate level. The number listed (27 units, which translates into 41%) includes only those research units that were determined to conduct undergraduate teaching.

15. It is unclear in the case of one (1) research unit whether workshop/conference activities are undertaken. The number listed (59 units, which translates into 89%) includes only those research units that were determined to conduct these activities.

16. It is unclear in the case of six (6) research units whether consulting activities are occurring. The number listed (45 units, which translates into 68%) includes only those units where consulting was determined to be occurring. (If we include here the six (6) research units where it is uncertain whether consulting activities occur, the situation appears much improved, as then 51/66, or 77% of the research units, would be engaging in this activity).