POLICY BRIEF: SCIENCE POLICY

Key points

- Governments today face complex domestic and international problems requiring access to scientific expertise to make sound decisions.
- Delivering effective science advice requires robust advisory mechanisms as wells as scientists who understand the broader contexts in which decision-making occurs and who can communicate specialized knowledge effectively across professional silos.
- Mitacs plays an important role developing these skills through its *Canadian Science Policy Fellowship* program, bridging academia and public policy by matching PhD graduates from all disciplines with participating government departments and agencies. Fellows apply their knowledge and gain valuable policy skills while host organizations benefit from the academic expertise that fellows bring.

Context: what is science policy?

Science policy occurs at all levels of government. The use of scientific evidence to inform policy-making - "science for policy" - is distinct from policy for administering science systems - "policy for science."[1] Science policy, understood as science for policy, involves relaying scientific advice to policy-makers to help inform decision-making, through formal and informal channels, using skills that effectively translate specialized knowledge for ready use by policy-makers.

Whether science policy is occurring at the local, national, or international level, science advice tends to fall into five broad categories. **Technical advice** is the ongoing input to departments and agencies provided by internal and external subject-matter experts. **Regulatory advice** supports the core mandates of regulatory agencies and science-based departments (e.g. aviation safety, pharmaceutical regulation, environmental protection). **Deliberative advice** is the examination of large, long-standing, or slow-burning problems by a panel of experts convened by government, typically involving consultations and other input mechanisms. **Informal advice** usually takes the form of on-demand advice given by trusted science advisors or scientists in civil society leadership roles (e.g. heads of science councils and academies). Finally, **science advice in crises and emergencies** is the scientific advice gathered from multiple sources and disciplines in response to urgent developments, often brokered by science advisors working closely with decision-makers. Effective knowledge brokerage in crisis scenarios is the role of the science advisor *par excellence*.[2] While this typology focuses on the executive branch of government, depending on the constitutional arrangements in different countries, parliamentarians and legislators often also have sources of science advice independent of the executive and typically focused on reviewing proposed legislation.[3]

Issue: how does science policy fit into decision-making?

The relationship of science to society has evolved to become more democratic over time, with an implicit social contract underpinning public confidence in, and support for, science.[4] Citizens expect science to yield tangible benefits for people and communities. The nature of science itself has also changed, with problems now typically involving increasingly complex, non-linear, and cross-disciplinary questions that include many unknowns. Scientists today often must reach conclusions based on probabilities rather than certainties, which can sometimes confuse decision-makers and frustrate the public. In addition, the inferential gap separating knowns and unknowns frequently overlaps with the most value-laden political aspects of a given problem.[5] For these reasons, scientists in advisory roles need skills and contextual knowledge that complement their scientific expertise and enable them to better inform the development of policy.

Not surprisingly, science policy has itself become the focus of academic inquiry. Theories of science policy tend fall into four general models: **Knowledge shapes policy** is a supply model that regards scientific knowledge as an independent variable that feeds into policy-making in

[1] Gluckman, Peter. "The art of science advice to government." *Nature,* vol. 507, issue 7491, March 13, 2014a, p. 164.
(accessible here: https://www.nature.com/news/policy-the-art-of-science-advice-to-government-1.14838).
[2] International Network for Government Science Advice (INGSA). "INGSA Manifesto for 2030: Scientific Advice for the Global Goals." 2018
(accessible here: https://www.ingsa.org/manifesto/).
[3] *Ibid.*
[4] Office of the Prime Minister's Chief Science Advisor, Government of Australia. "Address given by Sir Peter Gluckman, at the invitation of the Joint Research Centre of the European Commission." October 15, 2014b, p. 1.
(accessible here, PDF: http://www.pmcsa.org.nz/wp-content/uploads/JRC-Speech-The-Art-and-Science-of-Policy-Advice.pdf).
[5] *Ibid.* p. 3.

measurable ways. **Politics shapes knowledge** is a demand model that argues that funding influences what gets researched, and policy directions are difficult to change since previous decisions become increasingly embedded in institutional structures. The **Co-production** model asserts that research and policy are co-produced through an ongoing process of mutual reaction, and that the demand for more problem-solving knowledge is hardwired into the science-policy relationship as policy responds to scientific advances. Finally, the **Autonomous spheres** model argues that science and politics are entirely separate, with politics selectively appropriating scientific findings that are mediated by other important actors such as journalists, consultants, and lobbyists.[6]

Policy-making has been described as "a networked process in which scientific evidence is only one of many inputs."[7] Effective science policy includes awareness that policy-makers must weigh a range of considerations and priorities, and that scientific advice is often one of many factors informing a decision. "Policy-makers and elected officials rightly guard their responsibility to define policy – and this means choosing between options with different trade-offs. This is not the domain of a science adviser."[8]

Public perception of science is very important in democratic societies, and scientists "must not overstate what is or can be known."[9] Overzealous claims can polarize the policy discourse and undermine public trust in science.[10] Scientists outside of advisory processes may act as advocates if they choose, but institutionalized science advice must prioritize honest brokerage of knowledge. This entails clear communication of knowns and unknowns and being alert to the insertion of values into the scientific process while recognizing that the task of mediating those values belongs to other components of the policy process. Science advisory mechanisms must have the trust of policy-makers in all political seasons, no less when there is a gap between the scientific evidence and the prevailing political ideology of the day. In the words of Sir Peter Gluckman, Chief Science Advisor to the Prime Minister of New Zealand: "When formal science advice is perceived as advocacy, trust in that advice and in the adviser is undermined, even if the advice is accepted."[11]

Mitacs Canadian Science Policy Fellowship Program

The growing relevance and urgency of effective science policy demonstrates the importance of programs like Mitacs' *Canadian Science Policy Fellowship* program, the first of its kind in Canada. By supporting the critically important human dimension of evidence-based policy, Mitacs is a leader in helping to bring the latest insights and evidence to bear on government problem-solving in support of science-informed public policy.

Through the *Canadian Science Policy Fellowship* program, Mitacs matches PhD graduates from all disciplines with participating government departments and agencies. Fellows apply their knowledge and gain valuable policy skills while host organizations benefit from the academic expertise that fellows bring.

Further reading:

"Framework for Skills for Evidence-informed Policy-making: Continuous Professional Development Framework." European Commission Joint Research Centre. October 10, 2017. https://ec.europa.eu/jrc/communities/community/evidence4policy/news/framework-skills-evidence-informed-policy-making

Canadian Science Policy Over the Years *	
1882	National Academy established by Canada's 4th Governor General, incorporated the following year by Act of Parliament as the Royal Society of Canada
1916 - 1945	National Research Council of Canada (NRC) established in response to World War I; president & committees act as primary source of science advice to government (along with the Royal Society of Canada to a lesser extent)
1964	Science Secretariat created within Privy Council Office (PCO) to respond to scientific information requests by the prime minister and cabinet
1966	Science Council of Canada (SCC) created as a crown corporation (i.e. arms-length) to advise on national S&T resources
1969	Chief Science Advisor (CSA) appointed to direct PCO's Science Secretariat and to advise cabinet
1971	First Minister of State for Science and Technology appointed to cabinet
1983	First departmental CSA appointed within the Min. of State for Science and Technology, effectively serving as deputy minister
1987	National Advisory Board on Science and Technology (NABST) established to provide strategic advice, chaired by the prime minister and reporting publicly
1992	Federal government closes the SCC
1995	Federal government closes NABST
1996	Advisory Committee on Science and Technology (ACST) established to replace NABST, chaired by Secretary of State for Science and reporting secretly. Council of Science and Technology Advisors (CSTA) created to replace SCC as source of external advice on management of federal S&T resources
2000	CSTA report *Science Advice for Government Effectiveness* (SAGE) adopted by federal government, prompted by series of crises (fish stocks, blood supply, GMOs, dairy cow growth hormone)
2002	Council of Canadian Academies established (initially the Canadian Academies of Science, renamed in 2006)
2004	National Science Advisor (NSA) appointed to advise the prime minister, situated in PCO (moved to Industry Canada in 2006)
2007	CSTA and ACST abolished, replaced with the Science, Technology & Innovation Council (STIC) mandated to provide confidential (non-public) advice and report publicly every two years on national S&T performance
2008	NSA post abolished upon retirement of the incumbent
2011	Government of Quebec appoints Chief Science Advisor combining advisory function and executive role over provincial research funding agencies
2017	Federal government appoints national Chief Science Advisor. Ontario appoints Chief Scientist (abolished 2018)
2018	Fundamental Science Review (Naylor Report) recommends arms-length National Advisory Council on Research and Innovation (NACRI) be established by Act of Parliament as source of independent strategic advice

* See Quirion, R. et al. "Reflections on science advisory systems in Canada." Palgrave Communications 2, article number: 16048. August 2016. https://www.nature.com/articles/palcomms201648

[6] Boswell, Christina and Katherine Smith. "Rethinking policy 'impact': four models of research-policy relations." Palgrave Communications, vol. 3, article 44, December 12, 2017.
[7] Gluckman, Peter. "The science-policy interface." *Science*, vol. 353, issue 6303, September 2, 2016, p. 969 (accessible here: http://science.sciencemag.org/content/353/6303/969).
[8] Gluckman, 2014a, p. 165.
[9] *Ibid.*
[10] Gluckman, 2014b, p. 2.
[11] Gluckman, 2014a, p. 165.