

A Costly Gap: The Neglect of the Demand Side in Canadian Innovation Policy

Jakob Edler

IN BRIEF

Canada's Innovation and Skills Plan is meant to tackle the country's triple innovation challenge: decreasing productivity growth, a growing gap in R&D investments, and the need to better harness innovation for the good of society. But it offers only part of the solution. As with previous policy, it is overly focused on the generation of knowledge, technology and innovation, and it does not directly address the issues of business readiness and the market's ability to absorb innovations. For innovation policy to succeed, government must acknowledge the need to intervene on the demand side to accelerate diffusion, adoption and market creation, and must act on it.

EN BREF

Le Plan pour l'innovation et les compétences du Canada vise à relever le triple défi du pays en matière d'innovation : recul de la croissance de la productivité, diminution des investissements en R-D et nécessité de canaliser l'innovation au profit de l'ensemble de la société. Mais il ne traite que d'une partie de la question. Comme les mesures qui l'ont précédé, il insiste trop fortement sur la production de connaissances, de technologies et d'innovations sans cibler directement la préparation des entreprises et la capacité du marché à absorber l'innovation. Pour assurer la réussite de son plan, le gouvernement doit reconnaître l'importance de stimuler la demande afin d'accélérer la diffusion et l'adoption d'innovations ainsi que la création de marchés, et mettre en œuvre un plan d'action.

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FOREWORD

In May 2018, the IRPP invited Jakob Edler to give the keynote address at the innovation policy symposium that launched the Institute's research program Unlocking Demand for Innovation. An academic who has worked on innovation policy for 20 years, he was at that time executive director of the Manchester Institute of Innovation Research. His remarks at the symposium focused on his work on demand-side innovation policy and the extensive evidence produced by the Manchester Institute on the effectiveness of innovation policies and programs in Europe. The IRPP subsequently asked Edler to write this commentary on Canada's Innovation and Skills Plan, with a particular emphasis on the country's major challenge on this front: the long-standing weakness of business demand for innovation.

The paper therefore provides an outside observer's perspective on Canada's innovation policies, based on the current state of knowledge in the policy literature and evidence on innovation policy outcomes in other jurisdictions. As several of the government's initiatives are recent and some are still evolving, the analysis is limited to the information available in public documents and may not reflect the latest developments.

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INTRODUCTION

The discussion on innovation policy in Canada long ago revealed a Canadian paradox.¹ Canada is a country with enormous capabilities and potential. The performance of its education system is second to none, and the country has pockets of true scientific excellence and a strong scientific infrastructure. Overall, it benefits from a stable macroeconomic environment and is attractive for the world's scientific elite.

However, Canada's existing strength in education and research and the country's macroeconomic stability have not translated strongly enough into innovation performance or economic growth. Recent years have seen some concerning trends across a range of indicators. Productivity growth has slumped, as has business and government investment in R&D relative to that of most other OECD countries.² The bottom line is that the country's innovation potential has not been realized.³

At the same time, society and political actors continue to have high expectations that innovation can not only bolster economic growth but also contribute more directly and visibly to societal welfare. As the 2017 budget claims:

Done right, innovation not only helps to strengthen and grow the middle class, it opens up possibilities for improving our quality of life: better, more effective health care; smarter, more connected cities; and cleaner, more sustainable energy, among many other examples.⁴

Canada is thus faced with a triple challenge. Collective efforts are needed to (1) turn around the trend in R&D investment, (2) boost productivity and (3) fulfill Canadians' expectations that innovation will enhance welfare and address the grand challenges that the country and the world face.

This paper argues that Canadian innovation policy needs to significantly change course if it is to tackle this triple challenge. Relying on policies of the past, which focus on increasing the generation of knowledge, technology and innovation, will not do the job. While for decades this approach has served the country comparatively well, governments need to recognize that for firms, the incentive to innovate stems from their expectations regarding the acceptance and absorptive power of the market. Further, innovations contribute to welfare and greater productivity only if they diffuse throughout the economy and society. For this to happen, the state needs to do more to support processes and practices that ensure a better match between demand for

¹ Council of Canadian Academies, "Paradox Lost: Explaining Canada's Research Strength and Innovation Weakness" (Ottawa: Council of Canadian Academies, 2013). The paradox "idea" dates back to the Senate Special Committee on Science Policy, "A Science Policy for Canada" (1970, 1972, 1973).

² Council of Canadian Academies, Expert Panel on the State of Science and Technology and Industrial Research and Development in Canada, *Competing in a Global Innovation Economy: The Current State of R&D in Canada* (Ottawa: Council of Canadian Academies, 2018).

³ P. Nicholson, *Facing the Facts: Reconsidering Business Innovation Policy in Canada*, IRPP Insight 22 (Montreal: Institute for Research on Public Policy, 2018).

⁴ Canada, *Budget 2017: Building a Strong Middle Class*, 18, <https://www.budget.gc.ca/2017/home-accueil-en.html>.

and supply of innovation. Although recent initiatives implemented as part of Canada's Innovation and Skills Plan⁵ show promising signs pointing in that direction, the main argument of this paper is that policy-makers need to take a close look at the market and system failures not only on the supply side of innovation but also on the demand side and respond accordingly.

A science, technology and innovation (STI) policy that keeps focusing primarily on strengthening the supply side but leaves the demand to "market forces" will limp toward better innovation performance for the economy and society rather than forcefully taking on the economic and societal challenges ahead. As other countries are increasingly recognizing the need for a more balanced innovation policy, Canada's international position as an attractive location for science and innovation will come under greater pressure.

CANADIAN STI: A BIASED READING OF A BIASED SYSTEM

Deteriorating R&D and economic performance

To support the argument for a more balanced STI policy in Canada, we need to reflect critically on the country's STI performance. I base this reflection on a deliberately biased reading of the most recent evidence produced by the Council of Canadian Academies in 2018, in order to highlight a combination of challenges that call for a change of approach.

Canada has a small but strong science, research and development system. Over decades, the country has maintained a powerful and attractive science base, which is well regarded internationally. Its Average Relative Citation score (a normalized indicator of research impact used for international comparison) has ranked in sixth place for the last 12 years or so.⁶ From 2009 to 2014, Canada's score was above the world average in all research fields and among the top five countries in five fields.⁷ Overall, Canada has a better standing than other strong economies such as Germany, the United States, France and Japan. In addition, the country has the highest share of population with a post-secondary education of all industrialized countries.⁸

What has been worrying consecutive governments for years⁹ and now appears to have become a real structural challenge is the poor translation of scientific strengths into economic performance. The first indication is Canada's relatively mediocre scientific performance in the enabling and strategic technological and scientific areas, such as

⁵ The government of Canada introduced its Innovation and Skills Plan in Budget 2017 as part of "an agenda to build Canada as a world-leading innovation economy that will create jobs and grow the middle class." The main components of the innovation plan included reviewing, consolidating and simplifying existing business innovation programs; establishing Innovation Canada as a one-stop shop for innovators; accelerating innovation through superclusters; increasing late-stage venture capital; and supporting innovation in key growth industries. Canada, Canada's Innovation and Skills Plan (2017), https://www.budget.gc.ca/2017/docs/themes/Innovation_en.pdf.

⁶ Council of Canadian Academies, *Competing in a Global Innovation Economy*.

⁷ Council of Canadian Academies, *Competing in a Global Innovation Economy*, xxi.

⁸ Council of Canadian Academies, *Competing in a Global Innovation Economy*, 24.

⁹ Council of Canadian Academies, "Paradox Lost."

nanotechnology, materials science and artificial intelligence, which will determine industrial competitiveness in the future.¹⁰ This may signal a deeper divide between scientific excellence and economic relevance. Second, investment in R&D has weakened. The gap between Canada's R&D spending as a proportion of GDP and the OECD average has widened from 0.1 percentage point in 2004 to 0.7 in 2015.¹¹ Canada spends 1.7 percent of GDP on R&D, compared with the OECD average of almost 2.4 percent.¹² Business R&D is particularly weak. Canada ranks 33rd based on a composite index of the magnitude, intensity and growth of industrial R&D.¹³ In addition, the economy's reliance on a number of relatively low-tech sectors (e.g., mining, wholesale) within the broader North American integrated market raises concerns over its future growth prospects. Those trends and indications are worrisome in terms of the country's future capacity to engage in technology-driven competition with other economies.

Poor absorption and poor analysis of demand-side problems

The picture is even more challenging if we consider the issue of innovation adoption. The productivity of an economy strongly depends on its ability to adopt and utilize the latest process technologies. However, Canadian businesses are poor at absorbing leading-edge technologies and knowledge, and appear to lack "receptor capacity."¹⁴ Importantly, in all available reports on the performance of Canada's STI system, this weakness is discussed mainly, if at all, as a structural impediment to the commercialization of university research. That is, the single lens used in these reports is the need to turn scientific excellence into economic strength, and the explanation provided for low absorptive capacity is poor university-industry relations. As a result, there has been a lack of full appreciation and analysis of a broader problem of absorption and absorptive capacity in industry.¹⁵ In addition, until very recently there has been no in-depth reflection on what businesses perceive to be the biggest obstacle to innovation: that is, uncertainty and risk.¹⁶ This narrow supply-side focus amounts to a problematic blind spot: the failure to recognize a deeper demand-side problem in industry and society and its root causes.

Canada's Economic Strategy Tables, launched by the federal government in fall 2017, may be an opportunity to begin addressing this gap. The tables, each chaired by industry leaders, are seen as a new model for industry-government collaboration in six interconnected sectors with high-growth potential: agri-food, resources of the future, health and biosciences, clean technology, digital industries and advanced manufacturing. The overarching goal of this initiative is "turning Canadian economic strengths into global advantages."¹⁷ Each table has been tasked with setting ambitious growth targets,

¹⁰ Council of Canadian Academies, "Paradox Lost," xxi, 60-62.

¹¹ Organisation for Economic Development and Co-operation, *Main Science and Technology Indicators* (Paris: OECD, February 2019), <http://www.oecd.org/sti/msti.htm>.

¹² OECD, *Main Science and Technology Indicators*.

¹³ OECD, *Main Science and Technology Indicators*.

¹⁴ OECD, *Main Science and Technology Indicators*.

¹⁵ This is obvious in a survey on impediment barriers in Council of Canadian Academies, *Competing in a Global Innovation Economy*, 168-70.

¹⁶ Council of Canadian Academies, *Competing in a Global Innovation Economy*, 140.

¹⁷ Canada, *Economic Strategy Tables*, <https://www.ic.gc.ca/eic/site/098.nsf/en/home>.

identifying sector-specific challenges and bottlenecks, and laying out an actionable road map to achieve the sector's goals.¹⁸ Although the reports issued by the sectoral tables emphasize the need to increase competitiveness, scale up promising companies and promote large anchor firms, they also identify, in each of the six sectors, obstacles to growth that inevitably overlap to some extent with obstacles to innovation. A corresponding overlap exists in some of the proposals put forward to mitigate these obstacles. In particular, proposals that pertain to technology adoption and agile regulations suggest some recognition of demand-side considerations and the need to improve the conditions for market creation. This point will be discussed in further detail below.

Consistent imbalance: Policy as a reflection of analytical biases

In line with this analytical imbalance, the policy mix of the country remains strongly biased toward the supply side. Tax incentives and R&D subsidies are generous, and financial support for “innovation sectors” in the form of grants and contributions has been expanded and enhanced. There is a broad portfolio of start-up assistance, and venture financing has picked up significantly, supported by the Canadian Venture Capital Action Plan.¹⁹ As for the Economic Strategy Tables initiative, it is essentially traditional sector-based policy.²⁰ Except for the broader “resources of the future,” and to a certain extent “clean technology,” the focal areas for support are mainly defined by specific technologies, and less by the economic and societal needs or challenges to be addressed. Of course, the technologies in question will eventually help respond to societal needs. The point here is that the policy analysis and support are focused on the factors that affect the supply or use of these technologies. By and large, the needs themselves are not explicitly addressed.

The enduring puzzle

So we are left with a puzzle. Analysis and policy have been focusing and continue to focus on very traditional supply-side issues, such as R&D investment, start-ups, venture capital and university–industry relations. While poor university–industry relations have often been cited as a major reason for low absorptive capacity in the country, broader issues of absorption of and demand for leading-edge innovations in the economy and society more generally are almost absent from the policy debate. Yet this supply-side focus bears less and less fruit – as evidenced by the slowdown of economic performance, poor productivity growth and declining business R&D – for two reasons: (1) if businesses do not use latest technologies, they fall behind in productivity; and (2) if businesses do not sense a readiness and ability of the market to absorb their innovations, they are reluctant to innovate. Existing policies do not address those two major demand-side problems in the economy.

¹⁸ Canada's Economic Strategy Tables, *The Innovation and Competitiveness Imperative: Seizing Opportunities for Growth*, [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_SeizingOpportunities.pdf/\\$file/ISED_C_SeizingOpportunities.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_SeizingOpportunities.pdf/$file/ISED_C_SeizingOpportunities.pdf).

¹⁹ Council of Canadian Academies, *Competing in a Global Innovation Economy*, 156-62.

²⁰ Canada, *Economic Strategy Tables*, <https://www.ic.gc.ca/eic/site/098.nsf/eng/home>.

Among the innovation policy measures announced in the last two years, there has been one explicit exception to this supply-side focus, and that is the role of public agencies and government departments as strategic buyers of innovation. We will turn to the issue of public procurement in more detail below, but it appears that the focus on public procurement as the one significant demand-side measure to boost innovation is limited to so-called precommercial procurement. This type of procurement does entail defining public needs and issues and calling for proposals to address those needs, but in essence it directly subsidizes the development of innovative solutions rather than committing to buy the solutions that might be produced.²¹

Overall, government policy does not reflect a recognition of the depth and breadth of the demand-side challenge and leverage. Rather, there remains a conceptual, analytical and policy gap. What we are left with is a very strong argument for expressly including the demand side as part of the problem analysis in order to identify potential innovation bottlenecks and levers to address the imbalance. Recognizing the demand side in the analysis would in turn enable the development of more effective innovation measures to improve economic performance as well as societal welfare through a demand-side policy that is worthy of its name.

RATIONALES AND INSTRUMENTS FOR SUPPORTING INNOVATION DEMAND

For decades, active government intervention on the demand side was seen as inappropriate. Market forces on their own, the argument went, would ensure the optimal allocation of innovation activities, and potential buyers know their preferences best. There are, however, strong theoretical and conceptual arguments for state intervention on the demand side.²² In particular, there is a strand of three rationales that are equally compelling for state intervention.²³

The first is a bundle of market and system failures. The traditional market failure rationale for intervention in STI in industry and public research organizations is broadly accepted. The state is supposed to intervene because of underinvestment in research. Knowledge, especially basic knowledge, inevitably spreads beyond the public or private lab where it is created. Private actors, therefore, tend to limit their knowledge creation to knowledge that they can immediately exploit as they seek to appropriate the full returns on their investment. This means that, if the initiative is left to the market

²¹ Canada, *Budget 2017*, 86; Canada, *Budget 2018: Equality and Growth: A Strong Middle Class*, 199, <https://www.budget.gc.ca/2018/home-accueil-en.html>.

²² This section summarizes arguments made more comprehensively elsewhere. In particular, see J. Edler, "The Impact of Policy Measures to Stimulate Private Demand for Innovation," in *Handbook of Innovation Policy Impact*, ed. J. Edler, P. Cunningham, A. Gök and P. Shapira (Cheltenham, UK: Edward Elgar Publishing, 2016), 318-84; J. Edler and L. Georghiou, "Public Procurement and Innovation: Resurrecting the Demand Side," *Research Policy* 36, no. 7 (2007): 949-63; J. Edler, "Demand-Based Innovation Policy," in *The Theory and Practice of Innovation Policy: An International Research Handbook*, ed. R. Smits, S. Kuhlmann and P. Shapira (Cheltenham, UK: Edward Elgar Publishing, 2010).

²³ This is based on Edler, "Impact of Policy Measures" and Edler, "Demand-Based Innovation Policy."

alone, there will be underinvestment in the longer-term, universally accessible knowledge that is more valuable to the economy and to society more broadly.

The reasons for tackling system failures are also well established. Innovation and the creation of knowledge require capable actors, exchange and cooperation between actors, and favourable framework conditions such as regulation and reliable financial institutions. Left on their own, innovation systems will only slowly, if at all, develop the necessary connections and capabilities. State intervention can accelerate and orient interactions, and help build up capabilities.

Examples of market and system failures include the following:

- *Adoption externalities, high entry costs and risk:* Early users (adopters) incur learning and adaptation costs. They have to bear the high entry price of an innovation and are confronted with the uncertainties about functionality and the costs and benefits of the innovation. Second-round buyers benefit from price reductions and improved functionalities enabled by the higher costs borne by first users. Those externalities add up to veritable hindering forces against early adoption of innovations, even if the individual and social benefits associated with adoption are obvious.
- *Information asymmetries:* Producers are often not fully aware of the market preferences of users who do not sufficiently articulate their preferences. And users lack full knowledge about the costs and benefits of innovations.
- *Insufficient interaction between users and producers:* Such interaction is required for the specification of needs and experimentation with innovations.
- *Lack of capabilities and willingness to use new technologies:* These factors combined with existing technological path dependencies can hamper innovation adoption.

A second line of reasoning relates to productive linkages between the supply and the demand sides. We know that in productive innovation systems, favourable conditions on the demand side are attractive to leading-edge innovators, thus allowing fruitful interaction with the supply side. Generating innovation often requires proximity to early users or geographically concentrated sectoral clusters. Such proximity facilitates interactions at different stages of value chains and eases necessary feedback loops and knowledge spillovers between producers and users. Poor demand conditions (abilities, readiness to experiment, etc.) hamper the necessary two-way flow of knowledge in numerous ways, and thus are an obstacle for leading-edge innovators. A further argument for supporting the uptake and use of innovations in the economy is that the quick uptake and use of novel technologies or services is a major contributor to the productivity of firms.²⁴

The third bundle of reasons for state intervention is societal and political. Societal goals have always been an important consideration in OECD countries, but have

²⁴ Edler, "Impact of Policy Measures."

hardly been expressed in the context of innovation policy, let alone demand-side innovation policy. The democratic state, representing societal interests, can mobilize the generation and use of innovation to achieve societal goals. In recent years, mission orientation to meet specific social challenges has re-entered the debate on innovation policy, in particular in the EU and other European countries.²⁵

The justification for government intervention stems from the state's responsibility for public services and for the pursuit of societal goals or concrete, clearly defined "missions": "Missions...can provide the means to focus our research, innovation and investments on solving critical problems, while also spurring growth, jobs and resulting in positive spillovers across many sectors."²⁶

However, if innovation policy is to be framed in this way, as contributing to problem solving, it is essential not only to generate innovations that promise to help solve the problem but also to take on missions that are socially acceptable in the first place. To do so, society and in particular potential innovation users must be engaged in the process of defining missions and identifying demand-side bottlenecks.

Demand-side policies

If we accept those three rationales as justifying policy intervention on the demand side, the call for demand-side innovation policy is compelling. Demand-side policy refers to all public action to do one or more of the following:

- *Induce* innovation and/or speed up the *diffusion* of innovation by supporting the willingness or ability to ask for and use innovation.
- Define *new functional requirements* for products and services.
- Improve *user involvement* in innovation production (user-driven).

Based on this definition, there is a range of policy instruments that can help mitigate demand-side bottlenecks (box 1). Some of those instruments are better suited to support the definition of societal needs and demand for innovations that are not yet on the market (policy to *trigger* innovation), and others are more suitable to support the diffusion of novelties (policy to support actors to be *responsive* to innovation).

²⁵ K.M. Weber and H. Rohracher, "Legitimizing Research, Technology and Innovation Policies for Transformative Change: Combining Insights from Innovation Systems and Multi-Level Perspective in a Comprehensive 'Failures' Framework," *Research Policy* 41, no. 6 (2012), 1037-47; S. Kuhlmann and A. Rip, "Next-Generation Innovation Policy and Grand Challenges," *Science and Public Policy*, 45, no. 4 (2018): 448-54; W. Boon and J. Edler, "Demand, Challenges, and Innovation: Making Sense of New Trends in Innovation Policy," *Science and Public Policy* 45, no. 4 (2018): 435-47.

²⁶ M. Mazzucato, *Mission-Oriented Research & Innovation in the European Union: A Problem-Solving Approach to Fuel Innovation-Led Growth* (Brussels: European Commission, Directorate-General for Research and Innovation, 2018), 4, https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf.

Box 1: Demand-Side Policy Instruments¹

- **Public procurement of innovation**, whereby the state uses procurement strategies and procedures to lower the risk for innovators and spark innovation. In this context, the state either defines new functionalities as a buyer or is open to innovative solutions. Public procurement of innovation has become the most fashionable demand-side measure in Europe because of its alleged simplicity and because it allows the state to act directly as an innovation-buying and -using agent. However, this strongly underestimates the obstacles that need to be overcome if public procurement really is to be effective in encouraging innovation.
- **Precommercial public procurement**, whereby public sector needs are identified and opened to contests for potential suppliers (demand-side element), who are granted service contracts to develop solutions (supply-side element). The final purchase of the resulting innovative product or service is not included as part of these programs, however, as it needs to go through the regular procurement process.
- **Price-based instruments**, such as demand subsidies or tax incentives, which lower the barriers for early buyers and signal a political will to create a market.
- **Awareness measures, labels, information campaigns**, which come in many forms to mitigate information asymmetries.
- **Demonstration projects**, whereby the state buys and uses large equipment or facilities to reduce uncertainties for potential private buyers.
- **Training** to enable potential users to take advantage of innovative products and services.
- **Articulation of needs and joint-need definition**, which are essential to give direction to demand and send signals to suppliers as to where future demand will be headed.
- **Support of user-producer interaction and user-driven innovation**.
- **Regulation** to help reduce uncertainties and align societal expectations with future developments and specifications.
- **Mix of demand-side measures**, whereby explicit strategies combine different instruments to overcome a range of identified bottlenecks and speed up adoption and diffusion processes.

¹ Based on J. Edler, "The Impact of Policy Measures to Stimulate Private Demand for Innovation," in *Handbook of Innovation Policy Impact*, ed. J. Edler, P. Cunningham, A. Gök and P. Shapira (Cheltenham, UK: Edward Elgar Publishing, 2016).

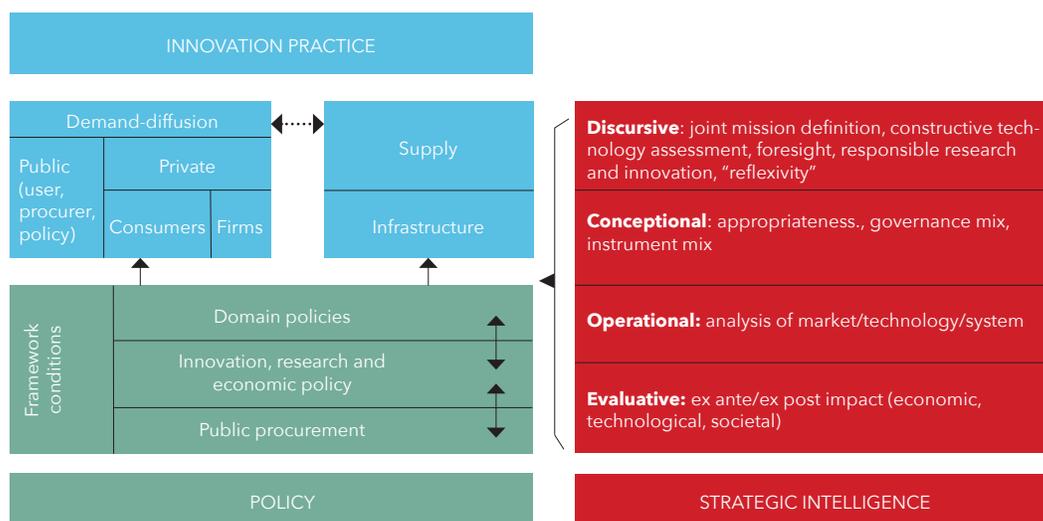
LAYING THE GROUNDWORK FOR DEMAND-SIDE POLICIES

A serious endorsement of demand-side policies within Canadian STI policy faces two basic challenges: the need to shift responsibilities for innovation policy within government and the new strategic intelligence requirements involved. Both challenges are reflected in figure 1 (page 10).

Indeed, the nature of the problem and the actor landscape are different when we choose to intervene on the demand side. The "problem" is not merely one of economic competitiveness based on science and innovation, but also one of fulfilling societal needs. Therefore, the "actors" that are targeted by policy are not only those producing knowledge and innovation but also those potentially using them, including private end-users and public agencies as buyers and users (top left, figure 1). In other words, demand-side policies need to engage with all (potential) users of innovation and to engage in societal debates about the future needs of society.

Ideally, demand-side policies stem from a sound, participatory definition of those future needs and link innovation policy systematically with the "domain policies" that serve those needs, such as transportation, health and energy. In effect, the lead for innovation policy within government must come from those departments responsible

Figure 1. Strategic intelligence for demand-side policy



Source: Author.

for tackling those needs (bottom left, figure 1). Those departments have the technological and issue knowledge as well as the connection to the societal debates that define the needs and political discourse. This means that new forms of responsibility and coordination are needed, whereby innovation ministries or agencies support the design and delivery of policies that are decided in other domains.²⁷ This is not trivial at all, especially if societal demands, or explicit missions, cut across established ministries. In those cases, horizontal organizations with dedicated missions, real power and responsibilities would be an appropriate organizational device.

Demand-side policies also face multiple design and implementation challenges that require different types of expertise, referred to as strategic intelligence (figure 1). First, the state would have to take on a direct role in supporting societal debates that define the needs to be addressed with demand-side policies. This discursive strategic intelligence to support the articulation of needs differs from traditional processes for defining sectoral or technological priorities due to the broader, more immediate engagement with citizens. Engagement with citizens with regard to technology is traditionally about the potential consequences of that technology for society, often in a negative discourse about avoiding detrimental societal effects or ethical tensions. However, with demand-side policies, defining needs should be at the centre, shaping which kinds of technologies and capabilities are to be mobilized to satisfy these needs.

Second, because the demand-side rationales presented above have not sunk into the collective mindset of policy-makers, politicians, media and the public more generally, deliberate efforts are needed to clearly articulate intervention rationales and, in so doing, justify and explain the added value of policy intervention. Again, not a trivial task given the dominance of “not-picking-winners” liberal market attitudes that are deeply

²⁷ Boon and Edler, “Demand, Challenges, and Innovation.”

institutionalized in the innovation policy discourse and practice in most OECD countries. Third, extensive operational expertise is required not only to understand societal needs but also to make the link with the supply side and to understand the maturity of the technological solutions offered or promised by the supply side. For instance, demand-pull interventions could end up supporting technologies that lack efficiency and ideally need further R&D investments before governments decide to artificially accelerate a market for them. There is not only a risk of premature support through demand-side policies, there is also a risk associated with intervening too late. In such cases, costly measures may only marginally help to accelerate diffusion, but may also lead to unjustified profit margins for suppliers (“windfalls”) and lessen pressure on them to increase the efficiency of their product or processes or to lower prices.²⁸

Fourth, to monitor and assess demand-side interventions in order to improve them over time is much more challenging than doing so for traditional supply-side policies. Evaluators would have to not only assess the changes on the demand side, such as greater diffusion and use of an innovation, but also consider the societal and economic effects of this enhanced diffusion and use. In particular, the latter requires technical expertise that most often is absent in traditional innovation policy circles, but commonplace in domain policies. The feedback effects on the supply side would also have to be assessed to gauge the interaction between the demand for innovations and subsequent investment for future innovations.

A systematic synthesis of the evaluation literature on demand-side policies has found that many of these strategic intelligence requirements are met individually in many countries, but this fourfold challenge has yet to be systematically addressed holistically in any country.²⁹

PROPOSALS FOR A DEMAND-SIDE SHIFT IN CANADIAN INNOVATION POLICY

Canada’s current STI policy as presented in the 2017 budget documents and subsequent documents represents a promising first step toward need-based, demand-driven innovation policy thinking and practice. It connects innovation support in broad terms with societal challenges;³⁰ includes a first “strategic” procurement program initiative;³¹ seeks to create network effects and enhance demand by supporting superclusters;³² and, through its Economic Strategy Tables, creates a mechanism allowing policy-makers to better understand growth and innovation bottlenecks in key sectors of the economy and define more effective policy responses. Still, the government is not explicitly acknowledging the needs-based and demand-driven rationale for policy intervention and is not taking full advantage of the breadth of demand-side policies. The next section provides some comments and suggestions on how recent initiatives could be steered toward a more balanced STI policy.

²⁸ For more information on the effectiveness of demand-side policies and the challenges of policy design, see Edler, “Impact of Policy Measures.”

²⁹ Edler, “Impact of Policy Measures.”

³⁰ Canada, *Budget 2017*, 81.

³¹ Canada, *Budget 2017*, 85-87.

³² Canada, *Budget 2017*, 79-80.

Innovation policy to address societal challenges

So far, the connection between policies and social challenges is rather weak. Beyond its call for ideas to make Canada more innovative,³³ the Canadian government has not proposed any process to help articulate societal needs and define the challenges to be met through innovation. Nor has it indicated possible support of early uptake of innovation or of lead markets to address the challenges. These types of measures were undertaken with success in other countries. Prominent examples include Sweden's plan to be at the forefront of implementing the UN's Sustainable Development Goals (the 2030 Agenda)³⁴ through a holistic innovation policy;³⁵ Austria's innovation-promoting procurement strategy to stimulate innovation aimed at solving societal problems (such as climate change and demographic change) and to introduce more (eco)efficient goods and services to the public sector to reduce government's environmental impact and costs;³⁶ and Germany's High Tech Strategy 2025, which promotes research and innovation based on the "needs of people" and organized around 12 missions.³⁷ Following similar approaches adopted elsewhere, the government could initiate a cross-government and cross-society consultation process to jointly define the societal challenges that innovation policy should tackle and, in doing so, mobilize citizens, businesses and public bodies as potential buyers of innovative solutions.

Further, in areas where innovative solutions are in the pipeline but diffusion is too slow, diffusion programs may be helpful to transform or create markets. Such programs have been implemented successfully for energy efficiency technologies, for example. This would require conducting thorough analyses of the demand-side bottlenecks and implementing a corresponding mix of demand-side measures, ranging from awareness raising and training to demand subsidies and public procurement. Diffusion policies must not target specific products on the market, but must focus instead on particular functionalities and specifications that innovative products should and can meet. The objective is not to push specific products onto the market, but rather to promote solutions to a particular problem. Market forces will still define which concrete solutions are favoured and how those solutions will be further developed. More importantly, for such policies to be designed and

³³ Prior to announcing its inclusive innovation agenda, the government issued a public call to Canadians to submit their ideas on how to make Canada more innovative, and it organized 28 round tables across the country in an effort aimed at "mobilizing Canadians for an Inclusive Innovation Agenda." This engagement exercise was focused on and structured around six interrelated themes: entrepreneurial and creative society, global science excellence, world leading clusters and partnerships, grow companies and accelerate clean growth, compete in a digital world, and ease of doing business. Canada, *An Inclusive Innovation Agenda: The State of Play* (2016), <https://www.ic.gc.ca/eic/site/062.nsf/eng/00014.html>

³⁴ Vinnova, Sweden's Innovation Agency, has been mandated to integrate the 2030 Agenda into all its operations and activities in order to boost the capacity to reach the sustainable development goals. For more details on the Swedish approach, see Vinnova, *The 2030 Agenda – Key Driver of Innovation* (2018), <https://www.vinnova.se/en/m/the-2030-agenda--a-key-driver-of-innovation>.

³⁵ C. Edquist, "Towards a Holistic Innovation Policy: Can the Swedish National Innovation Council (NIC) Be a Role Model?" *Research Policy* 48, no. 4 (2019): 869-79.

³⁶ See Austria, Ministry for Digital and Economic Affairs, "Public Procurement Promoting Innovation" (2019), <https://www.en.bmdw.gv.at/BusinessLocationInnovationandInternationalPolicy/Innovationandtechnologypolicies/Seiten/Procurement.aspx>.

³⁷ The fields of action include health care, sustainability, climate change and energy, mobility, security and the economy, and work 4.0. See Germany, *Hightech-Strategie 2025* (2018), <https://www.hightech-strategie.de/>.

implemented successfully, those departments responsible for the actual challenge need to be in charge, with innovation agencies and ministries supporting the innovation activities on both the demand and supply sides.

Strategic procurement

The 2017 budget announced a strategic procurement initiative:

Under Innovative Solutions Canada, a portion of funding from federal departments and agencies will be allocated toward early-stage research and development, late-stage prototypes and other goods and services from Canadian innovators and entrepreneurs. In return, the Government will have access to the latest, most innovative products and services – a true win-win for citizens and the businesses that employ them.³⁸

While the government's strategic procurement program is a very good start, it is a *pre-commercial* procurement measure, supporting near-market R&D up to the prototype stage, but it does not include the actual purchase of first batches and the creation of a real market through public procurement. It is not a scheme to procure innovation, but rather one to procure R&D services leading to innovations.³⁹

Evaluations of precommercial procurement programs have shown that they work effectively as supply-side instruments, with positive effects on the innovativeness and competitiveness of the companies supported.⁴⁰ However, in the absence of any built-in mechanism to guarantee market uptake by public agencies, the market creation effect is limited. The Canadian government should therefore think more strategically about market creation and look to other countries' experience in this regard – for example, the Innovation Partnership scheme of the European Union, which links pre-commercial and strategic procurement.

As the Economic Strategy Tables' summary report points out, "Government procurement can be used to accelerate adoption of Canadian innovation, drive solutions to big challenges and send powerful signals in the marketplace."⁴¹ In particular, it underscores how procurement could support the adoption of health innovations and drive the incorporation of clean and digital technologies into infrastructure projects. It remains to be seen whether these recommendations will be adopted.

³⁸ Canada, *Budget 2017*, 86.

³⁹ The Build in Canada Innovation Program is also aimed at precommercial innovators. Companies with existing precommercial innovations in priority areas identified by the federal government can submit proposals to have their innovation tested by potential client departments, which would provide feedback on the innovation's performance in an operational setting. If successful, this process could lead to the company's first reference sale. For more information about the Build in Canada Innovation Program, see Public Works and Government Services Canada, *Build in Canada Innovation Program*, <https://www.tpsgc-pwgsc.gc.ca/app-acq/picc-bcip/index-eng.html>.

⁴⁰ P. Boekholt, "Leveraging SBIR in the Netherlands," presentation by Technopolis Group at the Innovation Policy Forum, organized by the National Academies of Sciences, Engineering and Medicine, Washington, DC, March 19, 2015; J. Rigby, "The Impact of Pre-Commercial Procurement on Innovation," in *Handbook of Innovation Policy Impact*, ed. J. Edler et al., 382-402.

⁴¹ Canada's Economic Strategy Tables, *Innovation and Competitiveness Imperative*, 5.

Further, beyond dedicated schemes for strategic innovation procurement, a fundamental change is needed in the way public bodies in Canada perform their procurement function to make the country an attractive market location. Public procurement of innovation cannot be commanded; it faces all kinds of obstacles at multiple levels. Strategic innovation procurement requires public bodies at all levels to think about future demand, articulate it to the market, interact with the market, use the appropriate procurement processes and be ready to actually absorb and use innovations.

A range of studies have shown how well-known obstacles to public procurement can be overcome through dedicated support measures.⁴² The most important lesson from those studies is that public bodies face persistent obstacles in procuring innovation, including risk aversion, a narrow focus on price, lack of long-term life-cycle costing, poor pricing of the positive effects of innovation and of the learning and absorption costs, and the lack of articulation of needs.⁴³ To overcome those obstacles, public bodies need different types of support and intermediation.⁴⁴ But ultimately, even though effective support measures exist and have been tested, it takes both organizational culture change to accept that public bodies are the main target group for policy intervention and strong political will to set up and roll out those measures.⁴⁵

Without a combination of real strategic innovation procurement that includes the actual purchase of a first batch to initiate markets and support measures to turn the public sector into innovation-demanding and -absorbing partners for innovative firms, the “power of the public purse” – as the European Commission describes public procurement leverage – will not be harnessed.

Supercluster policies

The design of the Innovation Supercluster Initiative has a number of promising features. As with all cluster policies across the OECD countries, the focus is on connecting capabilities to generate knowledge and innovation in more efficient and effective ways. Stated objectives include bolstering “collaborations between private, academic and public sector organizations pursuing private-sector led innovation and commercial opportunities” and supporting activities that enhance technology leadership, scale-up potential and access to innovation.⁴⁶ The winning superclusters all aspire to improve

⁴² E. Uyarra, J. Edler, J. Garcia-Estevéz, L. Georghiu, and J. Yeow, “Barriers to Innovation through Public Procurement: A Supplier Perspective,” *Technovation* 34, no. 10 (Oct 2014): 631-45; C. Edquist, N. Vonortas, J.M. Zabala-Iturriagoitia and J. Edler (eds), *Public Procurement for Innovation* (Cheltenham, UK: Edward Elgar Publishing, 2015).

⁴³ The Health and Biosciences Economic Strategy Table argues that “the traditional cost-focused bulk-buying procurement approach favoured by health systems in Canada” is a primary barrier to the adoption of innovative products and services and calls for a systemic shift to value-based procurement and the establishment of a health procurement innovation agency. Canada’s Economic Strategy Tables, *Report of Canada’s Economic Strategy Tables: Health and Biosciences*, <https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISEDHealthBioscience.pdf>, 5-7

⁴⁴ J. Edler and J. Yeow, “Connecting Demand and Supply: The Role of Intermediation in Public Procurement of Innovation,” *Research Policy* 45, no. 2 (March 2016): 414-26.

⁴⁵ L. Georghiou, J. Edler, E. Uyarra, and J. Yeow, “Policy Instruments for Public Procurement of Innovation: Choice, Design and Assessment,” *Technological Forecasting and Social Change*, 86 (2014): 1-12.

⁴⁶ Innovation, Science and Economic Development Canada, *Innovation Superclusters: Program Guide* (Ottawa: ISED, 2017).

market growth, but they differ in the extent to which they integrate demand-side considerations into their strategy.

A positive example appears to be the Digital Technology Supercluster.⁴⁷ Its approach consists in matching industry-specific needs, mostly those of large multinationals, with the collective resources and capabilities of the digital technology sector. The initial emphasis will be on collaborative projects defined by near-term industry needs and challenges in the precision-health, natural resources and manufacturing sectors to co-develop required solutions – and eventually expand to other sectors. A key part of the Digital Technology Supercluster’s business model is the opportunity for start-ups and small and medium-sized businesses to gain pathways to customers, markets and partnerships that they could not access on their own.

Likewise, the Ocean Supercluster aims to strengthen the linkages between ocean-based value chains and providers of enabling technologies, to build a market-informed technology road map and give SMEs access to “significant reference customers in large global supply chains.”⁴⁸ This basic rationale of trying to include (potential) users in different ways, which manifests itself differently across the superclusters, is to be welcomed. However, fulfilling the ambitious vision of the superclusters to create important new markets will require policy support and in particular more stringent and creative instruments to tackle demand bottlenecks and mobilize the user side.

Innovation adoption

Although technology adoption does not feature as a key element in Canada’s Innovation and Skills Plan, it comes out quite strongly in the work of the Economic Strategy Tables. Indeed, support for technology adoption is one of six signature initiatives recommended to address the risks, uncertainties and information gaps that make Canadian companies in most sectors slow to invest in technology.⁴⁹ The proposals to that effect include establishing a network of technology adoption centres, implementing a digital technology readiness tool and various tax incentives such as accelerated capital cost allowance.

The need to reduce regulatory complexity, redundancy and compliance burden is another overarching theme highlighted in the tables’ summary report.⁵⁰ Canada’s regulatory system, it is argued, is not conducive to innovation. Four out of six sectors put forward proposals for more agile regulations as among their top priorities. In its 2018 Fall Economic Statement and Budget 2019, the federal government followed up on some of these recommendations.⁵¹ It has conducted a first round of reviews in three

⁴⁷ *Canada’s Digital Technology Supercluster: Business Plan*, November 2017, <https://www.digitalsupercluster.ca/wp-content/uploads/2018/02/Canadas-Digital-Technology-Supercluster-Business-Plan.pdf>.

⁴⁸ *Canada’s Ocean Supercluster: Our Strategy*, <https://oceansupercluster.ca/our-strategy>.

⁴⁹ Canada’s Economic Strategy Tables, *Innovation and Competitiveness Imperative*.

⁵⁰ Canada’s Economic Strategy Tables, *Innovation and Competitiveness Imperative*.

⁵¹ See Canada, *Fall Economic Statement 2018*, chap. 3, <https://www.budget.gc.ca/fes-eea/2018/docs/statement-enonce/chap03-en.html>; and Canada, *Budget 2019: Investing in the Middle Class*, <https://www.budget.gc.ca/2019/docs/plan/budget-2019-en.pdf>. The government also introduced the Accelerated Investment Incentive for businesses of all sizes making capital investments.

high-growth sectors and produced sector-specific “regulatory road maps.” These road maps propose ways to create a more user-friendly regulatory environment, facilitate cooperation, reduce duplication and make use of experimental approaches (such as pilots and regulatory sandboxes to test innovative products without the full burden of existing regulations) to accommodate emerging technologies.⁵² The objective is to better align regulatory frameworks with industrial realities, but it remains to be seen to what extent these new initiatives will translate into concrete, demand-oriented regulatory activity. Such a development would certainly accelerate the move toward a more balanced STI policy in Canada.

Still, even if the regulatory initiatives are successful, by and large there remains reluctance on the part of government to analyze and confront broader innovation adoption impediments in industry and society. Overall, the policy portfolio does not adequately reflect the need to improve the poor absorption of innovation on the part of Canadian businesses. Although the problem has been recognized, so far there is no strong solution offered to tackle the issue seriously.

Yet there are plenty of examples of how industries can be supported in identifying technological needs and in absorbing and using latest technologies. A classic example is that of Germany, which showed that a subsidy for businesses to invest in computer-aided manufacturing and design technologies in the late eighties and early nineties had dramatic effects in boosting the market uptake and subsequently the productivity of firms.⁵³ Further, Shapira and Youtie have shown that the US Manufacturing Extension Services program, which supports companies in identifying their needs and implementing new technologies, complements existing private consulting services and leads to higher innovativeness within technology-absorbing firms.⁵⁴ To design and implement those policies, however, requires willingness to actively intervene on the demand side.

CONCLUSION

Canada faces a triple innovation challenge: decreasing productivity growth, a growing gap in R&D investments and a need to harness innovation more directly for the good of society. Those challenges cannot be tackled if the country remains in its supply-side policy silo.

This paper has attempted to make the case for a more balanced approach to innovation policy in Canada, outlined the obstacles that would have to be overcome and suggested a few concrete lines of action. Most importantly, however, moving in this direction would require a new mindset and willingness to organize innovation policy

⁵² Canada, *Budget 2019*, 116.

⁵³ G. Lay and J. Wengel, *Wirkungsanalyse der indirekt-spezifischen Förderung zur betrieblichen Anwendung von CAD/CAM-Systemen im Rahmen des Programms Fertigungstechnik 1984-1988*, Kernforschungszentrum (Karlsruhe, Germany: Fraunhofer Institute for Systems and Innovation Research, 1989).

⁵⁴ P. Shapira and J. Youtie, “The Impact of Technology and Innovation Advisory Extension Services,” in *Handbook of Innovation Policy Impact*, ed. J. Edler et al., 161-95.

differently in order to realize the potential benefits of connecting innovation demand, R&D investments, productivity and societal problem solving.

All policy domains across government should take responsibility for innovation and should reflect on how asking for and diffusing innovation can support the delivery of public services and policies. Instrumentation and administration should be linked more appropriately. The various demand-side interventions that already exist in Canada should be mobilized systematically across government, with economic and innovation agencies playing strong supportive roles. The superclusters' plans to link suppliers to customers for co-generation and to build up markets, and the Economic Strategy Tables' proposals for innovation-oriented regulation and strategic procurement to spawn new markets must be encouraged and rolled out properly, complemented by further means to support the demand for innovation.

Where societal challenges or needs cut across policy domains, new structures responsible for addressing such challenges could be created and provided with earmarked budgets and the ability to intervene. Overall, this would require a fundamental change in strategic intelligence processes and meaningful investment across government.

Above all, the initiatives I have proposed should not be misconstrued as the state picking winners and being a stalwart of a planned economy through market creation. Rather, they should be viewed as complementary to supply-side approaches and justified on the basis of the three policy-intervention rationales for supporting innovation demand. The state, ultimately, is responsible not only for improving competitiveness and securing growth but also for articulating social needs and ensuring that the solutions required to fulfill these needs are delivered and diffused effectively and efficiently. Innovation is key, and linking societal purpose and economic benefit should be the guiding focus for a future-proof innovation policy in Canada.



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