



# Government Science and Innovation in the New Normal: Crisis and Opportunity

Literature Review

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## About Government Science and Innovation in the New Normal

In December 2020, the IOG launched *Government Science and Innovation in the New Normal (GSINN)*, a multi-year, collaborative research initiative designed to support medium-term planning for the federal science and innovation departments and agencies, and provide an in-depth examination of the evolving relationship among science, innovation and society. GSINN organizes an examination of this evolving relationship into eight themes:

- Equity, Diversity and Inclusion;
- Global Research Collaboration and Infrastructure;
- Inclusive Innovation;
- Interdisciplinary, Indigenous and Other Ways of Knowing;
- Mission-Driven Research and Innovation;
- Science Communications, Outreach and Public Engagement;
- Skills and Knowledge; and,
- Trust, Integrity and Science Ethics.

The first phase of the GSINN initiative includes a hindsight exercise, multiple foresight workshops, and a discussion paper on each of the above listed themes. The discussion papers explore how government science and innovation can remain relevant in the new reality.



# Government Science and Innovation in the New Normal (GSINN): Crisis and Opportunity

## Introduction

Vladimir Ilyich Lenin once said that “there are decades when nothing happens, and weeks when decades happen” (Zakaria, 2020:3). After a year of living under the threat, and limitations, of the COVID-19 pandemic a great many Canadians could well understand and identify with the sentiments expressed by Lenin. The COVID-19 pandemic has turned all of our world upside down, and nowhere else more so than in the fields of politics, government, science and innovation, and their intersections. As we ever so slowly start to turn the corner on this pandemic with the arrival of vaccines, academics, policymakers, and thought leaders are beginning to ask themselves some key questions, the most notable among them being, What will the post-pandemic world of 2021, and beyond, begin to look like? And what changes will COVID-19 bring to how government, politics, science and innovation operate and interact in a post-pandemic world?

One of the ways in which we can begin to answer these questions is by looking at what the experts are saying and the overall trends that they reveal. After we obtain a better understanding of what these experts are saying, and what trends they have uncovered, we can begin to think about what all of this means for science and innovation in general. Five articles will be synthesized in order to discern the major trends: (1) Andrew Parkin’s “Ten Trends that will shape Events in 2021,” (2) *Policy Options* special edition, *Building a More Inclusive Innovation Economy*, (3) McKinsey & Co., “Building an R&D Strategy For Modern Times,” (4) OECD *Science, Technology, and Innovation Outlook, 2021*, and (5) Fareed Zakaria’s, *Ten Lessons For A Post-Pandemic World*. As will become evident, the issues and trends identified by these authors have many links to the eight key themes of the GSINN initiative. These links will be highlighted in the final section of the paper.

## Key Trends in the Literature

In the OECD’s *Science, Technology, and Innovation Outlook, 2021* the authors delineate a number of trends worth noting. They observe that the COVID-19 pandemic has accelerated existing trends in the Science, Technology, and Innovation (STI) system. It has opened-up access to data and publications, increased the use of digital tools, enhanced international collaboration, developed a variety of public-private partnerships, and brought about the active engagement of new players. These developments are important because they could speed up the transition to more open science and innovation in the future.



That being said, such widespread engagement risks “diverting research efforts indiscriminately away from non-COVID related topics.” Therefore, governments as well as research funding bodies need to define and communicate more clearly and quickly their capacities to support research in the coming years, Governments will also need to define their strategic priorities in order to allow research-performing organizations time to create realistic long-term plans (OECD, Executive Summary 2021:1).

The COVID-19 pandemic has also disrupted the normal functioning of innovation systems, thus endangering key productive and innovation capabilities, especially in hard-hit sectors, including a large share of innovative small and medium-sized enterprises (SME’s), early-stage start-ups, young researchers, and women who devoted more time to care-giving at the expense of their STI careers (OECD, 2021:17). Given this fact, the pandemic “could exacerbate existing gaps in business research and innovation activities between leading and laggard sectors, large and small firms, and geographical areas.” These developments could reduce economic resilience and should be the target of innovation-support policies (OECD, Executive Summary, 2021:1). This emphasis by the OECD highlights the growing importance of the GSINN initiative’s themes of mission-driven research and innovation as well as equity, diversity and inclusion.

The authors of the report cannot emphasize enough their contention that the pandemic and its effects offer a stark reminder of the need to transition to more sustainable, equitable, and resilient societies. While science and innovation will be essential to deliver such transitions, this pandemic has exposed limits in research and innovation systems; if these limitations are not addressed it will prevent this potential from being realized. Therefore, governments should rethink STI policies along several lines in order to deal with these limits. The emerging trends that the OECD considers to be very important in this area are examined below.

The *first trend* that emerges is that the business R&D support policy mix has shifted in the past few decades towards a much greater reliance on tax credits as compared to direct support instruments such as contracts or grants. The current crisis serves as a reminder that policy needs to be able to guide innovation efforts to where they are most needed. While tax credits have been effective in persuading businesses to innovate, R&D tax credits are indirect, untargeted, and tend to generate incremental innovation. In contrast to this, well-designed, direct measures for R&D are better suited to supporting longer-term, high-risk research as well as targeting innovations that either generate public goods or have a high potential for knowledge spillovers. Therefore, governments would be well-advised to revisit their policy portfolios to ensure an appropriate balance exists between direct and indirect measures as they try to guide innovation efforts.



A *second trend* that emerges from this discussion is the multifaceted nature of addressing complex problems like COVID-19 and sustainability transitions. Addressing these complex problems underscores the need for transdisciplinary research to which current science systems and institutions are ill-adapted. Therefore, “disciplinary and hierarchical structures need to be adjusted to enable and promote transdisciplinary research that engages different disciplines and sectors to address complex challenges” (OECD, Executive Summary, 2021:1).

Yet a *third trend* that emerges is that governments should link support for emerging technologies, such as engineering biology and robotics, to broader missions such as health resilience that encapsulate responsible innovation principles. The responsible innovation approach tries to anticipate problems during the course of innovation, and steer technology to the best outcomes that are possible. Consistent with GSINN’s inclusive innovation theme, it also emphasizes the inclusion of stakeholders as early as possible in the innovation process (OECD, Executive Summary, 2021:2).

A *fourth trend* that is of critical importance is the necessity of reforming PhD and post-doctoral training in order to support a diversity of skills and career paths. This is essential for improving the ability of societies to react to crises and to deal with challenges like climate change that require science-based responses.” Moreover, reforms will also help relieve the precarious working conditions of early-career researchers, “many of whom are employed on short-term contracts without any guarantee of finding a permanent academic position.” The current crisis has also highlighted the need for academia to train a new group of digitally skilled research support professionals and scientists (OECD, Executive Summary, 2021:2).

A *fifth and equally important trend* to consider is the notion that global challenges require global solutions that draw upon international STI co-operation. For example, the development of COVID-19 vaccinations has benefited from global R&D preparedness measures, including technology platforms that can be activated when new pathogens emerge. The pandemic has created the opportunity to “establish effective and sustainable global mechanisms to support the range and scope of R&D necessary to confront a wider range of global challenges.” It will be important, therefore, for governments “to build trust and define common values to ensure a level playing field for scientific co-operation and an equitable distribution of its benefits” (OECD, Executive Summary, 2021:2).

A *final trend* from this report that is important to note is the fact that governments need to renew their policy frameworks and capabilities in order to fulfill a more ambitious policy agenda. In the future, the policy emphasis will be on building resilience, which in turn calls for policy agility, and this highlights the need for



governments to acquire dynamic capabilities to adapt and to learn in the face of rapidly changing environments. Therefore, engaging stakeholders and citizens in these efforts “will expose policymakers to diverse knowledge and values that will contribute to policy resilience” (OECD, Executive Summary, 2021:2). It can be expected that greater stakeholder and citizen engagement will help increase public trust, another key theme of the GSINN initiative.

Another article that is also concerned with building policy agility is McKinsey and Company’s “Building an R&D Strategy for Modern Times.” The authors of this article begin by stating that the global investment in research and development (R&D) is staggering; in 2019 alone, organizations around the world spent \$2.3 trillion on R&D. That is the equivalent of about 2 percent of global Gross Domestic Product (GDP), and about half of this came from industry and the remainder from governments and academic institutions. This amount of investment represents a huge potential source of funding that can be directed to addressing societal grand challenges and opportunities. Moreover, the annual investment has been growing at approximately 4 percent per year over the past decade (McKinsey & Co., 2020:1).

The authors also indicate that while the pharmaceutical sector receives much attention for its high R&D spending as a percentage of revenues, a comparison of industry profits shows that several industries, ranging from high tech to automotive to consumer, are putting more than 20 percent of earnings before interest, taxes, depreciation, and amortization back into innovation research (McKinsey & Co., 2020:1). Yet despite these impressive statistics, many companies lack an R&D strategy that has the necessary “clarity, agility, and conviction to realize the organization’s aspirations.” Therefore, instead of serving as the company’s innovation engine, R&D ends up “isolated from corporate priorities, disconnected from market developments, and out of sync with the speed of business” (McKinsey & CO., 2020:1).

The significant trends revealed in this article indicate that those companies wishing to get ahead and stay ahead of the competition today need a robust R&D strategy that makes the most of their innovation investments. Building such a strategy takes three steps: understanding the challenges that often work as barriers to R&D success, choosing the right ingredients for the R&D strategy, and then pressure testing the strategy before enacting it. As the authors stipulate, “as organizations mature, innovation-driven growth becomes increasingly important, as their traditional means of organic growth, such as geographic expansion and entry into untapped market segments, diminish. To succeed, they need to develop R&D strategies equipped for the modern era that treat R&D not as a cost center but as the growth engine it can become” (McKinsey & CO., 2020:1).



## Examining some practical problems within the Innovation Ecosystem

A great deal of our discussion so far has concerned itself with matters of a decidedly theoretical nature; what follows examines some practical problems and trends within the Canadian innovation ecosystem that have a profound effect upon that system and how it will be able to function in the future.

In June 2020, the Institute for Research on Public Policy produced a special edition of its Policy Options magazine entitled, “Building a More Inclusive Innovation Economy.” Several of the articles from this special edition disclose some serious policy trends that need to be understood and acted upon if the Canadian economy and innovation ecosystem are to continue to prosper.

In an article entitled, “Is this Canada’s last chance to revive manufacturing and long-term prosperity?” Professor Dan Breznitz, consistent with this initiative’s theme of inclusive innovation, argues that the scramble for medical equipment during the COVID-19 pandemic—especially for masks and ventilators—was a crucial moment for the Canadian economy because it revealed the fact that we do not know if we can produce what we need to produce in a crisis. This situation did not occur overnight. For the past two decades, Canadian corporations have engaged in rapid offshoring, the transferring of production to other countries. The huge short-term profits that accrued, along with decreases in the prices of consumer goods, provided an illusion for us that everything was going along well in the economy. The reality, however, was that we “were the mythical frog floating in a pot of water on the stove, slowly being boiled alive without realizing it” (Breznitz, 2020:1). The COVID-19 pandemic exposed Canada’s economic vulnerabilities, namely, that we no longer produce, and cannot even develop, many of the things we need to run a prosperous economy.

Whether it is swabs, face masks, ventilators, or advanced telecommunication equipment, we are to a very large extent dependent upon overseas suppliers. The supply networks that underpin the production and innovation of these goods have moved from North America to China. This has left us “with hollowed-out capabilities, broken production capacities, under utilized engineering and technical talent, and over-reliance on one relatively small region of the world” (Breznitz,2020:1).

Breznitz thinks that the COVID-19 pandemic might well be our last opportunity to regain prosperity because we have already lost so much productive capacity that reviving the Canadian economy will require us to overcome a great many challenges, and then sustain those efforts over many years after the pandemic is over (Breznitz, 2020:1). Breznitz proposes a strategy for action to overcome our diminished productive and innovation possibilities. First, we have to change the managerial and financial regulations and incentives that have made offshoring such an attractive and preferred option for corporations. Second, we have to



rebuild our depleted production capacities. This involves addressing our skills gap, not only on the shop floor, but also in systems production and tooling engineering. We can do this because these skills are not gone from Canada, at least not yet. They still exist in isolated pockets across Canada.

Breznitz concludes his article by stating that the pandemic gives us one last chance to secure prosperity for the future generations of Canadians, as well as making sure that the next crisis, when it comes, will not make us so vulnerable as the COVID-19 pandemic has done. Therefore, “let us all take collective leadership and action in shaping our future for the better” (Breznitz, 2020:7).

Another article in this special edition of Policy Options that looks at the important new trends emerging is Professor David Wolfe’s, “Reconstruction Planning must take into account existing economic trends.” Wolfe states that while the government has begun to consult a wide variety of people concerning the conditions needed to reopen the economy after the pandemic is over, it needs “to think and plan with two other longer-term economic trends in mind: the rapid diffusion of digital technology and the transition to a post-carbon economy. The recovery will require a comprehensive planning effort that also takes account of the two broader trends altering the shape of the economy” (Wolfe, 2020:1).

The first trend worth noting is the growing digitization of all aspects of the Canadian economy. Today there is a much greater reliance on cloud computing, mobile technology, data analytics, and artificial intelligence. Over the past two decades the pace of innovation has been accelerating at an incredible rate, compressing the time it takes to bring new products and services to market and disrupt established industries.

The second trend is the rapid shift away from carbon-based forms of energy to renewable forms of energy such as wind, solar, electric, fuel cells, batteries, and hydro power. This shift has been occurring over the past two decades, and the cost of this renewable energy, as well as energy storage, has been falling steadily approaching the crossover point with natural gas (Wolfe, 2020:1).

In order to bring this about, we need enhanced policies to support the following:

- the growth of domestic firms in the digital and cleantech sectors of the economy to accelerate the transformation of existing industrial processes to a more digitally enabled and sustainable basis;
- greater provision of renewable sources of energy, including, wind, solar and hydrogen;
- rethinking and redesign of urban mobility systems, including public transit;



- more attention focused on our public health system, through the effective use of digital technologies to track diseases;
- the application of new computing techniques to accelerate the discovery and development of new vaccines and antiviral drugs; and the use of these technologies to support and protect frontline workers in the health sector and other parts of the service economy (Wolfe, 2020:5).

Accomplishing all of this will not be easy since the challenges are massive; however, many of the solutions are already available in the form of existing technologies and the firms to develop these technologies. That being said, the Canadian economy that emerges from the lockdown, and the economic opportunities that will emerge “will differ significantly from the one that we have been accustomed to” (Wolfe, 2020:5).

Wolfe does not think that conventional policy processes will produce the desired results. What is needed is for governments to embrace a contemporary equivalent of the post-World War II reconstruction planning process because the lessons learned from that experience can help us to respond to the challenge of transitioning to a post-pandemic economy. All levels of government must work together to design and implement the necessary measures to solve the emerging “economic, health, and energy challenges of the 21<sup>st</sup>-century” (Wolfe, 2020:7).

A final article from this special edition of Policy Options, Shiri Breznitz and Daniel Munro’s “Cutting post-secondary budgets during COVID a bad move,” delineates a very disturbing trend facing the innovation ecosystem. The authors argue that Canadian universities are facing a financial crisis largely due to the COVID-19 pandemic. While governments have been putting significant resources into sustaining the healthcare system and the economy for well over a year, they are now beginning to look at ways to pay down the debt incurred from having to spend money on an array of support programs. Given this fact, universities may find themselves facing significant budget cuts.

That would be a mistake, according to the authors, because cutting funding in the midst of this pandemic would risk causing substantial harm “to the contribution that universities make to innovation and regional economies in Canada.” Moreover, putting additional financial pressure on institutions that will be key players on the long path to economic recovery in Canada will only make that recovery take longer than necessary, thus harming the educational and employment prospects of students entering the labour market in the future (Breznitz and Munro, 2020:1).

Our universities are the agents of innovation. Over the years the basic research that has been conducted at our universities has produced some of the world’s most cutting-edge and valuable technologies such as insulin, the internet, and



lithium batteries that have changed the world. Furthermore, our universities are essential to the development and diffusion of innovation through their work “with local firms, social organizations, and governments.” A very important part of this work is the education of students who will graduate with advanced skills and knowledge and who will make major contributions to the economy in fields as diverse as, but not limited to, healthcare, technology development, and policy development, as well as to society in general. (Breznitz and Munro, 2020:2)

So what is to be done to solve this problem? The authors argue that in order to ensure that our universities can sustain their research mission and contribute to innovation, as well as to educating students, federal and provincial governments should commit to maintaining and increasing funding through the major research councils and other programs as well. While money from the federal and provincial governments for COVID-19 research is essential, more still needs to be done. Research is a long-term activity that requires stable funding to produce new knowledge and innovation thereby improving economic and social well-being. As the authors conclude, the short-term pressure to cut funding from our universities is understandable, “but the long-term innovation performance, economic prosperity, and individual and community well-being depend on universities. They must have the resources they need to fulfill their research and education missions” (Breznitz and Munro, 2020:6).

### Additional Broad-Based Perspectives

However, in order for much of these recommendations to become a reality, as Fareed Zakaria points out in his book, *Ten Lessons for a Post-Pandemic World*, it is necessary for us to listen to the experts, and for the experts to listen to us as well. In some countries people have listened to the experts, but in other countries they have not. But now that the world has experienced a global pandemic, “it should become painfully clear that people need to listen to experts” (Zakaria, 2020:75-76). In Germany, with Angela Merkel leading her government, her approach was fact-based, and as a trained scientist herself, she listened to what the medical science experts told her about the rise of the pandemic. In Greece, when the Prime Minister of Greece was asked what explained his country’s success at handling the pandemic, he answered that, “we listened to the experts” (Zakaria, 2020, 76).

In the United States, however, President Donald Trump “consistently undermined his own experts’ guidance.” And for months he refused to wear a mask in public, sending a signal that in his view face covering was for weak liberals. Trump even stated that it might be possible for people to inject disinfectant, thus prompting the makers of Lysol to warn their customers not to do anything like that, or to drink bleach (Zakaria, 2020:77).



At one point in the chapter Zakaria poses the question: What then is the best course for the real experts? His answer is that experts need to help the public understand how their field works. He quotes the Harvard scholar Steven Pinker who warned in April 2020 that scientists' "earned authority" may be breaking down and that much of the public may, "think that people in the white coats are just another priesthood." Pinker then asked advocates of science to start, "lifting the hood and showing how it works," through a process of "open debate and attempts at falsification" (Zakaria, 2020:81).

It is critical for experts to do this because very often the ordinary person thinks that elites lack empathy for them when they make public policy decisions that will affect their lives. Zakaria highlights the example of President Franklin Roosevelt and how, even though he was born to privilege, he became a champion of the poor and dispossessed. Stricken with polio, he went to Warm Springs, Georgia each year for a month to swim in the naturally heated mineral waters which eased the effects of his polio. During this time, he swam with other polio victims, most of whom came from very modest backgrounds. It was this experience of swimming with ordinary people at Warm Springs that allowed Roosevelt to learn how to connect with them. He came to care very much for these people who became friends, and he never forgot them and the feeling of powerlessness that they felt (Zakaria, 2020:95).

As Zakaria states at the end of his "Fourth Lesson" the world has become very complicated. We will need more experts, not less, to manage the affairs of nations, "from big companies to small counties, through these times" (Zakaria, 2020:95). This group of experts forms an elite by their education and training, and it gives them authority and power. But the alternative is unthinkable in the modern world, because we would have the celebration of ignorance and "government by gut" (Zakaria, 2020:95). In Zakaria's view, this alternative has already been tried in the United States, Brazil, and elsewhere and the results have been horrific. That being said, while the world needs experts, experts need to think about ways to connect with people and keep their needs and concerns "front and centre."

Zakaria maintains that the greatest moral failing of meritocracy is the belief "that your success, your higher perch in society, makes you superior in any fundamental sense" (Zakaria, 2020:96). This is not the case because in a democracy the peoples' wishes are the ultimate source of authority. As we navigate this COVID-19 pandemic, and the other pandemics that will arise in the future, Zakaria urges us to remember that the "people need to listen to the experts, but the experts also need to listen to the people" (Zakaria, 2020:96).

Another person concerned with the decline of elites as they relate to institutions is Andrew Parkin. In a brief article entitled "Ten Trends that will shape Events in



2021,” and published in *Policy Options* on January 4, 2021, the author discusses a number of trends ranging from climate change to western alienation. Parkin’s tenth trend can be linked to Zakaria’s concern about the need for experts to address societal problems as he states that the Canadian population is losing faith in the institution of federalism and the experts who deal with important federal issues.

Over time, Canadians’ views on federalism and its importance have soured. Fewer than one-in-two Canadians now agree that federalism has more advantages than disadvantages for their province. This decline has occurred in every region of the country (Parkin, 2021:6). The COVID-19 pandemic provided an opportunity for Canadians to see federalism working well as the federal, provincial, and municipal governments had to work together on vital issues related to lockdowns and the rollout of vaccines. However, there have been problems tailoring a swift response to the pandemic to each region, and this has soured many Canadians’ views of the nature of federalism. Applying Zakaria’s concern about elites to this situation, it would appear that this does not bode well for the future of our country, as complex policy problems like a pandemic require a multilevel governance approach to solving them, and the experts at all levels of government need to be actively involved in solving these problems (Parkin, 2021:6).

## Discussion

From this review, it is possible to develop several linkages between the literature and the eight themes of the GSINN research initiative. These themes will be particularly relevant to the science and innovation policy community as it works to renew the social contract between science, innovation and society. Two of these themes – mission-driven research and innovation and inclusive innovation – are briefly discussed here.

First, a major theme that emerges from this literature review is mission-driven research and innovation. The challenge for us today is to rethink the post-World War II social contract which stated that science best advances through “the free play of free intellects, working on subjects of their choice” (Bush, 1945). However, serendipity is not a strategy. A new contract needs to consider how to create the greatest possible compatibility between the new knowledge that science and innovation creates and the public’s capacity to assimilate it for society’s long-term benefit.

This is why McKinsey and Co argue that many companies lack, but need, an R&D strategy that has the necessary “clarity, agility, and conviction to realize the organization’s aspirations, and make the most of their investments.” In order to bring this about planning is essential. Making the most of a firm’s investments



could be helped along by greater use of direct measures of research support instead of indirect tax credits which are so much in use today. Mission-directed support helps prompt and guide the private sector's high-risk research much more than indirect tax credits.

All of this can be easily linked to Wolfe's warning that in order for the Canadian economy to recover from the COVID-19 pandemic, governments need to embrace a contemporary equivalent of the post-World War II reconstruction planning process because the lessons learned from that experience can help us respond to the challenge of transitioning to a post-pandemic economy. This would require that all levels of government work together to design and implement the necessary missions and measures to solve the emerging "economic, health, and energy challenges of the 21<sup>st</sup>-century" (Wolfe, 2020:7).

A second key theme that emerges is inclusive innovation, although the specific term is not used by the authors surveyed. The promotion and support of inclusive innovation suggests new approaches to innovation policy, consistent with the OECD's call for governments to renew their policy frameworks and capabilities, and build policy agility. This can be linked to Breznitz's article on reviving Canada's manufacturing capacity and long-term prosperity. Overcoming the managerial and financial regulations and incentives challenges that have made offshoring such an attractive and preferred option for corporations, as well as rebuilding our depleted production capacities will certainly require us to develop policy agility.

Moreover, given the fact that our universities are agents of innovation through their work with "local firms, social organizations and governments," cutting funding to our universities now will only make our economic recovery take longer than necessary, and by extension, harm the revival of our manufacturing capabilities which are closely tied to the innovation performance of our universities (Breznitz and Munro, 2020:2). All of these concerns can be subsumed under inclusive innovation and the need to bring a wider set of voices into our innovation policy thinking. While the postwar contract saw no role for non-scientists in research and innovation, today, if we are to revive Canada's innovative capacity and long-term prosperity, we will need these new voices more than ever.

## Conclusion

Canada is standing at a crossroads in history. Breznitz urges that the pandemic gives us one last chance to secure prosperity for the future generations of Canadians. Wolfe stresses that conventional policy processes will not produce the desired results of responding to the challenges of transitioning to a post-pandemic economy. Zakaria recognizes the important role of engaging with the



public in finding solutions. We have a chance to build back better and achieve a more equal and just society because this crisis has created the opportunity for change and reform. The opportunity is ours to seize or squander, since nothing is written in stone.

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