POLICY Brief

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Innovation Policy: Lessons from the Pandemic

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The devastating and far-reaching global impacts resulting from the COVID-19 pandemic represent a once-in-a-lifetime learning opportunity we cannot afford to overlook. It has caused many to re-evaluate their priorities and, in some cases, make permanent lifestyle changes. Similarly, governments have had to make significant policy decisions, oftentimes with great controversy.

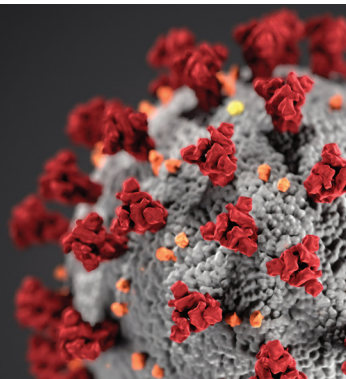
The pandemic has exposed the importance of innovation policy. The public health urgency presented by COVID has fuelled innovation in efforts to mitigate the effects of the pandemic and expedite the search for vaccines and other means that will protect the public from infection. But more than that, it revealed our vulnerabilities. Clearly, there are lessons to be learned from the experience.

For the purposes of this *Policy Brief*, innovation is defined as activities that are undertaken in a continuum. It includes knowledge generation, discovery, applied research to address a specific issue (usually, but not always, industrial in nature), development and scale-up and finally market commercialization. Implementation as a product, service or knowledge must be achieved before it can be considered an innovation. This definition implies collaboration and cooperation between academia, government and industry at all, or some, of the points along this continuum. A significant portion of the activity is pre-competitive.

The vulnerability and anger generated by the pandemic were in large part a result of the helplessness, confusion and philosophical differences that energized a highly emotional and engaged public. Guidelines and direction from governments varied from jurisdiction to jurisdiction, and did little to settle nerves as the public compared tactics of other jurisdictions to those which they were subjected. Authoritative perspectives were questioned and personal freedoms

COVID-19 SERIES: FROM CRISIS TO RECOVERY

This issue of *JSGS Policy Brief* is part of a series dedicated to exploring and providing evidence-based analysis, policy ideas, recommendations and research conclusions on the various dimensions of the pandemic, as it relates here in Canada and internationally.



restricted. As a consequence, public responses were very mixed and many grew exasperated when no end was in sight.

Innovative approaches to vaccines, therapeutics and testing were touted as the most probable means to contain and mitigate the impacts of the pandemic. The many proposed innovations varied significantly in their probability and credibility, thus creating another arena of conflict and disagreement. Governments which took a firmer position in establishing standards for acceptable behaviours and consequences for disobedience, began to achieve significantly greater success than those that shied away from the strict protocols. For example, New Zealand, China and Taiwan were successful in achieving and maintaining containment.

Another positive highlight of the pandemic was the success of innovations that were realized as a result of a focused, collaborative effort that involved all levels of government, the scientific community, industry and the general public. Industry responded to the need or market demand. The results were very significant and impressive in terms of how rapidly they reached the market.

But the pandemic also exposed sins of omission in our innovation policies. Personal protection supplies, testing capabilities and manufacturing capacity were some of the more obvious vulnerabilities experienced in Canada. Many new technologies for testing, therapeutics and supplies, such as ventilators, were advanced as solutions to address the public health need, but actually impeded our efforts to contain the virus and its spread. The urgency and focused allocation of significant resources led to a very aggressive and competitive effort to remedy these gaps. Organizations, such as the Vaccine and Infectious Disease Organization (VIDO) at the University of Saskatchewan, responded to the challenge by partnering across Canada, but their response could have been quicker if the integrated manufacturing they are building was available. Advances in genomics that slowly gained traction over the past two decades had positioned VIDO, UBC, other Canadian institutes and innovative companies for rapid response and efficacy.

During the last couple of decades policymakers have been asking themselves: "What returns are we receiving from our investments in publicly funded research and innovation?" The general direction has been towards applied and industrially relevant programs and projects. As a consequence, basic research that involves knowledge generation and discovery of new information and technology has been in the decline, especially as governments try to balance budgets. In times of constraint, the public attention has centred on erosion of funding for healthcare, education and infrastructure. This policy migration towards applied and commercial outcomes has often reduced resources allocated for knowledge generation and discovery. It has also created angst in the academic world as it may result in "biased" research. It further challenged academic expertise and resources as many programs required industrial funding to support their research so the commercial returns would be more immediate. Often the relevant business development skills and knowledge of the marketplace were not readily available in the public institutions.

These circumstances have facilitated a sharper vision than ever before when it comes to where and how we spend our public innovation dollars.

Lessons for Policy Makers

Five important lessons for policy makers are articulated as follows:

Public investments need to be strategic and prioritized.

Surely the COVID experience has demonstrated that the first strategic priority should be to protect the people of Canada from threats to public health, safety and well-being. Scientists and visionaries, such as Bill Gates, have been predicting a devastating pandemic for years.

Somehow, we either hoped their predictions were wrong or we thought it was just another tactic to get more funding. We know now that their warnings of a pandemic threat were real and based on many clear signs, such as the increased frequency of the emergence of multiple dangerous infectious diseases in recent years, including SARS, Ebola, HIV, Swine Flu, MERS and Zika, and now, COVID-19. The predictions are that these threats are not going away. In fact, they will likely get worse. The logical policy conclusion is that increased and sustained investments in research organizations are not a luxury; they are essential, if we have any hope of mitigating future pandemic perils and the devastating social and economic damage they bring. Government funding should identify their priority areas, such as public health and safety, and include accountability mechanisms. Outcomes need to be defined and evaluated against these stated priorities.

Sustaining appropriate infrastructure is essential.

In the case of infectious disease management, we must sustain the infrastructure necessary to develop and manufacture products, knowledge and services necessary to ensure public health, safety and well-being. The current shortage of vaccines underscores the risks of not sustaining our vaccine manufacturing capacity. Other solutions, such as global alliances, could have addressed these challenges. However, access to a pilot scale manufacturing capacity expedites the product development and approval process. In times of an emergency, speed is of the essence. It could also serve as an emergency manufacturing capability when global capacity is exceeded. Dr. Volker Gerdts, Director and CEO of VIDO, has publicly stated he believes that VIDO's clinical trials would have started six months ago if their manufacturing capacity had been in place. Governments of all levels over decades hesitated to support national vaccine manufacturing because of fiscal restraint and other voter priorities. If vaccines are seen as an insurance and a means of emergency response, similar to firefighting; then resources are needed to maintain a "standing response team". Adequate operating funding will ensure that the expertise necessary is in place to respond immediately in the event that we face these rapidly spreading infections. It can take months to bring new staff up to speed, and given the COVID experience we have a pretty good idea of how many lives this can cost. Funds to maintain the networks to anticipate and respond to impending

threats is another important component to effective and efficient action. Infectious diseases know no boundaries. That means we require strong partnerships with scientists and companies all over the world. For those who might balk at the cost, the fact is the cost of sustaining capacity in the event of a pandemic is trivial compared to the amount of money governments have spent on relief programs, supplies and healthcare costs.

Capacity for data analysis with specialized knowledge of infectious diseases is also a critical piece of the infrastructure. The expertise and capabilities we have begun to develop in bioinformatics would play a significant role in diagnoses and variant identification.

Risk mitigation plans need to be in place.

The gravest threats and challenges need to be identified, evaluated regularly and responded to by coherent and consistent planning. Risk assessment is a standard process that reflects good governance. As we have seen, the risk that a pandemic presents can be catastrophic—lives lost, jobs lost, healthcare stressed, businesses closed, mental health stressed, recreation curtailed and social interaction stymied. Much of the impact can be quantified, but much cannot. There is no way to measure social isolation, emotional trauma, decline in quality of life or the struggle of long-term effects. Perhaps many organizations had already included pandemics in their risk assessment plans, but didn't really believe it was very probable. Clearly, we have learned not to trifle with the reality of such an event. The lesson learned is the warnings that experts have offered in the past several decades cannot and must not be seen as self-serving or doomsaying. It clearly is not a "nice-to-have" investment that is a lower priority than funding for other health needs.

Once the pandemic has receded, there will be need for data gathering and analyses to inform policy choices and future strategies. Data and research will be required to credibly answer the numerous questions that caused public division and policy response indecision. For example: What trends are evident? How effective are face masks? Do we have enough capacity in our healthcare and testing facilities? Do public institutions like schools have emergency response plans in place? Is our capacity for online learning and daycare adequate? Answers to these questions require research, data collection and management and analysis.

Do not forgo long-term benefits for immediate gains.

Discovery and knowledge generation are not luxuries and should not be subverted by short-term commercial gain. Much of the data collection and analysis will have no immediate commercial return and mainly apply to policy questions and decision-making. Three decades of genomic research (that initially started with gathering sequencing data) has led to the development of the novel vaccines that so far have shown to not only be highly effective, but rapid in development. In the early days of genomics, there were many skeptics who thought this was a waste of taxpayers' money.

Building and maintaining a capacity to realize the benefits of new horizons in science requires patience and persistence. This discipline will often be rewarded by very significant and tangible benefits, for example plant genomics was key in the development of canola, a crop produced in Saskatchewan and Manitoba for a global market. The attraction of additional investment because of these discoveries is an added economic benefit. Unfortunately, these outcomes do not usually occur in a single term of government. Long-term commitment by all political parties to these priorities is needed, as short-term political decisions at the expense of support for innovation to address potential threats can be very costly. Investment in these priorities need to be acknowledged as part of long term, consistent policy that is also constantly monitored and evaluated as new information emerges. A good local example of the benefits of long-term investment in infrastructure and research is the Crop Development Centre at the University of Saskatchewan. Our farmers have been the beneficiaries of this sustained investment that has produced world leading varieties of oats, barley, wheat, lentils, to name a few.

Public awareness and engagement is critical to gain understanding and support of science and its benefits.

No politicians base their election or re-election on a platform focused on science and innovation because its benefits are not fully understood or appreciated by voters. The public must understand and accept the value that science yields in sustaining our safety, jobs and quality of life. Unfortunately, the anti-science movement has gained a significant foothold based on social media that is often filled with false or misleading claims and uninformed speculation. What's needed is to confront falsehoods with truth based on science and facts, and that means a strong and coordinated fact-based campaign/program that permeates our schools, universities, public media and public discourse. One Minister was heard to say, "If it wasn't in the news, it never happened". If the government were to cut scientific funding and capabilities to help balance the budget, would there be a huge public outcry?

The resistance we see from anti-vaxxers and climate change deniers is an indication of the urgency that must be given to this effort. It is the starting point for a change in innovation policy that is an imperative for this province and this country.

If you closely examine the government and university budget documents and annual reports over the past few years, you would find that cuts in funding, in fact, was the case. Without public awareness, concern and understanding, it is easy to understand how decisions to reduce funding to science can be seen as a good political choice. Public advocacy, apart from those who are part of the scientific community and thus are often perceived to be acting in their self-interest, is virtually non-existent in a province that is home to a scientific infrastructure unique in Canada and the world.

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Need for Effective Communications

Academia and the scientific community must confront their challenges in communicating effectively with stakeholders. Growing resistance to science means that much work must be done to regain public confidence and trust. A carefully constructed partnership with government and industry is necessary to provide the information and tools necessary to reach and educate an apprehensive audience. Government policy that requires the institution to translate effectively the results of its research can be an effective vehicle to achieve this objective. Genome Canada has utilized this approach with some degree of success.

Public education, awareness and engagement should target misinformation and fear mongering. The ability to respond quickly and effectively counter unfounded claims about the effectiveness of masks or the safety of vaccines are two examples where well-developed materials and well-coordinated public distribution of information would have alleviated much of the confusion and anxiety. The public resistance is the result of failure by the scientific community and governments to communicate effectively.

Genome Canada was a pioneer in this area. It initiated the GELS (Genomics and its Environmental, Ethical, Economic, Legal and Social aspects) program aimed at funding and mandating activities and projects related to social sciences to facilitate public acceptance of the genomic sciences. It succeeded in growing social science capacity, but there remains a long way to go in terms of funding and expertise development in order to counter the breadth of the anti-science movements. These "anti-science" movements are well-funded and exploit the speed of social media and the vulnerability of the general public pertaining to matters of a scientific and technical nature.

Innovation in information sharing and decision-making at multiple levels is another component of the overall response and an important piece of the communication strategy. In some cases, formal mechanisms such as scientific and regulatory collaboration would greatly enhance the speed and consistency of clinical research and regulatory approvals. The staggered approvals and inconsistent evaluations of vaccines, diagnostics and therapeutic candidates are very recent illustrations of these inefficiencies that have contributed to vaccine and testing supply shortages and public acceptance of vaccines and other drug options. This is a complicated and challenging multilateral topic, involving national and global institutions and includes the complex realties of international politics and collaboration. But the global challenge of coordination, as daunting as that might be, is no reason why Canada shouldn't learn from the lessons of COVID and invest to make sure that the next time a pandemic strikes we are much better prepared.

Another dimension of a communication strategy is the relationship between industry and the research community. For an innovation to be successfully implemented, it most often requires industry involvement. Many successes we have witnessed during the pandemic are a result of effective communication and collaboration between government, academia and industry. The vaccines, therapeutics and diagnostics were the result of the sharing or transfer of information, data, services or technologies between the academic institutions and industrial partners. The public institutions can facilitate these outcomes by their use of intellectual property and information sharing policies and practices that enable industry uptake and involvement.

Conclusion

The bottom line is successful innovation policies require a full understanding of the innovation process with a focus on desired outcomes. The roles and responsibilities of government, academia and industry must be clear and coordinated.

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Prior to his position at Innovation Saskatchewan, Jerome served as Director General of the National Research Council's (NRC) Plant Biotechnology Institute, where he was a member of a team that was awarded the Government of Canada Public Service Award of Excellence for contribution in science for the world's first flight fuelled by 100 % biofuel.

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