
Centre for International
Governance Innovation

Reimagining a Canadian National Security Strategy

No. 8

Economic Security and the Changing Global Economy

Dan Ciuriak and Patricia Goff



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About the Project

Canada's approach to domestic and international security is at a profound moment of change. The shock wave of COVID-19 and its looming future effects highlight the urgent need for a new, coordinated and forward-looking Canadian national security strategy that identifies emerging and non-traditional threats and considers their interrelationships. Complex interactions between foreign policy, domestic innovation and intellectual property, data governance, cybersecurity and trade all have a significant impact on Canada's national security and intelligence activities.

Reimagining a Canadian National Security Strategy is an ambitious and unprecedented project undertaken by the Centre for International Governance Innovation (CIGI). It aims to generate new thinking on Canada's national security, inspire updated and innovative national security and intelligence practices, and identify ways that Canada can influence global policy and rulemaking to better protect future prosperity and enhance domestic security.

CIGI convened interdisciplinary working groups, which totalled more than 250 experts from government, industry, academia and civil society, to examine 10 thematic areas reflecting a new and broad definition of national security. Each thematic area was supported by senior officials from the Government of Canada, designated as "senior government liaisons." They provided input and ideas to the discussions of the working group and the drafting of thematic reports. Project advisers provided support and advice through specific lenses such as gender and human rights. This was critical to strengthening the project's commitment to human rights, equity, diversity and inclusion.

The project will publish 10 reports, authored independently by theme leaders chosen by the project's co-directors. The reports represent the views of their authors, are not designed as consensual documents and do not represent any official Government of Canada policy or position. The project was designed to provide latitude to the theme leaders to freely express new thinking about Canada's national security needs.

A special report by the project's co-directors, Aaron Shull and Wesley Wark, will analyze Canada's new national security outlook and propose a security strategy for Canada.

About the Authors

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Patricia Goff is a CIGI senior fellow. She is also an associate professor of political science at Wilfrid Laurier University and the Balsillie School of International Affairs. She specializes in international political economy, international relations theory and international organizations, with a particular interest in trade, intellectual property and the cultural capacity of international organizations.

She is the author of *Limits to Liberalization: Local Culture in a Global Marketplace* (Cornell University Press, 2007), editor of *Trade and Culture: The Ongoing Debate* (Routledge Press, 2021) and co-editor (with Jörg Broschek) of *The Multilevel Politics of Trade* (University of Toronto Press, 2020), among other publications.

Acronyms and Abbreviations

5G	fifth-generation
AI	artificial intelligence
ASEAN	Association of Southeast Asian Nations
BERD	business expenditures on R&D
CDEV	Canada Development Investment Corporation
COVID-19	coronavirus disease 2019
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
CUSMA	Canada-United States-Mexico Agreement
FDI	foreign direct investment
FTAs	free trade agreements
IoT	Internet of Things
IP	intellectual property
ISED	Innovation, Science and Economic Development Canada
NAFTA	North American Free Trade Agreement
NSERC	National Sciences and Engineering Research Council of Canada
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty.
PPE	personal protective equipment
R&D	research and development
REEs	rare earth elements
WTO	World Trade Organization

Executive Summary

Several major developments have necessitated a reimagining of the interface between national security and economic policy: geopolitical developments related to the rise of China and its relations with the United States; the shift from trade concerns over access to foreign markets toward concerns about scarcity of supply and rising export restrictions; and new vectors of vulnerability created by the digital transformation, climate change and rapid development of new general-purpose technologies with dual-use applications. These developments are unfolding against an international landscape shaped by peak globalization, which features deep and intricate global/regional value chains. These were forged by private interests in the context of a unipolar world in which national security was a dormant background issue for the trading system. In our increasingly multipolar environment, national security considerations are now reshaping the contours of trade and innovation linkages as governments worldwide are responding to these concerns with ambitious industrial policy commitments.

This report considers how Canada's trade, investment and innovation policies and partnerships should be adjusted in light of these new political constraints and secular trends to mitigate the national security risks and threats arising from economic interdependence while ensuring fertile ground for innovation and enhanced competitiveness across the range of regional and sectoral needs in Canada.

The focus of this report is on the nexus of national security, economic security and economic prosperity. Nonetheless, any analysis offered here springs from a commitment to inclusive and sustainable policies that recognize the diversity of experiences across Canada, especially as they relate to economic prosperity. Any recommendation in this report should be viewed through such a lens, attentive to the varying regional, ethnic, racial, gender and other needs that characterize this country from coast to coast to coast.

Key messages:

- The new geopolitical and technological configuration of the world requires an expansion of our notion of security to include *economic* security.
- Any notion of economic security should distinguish among the defensive dimension (for example, guarding against risks related to exposure to supply disruptions that threaten the viability of the national economy), the offensive dimension (for example, risk taking to prosper in a competitive global economy) and the direct economic underpinnings of national security (for example, material support from the economy for national defence).
- Economic security can require a trade-off between security threats and economic opportunities. The critical challenge is to ensure that seeking opportunity through international trade, investment and technological collaboration does not expose Canada to material national security threats. At the same time, it also means carefully navigating the moments when national security concerns might unnecessarily constrain economic activity, all of this against the backdrop of the Canadian commitment to values of sustainability, inclusiveness and equity.
- A stable, resilient and prosperous economy provides a fundamental foundation for economic security and national security.

Introduction

The world is changing rapidly and disruptively in ways that impact how Canada is positioned in the global economy. These developments have made national economic security and the economic dimension of national security prominent themes in policy discussions worldwide. No longer siloed areas of government activity, economic and national security policy are intertwined in new ways.

First, the unipolar moment that prevailed following the end of the Cold War is giving way to a new geopolitical reality marked by China's rise as an economic and geopolitical rival to the United States. This threatens to disrupt established patterns of production and trade.

Second, the global pandemic highlighted vulnerabilities of economic interdependence, including risks to a secure supply of critical goods and disruptions to global supply chains. This

has prompted policy reviews and adjustments globally by firms and governments.

Third, the digital transformation and the shift of economic and social interaction online is generating qualitatively new risks to the functioning of our economies and societies. These include threats to the integrity of democratic processes and growing cybersecurity risks that loom large as the Internet of Things (IoT) evolves.

Fourth, the race to dominate the new general-purpose technologies based on big data, machine learning and artificial intelligence (AI), and other new technologies such as electric vehicles, is changing the global competitiveness landscape. Governments around the world, motivated by geopolitical and geo-economic rivalry, are making ambitious industrial policy commitments in new technologies.

Fifth, these developments are taking place in a context of a number of secular trends: climate change; the rise of the intangibles economy; steeply rising resource requirements for leading-edge innovation; and the accelerating adaptation of business models to the modern technological environment, such as through remote work, autonomous vehicles and drones, robots and AI applications. All of these trends drive disruptive economic change that will affect Canada's regions and communities differently, with inevitable strains on our social contract and political bargains.

Historically, national economic security has been in the policy spotlight intermittently following major economic shocks. More recently, it has attracted growing analytical attention due to the deepened interdependence of nations in the globalized economy. The confluence of the disruptive forces listed above has given new dimensions to the concept, making it a major element in today's national security policy frameworks:

- The administration of US President Joe Biden, like its predecessor, has bluntly stated: "economic security is national security" (The White House 2021a, 15).
- The European Union has set an objective of "strategic autonomy," which includes economic security, interpreted in this case as maintaining a favourable environment for investment and trade; and securing the European Union's supply of critical resources, including medical products,

rare earth elements (REEs) and microprocessors, which are seen as essential for the European Union's digital sovereignty (Michel 2020).

- China has long included economic and development-related threats in its concept of national security (Huang 2021). A separate chapter in its recent 14th Five-Year Economic Plan is devoted to national economic security, with specific focus on boosting self-sufficiency in agriculture, energy, technology and industry; securing supply chains; and increasing technological competitiveness. Moreover, with the adoption of the concept of "dual circulation,"¹ China is hedging against external risks, expressed as "properly handling the relationship between openness and independence" (Sutter and Sutherland 2021).
- Japan has created a new position of minister for economic security, with a remit that covers computer chips, REEs and cybersecurity, and could extend to foreign direct investment (FDI) in Japanese companies (Inagaki and Lewis 2021).
- For its part, the Government of Canada has struck a task force to examine economic-based threats to Canada's national security and prosperity, including "risks to intellectual property [IP] intensive businesses, access to innovative technologies and sensitive research, and any other economic-based threats to the safety and prosperity of Canadians" (Public Safety Canada 2021).

In this report, the concept of economic security is revisited with its expanded dimensionality in the complex context in which Canada finds itself as we move into the post-pandemic era.

¹ This concept echoes the calls in other countries to reduce exposure to supply chain risks by developing domestic supply chains in areas where China is vulnerable to foreign restrictions, while at the same time supporting its exports through initiatives such as the Belt and Road Initiative to maintain its economic growth. See, for example, García Herrero (2021).

Economic Security, National Security and Prosperity

The idea of a security dimension to economic policy is well established. It was discussed by German economists as early as 1900 (cited in Arato, Claussen and Heath 2020) and received renewed interest in the 1930s and 1940s in the context of the great power rivalry of the day (see Mastanduno 1998 for a discussion and sources). Subsequently, economic security considerations have been raised in many other contexts, including over energy security as in the Organization of the Petroleum Exporting Countries oil crises of the 1970s (Pelkmans 1982) and again with the energy price and supply shock of 2021 (*The Economist* 2021); financial instability as in the Great Financial Crisis of 2008–2009 (Whalen 2011); food security as in the rice crisis of 2007–2008 (Dawe 2010), and again due to export restrictions on staple food products during the coronavirus disease 2019 (COVID-19) pandemic (Falkendal et al. 2021); supply disruptions in critical medical supplies as in the pandemic (Allen and Mirsaedi 2020; Lincicome 2021); and the recent computer chip shortages that have stalled auto and cellphone production, among others.² The concept is thus protean and will mean different things to countries in different circumstances and facing different contingencies.

There are two particularly important novel features in today's understanding of economic security. First, the security dimension in science and technology policy is broadening beyond military and dual-use goods to innovation more generally (for example, "achieving economic security through innovation," Tyson and Guile 2021; see also Araya and Mavinkurve, forthcoming 2022, on the role of emerging technologies in national security). Second, the concept of interdependence risk is being updated to address supply chains. These extensions are natural consequences of the fact that national competitiveness in an era of accelerated technological change is based on innovation;

2 The list of issues with some economic dimension that have been "securitized" is even longer: it includes global health, cyberthreats, organized crime, money laundering, bribery, human trafficking, foreign investment, migration, national culture and cultural property. See Heath (2021) for a discussion and sources.

and because great power rivalry has re-emerged at a time of unprecedented interdependence through global value chains, an interdependence that can be, and has been, weaponized.

The idea of an economic dimension to national security is also well established. Traditional notions of national security emphasize the ability to defend the sovereignty of the state and the lives of its people through maintenance of armed forces capable of deterring or repelling a physical, armed assault, and through alliances that provide for collective security. Economic capacity underpins defence capacity. Michael Beckley (2010) reviews the empirical evidence of the role of economic development in providing an advantage in warfare; and as Emily O. Goldman and Leo J. Blanken (2005) document, scholars have long emphasized the link between the industrial and revenue-raising capacities of states and their military capabilities. With the advent of new and powerful general-purpose technologies with dual-use applications built on the nexus of big data, machine learning and AI, the economic underpinnings of national security in the sense of maintaining technological competitiveness have moved front and centre in strategic deliberations (see, for example, Gill 2020; National Security Commission on Artificial Intelligence 2021; Lewis 2021).

The third element of this conceptual framework is economic prosperity. Economic prosperity can be distinguished from economic security in that the latter concept focuses on measures to mitigate risks or threats and is "defensive" in nature, whereas the prosperity agenda is "offensive" in nature, seeking opportunities, which inherently entails *embracing* risk. As Vincent Cable (1995, 305) writes: "In a liberal international economic system, vulnerability to external economic events and dependence on foreigners are a necessary consequence of immersion in global markets. They are the source of opportunities for improved living standards, not threats to be avoided."

This distinction is not always made: for example, in a previous moment in Canadian history when economic security surged to the fore, it was defined as "the maintenance of those conditions necessary to encourage sustained long-term relative improvements in labour and capital productivity and thus a high and rising standard of living for a nation's citizens, including the maintenance of a fair and dynamic business environment conducive to innovation, domestic and foreign investment, and

Figure 1: The Relationship Between Risk, Threat and Opportunity



Source: Authors.

sustainable economic growth” (Potter 1998, vii). For the purposes of this report, this is seen as defining an offensive agenda aimed at economic prosperity.

In distinguishing between these three concepts, it is useful also to make a semantic distinction between “risks,” which involve exposure to adverse shocks that may come from many quarters, including nature, and “threats,” which involve deliberate hostile actions or exercise of coercion. All threats fall into the category of risks, but not all risks should be characterized as threats (see Figure 1). For example, from a current geopolitical perspective, India ceasing to be a supplier of vaccines is not a threat aimed at Canada — but it is a risk, as was evident when India blocked exports of COVID-19 vaccine when the Delta variant crisis hit.

Some risks are to be embraced as part of the calculation in seeking opportunity; the policy challenge is risk management and mitigation (for example, in the case of trade, through diversification of markets for one’s own products and securing alternative sources of supply of critical imports). Threats are to be deterred, and directly entail diplomatic, intelligence and/or military responses.

The critical area for policy in managing the economic dimension of national security under this formulation lies where seeking opportunity exposes a country to increased threat. For example, the risk of a supply disruption may be amplified when Canada sources its supply from an adversary, since this exposes Canada to the weaponization of interdependence.

In short, economic security, national security and prosperity are qualitatively different (although overlapping and possibly complementary) policy domains that implicate different government offices and societal stakeholders, and require different policy approaches.

This report argues for a nuanced understanding of security policy that acknowledges the expanding economic dimensions of national security policy, alongside the fundamental importance of providing for the country’s economic security both in a defensive sense of ensuring the ability of our economy to function in the face of potential supply disruptions, and in an offensive sense of securing our prosperity in an innovation-intensive era of strategic competition.

The Security Dimension to Economic Policy

Economic security concerns, in the sense of access to critical supplies, have not been particularly prominent in Canada given that it is a net food and energy exporter; has the greatest freshwater reserves in the world; controls vast mineral reserves; and faces no meaningful constraints on technology access given its security relationship with the global technology leader, the United States.

The security of supply issues over personal protective equipment (PPE) and vaccines experienced in the pandemic, the computer chip shortages that have slowed Canadian automobile production and the ongoing disruption of supply chain logistics that have created jarring shortages on store shelves thus have been somewhat of a rude awakening. This new awareness of economic security risks comes on top of the increasing economic costs and disruptions caused by climate-related weather events and the rising exposure to cyber disruption as the digital transformation progresses, in particular with the development of the IoT in the backbone economic infrastructure sectors (transportation, telecommunications, energy and finance).

Canada thus must shake off any complacency induced by favourable historical circumstances in insuring against heightened economic security risks in the future.

Critical Supplies

A key security dimension of economic policy is a reliable and resilient supply of critical goods. This dimension came into focus during the pandemic, when, as discussed by Adrian R. Levy (2021), the government's preparedness in terms of stockpiles of critical goods and response capacity was found wanting, notwithstanding experience with prior events. However, it extends beyond it.

With regard to the pandemic, the Auditor General acknowledges the extensive work that various government agencies did in the wake of the unprecedented demands of the COVID-19 pandemic. Nonetheless, it also notes that, "As a result of long-standing unaddressed problems with the systems and practices in place to manage the National Emergency Strategic Stockpile,

the Public Health Agency of Canada was not as prepared as it could have been to respond to the surge in provincial and territorial needs for PPE and medical devices brought on by the COVID-19 pandemic" (Auditor General 2021a, 5). Likewise, in a separate report, the Auditor General observed that the Public Health Agency of Canada had developed a pandemic response following the 2009 H1N1 experience. However, a series of gaps in data exchange across levels of government and preparedness testing, among other things, led to less preparedness than one might have hoped (Auditor General 2021b, 5).

The upshot of these reports is that there is extensive knowledge about how to confront a pandemic, but resilience and preparedness also require ongoing efforts at updating and implementing those plans to ensure that Canada is better prepared for the next pandemic. Learning the lessons of the pandemic-induced supply chain disruptions will also mean developing contingency measures to mitigate exposure to supply chain disruptions for critical products more generally.

As the global economy moves into the post-pandemic era, it faces an unusual confluence of supply-side constraints: an energy supply crisis, the first in the transition to a low-carbon economy (Baker et al. 2021); a global food supply crisis — in a context of wheat harvest setbacks, strong demand and supply chain disruptions, global food prices are up by a third in 2021 (Durisin 2021); a labour supply crisis as signalled by the "great resignation" (Tharoor 2021); and a logistics supply chain crisis due to disruption of container shipping patterns ("containergeddon" [Baertlein, Saul and Cavale 2021]).

Some of these will undoubtedly prove to be transient (for example, the container misalignment). Others will likely be beneficial in some ways, and to some countries (for example, the facilitation of job transitions and a boost to wages from the labour shortage; and for Canada, as a net energy and food exporter, an improvement in the terms of trade). Some constitute macroeconomic risks that will need to be managed but are well understood — for example, the inflationary implications of the pass-through of higher energy prices (Krugman 2021).

However, some reflect ongoing structural changes driven by the accelerated pace of innovation and present a governance challenge in that they

demand an unprecedented degree of horizontal integration across issue areas, analytical depth and rapid response capacity (Balsillie 2021). For example, a contributing factor to the current energy supply crisis was an unexpected sharp decline in wind power supply in Europe in the midst of its energy transmission, which ironically may be due to climate change impacts on average wind speed (Carita 2021; Bernard 2021). Meanwhile, the rise in energy prices drove the price of fertilizer production, which fed through into agricultural production. In short, the 2020s are likely to be a decade of transition that is unprecedented in the experience of today's policy community.

Given the range of sectors and industries that might be vulnerable, as well as the variety of possible risks, some combination of potential solutions will likely be necessary. Some solutions, such as stockpiling PPE for pandemics, are straightforward; this is the responsibility of governments. However, diversifying sources of supply for risk mitigation implicates the private sector.

Policy-driven reshoring and/or increasing domestic manufacturing capacity to attenuate specific risks to international sourcing is much more complicated since this entails longer-term efforts to develop the innovation ecosystem necessary to support that capacity; and strategic assessments concerning the viability of this manufacturing capacity in between crises. Chad P. Bown and Douglas A. Irwin (2021) highlight the trajectory in the US PPE industry from industrial policy-induced expansion of supply to meet shortages to subsequent pleas for protection against “dumping” of foreign PPE once the supply crunch passed. Various assessments of the recent supply disruptions emphasize that resilience is enhanced by global sourcing.³ For Canada — a small, open economy that depends on trade to supply a wide range of products — policies in this area thus require very careful evaluation, with a particular eye to sustainability in between crises.

Climate Change-Related Economic Risks

The experience with the pandemic, a well-understood risk following the 2003 severe acute respiratory syndrome outbreak in Canada (see, for

example, Knobler et al. 2004), raises the question of whether Canada has adequately prepared for other much discussed risks to the economy, such as those posed by climate change.⁴

With specific reference to economic security, it is encouraging to note that systematic stress testing of financial systems for climate change risk is an emerging practice.⁵ The work of national financial authorities on stress testing financial systems is coordinated through the Network of Central Banks and Supervisors for Greening the Financial System, which was launched at the Paris One Planet Summit in 2017 and has grown to a membership of 101 members and 16 observers as of November 24, 2021.⁶

While the stress tests are generally considered to be exploratory and preliminary at this stage (Baudino and Svoronos 2021), the recent European Central Bank exercise significantly expands on previous tests, covering some four million non-financial corporations worldwide and 1,600 consolidated banking groups in the euro area with backward- and forward-looking climate and financial information. It further analyzes the interactions between climate transition and physical risk on the basis of macro scenarios and a modelling framework that takes into account both direct and indirect impacts of more severe and frequent natural disasters on non-financial corporations and banks (Alogoskoufis et al. 2021). For its part, the US Financial Stability Oversight Council has assessed economic risks to the US economy in terms of property damage, lost income and business disruptions that affect real estate and other asset valuations due to more frequent and destructive hurricanes, floods and wildfires; it has called for improved data, disclosure and scenario analysis of climate-related risks to the financial system (Financial Stability Oversight Council 2021).

Canadian authorities are in step with these efforts: the Bank of Canada and the Office of the Superintendent of Financial Institutions have conducted an assessment of climate-related risks to federally regulated financial institutions

3 See Bown and Irwin (2021), writing from a US perspective; Guinea and Forsthuber (2021), writing from an EU perspective; Calvert and Ciuriak (2020), on the Asian experience during the pandemic; and Bonadio et al. (2020), evaluating the global impact in a quantitative framework.

4 The implications of climate change for national security in other dimensions such as increased migration, conflict over water and so on are discussed elsewhere in this series; see Dalby and Lawrence (2021).

5 See, for example, work at the International Monetary Fund reported in Adrian, Morsink and Schumacher (2020); and work at the Bank of International Settlements reported in Baudino and Svoronos (2021).

6 See www.ngfs.net/en/about-us/membership.

and pension funds, setting the groundwork for regular climate-related stress tests and new regulatory requirements for climate-risk disclosure (Langton 2021). This is an area that will require ongoing attention and resources to ensure that Canada is operating at best practice level in addressing potential vulnerabilities at a granular sectoral/regional level.

Research Security

Given the research that universities do, including in emerging technology industries, such as AI, they have become security targets. University researchers rely on private sector and foreign investment for research projects. At the moment, consistent and reliable mechanisms are not in place for all relevant university researchers to assess the nature or extent of a security risk that might accompany a particular partner or project.

In its March 2021 Research Security Policy Statement, the Government of Canada observed that “Canada’s world-class research, and its open and collaborative research environment, are increasingly targeted by espionage and foreign interference activities.” It encouraged “all members of the research community—including those in government, academia and the private sector – to take extra precautions to protect the security of their research, intellectual property, and knowledge development” (Government of Canada 2021). In terms of action, the statement notes that an effort is under way in the federal granting agencies and through the Government of Canada-Universities Working Group to review policies and procedures and to develop guidelines for researchers, research institutions and government funders.

This initiative was followed in July 2021 by National Sciences and Engineering Research Council of Canada (NSERC) guidelines that require science researchers to fill out a lengthy security assessment form to accompany their research applications. University administrators and individual researchers certainly need to be better informed about prospective security threats. However, it is inappropriate to expect researchers (and research offices) to take on the weighty task of protecting national security in this fashion, a task for which they are neither prepared nor qualified. Moreover, imposing this requirement on researchers may have the opposite effect than what is intended. Researchers may forego the opportunity to apply for funding that requires these national security

assessments. Even if they do proceed, they likely need more information and more specific guidance on this process since the risk assessment tool places the onus on the researcher to assess and mitigate the risk. Some useful information is available on the website of the Government of Canada;⁷ however, there does not appear to be wide awareness of this information among researchers in Canada.

At the same time, it is important to note that research funding is not plentiful and the appeal of private sector or foreign funding will be high. There would need to be compelling reasons to turn it down, as well as alternative funding sources to turn to. The NSERC program, for example, does not appear to be accompanied by a strategy to offset the funding losses that will likely emerge as researchers refuse opportunities that appear to carry security risks. In cutting off relations between academics and China, for example, the province of Alberta risks that academics will not necessarily easily find other sources of research funding and may not be able to continue their research. Furthermore, such a policy risks stoking an unjustified anti-Asian bias, with potentially dire consequences for the social fabric of Canada (see, for example, Chen, Yu and Price 2021; Houlden 2021).

There is a pressing need for the government to understand the constraints and conditions under which Canadian academics work. Government needs to provide leadership by giving clear guidelines and, where it prohibits (or makes prohibitively difficult to access) certain funding streams, to open up alternatives. Universities themselves operate under financial constraints, which makes unfunded security-oriented mandates onerous. These discussions must be informed by the commitments to openness that have allowed the Canadian research sector to thrive in the first place.

7 See www.ic.gc.ca/eic/site/063.nsf/eng/h_97955.html.

The Economic Dimension to National Security

In traditional discussions of national security, the economic dimension tends to mean defence *spending*. Since Canada's national security has been based historically on privileged relationships with the leading powers of the day (the United Kingdom during its imperial era and then the United States, which assumed the hegemon's role post-World War II), as well as participation in US-led regional alliance frameworks, in particular the North Atlantic Treaty Organization and the North American Aerospace Defense Command, defence spending has been guided by these considerations.

Defence *production* is relatively small in Canada. For example, it is estimated to have contributed \$6.2 billion to Canada's GDP in 2016 (Innovation, Science and Economic Development Canada [ISED] 2018) or about 0.31 percent of Canada's GDP that year.⁸ Canada's aerospace sector, which contributed about \$20 billion to Canada's GDP in 2018 (ISED 2019) is mostly civilian-oriented but defence-related maintenance, repair and operations production amounted to about \$1.55 billion, accounting for about 0.07 percent of Canada's GDP. The combined contribution is thus about 0.38 percent.

Discussions about defence spending remain important in the current moment, especially as the defence community considers how to ensure that Canada remains a relevant and reliable contributor to key alliances and as broader discussions about the ethical implications of recent arms sales continue (Amnesty International Canada and Project Ploughshares 2021). However, these are not the economic dimensions of security policy that are addressed here. Instead, new and pressing dimensions that merit attention in the national security conversation are highlighted.

The Northern Frontier

A key development affecting Canada's security status has been the opening of the North due to climate change, which has meant more commercial and military traffic across the Arctic

Ocean and increased interest in commercial development of Canada's Northern territories.

These changes mean that "the Arctic is no longer a fortress wall...[but an avenue] of approach for advanced conventional weapons and the platforms that carry them" (O'Shaughnessy 2020). Reflecting this understanding, Canada's 2017 defence policy, *Strong, Secure, Engaged*, includes commitments "to an ambitious program of naval construction, capacity enhancements, and technological upgrades to improve situational awareness, communications, and the ability of the Canadian Armed Forces (CAF) to operate across the Canadian Arctic" (Lackenbauer 2021). The changed national security context in the Arctic has led to calls to introduce a security dimension in the main Arctic regional body, the Arctic Council.⁹

The opening of Canada's North to ocean traffic requires a new perspective that considers the economic dimensions of national security as it applies to the region. As argued in the introduction to this report, national security, economic security and economic prosperity are intimately intertwined. This is especially true in Canada's North where economic development lags behind.

One consequence of the opening of the Arctic is China's increased interest and economic presence in the region, including its participation as an observer in the Arctic Council since 2013, and the inclusion of a "Polar Silk Road" component in its Belt and Road Initiative (Havnes and Seland 2019). China has clearly laid out its interests in the Arctic: "States from outside the Arctic region do not have territorial sovereignty in the Arctic, but they do have rights in respect of scientific research, navigation, overflight, fishing, laying of submarine cables and pipelines in the high seas and other relevant sea areas in the Arctic Ocean, and rights to resource exploration and exploitation in the Area, pursuant to treaties such as UNCLOS [the United Nations Convention on the Law of the Sea] and general international law. In addition, Contracting Parties to the Spitsbergen Treaty [now Svalbard Treaty, to which China has been a signatory since 1925] enjoy the liberty of access and entry to certain areas of the Arctic, the right under conditions of equality and, in accordance with law, to the exercise and practice

⁸ Unless otherwise specified, all dollar figures cited are in current Canadian dollars.

⁹ See, for example, Conley and Melino (2016); for a dissenting view on this, see Groenning (2016).

of scientific research, production and commercial activities such as hunting, fishing, and mining in these areas” (People’s Republic of China 2018).

Indeed, the future tensions between national security and economic development on the northern frontier are already upon us: a bid by the Chinese state-owned firm Shandong Gold Mining Co. Ltd. to acquire TMAC Resources and its Hope Bay gold mining project was rejected by Canada on national security grounds. Chinese state-owned firms had previously invested a cumulative total of US\$19 billion into the Canadian metals and minerals sector. A number of these projects are in the Arctic and Arctic-adjacent regions, including Northern Quebec, Labrador, Yukon, the Northwest Territories and Nunavut (Oddleifson, Alton and Romaniuk 2021).

China is potentially a complementary economic partner for Canada’s North: it wants to buy what Canada’s North has to sell (mineral resources); has the technical and financial capability to develop the supporting infrastructure; and has revealed committed interest in doing so at scale through its Polar Silk Road. At the same time, the TMAC-Shandong decision positions China as a security threat. There is an active debate now as to how Canada should handle this policy area, which lies at the intersection of risk, threat and opportunity.¹⁰

China is not the only potential international partner in Canada’s North, as the recent deal between CanArctic Inuit Networks and the Norwegian Bulk Fiber Networks A.S. to lay a submarine fibre optic cable to provide broadband access to Canada’s North makes clear.

The evolving security landscape in the North makes it even more urgent that the Government of Canada address not only the security threats, but also the basic economic, developmental and infrastructural needs of regional communities and the related environmental considerations. The three dimensions should be considered in an integrated fashion.

The Cyber Frontier

The digital transformation opens up a new security frontier that is becoming steadily larger and potentially more vulnerable as more devices and

systems become digitalized. The cybersecurity “attack landscape” includes personal items such as wearables, “smart” home devices such as IoT toothbrushes, smart cars, and even smart assistants that can be taken over by remote laser “light commands” to “open garages, make online purchases, and cause all manner of mischief or malevolence” (Greenberg 2019). Corporations are major targets and are being attacked through vulnerable devices such as connected printers, Voice over Internet Protocol phones and other unpatched equipment. Public facilities targeted by cyberattacks include health services, municipal services and even military systems (Centre for Strategic and International Studies 2019).

At the state-to-state level, the situation has been described as one of near-war: “cyber behavior below the threshold of armed attack” (Fischerkeller and Harknett 2019). Engagement is continuous: US cyber forces have been described as in “persistent engagement” with adversaries, and the United States has declared it will “defend forward” and “continuously contest” adversaries (Healey 2019). Meanwhile, China, Iran, North Korea and Russia are routinely named as conducting or sponsoring cyber “attacks” on Western states. As regards Canada, the Canadian Centre for Cyber Security (2020) gives this evaluation of the situation: “State-sponsored actors are very likely attempting to develop cyber capabilities to disrupt Canadian critical infrastructure, such as the supply of electricity, to further their goals. We judge that it is very unlikely, however, that cyber threat actors will intentionally seek to disrupt Canadian critical infrastructure and cause major damage or loss of life in the absence of international hostilities. Nevertheless, cyber threat actors may target critical Canadian organizations to collect information, pre-position for future activities, or as a form of intimidation.”

As the IoT transforms the economy’s backbone infrastructure — transportation, communications, energy and finance — into an interactive central nervous system (Balsillie 2018), cybersecurity concerns will inevitably escalate.

What are the implications for Canada as it considers economic engagement across the security divides of our newly multipolar world? In particular, does it warrant some level of decoupling in cross-border services trade (a “splinternet” based on nationalist approaches to platform governance, as discussed in Aaronson et al. 2020) or specific restrictions on foreign participation in the

¹⁰ For contrasting views, see, for example, Studin (2018) and Lajeunesse (2018); and Brady (2019) and Pugliese (2021).

development of Canada's digital infrastructure (for example, the exclusion of Huawei from the buildout of fifth-generation [5G] networks in Canada)?

To get at these questions, a quantitative perspective is helpful.

First, while clearly growing very rapidly, the cost of cybercrime is still relatively small: a 2018 report by the US Council of Economic Advisers placed the cost to the US economy at between 0.31 percent and 0.58 percent of US GDP in 2016 (Council of Economic Advisors 2018). James Lewis (2018) raised the estimate to 0.8 percent, in this case of global GDP. Lewis, Malekos Smith and Lostri (2020) further raised the estimate to 1.07 percent of global GDP or about US\$1 trillion.

To put these figures in context, occupational fraud is estimated to cost 5 percent of global GDP; illicit financial flows 3.7 percent of the measured countries' GDP; US tax evasion 3.5 percent of US GDP; corruption 2.9 percent of global GDP; black market activities 2.5 percent of global GDP; narcotics trafficking 1.4 percent of US GDP; and copyright infringement and software piracy 0.1 percent of global GDP (Michel, Stronberg and Geday 2014).

Corroborating evidence for a still relatively modest cost is provided by expenditures by corporations and governments on cybersecurity. The global cybersecurity market is estimated to be about US\$150 billion or 0.18 percent of global GDP (Business Research 2021); the cyber insurance market is only US\$7.8 billion or 0.009 percent of global GDP (Statista 2021a). The US government allocated US\$18.78 billion or 0.28 percent of its \$6.82 trillion budget for fiscal year 2021 to cybersecurity (Statista 2021b).

The most prominent forms of cybercrime are ransomware and trade secret theft. Ransomware is estimated to cost the global economy about US\$330 billion or 0.4 percent of global GDP (Emsisoft 2021).¹¹ Of this, about US\$75 billion is due to payment demands and the remainder

to downtime. As regards trade secret theft, this represents an illegal form of cross-border flow of IP. The legal flow of global cross-border payments for IP in 2020 was US\$370 billion.¹² The illegal flow would be a fraction of this — at most about five percent (based on the examples cited by Michel, Stronberg and Geday 2014), which amounts to US\$18.5 billion, or 0.022 percent of global GDP. Dan Ciuriak and Maria Ptashkina (2021) use a point estimate of 1.62 percent for this ratio, which would put the global cost at about US\$6 billion or 0.007 percent of global GDP. These figures would be interpreted as royalty and licence payments foregone.

Canada's exposure to cybercrime appears to be well below the global average for several reasons.

First, the cost of ransomware attacks on Canadian companies and institutions is estimated at about US\$4.04 billion (of which about US\$660 million is due to payment demands, the rest to downtime; Emsisoft 2021). This amounts to about 0.23 percent of Canada's GDP, about half of the global average of 0.4 percent. This may be a reflection of stronger than average cybersecurity capability — notably, Canada has long been home to global cybersecurity leaders such as BlackBerry and ranks eighth globally on the International Telecommunication Union Global Cybersecurity Index (International Telecommunication Union 2021). Note that these costs include not only cross-border but also in intra-national cybercrime.

Second, Canada's exposure to trade secret theft and commercial cyber espionage is proportional to the stock of Canada's intangible assets, which are well below the Organisation for Economic Co-operation and Development (OECD) average, given where Canada ranks in research and development (R&D) intensity. Legal cross-border flows of IP out of Canada generated payments to Canada of US\$6.02 billion in 2020. Illegal flows would be at most 5 percent of the legal flows, which would amount to about US\$300 million or 0.017 percent of Canada's GDP, again below the global average. This is an upper-bound estimate: the actual amount is more likely about one-third of that and perhaps even lower insofar as Canada is above average

¹¹ These estimates are based on reported ransomware data multiplied by four to take account of under-reporting of cases: Emsisoft estimates that only 27 percent of ransomware cases are reported. These estimates can safely be assumed to be upper bounds because the size of cases is likely to follow a power law distribution with a few large cases and a large number of small cases. The unreported cases are more likely to be small; accordingly, using the average cost of reported cases results in a likely over-estimate of the full total.

¹² World Bank Indicators, "Charges for the use of intellectual property, receipts (BoP, current US\$)," <https://data.worldbank.org/indicator/BX.GSR.ROYL.CD>.

in cybersecurity. Commercial cyber espionage would comprise some fraction of that amount.

The digital transformation necessarily requires Canadian individuals, corporations and institutions to take measures to guard against cyber intrusions by criminal and state actors. The frequency and sophistication of cyberattacks are growing rapidly, and Canada will need to make the necessary investments to maintain a secure operating environment in digital space — as will the world.

While it is clear that the Government of Canada is taking steps to guard against cyberattacks, there is still room for individuals and the private sector to raise stronger defences. This will likely require incentives, as well as information, from policy makers. Furthermore, this should be seen as an area of opportunity for Canada, both in terms of domestic investment to make Canada a secure and hence attractive place to do business and in terms of being a global provider of cybersecurity services. Ontario, for example, has positioned itself as a cybersecurity hotbed with hubs in Toronto, Waterloo and Ottawa, star firms such as Herjavec Group and BlackBerry, and clusters emerging elsewhere (Invest Ontario 2021). This market is being contested internationally (Janke 2019). Canada should compete.

Supply Chain Restructuring

The geopolitical rivalry between the United States and China is creating fault lines for the global economy. The focus of the rivalry is on the new general-purpose technologies built on big data, machine learning and AI. The United States has articulated a national security strategy that is based on maintaining technological superiority over China and views with alarm China's advances in areas such as 5G telecommunications equipment, electric vehicles and batteries, and AI, to name a few. In this regard, China is a challenge to American economic supremacy in a way that its former rival, the Soviet Union, was not (Cohen 2020). This is quite apart from traditional national security concerns such as the modernization of China's armed forces, which confronts US force projection in the West Pacific, and which the United States is countering with its Quad/AUKUS alliances.

The US decision to slow down China's technological development has triggered a targeted decoupling dynamic — de-Americanization of China's supply chains and de-Sinification of US supply — which, in

turn, has driven an associated industrial policy on both sides of the divide to fill in the supply gaps.

President Biden's February 2021 Executive Order mandated a comprehensive and coordinated audit of US supply chains across several government departments and agencies. In early June, the White House unveiled the first report concerning four key product groups: semiconductor manufacturing and advanced packaging; large-capacity batteries, such as those for electric vehicles; critical minerals and materials; and pharmaceuticals and active pharmaceutical ingredients (The White House 2021b). Subsequent efforts are ongoing.

For its part, China has committed essentially whatever it takes to replace American technology in its critical supply chains, especially in semiconductors where the United States currently has a lead in key technology and equipment used in their production.

Third parties face opportunity and risk. On the one hand, the policy-driven demand for new supply capacity for particular links within various supply chains on either side of the security divide creates opportunities for firms capable of stepping into the breach (from Canada's perspective "ally-shoring" — the repatriation of outsourced tasks to within the alliance structure — could work to our advantage). At the same time, these are global markets that often feature very high capital expenditure, extreme process sophistication and short product life cycles. Almost by definition, any firm committing significant resources to filling these niches will not be the global low-cost producer and will face a high degree of commercial and political risk if the decoupling dynamics change. The considerations in two specific areas that are currently under discussion in supply chain reviews — computer chips and REEs — may be contrasted here.

Disruption in the supply of computer chips is a clear economic risk, as the impact on Canada's automobile production has starkly revealed. Canada has a foothold in this industry with a small semiconductor sector that generates about \$2 billion in GDP on sales of \$4 billion (based on 2018 data) (ISED 2021). A new Semiconductor Council was launched in May 2021 to advocate for strengthening Canada's semiconductor sector and supply chain resilience in the face of the global chip shortage (Canada Semiconductor Council 2021). The council sees the current supply difficulties as "a unique opportunity to...think strategically

about where Canada should play as a matter of national security and global competitiveness” (council member Sarah Prevette, cited in Kao 2021). While Canada has no plausible prospects for chip self-sufficiency in general, and thus must rely principally on trade to meet the full spectrum of its needs, building specialized capacity in areas where Canadian industry is a major chip user could contribute meaningfully to mitigating security of supply risks for Canadian industry and represent an opportunity to enhance Canada’s prospects for future prosperity. That said, Canada would have to choose its niche carefully given that the United States, China, Japan and Europe are all committing major public support for expanded chip production, which raises a future risk of oversupply in what has historically been a highly cyclical industry.

Critical minerals and REEs in particular represent a more promising area for Canadian industrial policy. In this case, there is a combination of security of supply and national security risks given that some 80 percent of global REE processing is concentrated in China. Canada has large and very high-grade deposits, including of the heavy REEs used in high-technology and clean-energy applications (Natural Resources Canada 2021), and is developing processing capacity in Saskatchewan (Lasley 2021). Strategic commitment to this industry would thus materially contribute to mitigation of economic security challenges; claim a share of a major growth industry to contribute to Canada’s future prosperity (Lilly 2020), including especially for Northern communities; and mitigate a potential threat vector, and thus materially contribute to Canada’s national security, over and beyond the risks associated with possible disruption of supply due to regional concentration of production in Asia.

This is not without controversy, because Canada’s REE reserves are small relative to the global reserves, largely undeveloped, and located in areas that are difficult to access (Panetta 2021). Moreover, given the need for production capacity along the entire length of the supply chain, Canada may need to make strategic commitments to early-stage support to scale up production across the supply chain, including supporting infrastructure development in remote areas and development support to address technological problems, if it is to take advantage of ally-shoring initiatives in this area. Further, production of REEs comes with environmental challenges. Any strategy has to track with efforts to achieve net-zero carbon emissions as per Canada’s environmental commitments.

Canada is already positioning itself to be a key supplier of critical minerals. This is partly reflected in efforts at joint action with the United States. Providing that environmental concerns can be allayed, and provided that incentives, including procurement, can support local industry, this effort has the potential to address security and economic goals simultaneously.

Other interesting niches where reshoring/ally-shoring may create opportunities and where Canada can play to its strengths potentially include carbon capture and conversion, design engineering to underpin AI and quantum computing, and agriculture technology (Nye, Powell and Leach 2021). At the same, such reshoring policies can expose Canada to risk, as highlighted by the protectionist framing of the Biden administration’s proposed industrial policy for electric vehicles, which threatens the development of Canada’s auto industry and has elicited threats of retaliation and WTO challenges (Zimonjic 2021; Hanley 2021). In all areas, economic sustainability of Canada’s industrial policy engagements needs to be a key consideration.

Prosperity and National Security

The broadest lens to apply in considering the economic underpinnings of national security is that of economic prosperity. This differs from the defensive orientation of considerations about economic security and national security in that it entails a proactive, offensive risk-taking agenda that is aimed at ensuring that Canada has the wherewithal to provide for its future needs, including to underwrite the costs of national security, in an intensely competitive global environment that now includes significant strategic investment initiatives by the major economic powers. Beyond these security considerations, the prosperity agenda must be delivered in an equitable, inclusive and sustainable way to strengthen fair social bargains and the political unity upon which a strong Canada must be based.

For the purposes of this report, there are two major areas where economic policies aimed at prosperity have a significant security

dimension: trade (including participation in global value chains) and innovation.

Trade

As a small, open economy that depends on trade to support its standard of living, Canada is committed to an open, rules-based multilateral trading system and has pursued deeper free trade agreements (FTAs) with its major trading partners. Rising protectionism, often invoked in the name of national security, is thus a threat to Canada's economic security.

Re-establishing WTO Disciplines

With the Appellate Body sidelined, access to legal redress in trade disputes between World Trade Organization (WTO) members has become uncertain as members can “appeal into the void” (Ungphakorn 2021).¹³ This is particularly problematic in a context in which the WTO security exceptions are being invoked in defence of non-conforming measures. As Arato et al. (2020) observe: “the emerging narrative that ‘economic security is national security,’...if carried to its conclusion, could ‘create a permanent state of exception’ in economic law, ‘justifying broad protection/protectionist measures across time and space.’ The pandemic could accelerate this slide toward permanent exception, as states increasingly consider self-sufficiency to be an overriding security priority” (citations in the original omitted).

Canada has a multi-faceted economy featuring agriculture, energy, other natural resources manufacturing and a vibrant services sector. Many sectors are potentially affected by the new national security lens being applied to economic activity; many others are not. It is generally in Canada's national interest to circumscribe the use of national security as a rationale for trade measures.

Canada has supported the creation of an alternative interim mechanism for WTO dispute settlement and through the Ottawa Group has promoted a dialogue on WTO reform. Discussions have covered the Appellate Body impasse, negotiations on fisheries subsidies, the Joint Statement Initiatives (which include domestic regulation of services and e-commerce), and trade-related aspects of health,

¹³ The panel decision in *Russia–Transit* established a precedent for justiciability of national security claims under the WTO's Dispute Settlement Body (WTO 2019). However, in the absence of a functioning Appellate Body, access to a binding decision is uncertain.

agriculture, environment, transparency and gender. The national security exception is not mentioned in communiqués (see, for example, Global Affairs Canada 2021a). Yet arguably, this is the most important issue for Canada in the longer run.

Market Access Risks in the United States

Canada faces a risk of being negatively affected by its largest trading partner's domestic economic policies as the United States moves to address its fiscal and trade deficits and the plethora of domestic issues that leave the country sharply divided (see, for example, Crane 2021). Of particular concern is a bipartisan consensus that America's problems in good measure can be traced to unfair trade and that America should look after America first. This was the perspective of the Trump administration; the Biden administration has been unwilling or politically unable to move away from its predecessor's measures. Canada was unable to obtain exclusion from section 232 “national security” tariffs in the renegotiation of the North American Free Trade Agreement (NAFTA), thus leaving this source of uncertainty about future market access in place (Ciuriak, Dadkhah and Xiao 2020). Since NAFTA's government procurement chapter was not retained in the Canada-United States-Mexico Agreement (CUSMA), Canada faces less secure access to the US government procurement market — indeed, Canada's finance minister, Chrystia Freeland, has indicated that Canada might limit US companies' ability to win Canadian procurement contracts if the Biden administration makes its “Buy American” rules more restrictive (Ljunggren 2021). This underscores the reality that assured access to the US market is always the most important task for Canada's trade diplomacy.

Trade Diversification

Canada's active trade policy agenda has resulted in Canada having newly signed and implemented agreements with its North American partners through CUSMA; with many of its Pacific Rim partners through the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Canada-Korea FTA; and with its European partners through the Canada-EU Comprehensive Economic and Trade Agreement and the post-Brexit Canada-UK Trade Continuity Agreement. In addition, the government recently notified Parliament that it will open

trade talks with the Association of Southeast Asian Nations (ASEAN) and with Indonesia.

However, Canada's new trade agreements are not sufficient to secure its trading future. First, Canada faces ongoing erosion of existing trade preferences. For example:

- The coming into force of the 15-member Regional Comprehensive Economic Partnership, which includes ASEAN, Australia, New Zealand, China, Japan and Korea, will erode Canada's competitiveness in East Asia, particularly in the "CJK trio" of China, Japan and Korea, where the main bilateral liberalization takes place under this agreement.
- The United States is seeking to leverage trade concessions from China, building on its phase 1 trade deal, which requires China to buy a stipulated amount of US products, to the detriment of competing suppliers.¹⁴
- India has re-engaged on trade liberalization (Chaudhary 2021) in a deal with Australia (apparently well advanced) and one with the United Kingdom (being fast-tracked).
- The United Kingdom is actively pursuing FTAs to secure its trading future in a post-Brexit context, which will inevitably erode the value of Canada's preferences in the UK market and with other trading partners with which Canada currently enjoys advantageous market access compared to the United Kingdom — for example, the CPTPP, to which the United Kingdom has applied to accede.

Second, as noted above, Canada faces perennial risks of recurrent trade protectionism in its main market, the United States.

On both counts, Canada will need to redouble its efforts to clinch new trade agreements. At the same time, it is worth noting that negotiating market access is not always sufficient to bring about change in the practices of exporting companies. Accordingly, trade negotiations should be backed up with concerted trade diplomacy and domestic support policies.

¹⁴ See, for example, US Commerce Secretary Gina Raimondo's comments regarding her intention to seek "robust engagement" with China (Davis 2021).

Upgrading Canada's Innovation Sector

The other major prosperity-related concern for Canada is with regard to its footing in the innovation-intensive, knowledge-based and data-driven economy. Several indicators suggest that Canada has a structurally disadvantageous business model and establish a prima facie case of innovation underperformance.

As regards the business model, Canada has a large trade surplus in R&D services and a larger trade deficit in IP. Table 1 provides the data for 2016, the latest year for which data is available for both flows.

Table 1: Canada's Trade Balance on R&D Services and IP, 2016, CDN\$ billions

	R&D Services	IP	Total
Receipts	5.5	6.0	11.5
Payments	1.6	15.3	16.9
Balance	3.9	-9.3	-5.4

Source: R&D services data from Global Affairs Canada (2021b); IP receipts and payments from the World Bank Indicators, charges for the use of IP, receipts and payments (BoP, current US\$) converted to CDN\$.

In effect, Canada contributes substantially to generating IP for foreign firms and then is a net buyer of IP, whose value is inflated by the economic rents that accrue to it by virtue of IP protection. This point is illustrated by Jim Hinton and Anton Malkin (2019) who observe that Canada provided taxpayer funding to a Finnish firm, Nokia, so that "Canadians can help create 5G technology that will be owned by Nokia, which Canada will then pay to use." This structure effectively shifts economic rents abroad and positions Canada at the bottom of the "smile curve," where the rent capture is at a minimum.¹⁵

¹⁵ The "smile curve" is a U-shaped curve that illustrates value capture in a knowledge-based economy. The main sources of value are found in pre-production R&D that generates valuable IP (the upper left-hand side of the curve), and post-production in the form of branding and trademarks that capture markets for those products (the upper right-hand side of the curve). The production process itself, which is the depressed middle section of the curve, faces highly competitive markets and generates minimal economic rents. See Taylor (2017) and Baldwin, Ito and Sato (2014) for detailed explanations of the capture of value along the curve. See Ye, Meng and Wei (2015) for an application of the firm-level smile curve to national economies.

Figure 2: Business Expenditures on R&D (BERD) – Canada and the OECD



Source: OECD and the Government of Canada (www.ic.gc.ca/eic/site/062.nsf/eng/00088.html).

Note: Canada ranked 22nd in the OECD in 2016.

This is a disadvantageous strategic positioning from a wealth optimization perspective, since it means that Canada specializes in an activity that is facing rising costs and declining productivity (R&D services) and does not capture the productive assets (IP and data) that represent a growing share of global income.

Canada's current business model in the innovation sector thus risks positioning it as a branch plant economy, just as Canada's manufacturing economy has been, with the valuable economic rents that accrue to IP being captured abroad and Canada running a persistent deficit in trade in knowledge products. Accordingly, urgent attention should be given to the issue of the business model with which Canada engages the world.

As Canada approaches this task, there would be enormous value in opening up the lines of communication to a much greater degree between policy makers and the technology sector to ensure that there is a deep understanding of each other's needs and capabilities.

As regards Canada's innovation performance, two indicators stand out.

First, Canadian spending on R&D as a share of GDP stands at about 1.6 percent (OECD 2021), which is significantly below the OECD average of about 2.5 percent and far below the global leaders (Israel at close to 5 percent and Korea at 4.6 percent). Moreover, Canada's R&D spending has been declining over the past two decades in contrast to an increasing trend in the member countries of the OECD as a whole. Structurally, the source of Canada's R&D weakness lies in the business sector: Canada ranks above the OECD average in higher education expenditure on R&D; however, since the bursting of the "tech bubble" in 2001, Canadian business R&D spending has declined steeply as a share of GDP (see Figure 2).

Canada converts R&D spending into patents with comparable efficiency to the United States (over the period 2015–2019, Canada generated 0.18 Patent Cooperation Treaty [PCT] patents¹⁶ per US\$1 million in R&D compared to 0.14 for the United States).¹⁷ Accordingly, a low level of

¹⁶ Under the PCT, an applicant can obtain patent protection in all 154 contracting parties through one patent application.

¹⁷ OECD Data, "Gross domestic spending on R&D," <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>.

R&D translates into a low level of patenting and thus in a limited accumulation of valuable IP.

Second, Canada lags in the formation of new high-growth firms: while Canada's count of Global 500 firms (12 in 2021) is reasonably proportionate to the US count (123), Canada's count of unicorns (16 as of September 30, 2021) lags far behind the US count (424) on a proportionate basis.¹⁸ Firms are the essential software of a market economy, and Canada's future prosperity in an age of rapid innovation and superstar firms that dominate their markets on a global basis is contingent on the ability to foster the creation of dynamic new entrants.

Many reasons have been suggested to explain the weaknesses in Canada's innovation sector; with few exceptions, these have an international dimension. They are outlined below.

First, the high share of foreign ownership in Canada's economy has arguably weakened Canadian business R&D, since this activity tends to be concentrated in headquarters and thus abroad. This point stands, notwithstanding that foreign-invested firms undertake more R&D in Canada than do purely domestic firms (see, for example, Independent Panel on Federal Support to Research and Development 2011). Taking due account of this structural issue, Canadian policy needs to focus on complementary policies for domestic firms to catapult Canada's R&D intensity from below OECD average to well above.

Second, Canada ostensibly provides inadequate incentives for IP commercialization. As a result, the Intellectual Property Institute of Canada, an advocacy organization, has proposed a "First Patent" rebate on services and an IP box tax incentive to improve the operating environment for Canadian businesses for commercialization of IP.¹⁹

Third, Canada's approach to government procurement, which cedes the IP and data generated in projects to foreign entities, has been described as naïve. An example of this was the contract with Alphabet for the Toronto Waterfront smart city development project, under which

the IP and data would have flowed largely to Alphabet (see, for example, Hinton and Raffoul 2019). Furthermore, Canada has arguably failed to use government procurement to act as the "launch customer" for Canadian innovators.

Fourth, Canada is described as having a similarly naïve approach to university-business research partnerships that assign IP to the business partners (Dobby and Silcoff 2019). Related to this is the fact that university offices charged with aiding researchers in tech commercialization or in finding industry partners can be understaffed or under-resourced. The incentive system for research projects does not always match the demands of industry. Attention to this aspect of the equation can increase the possibility of fruitful domestic research partnerships.

Fifth, mergers and acquisitions can expatriate Canadian technology firms and thin out Canada's innovation capabilities (Ciuriak 2018). Steven Davidoff Solomon (2016) comments on the limited scrutiny by competition authorities of acquisitions in the technology sector by the technology giants to pre-empt future competition. While the "techlash" has resulted in heightened scrutiny of potentially anti-competitive actions by the technology giants in the major economies (including the European Union, the United States and China), for Canada, this is an FDI issue.

Sixth, Canada is not immune to the negative impact on business dynamism that flows from exposure to "patent enforcement entities" (also known as "non-practicing entities" or pejoratively as "patent trolls") that exploit large holdings of non-performing IP to mount patent infringement lawsuits against successful companies (see, for example, Bessen 2014).

Finally, much of the focus of commentary on Canada's poor innovation performance has been on Canada's venture capital sector, which has been described as underperforming, especially in terms of scaling up deal size (Independent Panel on Federal Support to Research and Development 2011; BDC Capital 2017; Rowe et al. 2019). However, given Canada's essentially unfettered access to international capital, it would require a global market failure for promising companies in Canada to fail to find investment (see, for example, Pack and Saggi 2006). In any event, in 2021, Canadian venture capital is having a breakout year with a near vertiginous increase

¹⁸ See *Fortune's Global 500*, <https://fortune.com/global500/search/>; and CB Insights' Global Unicorn Club (private companies valued at US\$1 billion or more; as of September 30, 2021), www.cbinsights.com/research-unicorn-companies.

¹⁹ See <https://ipic.ca/advocacy/ip-incentives>.

in the number and size of deals (Canadian Venture Capital and Private Equity Association 2021).

Addressing Canada's weak innovation performance is critical to ensuring Canada's longer-run prosperity. Given the many possible reasons for this state of affairs, a range of policy initiatives should be considered to chip away at the problem.

The focus should be on the following objectives:

- initiate R&D in high-impact areas with potentially high returns to society;
- provide a support mechanism for solving technological issues encountered by firms engaging in R&D, especially in the critical domain of big data/machine learning/AI;
- provide the funding at the necessary scale to put Canada on the global map; and
- create the institutional infrastructure to pull this all together.



Recommendations

Critical Supplies

Any targeted review of supply chain interdependence risks for critical products should be informed by the supply chain reviews being conducted (and policies being adopted) by Canada's major trading partners and should guide efforts to operationalize both the Roadmap for a Renewed US-Canada Partnership and the Joint Action Plan on Critical Minerals Collaboration. Emergency preparedness plans and policies should be updated as necessary in light of the findings, in particular the *Emergency Management Strategy for Canada: Toward a Resilient 2030* (Public Safety Canada 2019). There must be an ongoing and sufficient budgetary commitment to maintaining and implementing readiness plans.

Climate Change-Related Economic Risks

With regard to climate change and its relationship to economic security, Canada should ensure that authorities have the data and modelling capacity to conduct regular, thorough stress tests of potential vulnerabilities of Canada's economy to climate-induced risks, including potential vulnerabilities to economic disruption at a granular sectoral/regional level from the increased frequency of what were previously "hundred-year" events. Consideration should be given as to whether the current economic stress testing efforts being conducted for Canada's financial sector need to be broadened and coordinated at the federal-provincial level.

Research Security

Greater effort is needed to raise awareness among researchers about security risks and their personal responsibility in assessing prospective funding partners or projects. At the same time, researchers need greater support in navigating this process. In particular, there must be recognition that downloading the responsibility for protecting national security can be ineffective from a national security perspective and dampen research dynamism in the process. Ongoing exchange between the government and the academic community to understand the costs and benefits of certain approaches can help to provide a better outcome on both of these fronts.

University research offices will be key partners in sharing information and providing guidance, as will the network of professional associations to which many academics belong. They must be supported to understand what is required and provided the resources to fulfill this task. At a minimum, it might be useful to have a focal point person in government who can answer questions about security issues in specific research opportunities. More importantly, there needs to be deeper, ongoing exchange between the government and the university community on this issue. Canadian Security Intelligence Service briefings are insufficient to create the deep understanding that will ensure both the protection of national security and the vibrancy of our academic institutions' research mission.

The Northern Frontier

The opening of the North creates an urgent demand for policy integration across national security, the economic development and infrastructure development needs of Northern Indigenous communities, and the need for environmental protection. A government focal point — who can work across ministerial silos to ensure that the economic needs and environmental concerns of Northern communities are front and centre in security conversations — should be appointed, with staff support sufficient to ensure the capacity to advocate effectively.

The Cyber Frontier

Cybersecurity is an area of both risk and opportunity for Canada. Given the expanding cyber threat landscape and Canada's rapidly developing capabilities in cybersecurity, the government should support the uptake of Canadian cybersecurity services to minimize the exposure of Canadian individuals, firms and institutions to cyberattacks and thus contribute to Canada's attractiveness as a place to do business, while at the same time supporting the development of world-class providers of cybersecurity.

Supply Chain Restructuring

Canada should generally exercise caution in engaging in industrial policy to take advantage of policy-driven supply chain restructuring that involves reshoring or ally-shoring. However, areas such as REEs that promise economically rational diversification of supply, reduce or eliminate a national security threat, and that are evaluated as sustainable on comparative advantage grounds should be vigorously pursued.

Re-establishing WTO Disciplines

Given the risk to Canada of the abuse of national security arguments for trade protectionism, Canada should use its chairing of the Ottawa Group to propose and promote reforms of the national security exception in the WTO Agreement to circumscribe the use of national security as a rationale for trade measures in the context of the modern knowledge-based and data-driven economy.

Market Access Risks in the United States

Given the influence of economic geography on Canada's trade, the main task for Canada's economic diplomacy will be, as always, to secure Canada's market access in the United States. The main current issue is to ensure regional sourcing rather than purely national sourcing under the US Buy American policy. Federal and provincial economic diplomacy should continue to focus on that.

Trade Diversification

Given the risks of trade protectionism in the United States and the erosion of Canada's competitive position in other markets through ongoing implementation of new preferential trade agreements, Canada cannot afford to stand still on trade policy.

- While a trade agreement with China is off the table in the near to medium term, Canada should adopt a multi-pronged strategy to navigate the trade-related economic dimensions of national security:
 - disassociate non-strategic trade and investment from geopolitical considerations to the extent possible; and, on that basis,
 - engage China on its CPTPP accession bid in order to offset the negative trade diversionary impact on Canada of the US-China Phase One agreement.

- Canada should seek to conclude the negotiations on a Canada-ASEAN FTA as expeditiously as possible. Canada should seek to revive the moribund negotiations toward an FTA with India, particularly in light of indications that both Australia and the United Kingdom are in talks with India for fast-track deals. Having largely missed out on the last two decades of Africa's trade growth (Canada captured only about US\$2 billion of the US\$250 billion expansion of Africa's global imports since 2001; Ciuriak 2020), Canada should rebuild its trade diplomacy with a region that is moving toward trade deepening with the implementation of the African Continental Free Trade Area Agreement.

Upgrading Canada's Innovation Sector

The gap between Canada and the leading innovation nations in R&D spending and the emergence of new unicorns remains much too large. Canada has a number of innovation-funding initiatives: announced in Budget 2021, the Government of Canada has allocated up to \$450 million for a renewed Venture Capital Catalyst Initiative (ISED 2021); Sustainable Development Technologies Canada received a funding injection of \$750 million (Sustainable Development Technologies Canada 2020); and Genome Canada funded Canadian biotech innovation to the tune of \$205.7 million, including \$79.3 million from federal sources and \$126.4 million from co-funders (Genome Canada 2021). These amounts seem several orders of magnitude too small. The goal should be a doubling or even tripling of Canada's annual R&D investment.

Canada has a disadvantageous business model for capturing the benefits of the modern knowledge-based and data-driven economy. As an overarching objective, the Canadian government should seek to nudge Canada's role in international innovation activity toward one that captures the value of intangible assets rather than one that produces this value for other nations. As a first step, it should ensure that Canadian companies, especially small businesses, and Canadian universities have access to sophisticated IP counselling when they enter into international partnership agreements. While the breakout year that Canada is having in 2021 with venture capital flowing into our innovative companies is greatly encouraging, the gap between Canada and the leading innovation nations is daunting. Canada should accordingly float a Canada Innovation Bond to raise funds on the scale of major initial public offerings for use as angel equity investment to enable Canadian firms to scale up rapidly.

The deployment of the funds on the scale envisioned above will require new institutional infrastructure. Historically, Canada met many societal challenges by creating Crown corporations to step into the breach. This is such a time. The existing Crown corporation that is closest to what is required is the Canada Development Investment Corporation (CDEV), which has a mandate "to provide a commercial vehicle for Government equity investment and to manage commercial holdings of the Government" (Canada Development

Investment Corporation 2021). In practice, this Crown corporation manages the Government of Canada's holdings in the Trans-Mountain pipeline project and the Hibernia gas investments. The reprofiling of CDEV or the creation of a new Crown corporation for innovation should be considered.

Conclusions

Economic security is being treated as national security by the major economies, in each case with a nationalist bias (repatriation of industrial activity and supply chains by the United States, strategic autonomy by the European Union, and an idiosyncratic "dual circulation" model in China). How should Canada respond?

In reviewing the interface between economic policy and national security, a distinction can be drawn between economic security in a defensive sense (which, for example, involves guarding against risks related to exposure to supply disruptions that threaten the viability of the national economy); in an offensive sense (which involves risk taking to prosper in a competitive global economy); and the direct economic underpinnings of national security (which involves, for example, material support for national defence). The critical challenge in managing this interface is to ensure that seeking opportunity through international trade and investment and technological collaboration does not expose Canada to increased threat due to interdependence that can be weaponized. At the same time, it also means carefully navigating the moments when national security concerns might unnecessarily constrain economic activity, all of this against the backdrop of the Canadian commitment to values of sustainability, inclusiveness and equity.

As a small, open economy that is dependent upon international trade and is not in a position to safeguard against an untold number of potential supply risks, withdrawal into a nationalist model is not a realistic option for Canada. Moreover, the available evidence suggests that such withdrawal is, in any event, an inferior option: reliance on an open trading system provides more security. The lesson from the pandemic is that Canada's emergency preparedness fell short notwithstanding well-articulated plans; the problem lay in execution. Some responses

(for example, maintaining emergency stockpiles of critical goods, stress testing the economy for supply chain risks) fall to governments; others (for example, ensuring redundancy in supply chain options) fall to individual firms. Some may involve industrial policies to develop a base level of production of critical products to ensure capability of rapid response in an emergency, even factoring in the possibility that such production might require ongoing subsidization in between crises. Finally, in anticipation of novel, horizontal issues (such as those driven by climate change and the digital transformation, among others), there is an urgent need for a national conversation about the best approaches to monitoring and developing responses to the cross-cutting issues that Canada will face in this transitional decade.

The indirect economic underpinnings of Canada's national security — maintaining a prosperous economy that has the wherewithal to provide for its defence needs while preserving hallowed social bargains — depend, in the context of the globalized, innovation-intensive, knowledge-based and data-driven economy, mainly on trade and innovation. Indeed, there are opportunities for Canada to develop economic strengths in response to these changes.

On the trade front, the escalating resort to national security rationales for trade restrictions represents a threat to Canada's prosperity. Canada's optimal response is to circumscribe the use of this justification to the extent possible and to restore multilateral disciplines to ensure that they are available when such measures are invoked. Otherwise, Canada should pursue its traditional policy of economic diplomacy in the United States to combat protectionism in our main market and to seek trade diversification opportunities where they present themselves.

As regards innovation, Canada starts from a weak position with R&D spending as a share of GDP well below the OECD average, a relatively small number of unicorns in an age of unicorns, and a problematic structure of international trade specialization — a trade surplus in R&D services and a deficit in the IP that results from R&D, with a large net negative. In terms of reforms, this is the area where there is the greatest potential for Canada to improve its situation, both in economic and national security terms, by modifying Canada's business model in the innovation economy and by stepping up public sector investment in

line with the rise in the optimal public sector economic engagement in an era dominated by concerns in areas of public goods (and bads).

Economic considerations are only part of the more complex set of considerations to be taken into account in reimagining Canada's national security strategy in the conflicted geopolitics of a post-pandemic world facing enormous challenges on multiple fronts. However, economic considerations will loom large in Canada's policy deliberations. It is accordingly imperative that, as we expand our notion of national security to understand the crucial links to economic security and prosperity, we pay as careful attention to the need for risk taking and international engagement as to risk abatement and management.

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