



## STRESS TESTED: THE COVID-19 PANDEMIC AND CANADIAN NATIONAL SECURITY

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# Supply Chains during the COVID-19 Pandemic

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## Introduction

Recent years have brought attention to the relationship between the economy and national security. Canada experienced an era of protectionism in the 1960s and '70s before turning to free trade from the 1980s to the 2000s. However, concerns over the security implications of state-owned enterprises, foreign investment, and joint ventures have increasingly raised questions over the appropriate role of Western governments in protecting elements of the economy with strategic or national importance. In this context, the security of supply chains was already under discussion before the COVID-19 pandemic reached Western countries in early 2020 (CSE 2018; Farrell and Newman 2019; Williams, Lueg, and LeMay 2008).

The sudden shortage of supplies experienced in Canada during the pandemic, especially in the first few months, reveals shortfalls in how the country manages its supply chains, both domestically and internationally. Experiencing a surge in demand for certain products but cut off from many of its sources abroad, Canada struggled to maintain food security and protect vital workers in the health sector. Importantly, these issues represent more than an inconvenience—they show that supply chains are

vital lifelines upon which Canada's well-being and national security increasingly depend.

This chapter explores these issues using two case studies to understand the pandemic's impact on supply chains—one where adaptation challenges proved difficult (manufacturing personal protective equipment) and another where the sector proved to be more resilient (food and agriculture). The chapter then evaluates Canada's policy response to supply chain disruptions and makes preliminary policy recommendations. It concludes by noting that in an era of adversarial geo-economic strategies, both the government and private sector must do more to prepare supply chains for additional long-term global disruptions.

## Supply Chain

Generally, “supply chain” refers to the production flow of a good or service, starting from raw components and ending with the delivery of the final product to the consumer. To maintain this production flow, a company will create a network to move the components from suppliers to the end-user (adapted from IBM n.d.). The advantage of the supply chain is that when done efficiently, it helps both manufacturers and retailers reduce excess inventory, which in turn reduces costs associated with production, shipping, insuring, and storing goods and services (Perkins and Wailgum 2017).

As the nature of the supply chain is globalized, critical infrastructure systems are vulnerable to shocks from global events such as natural disasters, accidents, national instability, and, of course, epidemics and pandemics. A disruption in a single country may seriously impact a well-integrated, “just-in-time” approach to supply chain management worldwide. Governments recognize the security risks to such global vulnerabilities and incentivize local companies to make their supply chains more resilient.

We define resiliency in this chapter as a capacity for successful adaptation in the face of disturbance, stress, or adversity. One way to achieve this is to create redundancies (being able to obtain key components from more than one source or stockpiling others). Some democracies, such as Denmark, Japan, and the United States, encourage their domestic firms to return to producing goods in their home countries (Nuttall 2020). In

other cases, states are placing limits on certain activities, such as preventing takeovers by foreign companies in areas deemed strategic. For example, in April 2020, the Government of Canada announced that it was now subjecting “certain foreign investments into Canada to enhanced scrutiny under the *Investment Canada Act*” (ISED 2020). These investments include those into Canadian business related to “public health or involved in the supply of critical goods and services to Canadians or to the Government” due to national security risks. However, efforts to prevent further takeovers of Canadian companies should be understood as an emergency stopgap measure to prevent further weakening of sectors in disarray, rather than a genuine effort to promote resilience in Canadian supply chains and manufacturing.

Regardless of the steps taken before COVID-19, analysis of the supply chains in the following case studies reveals that Canadian supply chains struggled to adapt once the pandemic hit for five key reasons: a lack of manufacturing and production capacity; short time frames; non-diversified sources for materials and consumers; vulnerabilities to global disruptions; and a lack of redundant systems in place. Nevertheless, the pandemic did not impact all sectors evenly. Indeed, while Canada struggled to obtain personal protective equipment, the agriculture and food sector managed to adapt faster and more comprehensively. The following two sections outline the experience of both sectors and provide a brief comparison to help inform future policy decisions.

## **PPE: Health and Manufacturing Sectors**

The outbreak of the COVID-19 pandemic in Canada caused an extraordinary surge in demand for personal protective equipment (PPE) that domestic and international suppliers could not match. As a result, many Canadian health-care providers, front-line workers, and vulnerable populations lacked sufficient quantities of PPE as the pandemic took hold. This section explores why.

### *Manufacturing Capacity*

At the onset of the pandemic, no factories produced N95 masks in Canada (Tumilty 2020). As a result, foreign restrictions and competition impacted Canada’s access to the supply of this needed resource (Silcoff 2020).

Moreover, pre-COVID-19, Canada's international supply chain for PPE relied primarily on a few manufacturers based in the United States and China and did not have the mechanisms in place to counter disruptions (Dyer 2020; Linton and Vakil 2020). Canada could only procure 0.2 per cent of its required PPE from domestic sources, placing tremendous pressure on the country's health-care sector (Blatchford 2020).

To address the domestic shortage, both federal and provincial governments turned to emergency measures, investing in domestic companies to retool and develop Canadian PPE manufacturing capacity to meet demand. For example, investments from the federal and Ontario governments helped open a 3M production line to manufacture new N95 masks in Brockville, Ontario, which reportedly will supply 100 million masks annually over five years (Canadian Press 2020). Similarly, Medicom, a Quebec-based mask producer that previously had no manufacturing capacity in Canada, received funds from the federal government to produce 20 million masks in Canada (Blatchford 2020). As a result of the above investments, in September 2020, Navdeep Bains—the Minister of Innovation, Science and Economic Development—remarked that Canada is now buying almost half its PPE from domestic manufacturers (Blatchford 2020).

Another challenge was certification: just because a factory switches from producing cars or shirts does not mean it can produce medical-grade PPE. Certifications ensure that PPE meets specific standards and ensures that it does not allow blood and other liquids through the fabric. As such, certifications are not easily given, particularly in non-certified plants (Oved 2020). However, on 18 March 2020, the government announced that it was expediting authorizations at no cost to manufacturers (PHAC 2020). However, while these efforts brought more PPE manufacturers online, access to materials needed to make PPE remained a problem.

### *Lack of Diversity for Supply and Source Material*

Pre-COVID-19, Canada's international supply chains for PPE prioritized cost over potential supply disruptions. This choice resulted in a concentration of suppliers that could not meet the country's needs after the onset of the pandemic. Canada's heavy reliance on single-sourcing methods in a small number of factories, primarily based out of China and the United States, was arranged to save costs. The disruptions experienced in

China-based supply chains in the early weeks of the pandemic demonstrate the downside of prioritizing cost over reducing risk. Procurement and supply fulfillment took on a “Wild West” nature, whereby confirmed orders of PPE were redirected to higher bidders (Flanagan 2020).

Importantly, however, it was not just masks that were affected, but also the materials used to produce them. With the shortage of N95 masks, states turned to importing polypropylene meltblown non-woven fabric (commonly referred to as meltblown fabric), a polypropylene resin product. Indeed, the shortage of this product was arguably the biggest constraint in the procurement process for masks.

Canada was forced to outsource meltblown fabric for two reasons. First, Canada’s production capacity of polypropylene is not high; this was not necessarily due to a lack of local resources, but rather to a market-driven cost-cutting decision resulting in an increasingly asymmetrical trade in polypropylene. Second, the production of meltblown fabric is an exacting and complicated process. A single machine needed for the manufacturing process takes five to six months to produce and another month to assemble (Feng and Cheng 2020; Oved 2020). Considering these constraints, most companies choose to import polypropylene and polypropylene-related products from foreign countries. Unfortunately, the Chinese government banned the exports of meltblown fabric in early February (Subramanian 2020). Thus, countries like Canada were left without masks or the materials to make them. This supply shortage suggests that a close trading relationship may serve short-term economic interests, but it hinders the manufacturing sector’s ability to be self-reliant in an emergency.

China was not alone: at least sixty-seven other countries placed restrictions on the export of PPE and materials needed for PPE production in the first weeks of the pandemic (Reynolds 2020). This included the European Union, which followed Taiwan’s lead and banned all exports of PPE in March 2020, impacting hospitals in Toronto and southwestern Ontario that relied on one 3M plant in the United Kingdom for masks (which, despite Brexit, was still subject to EU rules at the time). This move raised concerns that by the end of March 2020, some areas of Canada would be down to two weeks’ worth of PPE (Oved 2020).

Canada narrowly avoided another major disruption when the Trump administration reversed a halt order placed on the export of

3M-manufactured PPE to Canada and Latin America under the *Defense Production Act* (BBC 2020). While 3M appears to have argued against the order, media reports indicate that the Canadian government resorted to threatening US supply chains by cutting off Canadian exports in the event the country is cut off from American PPE (MacCharles 2021). Had these steps not worked, Canada would have had very few mechanisms left to meet the demand for PPE.

### *Short Time Frame*

Canada's dependence on international suppliers operating with short lead times on order fulfillment meant that when countries enacted policies to halt exports and stockpile supplies, Canada could not respond to supply disruptions. Somewhat ironically, several disruptions were caused by attempts to ensure quality. For example, complaints from some Western countries about the poor quality of PPE from China resulted in the Chinese government clamping down on exports, requiring manufacturers to obtain certification through a national registry and documentation proving it meets the importing country's standards (Reynolds 2020).

Finally, even when internationally based PPE and manufacturing supplies were available, transportation to bring these goods into Canada was also disrupted. In the early days of the pandemic, the cost of air cargo rates doubled and, in some cases, tripled. This increase was due to plummeting travel demand, and the fact that passenger planes often carry freight as well as passenger luggage (Reynolds 2020). High prices continued throughout 2020 due to both an increase in e-commerce and, in the later part of the year, shipments of vaccines throughout the world (Nebhay 2020).

### *Lack of Redundancy*

Finally, it is worth noting that once international options were no longer available, Canada did not have alternative options or redundancies in place that could have helped to manage the transition from importing to manufacturing its own PPE. On paper, the most important alternative is the Canadian National Emergency Strategic Stockpile (NESS), a government-managed PPE stockpile dispersed across numerous warehouses and depots in Canada (Dyer 2020; Laing and Westervelt 2020; Leo 2020). Importantly, NESS is not considered part of the regular PPE supply chain; rather, it is part of an emergency stockpile intended to temporarily

provide critical sectors and key customers with PPE in case of a disruption at the manufacturing or distribution levels. While the NESS was activated in early 2020 to counter the supply shortage and demand surge caused by the COVID-19 pandemic, it was immediately apparent that it could not fully meet the PPE demands of the health-care sector and vulnerable populations.

There are numerous reasons why this failure took place. First, NESS was clearly unprepared to cope with an event like COVID-19. The stockpile, created in 1952 in a Cold War context, was designed for natural disasters and violent extremist attacks, not backing up provincial health-care systems in the event of a major and sustained pandemic (Tumilty 2020). Moreover, the NESS has a regular staff of only eighteen people, and an annual budget of about \$3 million, although both the Harper and Trudeau governments reportedly routinely failed to spend that much (Dyer 2020).

Finally, in recent years, the Public Health Agency of Canada (PHAC) decided to shrink the NESS from eleven warehouses in nine cities to eight warehouses in six cities. As part of this downsizing, PHAC threw away 2 million N95 masks and 440,000 medical gloves that had been expired for years (Leo 2020; Tumilty 2020). This suggests that officials had not only stored expired equipment for sustained periods—they also lacked any plan to cycle supplies out of the stockpile prior to expiration (Leo 2020). This was likely complicated by the lack of a comprehensive inventory management system capable of monitoring incoming and outgoing supplies, meaning that exact stock levels and needs were at times unknown (Laing and Westervelt 2020; Leo 2020).

## **Agriculture and Food Sector**

The COVID-19 pandemic exposed both the fragility and resiliency of Canada's food supply chain. The pandemic changed consumer purchasing behaviours, which in turn created challenges in agriculture production, food processing, and distribution. In addition, Canadian producers and businesses had to adapt to the Government of Canada's protective measures, which caused significant disruptions in the accessibility and affordability of food products. In this way, both domestic and international

factors contributed to disruptions in the food supply chain, although the majority of the disruptions were domestic in nature.

### *Manufacturing/Production*

When provincial governments imposed mandatory closures on businesses, the demand for some products quickly diminished (Israelson 2020). For example, what would usually be a steady demand for potatoes suddenly dropped as restaurants no longer regularly served french fries (Israelson 2020). Instead, as consumers were largely at home, there was increased demand for comfort foods such as peanut butter (Israelson 2020). Additionally, with growing concerns about outbreaks in meat packaging and processing plants, some consumers began to purchase meat directly from local farmers (Tucker 2020). To manage the shift in demand, the Canadian Food Inspection Agency made a number of temporary changes to the regulations surrounding the labelling and packaging of food, making it easier for items originally destined for restaurants, hotels, and other entertainment venues to be sold at retail (Hobbs 2020). In addition, some farmers quickly adjusted to what consumers wanted: fresh local produce and meat rather than their usual products, which they may have lost confidence in due to the pandemic (Hobbs 2020; Tucker 2020).

Some international factors contributed to a change in supply as well. For instance, border restrictions between the United States and Canada directly affected the availability of temporary foreign workers during the 2020 growing season. The restrictions put in place by both countries at the onset of the pandemic created confusion among these workers about whether they were permitted into the country (MacGregor 2020). The noticeable decrease in human labour affected Canadian harvesting. The government ultimately permitted temporary foreign workers entry into Canada and put in place measures to expedite the screening process (Statistics Canada 2020). Those measures included waiving some recruitment requirements, prioritizing key positions, and increasing the employment duration from one to two years for workers in the low-wage stream as part of a three-year pilot (Statistics Canada 2020). These proved to be a successful remedy to labour shortages among Canadian farms (Sheldon 2020).

### *Lack of Diversity*

There is a lack of diversity in Canada's food chain in at least two respects. First, Canada is heavily dependent on both exports and imports from the United States. In 2016, that country accounted for 50 per cent of all Canadian agriculture and agri-food exports, as well as approximately 60 per cent of the value of Canadian food imports (Agriculture and Agri-Food Canada 2020; Hobbs 2020). The United States is a net importer of Canadian beef and cattle, while Canada imports seasonal food, such as fresh produce, from the United States and Mexico. For this reason, border closures posed a serious risk to the food supply chain, particularly in the first weeks of the pandemic. By the end of March 2020, the Canadian Food Inspection Agency (CFIA) activated its business continuity plan, prioritizing activities related to food safety to facilitate trade across the closed border. These activities include food safety investigations and recalls, animal disease investigations, inspection services, export certification, import inspection services, emergency management, and laboratory diagnostics in support of the above (CFIA 2020; Hobbs 2020).

The second issue is the small number of large food manufacturers within Canada. A concentration of production left few alternatives when there were outbreaks of COVID-19 in these production facilities, which made it challenging to meet the demand for perishable items and frozen foods (Aday and Aday 2020; Holland 2020). Holland (2020) specifically points to the concentration of meat processing plants as an example of this issue. She notes that two plants in Alberta are responsible for over 70 per cent of Canada's beef processing capacity. Writing in June 2020, she observed that

Cargill's High River facility closed on 20 April for two weeks, reopening with reduced production levels, and the JBS plant in Brooks has cut its production by half. Potential shortages are anticipated to be only short-term for consumers but this decrease in beef supply has already led major buyers, like McDonald's Canada, to begin importing beef to meet their needs. (4–5)

### *Short Time Frame*

Concentration in the agriculture and food sectors within Canada is a concern not only for food trade and production, but also for distribution. As Hobbs (2020) notes, the food retailing sector in Canada “is dominated by large, concentrated supermarket chains with significant buying power and an emphasis on cost efficiencies.” Those chains rely on “just-in-time” approaches to delivery, which have increased efficiencies but resulted in short-term problems during the pandemic. For example, transport logistics were also disrupted by the pandemic, as companies could not deliver certain food items on time or in large quantities, hampering companies’ ability to ensure food accessibility for their consumers. Given the geography of Canada and its dispersed population, food supply chains tend to be long and heavily dependent on well-functioning, long-distance road and rail transportation networks (Hobbs 2020). For the most part, however, Hobbs assesses that these supply chains were able to adjust rapidly “to the demand signals from consumer markets with increased product flows,” and as such, the short-run problems of shortages eased.

Domestic disruptions in production also lead to disruptions in the international market. Typically, trucks travelling to the United States are full of Canadian-manufactured goods, such as automotive and meat products (Reuters 2020). However, Canada’s largest beef, cattle, and automotive plants temporarily closed to prevent COVID-19 outbreaks, and, as a result, drivers drove empty trucks to the United States to import fresh produce (Castaldo 2020; Hill 2020; Neustaeter 2020).

### *Lack of Redundancy*

Ultimately, the agriculture and food sector was able to adapt to the challenges posed by the pandemic faster than the manufacturing sector. Unfortunately, this does not mean that Canada is protected from future disruption or pandemics. Nor does it mean that Canada’s agriculture and food sector has the necessary redundancy built into its systems to withstand other disruptions. When dealing with perishable foods over short time frames, there are vulnerabilities in this heavily concentrated sector that may yet manifest in future emergencies or crises.

Although food resiliency is not truly redundancy, it is worth noting that Canadians who are food insecure cannot be resilient. Unfortunately,

food banks were severely affected by the pandemic due to an increase in demand and the above-noted challenges with food distribution and supply. In response, the Canadian government released a \$100-million emergency fund to support food banks, transport food to distribution centres, and provide basic necessities to food-insecure households (Agriculture and Agri-Food Canada 2021). While this is an effective strategy to sustain food bank operations, not all communities have the capacity to take full advantage of these funds (Leblanc-Laurendeau 2020). Specifically, some people have expressed concern that many communities are not part of “strong local and regional food systems,” nor do they have the logistical support required to supply food among their citizens (FEHNCY 2020).

## **Analysis and Sector-Specific Recommendations**

Although major disruptions impacted both the manufacturing and the food and agriculture sectors during the COVID-19 pandemic, they did not impact them evenly. The agriculture and food sector was affected, but not to the same extent as the manufacturing sector. What explains this difference? Some reasons are readily apparent. For example, while each supply chain was disrupted, we also saw a sudden surge in the demand for PPE. Additionally, farmers and grocery chains familiar with the environment and with Canadian consumers had the knowledge and capacity to adapt to the new market within weeks. PPE suppliers and manufacturers, however, found themselves in a geopolitical competition; products were sold and sent to unknown highest bidders at a time when global transportation logistics were in disarray.

There are no doubt other explanations, such as the level of government involvement in each sector. The federal government regularly intervenes in and regulates supply chains within the agriculture and food sector, and it is familiar with its operations. This familiarity likely assisted the government in making changes to rules and regulations, such as those surrounding foreign workers and product packaging. In contrast, the evidence presented in this chapter suggests that, before the pandemic, the government was unfamiliar with the manufacturing sector as it relates to PPE, despite the SARS pandemic that hit Canada seventeen years earlier. In this sense, it could neither make quick changes nor understand the impact of certain

decisions (such as those related to quality management) concerning access to PPE and related materials. If there is a success in the PPE story, it is that Canadian officials were able to lean on their international counterparts to ensure some level of supply—but we can hardly attribute this to government knowledge of, or familiarity with, the manufacturing sector.

All of this suggests that the government needs a better understanding of the manufacturing landscape in industries where disruptions—no matter how remote the possibility—could seriously impact the health and well-being of Canadians and the Canadian economy. It should work with industries to develop an awareness of the production capacity of companies that can produce critical products within our borders and their limitations (Dai, Bai, and Anderson 2020). It should also work with stakeholders to map risk in the form of dependencies and interdependencies. Businesses should be encouraged by government authorities and regulators to look beyond local and domestic factors toward their entire supply chains (Sodhi and Tang 2009) and cross-sector relationships like transportation (Golan, Jernegan, and Linkov 2020). Finally, Canada would benefit from developing international standards for PPE and other medical equipment (Ciuriak 2020). Such standards would not only assist in the rapid procurement of goods and materials in an emergency, but they could also help improve the production of PPE and medical devices worldwide.

Despite its relative success, the federal and provincial governments should take steps to enhance the security of the agriculture and food sector as well. Governments should work with industry to improve storage options that could keep a supply of food items that do not expire quickly and are likely to be in demand during a crisis (Aday and Aday 2020). They should also diversify Canada's export market (Farm Credit Canada 2019; Knutt 2020). In addition, Canada should maintain pressure on its trading partners to ensure they uphold trade agreements and that borders remain open, even in a crisis (Holland 2020). Finally, governments must better understand which areas are experiencing food insecurity generally and are consequently most likely to be hardest hit by another major disruption. The attempt to build such knowledge should start with an improvement in the way Canada collects data on food insecurity. Currently, provinces and territories are not required to collect statistics on food insecurity, leading

to inconsistent data upon which to make decisions (Pollard and Booth 2019; PROOF Food Insecurity Policy Research n.d.).

## The Wider Context and Policy Recommendations

While the previous section provided some recommendations for each sector, this section outlines key lessons and issues that the federal government should consider to secure Canada's supply chains in a post-pandemic but still uncertain future.

### *Recognizing the Limits of Co-operation*

As noted in the introduction to this chapter, even before COVID-19, Western countries have been rethinking supply chains and encouraging their domestic companies to move manufacturing back home from overseas. There has also been discussion about Western countries working together to create an alliance of democracies that can provide an alternative to countries like China when it comes to securing supply chains, particularly in relation to emerging technology (The Economist 2020; Reuters 2020). In this sense, Canada may be able to seize opportunities to work with its allies on securing and diversifying its supply chains in key areas.

Unfortunately, Canada's experience during the COVID-19 pandemic suggests that its ability to depend on its allies in the crunch is decidedly mixed. In the agriculture and food sector, Canada engaged in co-operation with its partners in terms of bringing in temporary foreign workers. Additionally, in the early weeks of the pandemic, Canada signed an agreement with twenty-two other countries, representing 63 per cent of global exports and 55 per cent of global imports of agriculture and agri-food products, to ensure that international co-operation and trade continued (Global Affairs Canada 2020; World Trade Organization 2020). Although there were problems, there appears to be a certain level of willingness to work through food and agriculture issues at the international level.

The same cannot be said for PPE. This chapter makes clear that Canada's closest allies—the United States and the European Union—were willing to turn their backs on Canada and restrict PPE exports. There is no evidence that Canada would not have done the same were its position reversed. However, the restrictions imposed do raise questions about the strengths of Canada's international treaties and agreements. Indeed, it

would not serve Canada's interests to see a surge of nationalist or isolationist economic policies in the post-COVID-19 world. However, Canada's experience suggests that when it comes to supply chains, policy-makers need to rethink some of the assumptions about trade and global co-operation the country has relied on for the last four decades. For example, appreciating that international agreements may not hold up in a global crisis should inspire more long-term thinking about emergency preparedness, stopgap measures, and redundancy in security and supply chain strategies.

### *Planning for More Long-Term Global Disruptions*

Although government departments and agencies have business continuity plans, it is clear that they never anticipated worldwide disruptions lasting for two years. Nor did these plans consider supply chains. These assumptions are not entirely unreasonable—few (if any) countries appear to have had adequate policies in place for a pandemic like COVID-19. For now, it is more important to consider whether governments and private industry need to be more creative in their business continuity and emergency planning. Predictions that pandemics may become more common in the future (BBC 2021; Tollefson 2020) suggest that both governments and businesses should be considering plans for long-term disruptions. Indeed, beyond pandemics, given the anticipated changes in weather patterns due to climate change, an increase in geopolitical rivalries, and vulnerabilities coming from dependencies and interdependencies in our increasingly online and interconnected societies, Canada and its supply chains will face greater levels of uncertainty in the future. All of this speaks to a need for both the public and private sectors to take a much more coordinated and ambitious approach to conducting “all-hazard” risk assessments that can estimate the level and likelihood of events that may cause disruptions in the future as a result of natural hazards, accidents, and deliberate malicious acts.

### *Appreciating the Potential and Limits of Technology*

Part of the effort to create more resilient and agile supply chains will involve investments in technology. Advances in artificial intelligence and robotics mean that the factories of the future will feature higher levels of automation, resulting in the need for less employees working in close

contact. These changes should result in a more hygienic production of goods, as is needed during a pandemic.

In the future, artificial intelligence and machine learning will also help companies adjust their supply chains, improving their overall agility and ability to respond to disruption (Momani 2020). For example, companies may be able to sense and understand changes in market demand earlier. It is also likely that the pandemic will bring about changes in the way Canadians order and receive online goods. The food supply chain may change with the creation of highly autonomous food warehouses that deliver groceries and other goods directly to customers. Additionally, some studies estimate that automation could increase productivity by 25 per cent by automating tasks like loading/unloading, placing, and packaging goods (Iqbal, Khan, and Khalid 2017). Finally, more automation would have helped to manage Canada's outdated and woefully inadequate NESS—and, if implemented, could help prepare the NESS for future emergencies and crises. Indeed, the application of technology to the NESS may help better align it with Canada's emergency-management framework.

At the same time, planners in government and business need to appreciate the limits of technology. Had such developments been in place in early 2020, it is unlikely that Canada's situation would have been considerably better. Canada experienced challenges due to closed borders and limits on supplies—something automation and artificial intelligence may help to predict but not necessarily remedy in a hurry. Further, while technology may improve the agility of Canadian businesses, it likely cannot fix a situation in which sixty-eight countries impose export restrictions on needed goods at the same time.

### *Economic National Security Strategy*

As noted at the beginning of this chapter, the Canadian government has sought to extricate itself from business for decades, believing that the market should resolve key supply, demand, manufacturing, and production questions. However, in the last decade, thanks to concerns arising from foreign investment and from acquisitions by foreign state-owned enterprises, there is growing awareness of how economic decisions affect Canada's national security interests (CSIS 2021). Any such discussion of Canada's national security posture or emergency planning post-pandemic

must consider supply chain management. The best way to accomplish this is to develop an economic national security strategy, one that identifies those elements of the economy that are most relevant to national security and establishes what level of state involvement in the economy government and businesses will accept.

## Conclusion

Generally, the literature on supply chains emphasizes the need for companies to fully map and diversify their supply chains and create redundancy to manage economic and financial risks. This risk management approach should consider these issues in terms of both economic and national security and emergency management. Ideally, a resilient system should be able to maintain essential functions despite the double shocks of a pandemic and the severe disruption to supply chains in the short term, and to adapt and transform in the long term (Kruk et al. 2015). Policy-makers need to create a platform for inter-sectoral dialogue, encourage the transparent sharing of information about manufacturing capabilities and bottlenecks, and stress test the system to identify vulnerabilities, foster innovation, and provide incentives for investment. These moves are necessary to build and support resilient supply chains that will help secure Canada's vital supplies in an increasingly unpredictable world.

## NOTE

- 1 This chapter is based on research conducted during the fall 2020 term by students in the Critical Infrastructure Protection: Issues and Strategies class in the Infrastructure Protection and International Security Program at Carleton University. It was compiled and edited by Stephanie Carvin with the assistance of Jessica Davis.

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