ICI Canada

Risks Status:
Moderate – Ongoing

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COVID-19 Through the Lens of the Polycrisis: A Systemic Analysis

Image Credit: Edwin Hooper

The COVID-19 pandemic began in late 2019 and quickly escalated into a global crisis in a few short months. It disrupted nearly every facet of life, from public health to economic activity, before tapering off as vaccines and immunity became widespread. By May 2023, the World Health Organization declared the emergency phase over, marking a turning point in the pandemic's trajectory. This case study examines the pandemic's evolution and impact through two analytical lenses: the Risk Translation Matrix (RTM) and the Canadian Implementation Framework (CIF). The RTM is a diagnostic framework which identifies broad global risk trends (economic, social, technological, environmental, geopolitical), translates them into Canada-specific challenges, and then examines effects on Canada's Science, Technology, and Innovation (STI) ecosystem (knowledge, technology, talent). The CIF is a prescriptive framework which builds on those findings to recommend resilience and recovery strategies, outlining key stakeholders in Canada, how to mobilize knowledge/technology/talent, and the feasibility of implementing solutions. As we move forward in the post-pandemic era, understanding these interconnected risks and responses is crucial. This systemic analysis aims to provide Canadian STI ecosystem stakeholders with strategic insights for navigating and mitigating future global crises.

Global and Canadian Effects of COVID-19

Mortality	Infections	Economic Contraction	Unemployment	Government Expenditure
6.3 million	557.8 million	-3.1%	6.5%	$14-16 Trillion
59,000	4.65 million	-5.4%	9.6%	$322 Billion

CANADIAN RISK IMPLICATIONS

The COVID-19 pandemic serves as a critical example of global risks outlined in Dimension 1 of the RTM, highlighting significant international disruptions and systemic challenges that span economic, social, technological, environmental, and geopolitical domains. Economically, the pandemic triggered unprecedented global recessions, supply chain disruptions, and fiscal strain. Socially, it exacerbated existing inequalities, stressed public health systems, and disrupted education. Technologically, it intensified reliance on digital infrastructures, exposing vulnerabilities like rural broadband gaps and heightened cybersecurity threats. Environmentally, the pandemic underscored the delicate balance between human activity and natural ecosystems, bringing attention to zoonotic risks and waste management challenges. Geopolitically, it tested international relations and alliances, notably impacting Canada's diplomatic and trade positions. Utilizing the RTM, these global disruptions can be effectively translated into Canada-specific vulnerabilities, enabling targeted strategies to fortify the nation's resilience against similar complex risks in the future.

ECONOMIC RISK IMPLICATIONS

Constricting Economic Growth - PAST:
The pandemic triggered a sudden and deep economic downturn. In 2020, global GDP contracted sharply as consumer spending and industrial output plummeted under lockdown measures. Canada saw its GDP fall by 5.4% in 2020, the steepest annual decline on record, and unemployment spiked to 14% (Pham et al., 2022). As a result Canada like many countries entered a recessionary period with small businesses closing and government and government revenues shrinking.

Industry Disruption - PAST :
COVID-19's economic shock was unevenly felt across sectors. Notably, service industries reliant on face-to-face interaction – such as tourism, hospitality, retail, and entertainment – were hit hardest by distancing and capacity restrictions. Travel bans brought airlines and hotels to a standstill, while local lockdowns forced entertainment and cultural venues to shut their doors. In Canada exports and manufacturing also suffered from supply chain interruptions falling ~10.7% in 2020 with steep losses felt in the automotive, electronics, and energy industries (Pham et al., 2022).

Mounting Public Debt and Fiscal Strain - ONGOING:
To counter the economic freefall, the Government of Canada unleashed unprecedented fiscal stimulus of **$82 b**illion dollars– funding healthcare surges, business bailouts, wage subsidies, and social assistance. While necessary, these measures led to ballooning public debt and record deficits, which now pose risks to fiscal sustainability (C.D. Howe Institute, 2024). Canada now must manage the long-term implications of the massive public expenditures incurred during the pandemic and the strain on public finances could constrain future investments or force difficult choices in budgeting, especially if economic growth remains subdued. Ensuring debt remains manageable without stifling the recovery or critical services is an ongoing balancing act for policymakers.

Uneven Inflationary Pressures - ONGOING :
As restriction measures eased in 2021-2022 Canada saw a rapid rebound in consumer demand which collided with pandemic induced supply chain bottle necks, triggering a surge in inflation. Consequently, Canadians have faced rising living costs in key areas such as food, fuel, and housing, eroding household purchasing power (Bank of Canada, 2022). Balancing the recovery by managing inflation and resolving supply chain disruptions while still supporting economic growth continues to be a central challenge in the post-pandemic landscape.

SOCIAL RISK IMPLICATIONS

Strain on Public Heath Systems - PAST:
During the pandemic, Canadian healthcare systems and community well being were severely strained. Hospitals in numerous regions became overwhelmed with COVID-19 patients, forcing the postponement of elective surgeries and stretching intensive care capacities to their limits. Stacked on top of this, healthcare workers faced significant burnout and trauma from battling prolonged surges and multiple waves of the pandemic (CIHI, 2024). Moreover, in long-term care facilities, the impact was particularly devastating: although residents represented only about 3% of COVID-19 cases, they accounted for approximately 43% of the nation's COVID-19 deaths, underscoring the extreme vulnerability of congregate care environments (CIHI, 2021).

Disrupted Education Services - PAST:
COVID-19 caused the largest simultaneous disruption of education systems in modern history. At the height of the pandemic, over 90% of K-12 schools and nearly all post-secondary institutions in Canada closed their physical classrooms, forcing an abrupt shift to remote learning. This rapid transition exposed and exacerbated pre-existing digital inequalities (Statistics Canada, 2024). While over 90% of households in urban areas had access to high-speed internet, up to 30% of households in remote Indigenous and Northern communities lacked such access. Moreover, nearly 25% of households in rural regions reported insufficient connectivity for effective online learning (CRTC, 2021). These disruptions deepened educational divides, leaving vulnerable students disproportionately exposed to long-term academic setbacks and diminished socio-economic opportunities.

Healthcare Backlog and Mental Health Crisis - ONGOING:
Many Canadian health systems continue to grapple with the aftermath of the pandemic. Deferred treatments, diagnostic delays, and a fatigued workforce have led to significant backlogs in care, potentially degrading the quality of services over time (CIHI, 2023). Simultaneously, a mounting mental health crisis—marked by increased demand for services and enduring impacts on productivity and quality of life—remains inadequately addressed. Additionally, cumulative social trauma from the pandemic—including loss of loved ones, prolonged isolation, and the persistent effects of long COVID—continues to strain societal well-being and community resilience (CAMH, n.d.). Without targeted interventions, these overlapping health crises risk creating a generation burdened by chronic health disparities and weakened social cohesion.

Declining Social Mobility - ONGOING:
COVID-19 not only exposed but deepened longstanding social inequalities in Canada, stalling progress in social mobility. Youth unemployment in many provinces spiked above 25% during the crisis, and early-career disruptions are projected to reduce lifetime earnings for new graduates by 5–12%. These challenges are compounded by a widening wealth gap, as soaring home prices benefit established homeowners while young Canadians face escalating barriers to entry, reinforcing intergenerational inequality and impeding upward mobility (Clarke and Fields, 2022). If unaddressed, this trend threatens to entrench a persistent socio-economic divide, limiting Canada's long-term economic growth and undermining the foundational promise of equal opportunity.

ENVIRONMENTAL RISK IMPLICATIONS

Climate Action Setbacks - PAST:
As an unintended consequence of lockdowns and reduced travel, Canadian emissions saw a temporary drop in 2020, with global CO_2 emissions falling by roughly 9%—the largest single-year decline in decades (Government of Canada, 2022). However, this environmental reprieve had unintended repercussions, as the pandemic diverted political attention and resources toward immediate health and economic priorities, temporarily pushing climate action onto the back burner (World Economic Forum, 2021). Although Canada maintained relatively strong climate investments compared to other G7 nations, key climate initiatives were delayed or postponed, slowing overall momentum. This pause in decisive climate action may have inadvertently narrowed the window for achieving critical emissions targets, amplifying future environmental risks and increasing the urgency for renewed commitments.

Increased Waste and Environmental Strain - PAST:
During the pandemic, Canada witnessed a surge in various types of waste that placed significant pressure on environmental management systems. The massive scale of healthcare waste – including disposable masks, gloves, syringes, and other protective gear – created challenges for waste disposal and pollution control. Improperly discarded personal protective equipment (PPE) became a common sight in urban areas, posing hazards to wildlife and ecosystems. In response, several waste management facilities across Canada were forced to handle unprecedented volumes of medical and single-use plastic waste, prompting urgent calls for improved recycling systems and waste reduction strategies even during crisis conditions (IISD, 2020) .

Zoonotic Risks - ONGOING:
The COVID-19 pandemic has underscored the intricate connections between environmental health and human well-being in Canada. The suspected zoonotic origin of SARS-CoV-2 highlights the risks associated with wildlife trade and habitat disruption. Continued encroachment on natural habitats and biodiversity loss could increase the likelihood of future pandemics (Hamers et al., 2023). Recognizing these challenges, the Canadian government has committed over $2.1 million to wildlife disease surveillance across the country (Government of Canada, 2023). While this investment aims to enhance early detection and response capabilities for emerging zoonotic diseases.

TECHNOLOGICAL RISK IMPLICATIONS

Rural Broadband Gaps - PAST:
Canada's digital divide became more pronounced during COVID-19, particularly in rural and remote areas. As of 2021, about 90.9% of Canadian households had access to broadband at the CRTC's target speed (50 Mbps download/10 Mbps upload), but only 59.5% of rural households and 42.9% of households on First Nations reserves had that level of service. This gap meant many remote communities lacked reliable high-speed Internet. Without connectivity, people in remote areas were unable to participate in the digital economy and access online education, work, and medical services on equal footing (OAGC, 2023).

Strain on Digital Infrastructure and Cybersecurity Threats - ONGOING:
The sudden shift of work, education, and services online strained Canada's digital infrastructure. Internet usage surged as daily life moved onto home networks – 75% of Canadians (15 years and older) reported using the Internet more often since the pandemic began. By early 2021, about 32% of Canadian employees were working from home, a huge jump from just 4% in 2016 (Statistics Canada, 2021). The share of Canadians experiencing a cyber security incident climbed from about 52% in 2018 to 58% in 2020, and then to 70% by 2022 (Statistics Canada, 2024). These trends underscored that alongside connectivity, digital safety has become a growing concern as Canada's economy and public services have gone online.

Misinformation - ONGOING:
Canada's ongoing misinformation risk remains a serious technological threat that undermines public health and democratic processes. During the COVID-19 pandemic, nearly 96% of Canadians encountered misleading online content—with 40% later realizing they had believed false claims—which contributed to widespread vaccine hesitancy (Ganrneau and Zossou, 2021), as over 55% of unvaccinated Canadians endorsed conspiracy theories about vaccine safety (Claufield, 2024). Social media algorithms further amplified these narratives, while emerging AI-generated deepfakes heighten concerns that increasingly sophisticated disinformation could rapidly destabilize public discourse. Although initiatives like the $7 million Digital Citizen Initiative and enhanced election security measures have been launched to counter misinformation, persistent gaps in digital literacy and unequal access to reliable information continue to erode public trust and impede effective communication in Canada (Government of Canada, n.d.b).

GEOPOLITICAL RISK IMPLICATIONS

Strained Alliances - ONGOING:
The pandemic stress-tested Canada's alliances. Notably, early in the crisis, the United States briefly considered blocking exports of N95 masks to Canada under wartime powers (Carment, 2020). This strain has been further intensified by recent developments under the new Trump administration, which announced 25% tariffs on Canadian goods and services. Such actions have significantly eroded mutual trust, casting doubt on the notion of a "special relationship" between the two nations. Canada, heavily reliant on stable relations with its neighbor, has been starkly reminded of its vulnerability when allies turn inward. These events underscore the urgent need for Canada to diversify partnerships and bolster self-reliance to mitigate future geopolitical disruptions.

Energy Security - ONGOING:
COVID-19 delivered an unprecedented shock to global energy markets, significantly impacting Canada as a major oil-producing nation. By mid-2020, Canadian oil companies had reduced production by nearly one million barrels per day and cut capital investments by over $10 billion (Canadian Energy Regulator, n.d.). Although global demand rapidly rebounded in 2021 and 2022, supply constraints persisted, triggering a sharp rise in oil and gas prices and fueling broader inflation. The pandemic also reshaped resource diplomacy, highlighting the decisive role of OPEC and Russia (OPEC+), whose coordinated production cuts—approximately 14 million barrels per day by June 2020—helped stabilize prices. Canada, excluded from OPEC+ decisions yet directly impacted by them, was starkly reminded of its limited leverage in global oil markets. These experiences reinforce the necessity for Canada to strengthen diplomatic ties and collaborate strategically with allies to secure its energy interests during global crises.

CANADIAN IMPLEMENTATION FRAMEWORK

DIMENSION 1	*DIMENSION 2*			*DIMESION 3*
UPTAKE GROUP	**KNOWLEDGE**	**TECHNOLOGY**	**TALENT**	**ADAPTATION READINESS**
 **GOVERNMENT**	Utilize public health data and global research to inform evidence-based policies and early warning systems.	Invest in health tech and digital infrastructure (e.g. contact tracing apps, telehealth, digital service delivery) to improve crisis response.	Expand training and recruitment for healthcare workers, epidemiologists, and emergency managers; upskill civil servants in risk management.	**High** - Strong mandate and funding capabilities, but success depends on inter-agency coordination and public trust for policy compliance.
 **INDUSTRY**	Apply risk intelligence and lessons learned (business continuity plans, market analytics) to strengthen supply chain resilience and adaptive business models.	Upgrade and integrate technologies for remote work, e-commerce, and cybersecurity to maintain operations during disruptions.	Re-skill and cross-train employees for flexibility (e.g. digital skills, agile manufacturing) and develop in-house health & safety expertise.	**Moderate** - Large firms are generally agile and innovative (many pivoted successfully), while SMEs may need support and incentives to implement changes.
 **ACADEMIA**	Mobilize research and expertise on pandemics, including epidemiological modeling and socio-economic impact studies, to guide evidence-based decisions.	Develop and share innovations such as rapid diagnostics, vaccine research (e.g. mRNA technology), and data analytics tools for tracking and containment.	Educate and train the next generation of scientists, public health professionals, and policy experts; facilitate knowledge exchange through multidisciplinary teams.	**High** -(Knowledge); Universities readily contributed research during COVID-19. Moderate (Adoption): Implementation of academic insights requires partnerships with government/industry and adequate funding.
 **CIVIC ORGS**	Leverage on-the-ground community knowledge to identify vulnerable groups' needs and tailor outreach	Use communication platforms and mobile tools to disseminate accurate information, counter misinformation, and coordinate volunteer efforts.	Recruit and train community volunteers and local health workers in basic crisis response, counseling, and support skills; build networks of trust within communities.	**Moderate** - Highly trusted at grassroots level and can innovate locally, but often limited by funding and scope. Partnerships with government and private sector improve scalability.
 **CITIZENS**	Stay informed via credible sources; engage in public dialogue and knowledge-sharing (for instance, reporting local issues, participating in contact tracing, citizen science initiatives).	Embrace useful technologies such as exposure notification apps, telemedicine services, and remote learning/work tools to stay safe and connected.	Develop personal and family preparedness skills (first aid, digital literacy, adaptive learning) and participate in training or drills when available; contribute talents in emergencies.	**Varied** - Readiness ranges from high to low. Ongoing public education and inclusive access are needed to improve broad adoption.

CONCLUSION

The COVID-19 pandemic has underscored the systemic interdependencies between global risks and national vulnerabilities, reinforcing the critical value of strategic foresight and proactive intervention. Through the structured lens provided by the Risk Translation Matrix (RTM) and the Canadian Implementation Framework (CIF), this analysis offers essential insights into the diverse yet interconnected challenges faced by Canada's STI ecosystem. It highlights the imperative for robust and adaptive policy-making, grounded in assessments of economic contraction, technological transformations, environmental setbacks, social inequalities, and geopolitical shifts.

To effectively enhance Canada's resilience, stakeholders within the STI ecosystem must leverage these insights to drive actionable, sustainable solutions. This includes fostering deeper collaboration across government, industry, academia, civic organizations, and citizens to ensure the integrated development and deployment of knowledge, technology, and talent. Such collective action will be pivotal in building adaptive capacities capable of not only managing but also capitalizing on disruptions. Ultimately, embedding systemic risk-awareness and collaborative innovation into Canada's strategic STI initiatives will prove fundamental to navigating and mitigating future crises, safeguarding economic prosperity, societal well-being, and national security in an increasingly complex global environment.

RECOMMENDATIONS

Government: Establish and fund an integrated national resilience strategy that leverages data-driven policy-making, enhances intergovernmental coordination, and invests in critical infrastructure (including digital and healthcare systems) to better anticipate and manage multifaceted crises.

Private Sector: Embed resilience into core business models by diversifying supply chains, investing in sustainable innovation, and forging strategic partnerships with government and research institutions to drive adaptive growth and safeguard against future disruptions.

Academia: Prioritize translational research that bridges theoretical insights and real-world applications—focusing on public health, climate, and digital transformation—to inform evidence-based policy and spur collaborative innovation across sectors.

Civic Organizations: Strengthen community engagement and capacity-building initiatives by targeting underserved populations, ensuring that local voices and needs shape crisis preparedness and recovery programs, and facilitating grassroots collaboration with public and private stakeholders.

Citizens: Actively participate in the collective effort to build societal resilience by staying informed, embracing digital literacy and sustainable practices, and engaging in community decision-making processes to ensure that recovery efforts are inclusive and reflective of local realities.

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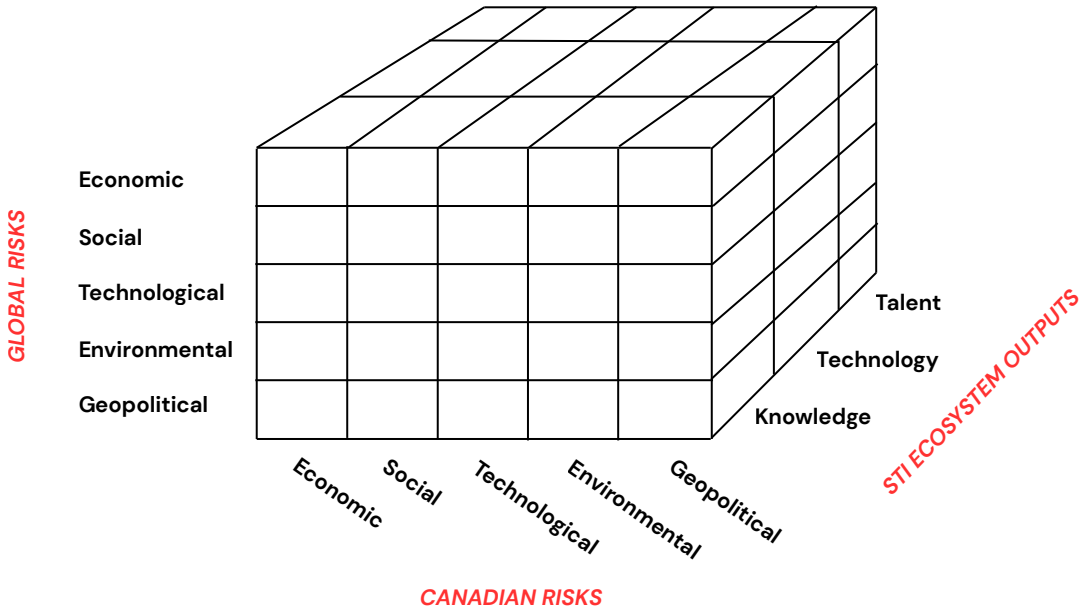
APPENDIX 1 – RISK TRANSLATION FRAMEWORK



DIMENSION 1 GLOBAL RISK CATEGORIES

This dimension captures broad international trends and disruptions that affect multiple regions and economies. It focuses on systemic challenges that arise from worldwide developments, serving as a framework to monitor and assess emerging risks on a global scale. The five key global risk categories are: Economic, Social, Technological, Environmental, and Geopolitical.

DIMENSION 2 CANADIAN RISK IMPLICATIONS

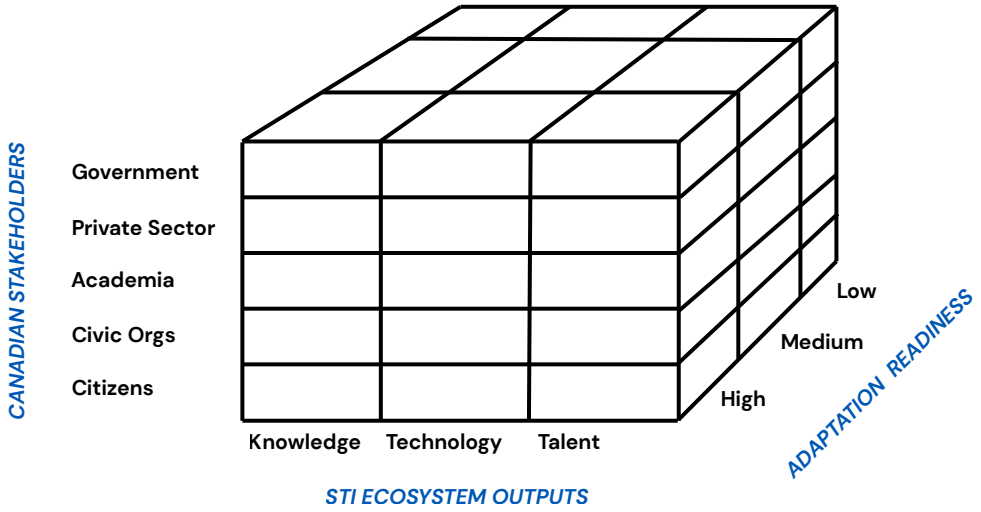
This dimension translates global risks into the specific context of Canada. It focuses on how international trends and disruptions manifest as country-specific challenges and vulnerabilities, taking into account Canada's unique economic, social, technological, environmental, and geopolitical conditions.

DIMENSION 3 IMPLICATION ON STI ECOSYSTEM PRODUCTS

The third dimension focuses on Canada's STI ecosystem outputs—Knowledge, Technology, and Talent—and is intended as a diagnostic tool. It id used to analyze and understand how each risk impacts the foundational elements of innovation in Canada

- **Knowledge:** How might this risk disrupt the generation, dissemination, or application of knowledge in Canada? In what ways could research priorities or academic funding be reoriented as a response to this risk?
- **Technology:** How might this risk affect technological innovation, deployment, or infrastructure in Canada? What are the implications for digital connectivity and the integration of emerging technologies?
- **Talent:** How might this risk impact the availability, mobility, or development of skilled personnel in the Canadian STI ecosystem? What potential challenges could arise in workforce development, retention, or upskilling as a consequence of the risk?

APPENDIX 2 – CANADIAN IMPLEMENTATION FRAMEWORK



DIMENSION 1 CANADIAN STI STAKEHOLDERS

This dimension identifies the key Canadian stakeholders responsible for implementing solutions. It emphasizes the roles and responsibilities of each group in addressing challenges and driving innovation. The focus is on tailoring recommendations to the specific capacities and mandates of these stakeholders. These stakeholders include: Government, Private Sector, Academia, Civic Orgs, and Citizens.

DIMENSION 2 STI ECOSYETM SOLUTIONS

This dimension examines the foundational outputs of Canada's science, technology, and innovation (STI) ecosystem—Knowledge, Technology, and Talent—but with a prescriptive focus. Here, the products are evaluated in terms of how they can be leveraged to craft and deploy solutions, rather than diagnosing risk impacts.

- **Knowledge:** How can research, data, and academic expertise be mobilized to support innovative solutions?
- **Technology:** In what ways can technological advancements or digital infrastructure be harnessed to overcome challenges?
- **Talent:** How can the development, attraction, and retention of skilled personnel drive effective solution implementation?

DIMENSION 2 ADAPTIVE CAPACITY

This dimension evaluates the readiness and feasibility for each stakeholder group to adopt the proposed solutions. It categorizes the adoption capacity as high, medium, or low, providing a clear indication of the likelihood that a stakeholder can successfully implement and sustain the recommended interventions. This layer is essential for prioritizing actions and ensuring that strategies are aligned with practical capabilities and resource availability.