



A ROADMAP FOR CANADA'S DIGITAL ECONOMY TO 2030

Policy recommendations for Canadian
policymakers on Canada's digital economy
from the Information and Communications
Technology Council (ICTC).

Research by



PREFACE:

The Information and Communications Technology Council (ICTC) is a neutral, not-for-profit national center of expertise with the mission of strengthening Canada's digital advantage in the global economy. For over 30 years, ICTC has delivered forward-looking research, practical policy advice, and capacity-building solutions for individuals and businesses. The organization's goal is to ensure that technology is utilized to drive economic growth and innovation and that Canada's workforce remains competitive on a global scale.

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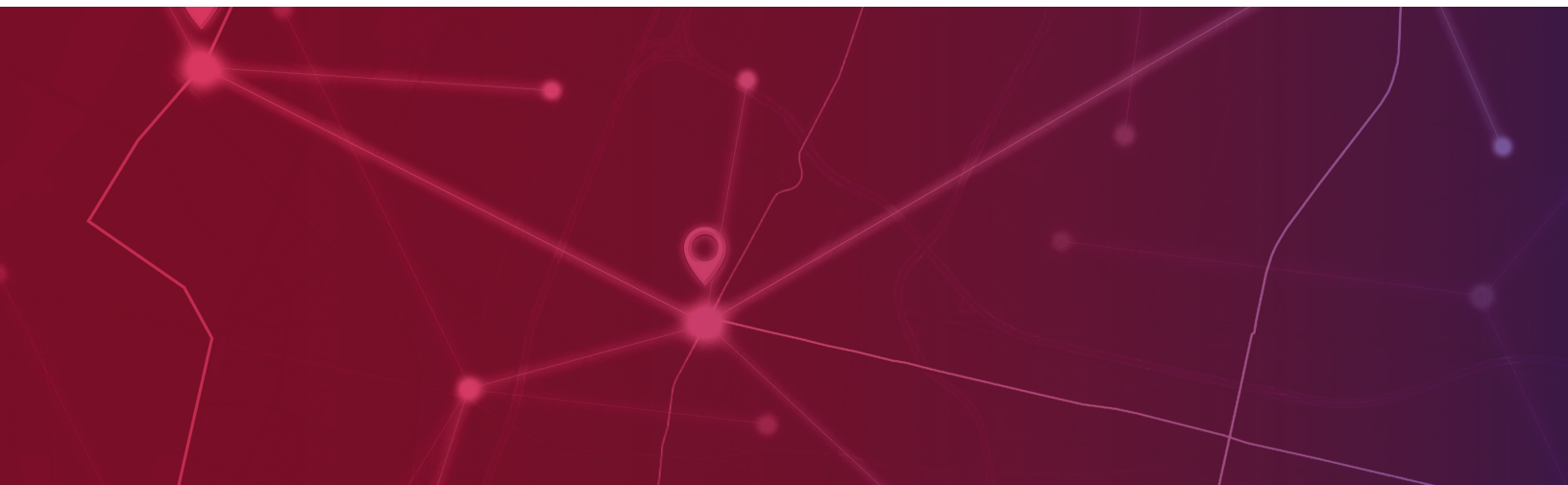
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EXECUTIVE SUMMARY

Canada's digital economy is the cornerstone of its future economic prosperity and global competitiveness.

The digital economy consistently outperforms other areas of the Canadian economy and, indeed, makes up an ever-growing share of economic activity in the country. Digital technology is being used to produce and deliver more and more products and services over time.

Currently, 2.48 million Canadians are employed in the digital economy—either directly in the information and communications technology (ICT) sector or in digital technology roles across various other sectors. The digital economy now accounts for 10% of Canada's GDP and plays a significant role in the country's economic growth, employment, innovation, and entrepreneurship, making it a vital asset in tackling

Canada's productivity challenges. As global competition accelerates and technological sovereignty becomes a key economic imperative, Canada must ensure its digital strategy aligns with its broader economic and geopolitical objectives.

Policies that advance fiscal responsibility, competition, private sector leadership, and streamlined governance are crucial for Canada to tackle the challenges posed by emerging technology, economic disruption, and global uncertainty.

This paper by the Information and Communications Technology Council (ICTC) outlines a roadmap addressing key issues, considerations, and concerns related to the future of Canada's digital economy through to 2030.



THE IMPORTANCE OF CANADA'S DIGITAL ECONOMY

The digital economy contributes significantly to Canada's GDP, employment growth, productivity, and innovation. The digital economy's share of Canada's GDP has grown at an average annual rate of 7.67% over the past decade.¹ In 2024, it made up 10% of Canada's total GDP.² Between 2014 and 2024, employment in the digital economy increased by 51%, compared to only 15% growth in employment across the entire Canadian economy.³ As of early 2025, over 2.48 million Canadians are currently employed in the digital economy.⁴

As Canada's economy digitalizes, more Canadian workers can expect to engage with the digital economy. Emerging technologies such as artificial intelligence (AI) and quantum computing foretell significant economic, technological, and societal developments in the coming years.

CANADA'S DIGITAL ECONOMY COULD CONTRIBUTE \$249.65 BILLION TO THE GDP BY 2030

Canada's digital economy contributed \$223.45 billion to the country's GDP in 2024,⁵ driven by high-value industries such as ICT, advanced manufacturing, energy, mining, smart health, digital banking, agriculture, connected transportation, e-commerce, and digital trade.

Provided Canada adopts a supportive policy environment and digital technology can be effectively embraced throughout the economy, by 2030, the digital economy could contribute an estimated \$249.65 billion annually to Canada's GDP.⁶

TWELVE PERCENT OF THE CANADIAN WORKFORCE IS EMPLOYED IN THE DIGITAL ECONOMY

In early 2025, 12% of the Canadian workforce was employed within the digital economy.⁷ Digital economy employment will remain a key driver in Canada's wider labour market and represent some of the most skill-intensive and economically productive jobs in the economy.

Canada's post-secondary education sector and workforce training system is struggling to keep programs relevant while meeting employer demand for graduates with needed digital skills. Closing the skills gap through targeted workforce strategies is essential.

¹ Calculations based on data from: Maryna Ivis, et al., "Canada's Digital Economy: Talent Outlook 2030," Information and Communications Technology Council (ICTC), 2025 (forthcoming), 37.

² Ibid., 37.

³ Ibid., 29-30.

⁴ eTalent Canada, "Employment Data: Canada's Digital Economy," Information and Communications Technology Council (ICTC), accessed February 24, 2025, <https://etalentcanada.ca/for-job-seekers/employment-data>.

⁵ Maryna Ivis, et al., "Canada's Digital Economy: Talent Outlook 2030," 35-37.

⁶ Ibid.

⁷ eTalent Canada, "Employment Data: Canada's Digital Economy."



WHAT IS THE DIGITAL ECONOMY?

The digital economy encompasses all economic activities and transactions facilitated by networked digital systems. Employment includes a blend of workers in the information and communications technology (ICT) sector, as well as those in ICT roles outside the technology sector. Given the rapid pace of digitalization across Canada's economy, the digital economy is nearly ubiquitous throughout Canadian industry and intersects with all major sectors, from resource extraction to manufacturing to construction.

ADOPTION OF ADVANCED TECHNOLOGIES COULD INCREASE CANADA'S PRODUCTIVITY AND COMPETITIVENESS

Adopting advanced digital technologies like AI could increase Canada's productivity growth by 1.5% annually over a ten-year period,⁸ narrowing the gap with leading economies like the United States and Germany.

Firms that invest in AI experience higher growth in sales, employment, and market valuations, primarily as a result of increased product innovation.⁹ The adoption of advanced digital solutions, like AI, also enhances business competitiveness in global markets, including in key sectors such as agriculture, energy, and health care.

INVESTMENTS IN TECHNOLOGY COMMERCIALIZATION WILL TRANSFORM CANADA INTO A GLOBAL INNOVATION AND MARKET LEADER

Canada ranks highly in research output, including metrics such as scholarly publications and

research impact,¹⁰ but lags in commercialization and technology adoption. Nationally, Canadian businesses and government spent 1.5% of Canadian GDP on R&D activities in 2021.¹¹

Global Advantage Consulting Group notes that in 2021 there was a \$27 billion gap between Canada's business enterprise expenditure on R&D and the OECD average.¹² Targeted policies to bridge this gap will transform Canada into a global innovation and market leader.

ENHANCING DOMESTIC DIGITAL CAPACITY IS AN INVESTMENT IN NATIONAL SOVEREIGNTY

Emerging digital technologies, such as AI and quantum computing, have significant implications for the global economic order and Canada's national sovereignty. To secure its digital and economic future, Canada must develop domestic digital capacities, such as sovereign AI compute, while also advocating for the digital and physical trade of goods and services. A key component of maintaining sovereignty in the digital realm includes developing and retaining a skilled digital workforce in critical sectors, as well as protecting and fostering Canadian intellectual property (IP).

⁸ Peter Nicholson, "Industrial Revolutionary: How artificial intelligence will fuel Canadian productivity and prosperity," Public Policy Forum, December 11, 2024, <https://ppforum.ca/publications/industrial-revolutionary-ai-productivity-prosperity/>; Jan Hatzius, "The Potentially Large Effects of Artificial Intelligence on Economic Growth," Goldman Sachs, March 26, 2023, <https://www.gspublishing.com/content/research/en/reports/2023/03/27/d64e052b-0f6e-45d7-967b-d7be35fabd16.html>.

⁹ Tania Babina, et al., "Artificial intelligence, firm growth, and product innovation," *Journal of Financial Economics* 151 (January 2024): <https://doi.org/10.1016/j.jfineco.2023.103745>.

¹⁰ See: Council of Canadian Academies, "Preliminary Data Update on Canadian Research Performance and International Reputation," 2016, https://cca-reports.ca/wp-content/uploads/2018/09/Preliminary_Data_Update_EN.pdf; Council of Canadian Academies, "Competing in a Global Innovation Economy: The Current State of R&D in Canada," 2018, <https://rapports-cac.ca/reports/competing-in-a-global-innovation-economy/>.

¹¹ James Marple, "Meeting Canada's Innovation Challenge Through Targeted Investment & Competition," TD Economics, July 15, 2021, <https://economics.td.com/ca-innovation>, chart 2.

¹² Global Advantage Consulting Group, "Canada's Private Sector R&D: A Tale of Potential and Challenges," June 9, 2023, <https://globaladvantageconsulting.com/canadas-private-sector-rd-a-tale-of-potential-and-challenges/>.



SUMMARY OF RECOMMENDATIONS

1

Enable a competitive landscape for Canada's digital economy

Canada could significantly benefit from fostering competition and cultivating a more economically competitive environment across the country. This should encompass initiatives for policy harmonization, regulatory sandboxes, and effective regulations tailored to emerging technologies, in addition to enhancing market access and curbing monopolistic practices in key Canadian sectors. Canada should also aim to liberalize inter-provincial trade and develop strong regional startup ecosystems to bolster innovation and support new businesses.

2

Create a robust digital infrastructure for Canada

To engage in the next wave of digital technological advancement, Canada requires a robust digital infrastructure to leverage emerging technologies such as AI, quantum computing, and 5G/6G networks. Canada must also achieve its long-term goal of universal broadband access for all Canadians and establish a strong and extensive cellular network. Additionally, Canada should bolster its cybersecurity defenses and establish the technological infrastructure for digital trust and identification systems. Securing access and maintaining the national semiconductor supply chain, which supports all digital technology, is also essential.

3

Bolster innovation and commercialization in Canada

Canada faces challenges in commercializing intellectual property and transforming great ideas into successful businesses. Researchers at the country's universities, polytechnics, and industrial research labs produce significant and valuable research,¹³ yet Canada struggles to translate this intellectual and technological output into economic benefits for the nation. Catalyzing Canada's research capabilities requires reforming business R&D incentives, bolstering university technology transfer offices, better utilizing international trade agreements, enhancing IP protections, and improving research security, while safeguarding IP against theft.

4**Enhance digital economy policy and governance frameworks**

Powerful emerging technologies such as AI and quantum computing require the enhancement of policy and governance frameworks. As a medium-sized economy with an outward orientation in trade and international engagement, Canada stands to gain from participating in multilateral cooperation in international technology governance. Moreover, Canada can benefit from adopting international best practices in privacy standards, implementing smart regulations, and promoting principles of proactive disclosure in regulating advanced computing technology like AI.

5**Develop Canada's digital talent**

For Canada's digital economy to thrive, it will need to further develop and maintain a highly skilled and innovative workforce. Labour market needs in digital industries will continue to evolve with advances in technology. Upskilling and reskilling programs can help workers keep their workplace skills and competencies relevant. Matching skilled immigration to labour market demand and building pathways for women, Indigenous peoples, and other underrepresented groups to pursue STEM education and technology careers are critical to maximizing participation and productivity in Canada's workforce.

6**Boost digital technology adoption for Canadian businesses**

To enhance productivity across Canada's economy, Canadian businesses must incorporate digital productivity tools, including generative AI, into their operational processes. Additionally, businesses need to improve their digital maturity to stay competitive with their global counterparts by integrating digital technology directly into their business models. Canadian companies—particularly small- and medium-sized enterprises—are lagging behind their peers in other countries regarding digital transformation. Supporting these companies in embracing emerging technologies will strengthen their competitive edge.



7**Develop an industrial strategy for Canada's digital future**

A digital economy industrial strategy will help Canada align its policies with its natural strengths and advantages in the global marketplace. An industrial policy that emphasizes Canada's significant natural resource and energy potential, including critical minerals necessary for electronic devices, computing hardware, and high-capacity batteries, offers Canada a substantial economic opportunity. An industrial strategy for Canada's future digital economy should also include funding and commercialization support for Canadian innovators to introduce next-generation digital technologies to market, such as AI, quantum computing, and semiconductors, to enhance growth in energy, manufacturing, and life sciences, as well as in agriculture and medical technology.

8**Accelerate sustainable development for Canada's digital future**

To harness Canada's vast digital economy potential and secure the nation's economic future, the country should expedite the development of sustainable energy resources, including green hydrogen, biofuels, and nuclear technology, while also expanding its national electrical grid capacity to meet the energy requirements of advanced computing technology. Additionally, Canada can establish circular economies to minimize and recycle e-waste and create innovative processes for reprocessing and reintegrating valuable and scarce materials back into electronic supply chains. To address growing energy demands, Canada can also explore technological solutions to enhance energy efficiency wherever possible.

9**Earn public trust and promote citizen engagement**

Canadians are navigating uncertain times, influenced by advanced digital technologies and a tumultuous global landscape. To ensure the digital economy thrives in Canada, it is essential to earn the trust of Canadians by improving citizen engagement and involvement in discussions about the country's digital future. Furthermore, Canada must address misinformation and disinformation, especially that propagated by hostile foreign entities. Additionally, it is crucial for Canada to safeguard Canadians' privacy and digital sovereignty, with special consideration for Indigenous communities.





A ROADMAP FOR CANADA'S DIGITAL ECONOMY: KEY RECOMMENDATIONS

RECOMMENDATION 1

ENABLE A COMPETITIVE LANDSCAPE IN CANADA'S DIGITAL ECONOMY

To ensure Canada's digital economy thrives, Canada must create conditions for robust competition and entrepreneurship.

1.1 POLICY HARMONIZATION:

Implement market-based regulations to streamline regulations and lower barriers to entry for small- and medium-sized enterprises. This could involve smart regulations and establishing regulatory sandboxes that facilitate regulatory experimentation in controlled environments.

Harmonizing regulations and standards across Canada can promote cross-regional economic integration, enhance international export opportunities for Canadian companies, and alleviate frictions and uncertainties for Canadian innovators and entrepreneurs. To foster digital technology innovation, smart regulations

should be designed to be technology-neutral and responsive to new technical and scientific advancements. Regulatory sandboxes, pilot programs, and phased approval processes are methods by which regulators can effectively oversee emerging technology while remaining adaptable enough for innovation to flourish.¹⁴

1.2 ICT MARKET ACCESS:

Ensure fair competition by enforcing antitrust laws and reducing monopolistic practices in digital marketplaces, particularly in the telecommunications sector. Fair competition in the digital economy is crucial for fostering digital adoption and improving productivity.

Encouraging competitive pricing by easing foreign ownership regulations and welcoming international entrants from like-minded economies into the Canadian market is essential. Canada should aim to promote the liberalization of trade in goods and services on an interprovincial level. Canada must uphold its

established international trade relationships while pursuing new trade agreements in emerging markets to maintain its global edge in the digital economy. To fully leverage Canada's extensive portfolio of international trade relationships, the country should renew and enhance its trade infrastructure, both physical and digital.

¹⁴ See: Government of Canada, "What We Heard: Report on Regulatory Modernization," last update March 9, 2023, <https://www.canada.ca/en/government/system/laws/developing-improving-federal-regulations/regulatory-evaluation-results/what-we-heard-report-regulatory-modernization.html>.



1.3 STARTUP ECOSYSTEMS:

Increase funding for venture capital and technology incubators, especially in underserved regions, to strengthen a dynamic, cross-country startup ecosystem.

Canada boasts a vibrant and extensive startup ecosystem. StartupBlink ranks Canada among the top five countries globally for startup ecosystems, with Toronto, Montreal, Vancouver, Calgary, Ottawa, and Kitchener-Waterloo listed in the top 120 cities worldwide for local startup ecosystems in 2024.¹⁵

Technology transfer and commercialization incubators such as the MaRS Discovery District (Toronto) and the Creative Destruction Lab (Toronto, Montreal, Vancouver, Calgary, and Halifax) are crucial for developing Canadian innovations and research IP into new businesses and successful products and services. However, while important, various technology incubation schemes have experienced differing levels of success in Canada over the years.¹⁶ Canada's technology transfer and commercialization

incubators system as a whole can benefit from learning from and adopting best practices.

According to BDC, in 2023 there were 660 venture capital transactions nationally, amounting to a combined total of \$6.9 billion.¹⁷ Furthermore, 58% of venture capital investments in Canada were directed towards the information and communications technology sector in 2023.¹⁸

Nevertheless, Canada lags in fostering startup ecosystems in the country's rural regions. Rural Canada stands to gain significantly from investments and digital innovation in sectors such as agriculture and natural resources.¹⁹ Developing robust startup ecosystems in rural Canada that cater to local needs and leverage regional strengths in industries, such as agritech and natural resources, is essential for enhancing economic growth and productivity in these areas.

¹⁵ StartupBlink, "The Startup Ecosystem of Canada" accessed February 12, 2025, <https://www.startupblink.com/startup-ecosystem/canada>; StartupBlink, "Startup Ecosystem Report 2024," <https://www.startupblink.com/startupecosystemreport>, 66-68.

¹⁶ See: Manasi Joshi and Jiong Tu, "The Effect of Business Accelerators and Incubators on Business Performance: Findings from the Business Accelerator and Incubator Performance Measurement Framework," Innovation, Science and Economic Development Canada (Government of Canada), <https://ised-isde.canada.ca/site/sme-research-statistics/sites/default/files/documents/2024-the-effect-of-bai-on-business-performance-en.pdf>.

¹⁷ BDC, "Canada's Venture Capital Landscape 2024," May 2024, <https://www.bdc.ca/en/about/analysis-research/canada-venture-capital-landscape>, 5.

¹⁸ Ibid., 13.

¹⁹ OECD, "Enhancing Rural Innovation in Canada," OECD Rural Studies, 2024, <https://doi.org/10.1787/a9919c66-en>; also see: Alexandra Cutean and Mairead Matthews, "Seeding Rural Innovation: Nurturing the Tech Frontier in Alberta," Information and Communications Technology Council (ICTC), September 2023, <https://ictc-ctic.ca/reports/seeding-rural-innovation>.

RECOMMENDATION 2

CREATE A ROBUST DIGITAL INFRASTRUCTURE

A strong digital infrastructure underpins economic growth and innovation.

2.1 AI COMPUTE:

Expand access to high-performance computing resources for startups and researchers so that Canada can embrace the economic and scientific gains made possible by AI.

While Canada has strong research capabilities in AI, boasting leading researchers and a significant concentration of AI specialists,²⁰ it falls short in developing domestic AI compute infrastructure.²¹ A shortage of high-end AI compute may prevent Canada from fully leveraging its current strengths in AI research and its solid talent pool in the field.²²

The Government of Canada released an AI Compute Strategy in December 2024, which committed new funding to improve Canadian sovereign compute capacity.²³ This Strategy was followed by the announcement of a \$705 million federal AI Sovereign Compute Infrastructure Program in February 2025.²⁴

Due to the critical nature of AI compute to Canada's economic well-being and scientific and technological development, ongoing advancement is essential. Existing multilateral partnerships, like Canada's participation in the European Union's Horizon Europe research and innovation

program, present Canada with a crucial pathway to unlocking further resources to pursue joint AI computing research.²⁵

Peer economies are making substantial investments in their own AI computing infrastructure. In January 2025, the United States announced the USD \$500 billion Stargate Project, jointly funded by SoftBank, OpenAI, Oracle, and MGX—with Arm, Microsoft, and NVIDIA participating as technology partners.²⁶ According to project partner OpenAI, Stargate aims to “secure American leadership in AI.”²⁷ It will involve the construction of 20 new AI data centres across the United States, along with the necessary electricity generation infrastructure to power these data centres.²⁸ The United States government also started developing a national AI Action Plan.²⁹ In February 2025, France revealed €109 billion in public investments in AI, which will concentrate on constructing new AI data centres.³⁰

²⁰ Nikolaus Lang, et al., “How CEOs Can Navigate the New Geopolitics of GenAI,” Boston Consulting Group, December 9, 2024, <https://www.bcg.com/publications/2024/how-ceos-navigate-new-geopolitics-of-genai>

²¹ “Canada lacks AI compute capacity to compete: Study,” The Logic, March 22, 2024, <https://thelogic.co/news/canada-lacks-ai-compute-capacity/>; Innovation, Science and Economic Development Canada (Government of Canada), What We Heard Report: Consultations on AI Compute, November 22, 2024, <https://ised-isde.canada.ca/site/ised/en/what-we-heard-report-consultations-ai-compute>.

²² Bridget Boakye, et al., “State of Compute Access: How to Bridge the New Digital Divide,” Tony Blair Institute for Global Change, November 2023, <https://institute.global/insights/tech-and-digitalisation/state-of-compute-access-how-to-bridge-the-new-digital-divide>.

²³ Innovation, Science and Economic Development Canada (Government of Canada), “Canadian Sovereign AI Compute Strategy,” last updated December 5, 2024, <https://ised-isde.canada.ca/site/ised/en/canadian-sovereign-ai-compute-strategy>.

²⁴ Innovation, Science and Economic Development Canada (Government of Canada), AI Sovereign Compute Infrastructure Program, last update February 27, 2025, <https://ised-isde.canada.ca/site/ised/en/ai-sovereign-compute-infrastructure-program>.

²⁵ European Commission (European Union), “Canada joins Horizon Europe programme (press release),” July 2, 2024, https://ec.europa.eu/commission/presscorner/detail/en/ip_24_3626.

²⁶ “The Stargate Project: Trump Touts \$500 Billion Bid for AI Dominance,” Forbes, January 30, 2025, <https://www.forbes.com/sites/moorinsights/2025/01/30/the-stargate-project-trump-touts-500-billion-bid-for-ai-dominance/>.

²⁷ OpenAI, “Announcing the Stargate Project,” January 21, 2025, <https://openai.com/index/announcing-the-stargate-project/>.

²⁸ “Trump highlights partnership investing \$500 billion in AI,” Associated Press, January 22, 2025, <https://apnews.com/article/trump-ai-openai-oracle-softbank-son-altman-ellison-be261f8a8ee07a0623d4170397348c41>.

²⁹ The White House (United States of America), “Public Comment Invited on Artificial Intelligence Action Plan (press release),” February 25, 2025, <https://www.whitehouse.gov/briefings-statements/2025/02/public-comment-invited-on-artificial-intelligence-action-plan/>.

³⁰ “AI: With announcement of investments worth €109 billion, Macron intends to take on US,” Le Monde, February 10, 2025, https://www.lemonde.fr/en/economy/article/2025/02/10/ai-with-the-announcement-of-a-109-billion-investment-macron-intends-to-take-on-the-us_6737985_19.html.



2.2 QUANTUM COMPUTING AND QUANTUM TECHNOLOGY:

Accelerate the development of quantum technology, including advancements in quantum computing, to help Canada establish a robust position in the emerging global market.

By 2045, Canada's emerging quantum technology industry is projected to reach a value of \$139 billion, with an expectation of creating 200,000 jobs across the country.³¹ A 2024 report from the Quantum Algorithms Institute reveals that Canada accounts for 5% of the global quantum computing talent, ranks among the top 10 countries in quantum computing research, and boasts a vibrant startup ecosystem for quantum computing.³² Innovative Canadian companies are already achieving substantial progress in commercial quantum computing technology.³³ However, fostering and retaining quantum computing talent in Canada continues to pose a significant challenge for both the nation's quantum computing research community and the industry.³⁴

The Government of Canada's 2022 National Quantum Strategy aims to "make Canada a world leader in the continued development, deployment, and use of quantum computing hardware and software."³⁵ This strategy seeks to enhance Canada's strengths in quantum research, talent development, and technology commercialization. Leveraging these existing advantages in research and early commercialization success, Canada has an opportunity to expedite the development of quantum technology and establish a prominent position in the global market. Similar to AI research and innovation, Canada can gain from its involvement in Horizon Europe to pursue collaborative quantum computing research and innovation initiatives.

2.3 DIGITAL TRUST & IDS:

Establish a comprehensive digital identification (ID) and trust system in Canada to enhance effective "digital handshakes" between citizens and the government, as well as between businesses and their clients and customers.

Canadians desire convenient and secure access to government services. This comes at a time when online banking, digital payments, and e-commerce are integral to Canadians' daily lives. A comprehensive and trusted form of identification for Canadians could facilitate efficient public service delivery, enable businesses to securely transact with clients and customers, and enhance trust and security.

According to a 2024 survey by consulting firm Nortal on digital public service delivery in Canada, 70% of respondents "demand fully digital public

services," and 87% expect a "shift" towards fully digital services by 2026.³⁶ A 2022 survey commissioned by VMware found that 88% of Canadians have "accessed government services online," and 67% prefer to do so.³⁷ However, the VMware survey also discovered that only 50% of Canadians "trust the government to protect information used in online services," although 66% would be willing to create personal profiles for "single sign-on access to government services."³⁸

A 2021 survey conducted by the Angus Reid Institute on online government services supports

³¹ Innovation, Science and Economic Development Canada (Government of Canada), "Canada's National Quantum Strategy," 2022, <https://ised-isde.canada.ca/site/national-quantum-strategy/en/canadas-national-quantum-strategy>, 4.

³² Louise Turner and Yoan Mantha, "The Canadian Quantum Ecosystem Report 2024," Quantum Algorithms Institute, 2024, <https://www.qai.ca/2024-quantum-ecosystem-report>.

³³ For example, see: "Canadian company Xanadu tests building blocks for commercial quantum computer," The Globe and Mail, January 22, 2025, <https://www.theglobeandmail.com/business/article-xanadu-tests-building-blocks-for-commercial-quantum-computer/>.

³⁴ Innovation, Science and Economic Development Canada (Government of Canada), "National Quantum Strategy Consultations: What We Heard Report," 2022, <https://ised-isde.canada.ca/site/national-quantum-strategy/en/national-quantum-strategy-consultations-what-we-heard-report>, 17-19

³⁵ Innovation, Science and Economic Development Canada (Government of Canada), "Canada's National Quantum Strategy," 2022, <https://ised-isde.canada.ca/site/national-quantum-strategy/en/canadas-national-quantum-strategy>, 3.

³⁶ Nortal, "70% of Canadians Demand Fully Digital Public Services & 87% Expect This By 2026," April 24, 2024, <https://nortal.com/insights/70-of-canadians-demand-fully-digital-public-services-87-expect-this-by-2026/>.

³⁷ See: Rodney Helal, "Elevating Government Services for a Digital-First Canada," Canadian Government Executive, accessed February 28, 2025, <https://canadiangovernmentexecutive.ca/elevating-government-services-for-a-digital-first-canada/>.

³⁸ Ibid.



these findings. According to the survey, 79% of participants felt that “the Canadian government should be a world leader in providing access to digital services,” while 92% agreed or strongly agreed that cybersecurity threats represented “a huge risk to countries like Canada.”³⁹

A national digital ID system for Canada would significantly aid all levels of government in delivering critical services more efficiently and responsively. It would support innovations in e-government, open banking, intelligent retail, e-commerce, and connected health. Additionally, it would reduce friction and transaction costs for businesses, thereby boosting Canadian productivity.

Estonia, which has implemented a digital ID for over 20 years, serves as a valuable case study and model for Canada’s digital ID adoption. Research by the McKinsey Global Institute across seven national economies predicts that a widely adopted

digital ID could raise a country’s national GDP by up to 3% in advanced economies by 2030.⁴⁰

A widely used, secure, and efficient digital ID system would also assist Canadians in safeguarding against fraud and identity theft. Digital IDs can significantly bolster Canada’s national cybersecurity posture by making data breaches and fraud much more challenging for cybercriminals. A 2024 survey conducted by TransUnion revealed that 54% of Canadians reported being targets of digital fraud (via email, phone call, or text message).⁴¹ Payments Canada indicates that over six months in 2024, 20% of Canadian businesses were victims of payment fraud.⁴²

A Canadian digital ID system must incorporate safeguards that protect privacy, ensure sovereignty over personal data, and provide users with express and informed consent.

2.4 DIGITAL CONNECTIVITY:

Achieve nationwide high-speed internet coverage by 2030, prioritizing rural and remote areas. Improve mobile network coverage in rural areas and along transportation corridors.

While Canada enjoys extensive digital connectivity, rural and remote areas continue to lag behind urban regions. Access to broadband is only 62% in rural areas, compared to 91.4% in urban areas.⁴³ A lack of broadband access is particularly acute in Indigenous communities, with 61% of First Nations lacking service, according to a 2023 study by the Assembly of First Nations.⁴⁴

Canada has significant mobile coverage, though gaps persist in remote regions. While 97.1% of rural communities have mobile LTE coverage, coverage along remote sections of major transportation corridors is less extensive, with only 87.2% of rural roads and highways

covered.⁴⁵ With the rapid adoption of 5G and ongoing development of 6G technologies, continuous improvements to Canada’s mobile networks are essential.

Access to reliable cellular services and broadband internet across Canada strengthens connections nationwide, enabling Canadians to maintain communications that support digital sovereignty. It also provides equal opportunity for all Canadians, including those in rural and remote areas, to participate in the digital economy. Digital connectivity is vital for enhancing productivity through digital technologies in rural Canada, such as precision farming.

³⁹ Angus Reid Institute, “Advancing online government service: Canadians open to more & better access; concerned about cybersecurity,” March 4, 2021, <https://angusreid.org/online-government-services/>.

⁴⁰ Olivia White, et al., “Digital identification: A key to inclusive growth,” McKinsey Global Institute, April 2019, <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/digital-identification-a-key-to-inclusive-growth>.

⁴¹ TransUnion, “Suspected Digital Fraud Coming from Canada Up Nearly 11% Since H1 2023, Reveals New TransUnion Analysis (press release),” GlobalNewsWire, October 16, 2024, <https://www.globenewswire.com/news-release/2024/10/16/2963846/0/en/Suspected-Digital-Fraud-Coming-from-Canada-Up-Nearly-11-Since-H1-2023-Reveals-New-TransUnion-Analysis.html>.

⁴² Payments Canada, “One in five Canadian businesses experienced payment fraud in the past six months – despite 63 per cent who feel confident in protecting their business against scams (press release),” September 9, 2024, <https://www.payments.ca/one-five-canadian-businesses-experienced-payment-fraud-past-six-months-despite-63-cent-who-feel>.

⁴³ Employment and Social Development Canada (Government of Canada), “Building a Modern 21st Century Workforce: Discussion Paper,” last updated August 13, 2024, <https://www.canada.ca/en/employment-social-development/programs/training-agreements/workforce-summit/wf-discussion-paper.html>, 6-7.

⁴⁴ Assembly of First Nations, “Ensuring First Nations have the opportunity to thrive with full digital connectivity,” accessed January 30, 2024, <https://afn.ca/economy-infrastructure/infrastructure/closing-the-infrastructure-gap/digital-connectivity/>.

⁴⁵ Employment and Social Development Canada (Government of Canada), “Building a Modern 21st Century Workforce: Discussion Paper,” last updated August 13, 2024, <https://www.canada.ca/en/employment-social-development/programs/training-agreements/workforce-summit/wf-discussion-paper.html>, 6-7.



2.5 5G AND BEYOND:

Accelerate deployment of 5G networks and invest in R&D for 6G technologies.

Expanding Canada's 5G network promises significantly faster network speeds and greater network capacity for Canadians and Canadian businesses. This advancement in Canada's telecommunications networks is essential for operating modern mobile applications and enabling critical digital technologies, such as Internet of Things (IoT) networks, to be implemented in key sectors including agriculture, shipping and logistics, and infrastructure.⁴⁶ According to economic analysis by Accenture, achieving national 5G coverage is projected to increase Canada's GDP by \$40 billion by 2026.⁴⁷

As 5G networks become widespread across Canada, the next generation of telecommunications networks, known as 6G, is on the immediate horizon. In comparison to current 5G technology, 6G is expected to be significantly faster and offer even greater network capacity. Data-intensive quantum computing and AI applications, hosted on cloud services, will greatly benefit from the availability of robust 6G network infrastructure throughout Canada. Telecommunications firm Ericsson anticipates that 6G network technology will be in place starting in the early 2030s.⁴⁸

2.6 SEMICONDUCTOR SUPPLY CHAIN SECURITY:

Ensure national access to global semiconductor supply chains while preserving the country's niche yet innovative semiconductor industry.

Semiconductors serve as the foundation of the modern digital economy. Without a secure semiconductor supply chain, including access to the chips required for advanced computing applications, Canada will lack the hardware essential for developing, adopting, and implementing cutting-edge digital technologies, such as AI and quantum computing.

Over time, failing to access and engage in global semiconductor supply chains will erode Canada's status as an advanced economy. This does not imply that Canada must achieve self-sufficiency in semiconductor production; rather, Canada needs to safeguard its access by prioritizing semiconductor supply chain security as a strategic national concern.

According to a 2024 report by the CSA Group, Canada is home to an estimated 500 semiconductor and electronics component firms, with between one-third and one-half of these being pure-play semiconductor companies, mainly concentrated in Ontario and Québec, along with notable clusters in Alberta and British Columbia.⁴⁹

Canada's current semiconductor industry is estimated to contribute \$1.3 billion to GDP and employs roughly 16,000 workers.⁵⁰ The industry's size and economic activity have significantly declined since the early 2000s, coinciding with the downturn of Nortel. As of now, the industry is primarily made up of small firms employing fewer than 100 workers.⁵¹

Despite the small size of these firms, Canada's semiconductor industry is both innovative and a global leader in various specialized semiconductor technologies. This includes those critical for enhancing data centre heat management and energy efficiency, as well as advanced computing applications such as AI and quantum computing. The CSA Group also notes that Canadian firms produce world-leading semiconductor technologies like compound semiconductors, photonics, and advanced packaging.⁵² Investing in Canada's semiconductor sector and leveraging its strengths in specialized chip design and fabrication can boost Canada's global impact within the semiconductor supply chain and foster more resilient domestic industries.

⁴⁶ IBM, "5G Will Accelerate a New Wave of IoT Applications," accessed January 31, 2024, <https://newsroom.ibm.com/5G-accelerate-IOT>

⁴⁷ Accenture Strategy, "Accelerating 5G in Canada: Benefits for Cities and Rural Communities," March 2023, <https://canadatelecoms.ca/wp-content/uploads/2023/03/Accelerating-5G-in-Canada-V11-Web.pdf>, 3.

⁴⁸ Ericsson, "Follow the journey to 6G," accessed September 27, 2025, <https://www.ericsson.com/en/6g>.

⁴⁹ Daniel Munro and Creig Lamb, "Chip Shot: A Semiconductor Strategy for Canada," CSA Group, June 2024, <https://www.csagroup.org/article/public-policy/chip-shot-a-semiconductor-strategy-for-canada/>, 13.

⁵⁰ Ibid., 13-16.

⁵¹ Ibid., 12-13.

⁵² Ibid., 21.



2.7 CYBERSECURITY:

Expand Canada's cybersecurity workforce and talent development pipeline to enhance its cybersecurity posture and enhance governmental, public-private, and international cooperation in cyberspace.

Canada is facing a rapidly deteriorating security situation in cyberspace. According to the Canadian Centre for Cyber Security's 2025-26 cybersecurity threat assessment, both cybercriminals and hostile foreign governments are launching sophisticated cyberattacks against Canadian networks.⁵³ Tackling the issue of cybercrime, including fraud, identity theft, ransomware, and malware attacks, is a priority for Canada's national security community.⁵⁴ Statistics Canada estimates that Canadian companies spent a total of \$1.2 billion recovering from cyber incidents in 2023.⁵⁵ Emerging digital technologies such as AI and quantum computing are poised to add further complexity to Canada's cybersecurity landscape.

According to the Canadian Cyber Security Network's State of Cybersecurity in Canada Report 2025, Canada is facing a significant shortage of cybersecurity talent and lacks an adequate education and training pipeline for prospective cybersecurity professionals.⁵⁶ A report by ICTC in 2022 revealed that one in six cybersecurity jobs currently remains unfilled in Canada.⁵⁷ The Government of Canada's 2025 national cybersecurity strategy also underlines the need to strengthen Canada's future cybersecurity workforce.⁵⁸ Canada's cybersecurity workforce will continue to be a crucial asset in safeguarding the digital economy, yet the existing talent pipeline is insufficient to meet the rising demand for highly skilled and diverse cybersecurity professionals equipped with advanced digital skills.

⁵³ Canadian Centre for Cyber Security, Communications Security Establishment (Government of Canada), "National Cyber Threat Assessment 2025-2026, 2024," <https://www.cyber.gc.ca/en/guidance/national-cyber-threat-assessment-2025-2026>.

⁵⁴ Erik Henningsmoen, "Cybercrime is a 2024 intelligence priority for Canada, but one in six cybersecurity jobs go unfilled," Information and Communications Technology Council (ICTC), November 22, 2024, <https://ictc-ctic.ca/news-and-events/news-articles/cybercrime-2024-intelligence-priority-canada-one-six-cybersecurity>.

⁵⁵ Statistics Canada (Government of Canada), "Impact of cybercrime on Canadian businesses," 2023, November 21, 2024, <https://www150.statcan.gc.ca/n1/daily-quotidien/241021/dq241021a-eng.htm>.

⁵⁶ Randy Purse, "Addressing the talent gap: Focusing on mid-career transitions," in The State of Cybersecurity in Canada 2025, Canadian Cybersecurity Network and Security Architecture Podcast, 2025, <https://canadiancybersecuritynetwork.com/stateofcybersecurity>, 95.

⁵⁷ "One in Six Canadian Cybersecurity Roles Go Unfilled: New Report Explores Talent Shortage and Solutions," Information and Communications Technology Council (ICTC), October 13, 2022, <https://ictc-ctic.ca/news-events/one-in-six-canadian-cybersecurity-roles-go-unfilled-new-report-explores-talent-shortage-and-solutions>.

⁵⁸ Public Safety Canada (Government of Canada), "Canada's National Cyber Security Strategy," 2025, <https://www.publicsafety.gc.ca/cnt/rsracs/pblctns/ntnl-cbr-scrty-strtg-2025/index-en.aspx>. Nikolaus Lang, et al., "How CEOs Can Navigate the New Geopolitics of GenAI," Boston Consulting Group, December 9, 2024, <https://www.bcg.com/publications/2024/how-ceos-navigate-new-geopolitics-of-genai>



RECOMMENDATION 3

CATALYZE AND BOLSTER INNOVATION AND COMMERCIALIZATION

Innovation and commercialization require targeted investments and incentives.

3.1 TRADE AGREEMENTS:

Expand trade provisions in international agreements to open new markets for Canadian technology in Europe as part of CETA, leveraging the Horizon Europe partnership.⁵⁹

Participation in Horizon Europe enables Canadian researchers and innovators to access funding for collaboration with EU-based counterparts in strategic digital technologies such as AI, quantum computing, 6G, and other advanced communications infrastructure.⁶⁰ Canada's impressive lineup of international trade agreements enhances the freedom of Canadian

exporters to act when faced with uncertainties regarding access to key international markets.⁶¹ Increasing the number and scope of international trade agreements benefits the Canadian economy by providing a buffer as it navigates potential tariffs from the United States and engages in a joint review of the Canada-United States-Mexico Agreement (CUSMA) in 2026.

3.2 BUSINESS R&D INCENTIVES:

Enhance SR&ED tax credits for private-sector R&D to encourage innovation in strategic sectors of the digital economy, including AI, quantum computing, life sciences, and advanced energy solutions (e.g., green hydrogen, biofuels, small modular reactors, etc.).

The Scientific Research and Experimental Development (SR&ED) tax incentives program is Canada's flagship innovation tax credit initiative designed to incentivize companies to conduct scientific and technological research activities within the country. According to KPMG, over 20,000 companies and organizations benefit from SR&ED, with tax incentives totaling \$4.2 billion annually.⁶²

SR&ED tax incentives can be applied to basic, applied, and experimental development research, though these distinct levels of research activity are not currently differentiated under SR&ED.⁶³ While SR&ED undoubtedly increases the volume

of R&D activities occurring in Canada, a 2022 report by ICTC indicates that SR&ED tax incentives do not necessarily lead to the commercialization of Canadian innovations, nor do they support business scale-up activities surrounding successful IP.⁶⁴

Furthermore, since SR&ED tax incentives do not distinguish between basic, applied, and experimental development research, they fail to promote later stage research activities that can directly lead to commercially viable products and services. Companies that benefit from SR&ED tax incentives receive no recognition for bringing a

⁵⁹ See: Innovation, Science and Economic Development Canada (Government of Canada), "Horizon Europe," last updated November 5, 2024, <https://ised-isde.canada.ca/site/ised/en/horizon-europe>.

⁶⁰ Namir Anani, "Canada-EU Digital Pact: Strengthening Economic Sovereignty and Global Leadership," National News Watch, November 1, 2024, <https://nationalnewswatch.com/2024/11/01/canada-eu-digital-pact-strengthening-economic-sovereignty-and-global-leadership>.

⁶¹ See: Global Affairs Canada (Government of Canada), "Trade and investment agreements," last update January 10, 2025, <https://international.canada.ca/en/global-affairs/services/trade/agreements-negotiations/investment-agreements>.

⁶² KPMG, "The SR&ED landscape in Canada," July 19, 2024, <https://kpmg.com/ca/en/home/insights/2024/07/the-sr-ed-landscape-in-canada.html>.

⁶³ Ibid.

⁶⁴ Mairead Matthews and Faun Rice, "Context Matters: Strengthening the Impact of Foreign Direct Investment on Domestic Innovation," Information and Communications Technology Council (ICTC), March 2022, <https://ictc-ctic.ca/reports/context-matters>, 76.



product or service to market or for commercializing their IP under SR&ED; they are rewarded solely for conducting research activities.⁶⁵

The current SR&ED program also does not provide incentives for Canadian companies to commercialize their IP or scale their operations in Canada. Currently, Canadian innovators and early-stage entrepreneurs often tend to sell

their IP or R&D-intensive startups to foreign firms rather than pursuing business scalability or commercialization of their products or services domestically.⁶⁶ While opting to commercialize and scale outside the country may be a rational business decision for individual Canadian entrepreneurs and business owners, this trend gradually undermines Canadian productivity and the nation's innovation potential over time.

3.3 UNIVERSITY TECHNOLOGY TRANSFER OFFICES (TTOS):

Modernize TTOS to improve commercialization rates of Canadian innovations while creating linkages with strong industrial partners that have large international channels and markets.

TTOs are a vital part of Canada's technology development ecosystem, acting as a bridge between university researchers with promising innovations and new technologies, and industry, as well as potential investors. Across Canada, TTOs offer their universities expertise in IP management, commercialization, and strategic guidance on campus technology transfer policies. They play a role in a wider university innovation and commercialization ecosystem that encompasses other important assets, such as technology and innovation incubators, campus entrepreneurship centres, industry research parks, and IP marketplaces.⁶⁷

Driving innovations developed at universities into both domestic and international markets is crucial for effectively commercializing Canadian research IP. Research from the University of Calgary School of Public Policy revealed that at one Canadian

university, two-thirds of licensing agreements were made with companies located outside of Canada.⁶⁸ Efforts should be made to retain more university research IP within the country to foster innovative Canadian products and services.

To enhance technology transfer from Canadian universities to domestic companies, localized support, such as university-based business incubation programs and start-up funding, is essential.⁶⁹ To boost IP awareness, the federal government launched ElevateIP, a \$90 million initiative aimed at assisting business accelerators and incubators in helping entrepreneurs and start-ups register and strategically manage their IP through advice, resources, and training.⁷⁰ In the digital technology sector, DIGITAL, Canada's digital technology supercluster, offers funded innovation projects with advisory, education, and support services to safeguard and commercialize their IP.⁷¹

⁶⁵ Ibid., 76–77.

⁶⁶ Ibid., 35.59

⁶⁷ World Intellectual Property Organization, Technology Transfer Organizations, accessed February 27, 2025, <https://www.wipo.int/en/web/technology-transfer/organizations>.

⁶⁸ Mark R. Huson and Randall Morck, "Technology Transfer: The Rise of the Entrepreneurial University," University of Calgary School of Public Policy Research Paper, December 2024, <https://www.policyschool.ca/wp-content/uploads/2024/12/FMK12-TechnTransfer-Final.pdf>, 7–8.

⁶⁹ Mairead Matthews and Faun Rice, "Context Matters," 35.

⁷⁰ See: Innovation, Science and Economic Development Canada (Government of Canada), "ElevateIP," last update March 12, 2014, <https://ised-isde.canada.ca/site/elevateip/en>.

⁷¹ See: DIGITAL, "IP + Data Management," accessed March 7, 2025, <https://www.digitalsupercluster.ca/innovate-with-us/ip-data-management/>.

3.4 IP PROTECTION:

Strengthen intellectual property laws to safeguard innovators and draw global investment, while increasing Canadian innovators' IP literacy and improving access to IP protections.

Canada enjoys a reputation as an innovative economy, boasting a relatively high level of intellectual and technological output. The World Intellectual Property Organization's (WIPO) 2024 Global Innovation Index ranks Canada 14th among 133 countries for national innovation capacity.⁷²

Despite this, Canadian innovators and small to medium-sized business owners often do not take steps to register or otherwise protect their intellectual property (IP). According to Statistics Canada, between 2017 and 2019, only 18.2% of Canadian businesses reported owning IP, including that owned outside of Canada.⁷³ Among Canadian firms heavily involved in R&D activities, 24.4% opted not to formally protect their IP, citing reasons such as the costs associated with registering IP, a lack of perceived benefits, and challenges with enforcement as justifications for not formally safeguarding IP in Canada.⁷⁴

Economic modelling by WIPO suggests there are gaps in Canada's assessed scientific capacity, its ability to develop potential patented technology, and the actual patents produced. This is particularly evident in vital digital economy technologies such as semiconductors, optics, audio-visuals, and ICTs.⁷⁵ WIPO's analysis estimates that between 2001 and 2021, Canada had the research and technological capability to produce nearly two-and-a-half times as many patents

in these four digital technology categories as it actually generated.⁷⁶

Research by ICTC finds that when Canadian innovators and entrepreneurs seek to register their IP, they frequently do so outside of Canada—most often in the United States—due to differences in market size, as well as a strategic need to protect IP in the largest priority market rather than within Canada.⁷⁷ Moreover, Canadian innovators and entrepreneurs with viable products or startup businesses typically sell to foreign companies and investors instead of trying to commercialize their innovation or scale up their business domestically.⁷⁸

A 2023 report by the Canadian Senate found that strengthening IP protections in Canada could help incentivize Canadian innovation, enhance economic productivity, attract foreign direct investment (FDI), and provide Canadian companies with a “competitive edge in the global market.”⁷⁹ The Senate report emphasizes the need for Canadian companies to own and commercialize Canadian IP domestically to maximize the country's economic benefit.⁸⁰

In 2018, the Government of Canada released its Intellectual Property Strategy with the goal of accelerating Canadian innovations and convert Canada's high IP output into new commercial enterprises.⁸¹

⁷² World Intellectual Property Organization, “Global Innovation Index 2024 – Country Profiles: Canada,” accessed February 14, 2025. https://www.wipo.int/directory/en/details.jsp?country_code=CA.

⁷³ Statistics Canada (Government of Canada), “Intellectual Property Awareness and Use Survey, 2019,” February 18, 2021, <https://www150.statcan.gc.ca/n1/daily-quotidien/210218/dq210218b-eng.htm>.

⁷⁴ Ibid.

⁷⁵ World Intellectual Property Organization, “World Intellectual Property Report: Making Innovation Policy Work for Development,” 2024, <https://www.wipo.int/en/web/world-ip-report/2024/index>, Figure 2.16, 60–62.

⁷⁶ Ibid., Figure 2.16, authors' calculations.

⁷⁷ Mairead Matthews and Faun Rice, “Context Matters,” 31.

⁷⁸ Ibid., 35.

⁷⁹ Senate of Canada, “Needed: An Innovation Strategy for the Data-Driven Economy,” Senate Standing Senate Committee on Banking, Commerce and the Economy, June 2023, <https://sencanada.ca/en/info-page/parl-44-1/banc-data-driven-economy/>, 13.

⁸⁰ Ibid., 15.

⁸¹ Innovation, Science and Economic Development Canada (Government of Canada), “Government of Canada launches Intellectual Property Strategy,” April 26, 2018, <https://www.canada.ca/en/innovation-science-economic-development/news/2018/04/government-of-canada-launches-intellectual-property-strategy.html>

3.5 RESEARCH SECURITY:

Maintain vigilance against intellectual property theft of valuable Canadian research by hostile foreign actors. Enhance Canada's research security framework.

Canada regularly faces threats from hostile foreign actors who attempt to steal Canadian research and technology IP.⁸² Due to the increasing instances of IP theft, foreign interference, and cybersecurity breaches, safeguarding the sensitive, innovative, and valuable research produced at the country's universities, colleges, polytechnics, and industrial laboratories is crucial.⁸³ To address this risk, the Canadian government introduced the National Security Guidelines for Research Partnerships in 2021 to provide guidance and accountability

for Canadian research institutions, individual researchers, and research funding agencies.⁸⁴

Dual-use digital technologies, such as quantum computing and AI technology, cutting-edge sensors, and semiconductor technology, are particularly sensitive to IP theft. Maintaining a robust research security regime in Canada must be balanced with the principles of openness and transparency, international scientific cooperation and collaboration, and academic freedom.

⁸² "A new era of research security," University Affairs, June 14, 2023, <https://universityaffairs.ca/features/a-new-era-of-research-security/>.

⁸³ See: Government of Canada, "Research Security," last update November 29, 2024, <https://www.canada.ca/en/services/defence/researchsecurity.html>.

⁸⁴ Government of Canada, "National Security Guidelines for Research Partnerships," last update October 6, 2022, <https://science.gc.ca/site/science/en/safeguarding-your-research/guidelines-and-tools-implement-research-security/national-security-guidelines-research-partnerships>.



RECOMMENDATION 4

ENHANCE DIGITAL ECONOMY POLICY AND GOVERNANCE FRAMEWORKS

Effective and forward-looking policy and governance frameworks create certainty for technologists, innovators, and entrepreneurs, while maintaining public trust in emerging technologies and new business models.

4.1 AI AND QUANTUM MULTI-LATERAL GOVERNANCE:

Develop ethical frameworks for AI and quantum technologies to ensure interoperability and trust in collaboration with strong and likeminded economies such as the United States and Europe.

To remain at the forefront of the development and application of advanced computing technologies, such as AI and quantum computing, Canada should insist on the continued development of multilateral governance frameworks for ethical and responsible use of these technologies.

Positive steps in multilateral governance to date include Canada signing the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, the Democracy and the Rule of Law in February 2025,⁸⁵ the Bletchley Declaration on responsible AI use in 2023,⁸⁶ and the Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems.⁸⁷

As a medium-sized economy, Canada should collaborate with international partners to encourage harmonization of standards and governance approaches to ensure the

interoperability of advanced computing technologies. Canada should also guide the development of AI and quantum computing in a way that remains congruent with democratic norms, principles of non-interference in state sovereignty, human rights, and market economics.

The question of trust is critical in the development and operation of increasingly powerful and consequential digital technologies, such as AI-enabled systems. Edelman's 2024 Trust Barometer found that Canadians, on average, are less trustful of AI than the global average, with only 31% of Canadians surveyed expressing trust in AI technology.⁸⁸ Indeed, a 2022 global survey by Ipsos revealed that Canadians are measurably more skeptical about the benefits of AI and maintain a less positive outlook regarding AI adoption than the global average.⁸⁹ Promoting public trust and engagement in the governance of advanced digital systems, like AI, is crucial.

⁸⁵ Global Affairs Canada (Government of Canada), "Canada signs the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law," February 11, 2025, <https://www.canada.ca/en/global-affairs/news/2025/02/canada-signs-the-council-of-europe-framework-convention-on-artificial-intelligence-and-human-rights-democracy-and-the-rule-of-law.html>.

⁸⁶ Foreign, Commonwealth & Development Office (United Kingdom), "The Bletchley Declaration by Countries Attending the AI Safety Summit, 1-2 November 2023," last updated February 13, 2025, <https://www.gov.uk/government/publications/ai-safety-summit-2023-the-bletchley-declaration/the-bletchley-declaration-by-countries-attending-the-ai-safety-summit-1-2-november-2023>

⁸⁷ Innovation, Science and Economic Development Canada (Government of Canada), "Voluntary Code of Conduct on the Responsible Development and Management of Advanced Generative AI Systems," September 2023, <https://ised-isde.canada.ca/site/ised/en/voluntary-code-conduct-responsible-development-and-management-advanced-generative-ai-systems>.

⁸⁸ Edelman Trust Institute, "2024 Edelman Trust Barometer: Canada Report," Edelman 2024, https://www.edelman.ca/sites/g/files/aatuss376/files/2024-03/2024%20Edelman%20Trust%20Barometer_Canada%20Report_EN_0.pdf, 12.

⁸⁹ Ipsos, "Canadians Among Least Likely to Believe Artificial Intelligence Will Make Their Lives Better," January 14, 2022, <https://www.ipsos.com/en-ca/news-polls/Canadians-Least-Likely-AI-Make-Lives-Better>.



4.2 SMART REGULATIONS AND REGULATORY SANDBOXES:

Introduce market-based regulations and regulatory sandboxes for testing emerging technologies in controlled environments.

Regulatory sandboxes are arrangements where government regulators offer temporary relief from certain rules and regulations to allow innovators to trial new products and services in the early stages of developing markets. The Government of Alberta defines regulatory sandboxes as “a ‘safe space’ in which companies can test innovative products or services without immediately meeting all regulatory requirements.”⁹⁰ According to the Organization for Economic Co-operation and Development (OECD), regulatory sandboxes are temporary, reliant on iteration or a trial-and-error approach, and promote collaboration with stakeholder groups.⁹¹

Regulatory sandboxes should be applied on an experimental basis to emerging technologies within limited timeframes to encourage innovation in novel digital technologies.⁹² They provide policymakers and regulators with a specific time period to gather data on emerging industries and then enact carefully considered smart regulations that are responsive to markets without inadvertently stifling innovation. Regulatory sandboxes followed by enacting smart regulations will be especially crucial for establishing new industries around emerging technologies like AI and quantum computing.

4.3 PROACTIVE DISCLOSURE AND THE RIGHT TO BE INFORMED:

Foster accountability through reporting mechanisms that require organizations to disclose their use of AI systems to process sensitive personal information, including the associated functionalities, risks, and mitigation efforts. This should entail direct disclosure to individual users of AI systems and public reporting of overall system functionalities, risks, and mitigation strategies.

Implementing a proactive disclosure reporting system enhances transparency in AI systems and bolsters public trust in AI technology, similar to how corporate financial reporting fosters societal confidence in capital markets.⁹³ Given the rapidly evolving nature of AI technology and ongoing research, developing a standardized and robust system for AI transparency and disclosure will likely be an iterative process that matures and refines over many years.

At the government level, this should include regulatory spot checks and ongoing audits by trusted and accredited firms or institutions. On an individual level, proactive AI disclosure

should ensure that users are provided with informed consent and disclosure whenever they offer data to or interact with an AI-enabled system. It should also clarify how personal data will be retained and how it can be removed or corrected within the system.

Furthermore, proactive disclosure for AI-enabled systems should notify users whenever AI is involved in decision-making processes and disclose any potential biases inherent to the technology or the training data it utilizes. Users should also have clear access to privacy impact assessments related to the AI-enabled system.⁹⁴

⁹⁰ Government of Alberta, “Financial services and fintech regulatory sandbox,” accessed February 28, 2025, <https://www.alberta.ca/financial-services-and-fintech-regulatory-sandbox.aspx>.

⁹¹ Organisation for Economic Co-operation and Development (OECD), “Regulatory Sandboxes in Artificial Intelligence, OECD Digital Economy Papers, No. 356, July 2023, https://www.oecd.org/en/publications/regulatory-sandboxes-in-artificial-intelligence_8f80a0e6-en.html, 14.

⁹² See: Aftab Ahmed, “Encouraging innovation and competition through smart regulation,” Policy Options, July 18, 2024, <https://policyoptions.irpp.org/magazines/july-2024/competition-smart-regulation/>.

⁹³ Mary Graham, “Disclosure Dilemmas: AI Transparency is No Quick Fix,” Ash Center for Democratic Governance, Harvard Kennedy School, Harvard University, August 15, 2023, <https://ash.harvard.edu/articles/disclosure-dilemmas-ai-transparency-is-no-quick-fix/>.

⁹⁴ Information and Communications Technology Council (ICTC), “Harnessing the Benefits of AI While Reducing the Harms,” March 2020, <https://ictc-ctic.ca/reports/harnessing-benefits-ai-while-reducing-harms>.

RECOMMENDATION 5

DEVELOP CANADA'S DIGITAL ECONOMY TALENT

Developing and maintaining a talented digital economy workforce is essential to drive innovation and sustain economic growth.

5.1 UPSKILLING:

Establish national programs for upskilling and reskilling, with a focus on digital skills for workers displaced by automation, market shifts, interruptions to market access, and other economic disruptions.

Analysis by IBM suggests that 42% of the Canadian labour force will need reskilling because of the adoption of automation and AI technology. Meanwhile, a 2024 study by Mercer reports that 61% of Canadian executives believe advancements in technology are outpacing their business's capacity to retrain their workforces.⁹⁵ Research by the Conference Board of Canada indicates that

skill gaps in Canada's workforce hinder productivity growth and account for 7% of the productivity gap between Canada and the United States.⁹⁶ A potential solution for the rapid upskilling and reskilling of the Canadian workforce could be through micro-credentials that are directly linked to contemporary labour force needs and developed by learning providers in partnership with industry.⁹⁷

5.2 IMMIGRATION:

Streamline pathways for international tech talent and develop incentives to retain internationally educated professionals.

Recent immigrants to Canada face a persistent mismatch between their educational qualifications and available occupations. According to Statistics Canada, 26.7% of immigrants with a bachelor's degree or higher are employed in roles that require only a high school diploma or less.⁹⁸ In contrast, the rate of education-occupation mismatches among Canadian workers has declined over time,

from 14.8% in 2016 to 13.5% in 2021.⁹⁹ Even in high-demand sectors like information technology, skilled newcomers with the necessary qualifications to fill technical roles still encounter social and institutional barriers to employment in Canada.¹⁰⁰

A 2024 report by the C.D. Howe Institute reveals that underemployment and overqualification among skilled immigrant workers lead to lower

⁹⁵ Mercer, "Canadian C-Suite executives believe AI is key to increased productivity, yet most workforces are not ready to transform, according to Mercer's 2024 Global Talent Trends Study," March 6, 2024, <https://www.mercer.com/en-ca/about/newsroom/canadian-executives-believe-ai-is-key-to-increased-productivity/>.

⁹⁶ The Conference Board of Canada, "Skills and Productivity: Which Skills Shortages Are Impacting Canadian Productivity?," The Future Skills Centre, August 2024, <https://fsc-ccf.ca/research/skills-and-productivity-which-skills-shortages-are-impacting-canadian-productivity/>, 15.

⁹⁷ Heather McGeer and Erik Henningsmoen, "Accelerating Canada's Workforce: Micro-Credentialing in the Digital Economy," Information and Communications Technology Council (ICTC), March 2024, <https://ictc-ctic.ca/reports/accelerating-canadas-workforce>.

⁹⁸ Christoph Schimmele and Feng Hou, "Trends in education-occupation mismatch among recent immigrants with a bachelor's degree or higher, 2001 to 2021," Statistics Canada Economic and Social Reports, May 22, 2024, <https://www150.statcan.gc.ca/n1/en/pub/36-28-0001/2024005/article/00002-eng.pdf>, 4.

⁹⁹ Ibid., 3-4.

¹⁰⁰ See: Tyler Farmer, et al., "Settling for More: Matching Newcomers to Alberta's Tech Sector," Information and Communications Technology Council (ICTC), November 2021, <https://ictc-ctic.ca/reports/settling-for-more>.

¹⁰¹ Parisa Mahboubi and Tingting Zhang, "Harnessing Immigrant Talent: Reducing Overqualification and Strengthening the Immigration System," C.D. Howe Institute, December 2024, <https://cdhowe.org/publication/harnessing-immigrant-talent-reducing-overqualification-and-strengthening/>.



wages, slower career advancement, and reduced job satisfaction.¹⁰¹ Research by the Conference Board of Canada suggests that Canada is losing 20% of its newcomer population to onward migration, with 34% of these migrants leaving within the first five years of their arrival

in Canada.¹⁰² At a societal level, education-occupation mismatches among immigrant workers decrease national productivity, increase economic inefficiency, and undermine competitiveness in industries requiring highly qualified workers, such as the technology sector.¹⁰³

5.3 INCLUSION:

Promote workforce participation in STEM fields by providing on-ramps to underrepresented groups, including women and Indigenous peoples.

Creating equal opportunities in Canada for underrepresented groups, including women and Indigenous peoples, to enter STEM fields and contribute to Canadian innovations in science, engineering, and technology is vital for Canada to unlock the full potential of its digital economy. As of 2023, women made up 48% of the Canadian workforce, yet they accounted for only 34.8% of Canada's digital economy workforce.¹⁰⁴ According to a 2024 study by The Dais, the Indigenous

participation rate in Canada's technology sector is 3.4 times lower than that of the general population.¹⁰⁵ Establishing pathways for young Canadians from underrepresented groups, including women and Indigenous peoples, to enter STEM fields and pursue technology careers is essential for Canada and its future economy. The country cannot afford to leave qualified talent on the sidelines.

¹⁰² Federica Guccini, Lauren Hamman, and Stein Monteiro, "The Leaky Bucket 2024: A Closer Look at Immigrant Onward Migration in Canada," Conference Board of Canada, November 2024, <https://www.conferenceboard.ca/product/the-leaky-bucket-2024/>, 7-8.

¹⁰³ Parisa Mahboubi and Tingting Zhang, "Harnessing Immigrant Talent: Reducing Overqualification and Strengthening the Immigration System."

¹⁰⁴ Allison Clark and Maryna Ivus, "Impact Analysis: Advancing Women in the Digital Economy by Implementing Actionable Solutions with Canadian Organizations," Information and Communications Technology Council (ICTC), April 2024, <https://ictc-ctic.ca/reports/impact-analysis-advancing-women-digital-economy-implementing-actionable-solutions-canadian>, 6.

¹⁰⁵ Angus Lockhart and Viet Vu, "Canada's Got Tech Talent: Diversity of Canada's tech workers," The Dais, Toronto Metropolitan University, June 2024, <https://dais.ca/reports/canadas-got-tech-talent-chapter-2/>, 23.



RECOMMENDATION 6

BOOST DIGITAL TECHNOLOGY ADOPTION FOR CANADIAN BUSINESSES

To maintain competitiveness in a global marketplace, improve workplace productivity, and thrive in the face of rapid technological advancement, Canadian businesses must be supported to boost the use of digital technology in the workplace.

6.1 SME SUPPORT:

Provide grants, tax credits, and technical assistance to assist SMEs in enhancing their knowledge and adopting advanced digital technologies.

According to Statistics Canada, approximately 1.2 million small- and medium-sized enterprises (SMEs) were operating in Canada in 2022.¹⁰⁶ That year, SMEs employed a total of 7.8 million Canadian workers, representing 63% of the private sector labour force.¹⁰⁷ In 2020, SMEs contributed nearly half (48.5%) of the private sector GDP output.¹⁰⁸ These figures highlight the crucial role SMEs play in Canada's economy and the well-being of Canadians.

Nevertheless, Canadian SMEs face challenges in adopting productivity-enhancing digital technologies. A 2021 study by BDC revealed that 91% of Canadian SMEs invested an average of \$118,000 in technology, yet only 5% were deemed to be using digital technologies effectively.¹⁰⁹ As highlighted by TD Bank, Canadian businesses overall underinvest in digital technologies and R&D, resulting in lower national productivity compared to the United States and the G7 average.¹¹⁰ A recent report from the Canadian Chamber of Commerce criticizes the "sluggish adoption" of generative AI technologies, with 73% of Canadian businesses not

even considering AI adoption at this time and only 14% identifying as early adopters of AI.¹¹¹

In 2022, the Government of Canada launched the Canada Digital Adoption Program (CDAP) to support Canadian businesses in digitizing their operations. However, CDAP encountered several shortcomings, including the complexity of the application process, difficulties in securing suitable consulting services from a list of approved vendors, and a lack of flexibility in how various types of businesses could utilize program funding.¹¹²

CDAP concluded in 2024 due to insufficient interest from Canadian businesses; however, the demand for promoting digital adoption among Canadian SMEs remains strong. A revised version of CDAP that addresses the shortcomings identified in the original program and is more adaptable to meet the digitalization needs of Canadian SMEs could help bridge this significant gap in the adoption of digital technology among Canada's SMEs.

¹⁰⁶ Innovation, Science and Economic Development Canada (Government of Canada), "Key Small Business Statistics 2023," last update December 21, 2024, <https://ISED-ISED.canada.ca/site/sme-research-statistics/en/key-small-business-statistics/key-small-business-statistics-2023>.

¹⁰⁷ Ibid.

¹⁰⁸ Ibid.

¹⁰⁹ BDC, "Small and medium-sized businesses that invest in digital technologies are more competitive: BDC study," May 10, 2022, <https://www.bdc.ca/en/about/mediaroom/news-releases/small-medium-sized-businesses-that-invest-digital-technologies-more-competitive-bdc-study>.

¹¹⁰ James Marple, "Meeting Canada's Innovation Challenge Through Targeted Investment & Competition," TD Economics, July 15, 2021, <https://economics.td.com/ca-innovation>.

¹¹¹ Canadian Chamber of Commerce, "Business Data Lab Report Projects Gen AI Tipping Point for Businesses. Faster Adoption Needed to Rescue Canada from Its Productivity Emergency," May 22, 2024, <https://chamber.ca/news/business-data-lab-report-projects-gen-ai-tipping-point-for-businesses-faster-adoption-needed-to-rescue-canada-from-its-productivity-emergency/>.

¹¹² Noah Zon, "A \$4-billion idea gone wrong: the Canada Digital Adoption Program," Policy Options, April 4, 2024, <https://policyoptions.irpp.org/magazines/april-2024/canada-digital-adoption-cancellation/>.



6.2 DIGITAL MATURITY:

Launch national campaigns to enhance digital maturity among SMEs, fostering technology adoption and competitiveness.

According to OECD research, SMEs struggle with digital transformation and face significant barriers to digitalizing their businesses, including high costs, a lack of affordable digital infrastructure solutions, and workforce skills shortages.¹¹³ Canadian businesses can greatly benefit from building emerging digital technologies, such as

generative AI, directly into their business models as they move from digital transformation to digital maturity.¹¹⁴ Future government policies and programs to promote digital adoption by Canadian SMEs—such as a reformed CDAP program—should assist businesses in their journeys towards digital maturity.

6.3 PRODUCTIVITY TOOLS:

Subsidize adoption of AI-driven productivity tools in key industries.

According to a 2024 study by Accenture, the adoption of generative AI tools in Canadian workplaces could increase productivity by 8% and save the average Canadian worker 125 hours annually.¹¹⁵ A global survey of CEOs conducted by PwC found that 56% of respondents indicated generative AI tools have already helped employees use their time more efficiently.¹¹⁶ Among highly skilled workers in professional, scientific, and technical fields, research suggests that the use of generative AI tools in the workplace could result in a 40% boost in individual worker performance.¹¹⁷ However, according to Statistics Canada, 72.7% of

Canadian businesses are not currently considering the adoption of generative AI tools.¹¹⁸

This body of evidence indicates that Canadian businesses must thoughtfully integrate AI tools into their workflows to achieve productivity gains, while acknowledging the risks associated with adopting AI technology. However, the potential benefits are considerable and persuasive. The Canadian government, through policy initiatives like future digital maturity programs, can assist businesses in mitigating the risks of experimentation and investment in AI-driven productivity tools across key sectors of the Canadian economy.

¹¹³ OECD, "SME digitalization," accessed February 6, 2025, <https://www.oecd.org/en/topics/digitalisation-of-smes.html>.

¹¹⁴ Brian Solis, "The end of digital transformation and the rise of business model innovation," CIO, August 20, 2024, <https://www.cio.com/article/3487701/the-end-of-digital-transformation-and-the-rise-of-business-model-innovation.html>.

¹¹⁵ Accenture, "Canada's Generative AI Opportunity," June 2024, <https://news.microsoft.com/en-ca/2024/06/04/new-report-highlights-how-generative-ai-can-transform-canadas-future-with-a-potential-to-add-187b-to-the-canadian-economy-by-2030/>, 4.

¹¹⁶ PwC, "PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow," January 20, 2025, <https://www.pwc.com/gx/en/issues/c-suite-insights/ceo-survey.html>

¹¹⁷ MIT Sloan School of Management, "How generative AI can boost highly skilled workers' productivity," October 19, 2023, <https://mitsloan.mit.edu/ideas-made-to-matter/how-generative-ai-can-boost-highly-skilled-workers-productivity>

¹¹⁸ Statistics Canada (Government of Canada), "Which Canadian businesses are using generative artificial intelligence and why?," March 18, 2024, <https://www.statcan.gc.ca/o1/en/plus/5847-which-canadian-businesses-are-using-generative-artificial-intelligence-and-why>.



RECOMMENDATION 7

DEVELOP AN INDUSTRIAL STRATEGY FOR CANADA'S DIGITAL FUTURE

In an increasingly interconnected global economy, nations that strategically prioritize growth in key sectors gain a significant competitive edge. For Canada, developing an industrial strategy that leverages its comparative advantages is not just a pathway to economic resilience, but also a cornerstone for long-term global relevance.

Countries such as Germany and South Korea have shown the transformative power of industrial strategies focused on comparative advantage. Germany's leadership in advanced manufacturing and South Korea's success in semiconductors and electronics provide blueprints for how targeted policies can cultivate global competitiveness.

Canada has unique strengths that can be harnessed to drive sectoral growth.

7.1 NATURAL RESOURCES:

With extensive reserves of critical minerals, an abundance of energy sources, and a leading role in clean technology innovation, Canada is ideally positioned to spearhead the global energy transition and the expansion of advanced computing and data processing infrastructure. This encompasses maintaining and advancing the nation's unparalleled position in the development and deployment of carbon capture, utilization, and storage (CCUS) technology.

The International Energy Agency (IEA) predicts a growing long-term demand for critical minerals, including rare earth elements, nickel, cobalt, and lithium, over the coming decades. The IEA also highlights that global production sites for critical minerals pose significant risks to supply chains during disruptive events.¹¹⁹ Canada boasts immense mining potential for several sought-after critical minerals, enabling it to meet its internal demand while also exporting to international markets.¹²⁰ The opportunity for Canada to supply critical mineral exports abroad represents not only an economic advantage but also a means to bolster the country's geopolitical influence.

As part of its critical minerals strategy, the Government of Canada maintains a list of 34 critical minerals essential in strategic industries such as electronics, renewable energy, automotive, advanced manufacturing, and defence and aerospace.¹²¹ Canada has the opportunity to engage in exploration and mining activities, as well as value-added activities such as refining and processing, while renewing the country's industrial base to turn natural resource inputs into value-added products.

The clean tech sector employed nearly 190,000 Canadians and accounted for \$34 billion in

¹¹⁹ International Energy Agency, "Global Critical Minerals Outlook 2024," May 2024, <https://www.iea.org/reports/global-critical-minerals-outlook-2024>.

¹²⁰ Government of Canada, "Canadian Critical Minerals Strategy Annual Report 2024," last updated September 25, 2024, <https://www.canada.ca/en/campaign/critical-minerals-in-canada/canadas-critical-minerals-strategy/canadian-critical-minerals-strategy-annual-report-2024.html>.

¹²¹ See: Government of Canada, "Canada's critical minerals," January 9, 2025, <https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.html>.



GDP in 2021.¹²² In 2022, Canada exported \$20.9 billion in environmental and clean technology, representing 2.2% of total Canadian exports.¹²³ Seventy-eight percent of Canada's environmental and clean technology exports went to the United States that year.¹²⁴ Canada's clean tech sector is renowned globally for its innovation. In 2024, nine Canadian firms were included in the 2025 Global Cleantech 100, which represents the top tier of companies globally poised to achieve significant advancements in clean tech innovation and market performance.¹²⁵

CCUS technology has immense potential as a key clean tech technology, both as a carbon management tool and as a potential technological export. Canada has a geological storage capacity of 389 gigatonnes centered in the Western Canadian provinces of Alberta, Saskatchewan, Manitoba, according to a 2024 study by Clean Prosperity, making CCUS technology a powerful tool for manage Canadian carbon emissions. Global market demand for CCUS technology could increase to USD \$26 billion over 2025,¹²⁶ providing a ready market for Canadian CCUS technology exports.

7.2 TECHNOLOGY AND ARTIFICIAL INTELLIGENCE:

With world-class AI research hubs in cities such as Toronto, Montreal, and Edmonton, Canada is a recognized leader in AI development and applications.

AI research hubs established in these Canadian cities serve as catalysts for innovation and offer a critical mass for companies to co-locate, fostering robust, long-term technological ecosystems. They also draw and cultivate world-class scientific and technical talent.

However, Canada is relatively slow to adopt AI technology for boosting productivity and commercializing Canadian AI research into new technologies. Research from KPMG shows that only 35% of Canadian companies have integrated AI into their operations, compared to 72% of American firms.¹²⁷ The lower rates of AI adoption in Canadian

workplaces could hinder productivity gains and contribute to further economic decline.

An AI industrial strategy for Canada should prioritize the economic necessity of AI commercialization, incorporating intellectual property protection and support for translating academic research and innovation into commercially viable AI products and services. This strategy must also empower Canada to uphold its strong position as a leader in AI research and innovation, ensuring safeguards that foster ethical and responsible applications of AI technology.

¹²² Clean Growth Hub (Government of Canada), "Clean Technology Data Strategy: Employment," last updated July 14, 2023, <https://ised-isde.canada.ca/site/clean-growth-hub/en/clean-technology-data-strategy/employment>; Clean Growth Hub (Government of Canada), "Clean Technology Data Strategy: GDP and trade," last updated July 14, 2023, <https://ised-isde.canada.ca/site/clean-growth-hub/en/clean-technology-data-strategy/gdp-and-trade>.

¹²³ Statistics Canada (Government of Canada), International trade in environmental and clean technology products by origin and destination, 2022, last update March 13, 2024, <https://www150.statcan.gc.ca/n1/daily-quotidien/240226/dq240226b-eng.htm>.

¹²⁴ Ibid.

¹²⁵ See: "9 Canadian startups feature on the Global Cleantech 100 in 2025," MaRS Discovery District, January 15, 2025, <https://www.marsdd.com/our-story/9-canadian-startups-feature-on-the-global-cleantech-100-in-2025/>; Cleantech Group, "Global Cleantech 100," 2025, <https://www.cleantech.com/the-global-cleantech-100/>.

¹²⁶ "Hydrogen and CCUS investment to soar in 2024, risks remain: IEA," S&P Global, June 6, 2024, <https://www.spglobal.com/commodity-insights/en/news-research/latest-news/energy-transition/060624-hydrogen-and-ccus-investment-to-soar-in-2024-risks-remain-iea>.

¹²⁷ KPMG, "More than one third of Canadian businesses experimenting with ChatGPT, KPMG Canada survey," April 19, 2023, <https://kpmg.com/ca/en/home/media/press-releases/2023/04/us-outpacing-canada-in-business-adoption-of-ai.html>.

7.3 AI FOR PRECISION AGRICULTURE AND DOMESTIC FOOD SECURITY:

Enhance agricultural productivity in Canada, mitigate risks, and strengthen the nation's food security by promoting innovation and the adoption of AI technologies for precision agriculture applications.

According to Statistics Canada, there are 189,874 farms in Canada, covering 6.2% of the country's land area.¹²⁸ Over the past 50 years, the average size of farms in Canada has doubled due to consolidation made possible by technological advancements.¹²⁹ Canadian farms produce \$93 billion annually (based on farm market receipts) and employ more than 247,000 workers.¹³⁰ Canada's agriculture and food manufacturing sector generated \$150 billion in revenue and accounted for 2.3 million jobs.¹³¹ Furthermore, Canadian agri-food products amounted to \$99.1 billion in exports in 2023,¹³² representing 12.9% of Canada's merchandise exports that year.¹³³

Technologies such as precision agriculture, robotics, and the application of digital technology, along with spatial and temporal data to enhance farm management and boost production, can play a vital role in increasing productivity within Canada's agriculture sector, thereby augmenting food production and domestic food security.¹³⁴ Innovative Canadian agritech firms—primarily composed of SMEs—are already developing AI and machine-learning applications and creating cloud-based solutions for agricultural producers.¹³⁵

A recent report by the Canadian Federation of Agriculture indicates that farmers who have embraced precision agricultural techniques have already elevated crop production by 4%, while considerably reducing inputs like fertilizer.¹³⁶

A study focusing on corn farmers in the United States utilizing precision agriculture techniques reveals cost savings for farmers of up to \$25 per acre.¹³⁷ On a global scale, adopting AI technology for farm management applications, such as precision agriculture, could unlock \$100 billion in economic activity,¹³⁸ highlighting a substantial international market opportunity for Canada's agritech innovators.

A 2021 report by ICTC notes the importance of increasing digital connectivity in rural areas of Canada. It highlights the importance of 5G networks for effectively using precision agriculture techniques.¹³⁹ As precision agriculture becomes more data-intensive with the adoption of AI, rural connectivity will become even more essential for improving agricultural productivity in Canada.

¹²⁸ Statistics Canada (Government of Canada), "Overview of Canada's agriculture and agri-food sector," last update June 27, 2024, <https://agriculture.canada.ca/en/sector/overview>.

¹²⁹ Ibid.

¹³⁰ Ibid.

¹³¹ Ibid.

¹³² Ibid.

¹³³ Authors' calculations, Statistics Canada (Government of Canada), "Canadian international merchandise trade: Annual review 2023," last update May 9, 2024, <https://www150.statcan.gc.ca/n1/daily-quotidien/240509/dq240509a-eng.htm>.

¹³⁴ KPMG, "Fighting food insecurity: How Canada can drive food security amid rising costs and supply chain disruptions," June 2023, <https://kpmg.com/ca/en/home/insights/2023/06/fighting-food-insecurity.html>.

¹³⁵ McKenzie Huneke, et al., "Crunching the numbers: A snapshot of Canada's agricultural technology landscape," University of Waterloo, August 2024, <https://uwaterloo.ca/disruptive-technologies-economic-development/sites/default/files/uploads/documents/ag-crunchbase-report-august-2024-final.pdf>, vi.

¹³⁶ Canadian Federation of Agriculture, "Data as a Foundation for Sustainable Productivity Growth," September 2024, <https://www.cfa-fca.ca/wp-content/uploads/2024/09/Data-as-a-Foundation-for-Sustainable-Productivity-Growth-2.pdf>, 4.

¹³⁷ David Schimmelpfennig, "Cost Savings from Precision Agriculture Technologies on U.S. Corn Farms," U.S. Department of Agriculture, Economic Research Service, Amber Waves, 2016, <https://www.ers.usda.gov/amber-waves/2016/may/cost-savings-from-precision-agriculture-technologies-on-u-s-corn-farms>.

¹³⁸ McKinsey & Company, "From bytes to bushels: How gen AI can shape the future of agriculture," June 10, 2024, <https://www.mckinsey.com/industries/agriculture/our-insights/from-bytes-to-bushels-how-gen-ai-can-shape-the-future-of-agriculture>.

¹³⁹ Maryna Ivus, et al., "Canadian Agri-food Technology: Sowing the Seeds for Tomorrow," September 2021. Information and Communications Technology Council (ICTC), <https://ictc-ctic.ca/reports/canadian-agrifood-technology>.



7.4 LIFE SCIENCES AND HEALTH INNOVATION:

Canada's healthcare system and research institutions create a solid foundation for breakthroughs in biotechnology and pharmaceuticals. Canada possesses the fundamentals to be a global leader in healthcare technology innovation and the digitalization of healthcare systems.

Canadians face a healthcare system that falls short compared to its counterparts in other high-income countries offering universal healthcare access. Research conducted by the Fraser Institute compares various high-income universal healthcare systems to Canada's and reveals that, despite being among the top third of healthcare spenders, Canada ranks among the lowest for access to doctors and hospital beds, the availability of advanced medical technology such as MRI machines and CT scanners, and wait times for specialist care.¹⁴⁰ By 2028, Canada is projected to encounter a shortage of 44,000 physicians, with 72% of this deficit consisting of family doctors, who serve as the primary point of access to the healthcare system.¹⁴¹

Adopting digital technologies, many of which are developed by Canadian healthcare technologists and health-tech entrepreneurs, could significantly strengthen Canada's universal healthcare system and enhance access to healthcare for Canadians. A 2021 study by ICTC found that Canada's healthcare system is already benefiting from the adoption of digital technologies such as electronic health

records—including centralized data management and patient access to health records—wearable sensors powered by cloud technology, telehealth services, and the use of big data and AI for clinical support and drug discovery.¹⁴²

A 2024 study by ICTC on the relationship between Alberta's healthcare system and the health technology innovation ecosystem found that technologists and innovators with expertise in healthcare and medicine are essential for translating clinical needs into technical solutions for new products and digital services.¹⁴³ Facilitating the connections between Canada's health technology innovation ecosystem and its healthcare system is crucial for driving advancements in the healthcare sector. Similarly, investment in robust digital infrastructure that supports digital health technology is vital for promoting the adoption of new technologies, fostering innovation in healthcare technology, and attracting investment.¹⁴⁴

¹⁴⁰ Mackenzie Moir and Bacchus Barua, "Comparing Performance of Universal Health Care Countries, 2024," Fraser Institute, <https://www.fraserinstitute.org/studies/comparing-performance-of-universal-health-care-countries-2024>.

¹⁴¹ Ben Richardson and Yadullah Hussain, "Canada needs more doctors—and fast," RBC Healthcare, November 15, 2024, <https://www.rbcroyalbank.com/healthcare-financial-solutions/advice-learning/article/?title=canada-needs-more-doctors-and-fast>.

¹⁴² Mairead Matthews, et al., "Digital Transformation: The Next Big Leap in Healthcare," The Information and Communications Technology Council (ICTC), August 2021, <https://ictc-ctic.ca/reports/digital-transformation>.

¹⁴³ Faun Rice, et al., "From Concept to Care: Health Technology Talent in Alberta," Information and Communications Technology Council (ICTC), April 2024, <https://ictc-ctic.ca/reports/concept-care-health-technology-talent-alberta>.

¹⁴⁴ See: Alexandra Cutean, et al., "Attracting FDI Toward Canada's Digital Economy: Covid-19 and Beyond," Information and Communications Technology Council (ICTC), <https://ictc-ctic.ca/reports/attracting-fdi-toward-canadas-digital-economy>, 36-37.

RECOMMENDATION 8

ACCELERATE SUSTAINABLE DEVELOPMENT FOR CANADA'S DIGITAL FUTURE

Adopting sustainable practices in Canada's digital economy is essential for safeguarding the environment for future generations of Canadians. Canada requires a mix of sustainable electricity generation solutions to meet the projected future electricity demand, including that needed for advanced computing applications, while remaining flexible and responsive to future market shocks and emerging technologies.

8.1 SUSTAINABLE ENERGY:

Incentivize the development and adoption of sustainable energy solutions, such as green hydrogen, biofuels, and nuclear energy, including small modular reactors.

Emerging technologies, such as AI and quantum computing, along with the necessary digital infrastructure to support these advanced computing systems, require substantial amounts of energy.¹⁴⁵ As digital systems become more integrated into the Canadian economy and the daily lives of Canadians, energy demand is anticipated to increase significantly.

According to the IEA, data centres and digital networks currently account for about 1-1.5% of global electricity demand and produce 1% of greenhouse gas emissions.¹⁴⁶ Ontario's Independent Electricity System Operator (IESO) predicts that electricity demand in Ontario will rise by 75% by 2050, increasing from today's annual consumption

of 151 terawatt-hours (TWh) to 263 TWh by that year.¹⁴⁷ The IESO states that data centres are a major contributor to electricity demand in Ontario, already making up 4% of the province's demand.¹⁴⁸

Nuclear technology, including small modular reactors and Canada's legacy CANDU reactor technology, is a key energy solution for meeting Canada's future electricity demand. Renewable energy sources, biofuels, and green hydrogen can also significantly contribute to Canada's future energy mix. Increasing energy production in Canada will help the country power future energy-intensive digital technologies while maintaining domestic energy security.

¹⁴⁵ Mairead Matthews and Allison Clark, "How to Advance Environmentally Sustainable ICT in Canada: ICTC Policy Brief, November 2023," Information and Communications Technology Council (ICTC), <https://ictc-ctic.ca/policy-briefs/advancing-environmentally-sustainable-ict-in-canada>, 10.

¹⁴⁶ International Energy Agency, "Data Centres and Data Transmission Networks," accessed February 15, 2025, <https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks>

¹⁴⁷ Independent Electricity System Operator (Ontario), "Electricity Demand in Ontario to Grow by 75 per cent by 2050," October 16, 2024, <https://www.ieso.ca/Corporate-IESO/Media/News-Releases/2024/10/Electricity-Demand-in-Ontario-to-Grow-by-75-per-cent-by-2050>.



8.2 ENERGY EFFICIENCY:

Promote AI-enabled energy management systems to improve efficiency, boost yield, and lower industrial emissions.

AI technologies hold significant potential for energy management systems, such as smart grid technology, to improve energy transmission while boosting resiliency and efficiency.¹⁴⁹ Smart grid technology is essential for Canada to improve efficiency and incorporate new energy sources into the country's electricity distribution system. However, considerable upgrades to Canada's broadband infrastructure in rural and remote areas are needed to fully realize the full potential of digital systems like smart grid technology.¹⁵⁰ Furthermore, AI technology can enhance efficiency and safety for other energy distribution systems, including Canada's oil and gas pipeline networks.¹⁵¹

AI technology also has the potential to help other industries reduce their greenhouse gas (GHG) emissions. It showcases promising applications for enhancing energy efficiency in the built environment. For instance, a 2024 study on AI applications for energy efficiency in commercial office buildings found that implementing AI in energy management systems could cut GHG emissions from commercial office buildings by 8-19%.¹⁵²

Despite their advantages, the environmental benefits of ICT are often undermined by negative impacts throughout the ICT supply chain, particularly during manufacturing, transport, usage, and disposal.¹⁵³ While ICT devices consume significant amounts of energy during their operational stage, the production process contributes the majority of greenhouse gas emissions throughout the lifecycle of end-user devices. Furthermore, AI technology necessitates substantial computing power to develop and run machine learning models before achieving commercial viability.

AI computing power requires significant amounts of electricity and can be GHG-intensive depending on the status of clean energy production within an electricity grid. The International Monetary Fund's analysis indicates that GHG emissions from data centres, which are utilized for AI, cloud services, and other advanced computing applications, could represent 1.2% of global GHG emissions by 2027.¹⁵⁴ Therefore, enhancing the energy efficiency of data centres is essential as the use of AI expands.

¹⁴⁸ Ibid.

¹⁴⁹ See: June Kim, "Four ways AI is making the power grid faster and more resilient," MIT Technology Review, November 22, 2023, <https://www.technologyreview.com/2023/11/22/1083792/ai-power-grid-improvement/>.

¹⁵⁰ Allison Clark and Todd Legere, "Strengthening Nova Scotia's Clean Energy Economy: An ICTC Policy Brief," Information and Communications Technology Council (ICTC), March 2024, <https://ictc-ctic.ca/reports/strengthening-nova-scotias-clean-energy-economy>, 26-27.

¹⁵¹ See: "Artificial Intelligence could unlock efficiency and safety gains for oil and gas sector," World Pipelines, September 23, 2024, <https://www.worldpipelines.com/special-reports/23092024/artificial-intelligence-could-unlock-efficiency-and-safety-gains-for-oil-and-gas-sector/>.

¹⁵² Chao Ding, et al., "Potential of artificial intelligence in reducing energy and carbon emissions of commercial buildings at scale," Nature Communications 15, 5916 (2024). DOI: <https://doi.org/10.1038/s41467-024-50088-4>.

¹⁵³ Allison Clarke and Mairead Matthews, "Advancing Environmentally Sustainable ICT in Canada," Information and Communications Technology Council (ICTC), November 2023, <https://ictc-ctic.ca/policy-briefs/advancing-environmentally-sustainable-ict-in-canada>.

¹⁵⁴ Shafik Hebous and Nate Vernon-Lin, "Carbon Emissions from AI and Crypto Are Surging and Tax Policy Can Help," International Monetary Fund, August 15, 2024, <https://www.imf.org/en/Blogs/Articles/2024/08/15/carbon-emissions-from-ai-and-crypto-are-surging-and-tax-policy-can-help>.

8.3 CIRCULAR ECONOMY:

Encourage digital solutions that minimize waste and enhance resource efficiency.

The digital economy produces significant amounts of electronic waste products known as e-waste, consisting of broken, disused, or obsolete electronic devices and hardware¹⁵⁵. E-waste is proving to be an immense waste management challenge, as heavy metals contained within electronic components, such as lead, mercury, nickel, and cobalt, are at risk leaching from landfills into surrounding environment if improperly managed, creating negative impacts on natural systems and human health.¹⁵⁶ Today, e-waste is amongst the fastest growing streams of solid waste, according to the World Health Organization.¹⁵⁷

Research suggests that Canadians produce an estimated of 20.3 to 25.3 kilograms of e-waste per capita as of 2019-20.¹⁵⁸ Canada is projected to produce 1.2 million tons of e-waste annually by 2030.¹⁵⁹ While only around 20% of e-waste is estimated to be recycled in Canada.¹⁶⁰ Furthermore, Canadians households stockpile disused electronic devices, such as old cell phones, computers,

and televisions, in significant quantities.¹⁶¹ While stockpiling can prevent these devices from ending up in the landfill, these devices would be better off being properly recycled.

Negative environmental impacts produced by the ICT sector, and wider digital economy, can be mitigated by using circular economy approaches to recycling, reusing, and repairing e-waste, like electronic components and computing hardware, high-performance batteries, and obsolete or disused devices.

For example, high-performance lithium-ion batteries used in electric vehicles can be repurposed for use in battery farms as they reach the end of their useful lives, or they can be recycled and the materials turned into new EV batteries.¹⁶² Circular economy approaches to reusing and recycling e-waste back into in-demand products helps remove potentially harmful waste from Canadian landfills and makes the digital supply chain more resilient and efficient.

¹⁵⁵ Gartner, "Information Technology Glossary: Electronic Waste (e-Waste)," accessed March 7, 2025, <https://www.gartner.com/en/information-technology/glossary/electronic-e-waste>.

¹⁵⁶ Kaitlyn Carr, et al., "Building a Sustainable ICT Ecosystem: Strategies and Best Practices for Reducing Environmental Harms in a Digital World," Information and Communications Technology Council (ICTC), January 2024, <https://ictc-ctic.ca/reports/building-a-sustainable-ict-ecosystem>, 22-25.

¹⁵⁷ "Electronic waste (e-waste)(fact sheet)," World Health Organization, October 1, 2024, [https://www.who.int/news-room/fact-sheets/detail/electronic-waste-\(e-waste\)](https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste)).

¹⁵⁸ Komal Habib, et al. "A first comprehensive estimate of electronic waste in Canada," Journal of Hazardous Materials, no. 448 (2023), <https://doi.org/10.1016/j.jhazmat.2023.130865>; Vanessa Forti, et al., The Global E-waste Monitor 2020: Quantities, flows, and the circular economy potential, 2020, United Nations University, United Nations Institute for Training and Research, International Telecommunication Union, and International Solid Waste Association, https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf, 106.

¹⁵⁹ Komal Habib, et al. "A first comprehensive estimate of electronic waste in Canada," Journal of Hazardous Materials, no. 448 (2023), <https://doi.org/10.1016/j.jhazmat.2023.130865>.

¹⁶⁰ Ibid.

¹⁶¹ Kaitlyn Carr, et al., "Building a Sustainable ICT Ecosystem: Strategies and Best Practices for Reducing Environmental Harms in a Digital World," 25-26.

¹⁶² See: Erik Henningsmoen, et al., "Fast Charging Ontario's Electric Vehicle Workforce," Information and Communications Technology Council (ICTC), April 2024, <https://ictc-ctic.ca/reports/fast-charging-ontarios-electric-vehicle-workforce>, 74-75.

RECOMMENDATION 9

EARN PUBLIC TRUST AND PROMOTE CITIZEN ENGAGEMENT

Ultimately, Canada's success in benefiting from and advancing its digital economy hinges on earning public trust and fostering citizen engagement. Canadian institutions and democratic norms depend on trustworthy relationships, a cohesive political culture, and respect for individual privacy and ownership.

9.1 MISINFORMATION AND DISINFORMATION:

Strengthen efforts to combat misinformation and disinformation by raising public awareness and implementing regulatory oversight.

A 2022 Leger survey found that 72% of Canadians believe “disinformation threatens Canadian democracy.”¹⁶³ A significant portion of disinformation entering Canada's information landscape comes from hostile foreign actors.¹⁶⁴ A 2023 report by the Council of Canadian Academies warns that rampant disinformation shapes public discourse in ways that heighten socio-political polarization, diminish trust in institutions, and normalize post-truth rhetoric.¹⁶⁵ A tainted Canadian information environment results in a compromised Canadian body politic.

The proliferation of AI-generated content accelerates the risks of disinformation facing Canadians. A risk analysis by Policy Horizons Canada cautions that a Canadian information environment flooded with such content, including deepfakes, makes it “almost impossible to know what is fake or real.”¹⁶⁶ Safeguards to reduce the damage caused by disinformation must also safeguard individual Canadians' Charter Rights, including the protection of freedom of expression.¹⁶⁷

¹⁶³ Leger, “2022 Disinformation in Canada Report,” December 2022, <https://leger360.com/wp-content/uploads/2024/02/Disinformation-Report-IPR-Final-Version.pdf>, 8.

¹⁶⁴ Public Safety Canada (Government of Canada), “Parliamentary Committee Notes: Foreign Interference: Overview of Hostile Activities by State Actors,” January 26, 2023, <https://www.publicsafety.gc.ca/cnt/trnsprnc/brfng-mtrls/prlmntry-bndrs/20230623/09-en.aspx>.

¹⁶⁵ Council of Canadian Academies, “Fault Lines: Expert Panel on the Socioeconomic Impacts of Science and Health Misinformation,” 2023, <https://www.cca-reports.ca/reports/the-socioeconomic-impacts-of-health-and-science-misinformation/>.

¹⁶⁶ Policy Horizons Canada (Government of Canada), “Disruptions on the Horizon,” April 2024, <https://horizons.service.canada.ca/en/2024/disruptions/index.shtml>, 14.

¹⁶⁷ See: Government of Canada, “Charterpedia: Section 2(b) – Freedom of expression,” last update July 31, 2023, <https://www.justice.gc.ca/eng/csj-sjc/rfc-dlc/ccrf-ccd/check/art2b.html>.



9.2 PRIVACY AND INDIVIDUAL DATA SOVEREIGNTY:

Ensure that digital services prioritize the privacy and security of citizen ownership and sovereignty over personal data.

To ensure the sovereignty of personal data is maintained, Canada should preserve a domestic, secure cloud infrastructure and implement strong protections around sensitive personal information. Privacy experts have recently raised concerns that sensitive data stored on cloud servers outside of Canadian jurisdiction is not subject to Canadian privacy law, and therefore lacks national safeguards and the same standards concerning the rule of law.¹⁶⁸ Additionally, data in digital transit that leaves Canada via internet networks—even if only momentarily—may be subjected to foreign law and thus fall outside of Canadian sovereignty.¹⁶⁹

To ensure the most sensitive data stored on Canadian servers remains within Canada during digital transit, critical Internet exchange points should continue to be located within Canada. This will help promote data sovereignty and avoid transiting sensitive and protected data outside of Canadian jurisdiction and legal protection.¹⁷⁰ Furthermore, privacy considerations should include special considerations for data sovereignty for Indigenous communities in Canada.¹⁷¹

¹⁶⁸ For example, see: “Changing U.S. relationship has thrust Canada’s data sovereignty into the spotlight”, The Globe and Mail, February 28, 2025, <https://www.theglobeandmail.com/business/article-changing-us-relationship-has-thrust-canadas-data-sovereignty-into-the/>.

¹⁶⁹ Emily Jackson, “What every Canadian CIO needs to know about data sovereignty,” CIO, March 10, 2022, <https://www.cio.com/article/305461/what-every-canadian-cio-needs-to-know-about-data-sovereignty.html>.

¹⁷⁰ See: Canadian Internet Registration Authority (CIRA), “Canada’s Internet Factbook 2019,” <https://www.cira.ca/en/resources/documents/about/canadas-internet-factbook-2019/#cyberattacks-and-malware>.

¹⁷¹ See: The First Nations Information Governance Centre, “First Nations data sovereignty in Canada,” Statistical Journal of the IAOS, no. 35 (2019), 58-66:10.3233/SJI-180478.



CONCLUSION

Canada possesses all the necessary elements to grow its digital economy and take advantage of emerging technologies like AI and quantum computing. With its abundant energy and natural resources, skilled workforce, innovative research ecosystem, effective governance, international connections, and industrial foundation, Canada is ideally positioned to seize the next stage of digital transformation.

Policies that stress fiscal responsibility, private-sector leadership, and streamlined governance are vital for Canada to tackle the challenges posed by new technologies, economic disruption, and global uncertainty. These are challenges that Canada is currently facing and will continue to confront in the foreseeable future.

The areas of focus, along with the gaps and opportunities outlined in this whitepaper, are intended to assist Canadian policymakers in mobilizing Canada's considerable resources and immense potential to create a better economic, social, and technological future for all Canadians. The digital economy offers a tremendous opportunity for Canada to achieve significant and rapid gains in productivity, economic prosperity, scientific and technological advancement, and global standing. Urging the advancement of the country's digital economy will also help strengthen Canada's economy, society, and institutions in the face of swift technological change, market instability, and an increasingly perilous geopolitical landscape. Canada must cultivate a viable digital future for itself.

