



The Digital-Led New Normal:

Revised Labour Market
Outlook for 2022



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Preface

ICTC is a not-for-profit, national centre of expertise for strengthening Canada's digital advantage in a global economy. Through trusted research, practical policy advice, and creative capacity-building programs, ICTC fosters globally competitive Canadian industries enabled by innovative and diverse digital talent. In partnership with a vast network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 25 years.

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Abstract

This report serves as an update and addendum to ICTC's *Digital Talent Outlook 2023* report released in 2019. It includes an analysis of the recent economic shocks that have impacted the global and Canadian economy, including the COVID-19 pandemic and the oil price collapse. Given the unprecedented disruption to economic output and employment, and the heightened uncertainty surrounding the global economic outlook, this report also provides updated employment and GDP forecasts for the Canadian economy overall, the digital economy, and six key innovation areas: cleantech, agri-foods and food tech, interactive digital media (IDM), advanced manufacturing, clean resources, and health and biotech. Insights into the volatile nature of the current global economy, employment, and GDP forecasts are provided until the end of 2022.

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Executive Summary

In March 2020, Canada entered the beginnings of a recession.¹ The main cause of this recession was a health crisis (COVID-19) unmatched in severity since the Spanish Flu of 1918. Officially declared a global pandemic in mid-March, its rapid spread led to large-scale economic shutdowns and supply chain breakages spanning nations, including Canada. In releasing *The Digital New Normal: Revised Labour Market Outlook for 2022*, ICTC contributes to the emerging analyses of these twin economic and health crises by updating previous forecasts conducted in the *Outlook 2023* report.²

Although COVID-19 is likely to be viewed as a global turning point, other economic shocks impacted the Canadian economy during 2019-2020. The United Kingdom's exit from the European Union—while not immediately impactful—has the potential to cause disruptions in the future, as “Brexit” will require the United Kingdom (among the world's largest economies) to exit the jurisdiction of the Comprehensive Economic and Trade Agreement (CETA) trade agreement between Canada and the European Union (EU). The Wet'suwet'en protests temporarily caused construction to halt on TransCanada's liquefied natural gas (LNG) pipeline in British Columbia, and then more importantly, halted rail traffic across the country for several weeks. This short-term supply chain disruption led the Parliamentary Budget Officer (PBO) to estimate a reduction of 0.2% in Canada's GDP during the first quarter. By end of March 2020, these disruptions—Brexit and the rail blockades—would seem minuscule in nature. COVID-19's economic contractions have had widespread effects, including a sharp decline in demand for Canadian oil. In April, Canadian crude prices entered negative territory,³ sending employment and budget shocks through the economies of Alberta, Newfoundland and Labrador, and Saskatchewan in particular.

¹ “Canada Entered Recession in First Quarter of 2020”, C.D. Howe Institute Business Cycle Council, May 1, 2020, <https://www.cdhowe.org/council-reports/canada-entered-recession-first-quarter-2020-cd-howe-institute-business-cycle-council>

² Alexandra Cutean, et al. “Canada's Growth Currency: Digital Talent Outlook 2023”, Information and Communications Technology Council, October 2019, <https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf>

³ Erica Alini, “What do negative oil prices mean for Alberta and Canada's economy?” *Global News*, April 29, 2020, <https://globalnews.ca/news/6853071/negative-oil-prices-alberta-canada-economy/>

The COVID-19 pandemic also highlighted other existing fissures in the Canadian economy. With 98% of Canada's businesses being small,⁴ the importance of accelerated digitization—and its slow adoption to date—became evident. Physical storefronts closed, and businesses had to adapt, often by moving online. This transition was met with varied success. Despite government support, many small businesses will struggle to stay afloat.⁵ As a result, ICTC forecasts both increased business insolvency in 2020 and a sharp decline in GDP. Under a baseline scenario, **ICTC forecasts 130,000 additional business insolvencies by the end of 2022 and a drop in GDP totalling -9.6% in 2020. Unemployment across the overall economy is expected to decline from the current rate of 11.8%, except in the event of a second wave in the fall. (In April and May, Canada recorded its highest rate of unemployment since the Great Depression.)**

Despite the stark realities brought on by the COVID-19 pandemic, the Canadian digital economy remains remarkably resilient to the current crisis. Due to increased demand for digital services and the ability of many digital economy employees to work remotely, **the COVID-19 crisis has actually led to an increase in the digital economy's share of total employment. Between February and June 2020, employment in the Canadian digital economy jumped from 10% to 11% of total employment.** Because of this resilience and expected growth in influence, ICTC forecasts that **employment in the digital economy will continue to grow to over 2 million by the end of 2022.** While slightly slower than was forecasted in *Outlook 2023* (over 2.1 million by 2023), employment in the digital economy will grow at a significantly faster rate than the overall economy and many other sectors.

COVID-19 has important implications for all sectors of the economy, yet those with a strong digital base have shown to be more insulated from shocks associated with lockdowns and travel restrictions. ICTC's digitally-based six innovation areas are all expected to grow faster—both in terms of GDP and employment—than their non-digital counterparts.

Digital adoption in this landscape is quickly becoming mission critical for Canadian small businesses. Many are focusing on investment in critical digital infrastructure like cloud technology, fintech applications, eCommerce, intelligent supply chains, and automation. Such investments are becoming essential to operational resiliency and thriving in a post-COVID economy.

Digital talent will also be a key enabler of a resilient economic recovery post COVID-19. A focus on in-career digital upskilling, transitional employment pathways for displaced and underrepresented workers into digital occupations, and stronger youth engagement will allow Canada to assert itself on the global stage.

COVID-19 has caused ripples across the economy and impacted all businesses and activities. While no business has been completely spared, the pandemic has heightened the importance of digital technology, clarifying its role as the essential fabric of our future economy. A post-COVID future will be one where technology and digital adoption is viewed as essential. A successful and competitive post-COVID Canada will, by its very nature, be digital-first.

⁴ "Key Small Business Statistics – January 2019", Government of Canada, https://www.ic.gc.ca/eic/site/061.nsf/eng/h_03090.html

⁵ Giacomo Panico, "Some small businesses quitting while they're still ahead", *CBC News*, April 30, 2020, <https://www.cbc.ca/news/canada/ottawa/small-business-covid-19-1.5549539>

Introduction

ICTC's 2019 report, *Canada's Growth Currency: Digital Talent Outlook 2023*, analyzed the labour composition of the Canadian digital economy.⁶ It defined the components of the digital economy, along with those of six key innovation areas: cleantech, agri-foods and food tech, interactive digital media, advanced manufacturing, clean resources, and health and biotech. It identified in-demand roles across the economy and the innovation areas, and the corresponding skill needs. It also examined essential supply streams of digitally skilled talent in Canada. These streams included women, youth, newcomers, career transitioners, and people with disabilities. Finally, leveraging primary research from surveys and interviews completed with industry leaders across Canada, the report forecasted employment in Canada's digital economy and the six innovation areas until 2023.

By the end of March 2020, it became clear that all forecasts completed in 2019 were obsolete. A number of economic shocks hit Canada and the world in late 2019 and early 2020: Brexit, the Wet'suwet'en protests, the oil price crash, and other developments all had an impact on our national economy and employment. Paramount among these shocks was the novel coronavirus COVID-19 pandemic, which swept the globe and resulted in chaos to healthcare systems and economies worldwide. *The Digital New Normal: Revised Labour Market Outlook for 2022* recreates ICTC's previous forecast and analysis for the labour market and economy according to new post-COVID assumptions. While several components of the original paper remain valid, the unprecedented nature of COVID-19 necessitates updates to previous forecasts for the Canadian economy.

Section I describes some of the factors that have impacted the Canadian economy since the release of the previous report. In particular, Brexit, Wet'suwet'en protests, COVID-19, and the oil price crash are discussed.

Section II analyzes the impact of COVID-19 on the general Canadian economy and provides updated forecasts for GDP and employment.

Section III discusses the effects of COVID-19 on the digital economy. While the digital economy is certainly not immune from the shock of the pandemic, this section presents evidence that the digital economy will fare better than other sectors.

Section IV breaks down the six innovation areas highlighted in *Outlook 2023*, provides an update for each since 2019, and presents new employment forecasts that account for the pandemic.

⁶ Alexandra Cutean, et al. "Canada's Growth Currency: Digital Talent Outlook 2023", Information and Communications Technology Council, October 2019, <https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf>

A description of research and forecast methodologies used in this trend report, along with forecasts for other sectors of the economy, can be found in **Appendix I**.

In general, ICTC's forecasts are in line with those emerging from other global economic institutions. However, the current economic circumstances are the most unusual the world has seen since the end of the Second World War.⁷ In such circumstances, forecasts should be taken as educated estimates, and the combination of scenarios and confidence intervals in ICTC's figures underlines this.

Strange economic times can contain silver linings. As the digital economy seems relatively insulated from the worst impacts of COVID-19 shocks, the pandemic may ultimately accelerate Canada's digital journey. This transformation will contribute to rejuvenate Canada's economy and pave the way for a resilient post-COVID recovery.

⁷ Dave Gower, "A note on Canadian unemployment since 1921", *Perspectives on Labour and Income*, Autumn 1992 (Vol. 4, No. 3), Chart A, <https://www150.statcan.gc.ca/n1/en/pub/75-001-x/1992003/87-eng.pdf?st=OsEjRij0>

SECTION I

2019-2020 Global Economic Shocks



Early 2020 will be remembered by headline-grabbing developments across Canada and the globe. COVID-19 is also likely to continue destabilizing supply chains worldwide, while other significant global and national events pass comparatively unnoticed.

Since the release of *Outlook 2023*, a number of developments have affected Canada's economy. In addition to COVID-19, the Wet'suwet'en protests and blockades, Great Britain's exit from the European Union, and the crash of oil prices have adversely affected the economy.



The exit of the UK from the European Union has potential to disrupt business relationships between Canada and the EU, including in the digital economy. At present, the UK is Canada's fifth largest individual trade partner (after the US, the EU, China, and Mexico) and represents around 3.3% of Canada's total trade.⁹ Two-way merchandise trade between Canada and the UK was \$29.04 billion CAD in 2019.¹⁰ On the other hand, Canada is the UK's 18th-largest trade partner (9th largest outside of the EU), accounting for less than 1.5% of the UK's total trade.¹¹ Historically, the UK has been one of the largest export markets for Canadian technology goods as well as a base for Canadian technology service companies seeking access to the European market. There are more than 1,100 UK firms owned or controlled by Canadian interests, and there are more than 700 UK firms that have a presence in Canada.¹²

The UK officially exited from the EU on January 31, 2020. For the rest of the year, the UK will be in negotiations with the EU to determine the terms of an exit deal.¹³ During this time, the UK will not have a seat in European institutions like the European Parliament and the European Commission, but it will still be governed by EU regulations and be part of EU trade agreements such as Canada-EU CETA.

There are at least four key uncertainties affecting the impact of Brexit on the Canadian digital economy. These have to do with how the UK leaves the EU, what kind of deal is implemented with Canada, and whether the new deal is implemented before or after the UK's departure from the EU.

Firstly, when the UK will fully disengage from the EU and its associated treaties (such as CETA) is not known for certain. At present, the transition period is set to conclude on December 31, 2020. On June 16, 2020, British and EU governments declared they would not extend the transition period.¹⁴ Such an extension could have added one or two years. June 30, 2020, was the last date for revising this decision on extending the transition period.¹⁵ Barring an unforeseen change in the UK government's approach, the UK will be fully out of the EU by January 2021. An extension of the transition period, although unlikely at this point, would give Canadian digital economy industry leaders more time to prepare for the full impact of Brexit.

⁸ "Brexit" is a portmanteau of "Britain" and "Exit".

⁹ "Table 12-10-0011-01: International merchandise trade for all countries and by Principal Trading Partners, monthly (x 1,000,000)", Statistics Canada, June 23, 2020, <https://www150.statcan.gc.ca/t1/tb1/en/cv.action?pid=1210001101>

¹⁰ Ibid.

¹¹ "Trade in goods: all countries, seasonally adjusted", Office of National Statistics, June 12, 2020, <https://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/datasets/uktradeallcountriesseasonallyadjusted>

¹² "Canada and the United Kingdom Relations", Government of Canada, June 23, 2020, https://www.canadainternational.gc.ca/united_kingdom-royaume_uni/bilateral_relations_bilaterales/index.aspx?lang=eng

¹³ Asa Bennet, "How will the Brexit transition period work?", *The Telegraph*, January 31, 2020, <https://www.telegraph.co.uk/politics/2020/01/31/brexit-2020-transition-period-eu/>

¹⁴ Alice Tidley, "Brexit: UK and EU agree not to extend transition period beyond December 2020", *Euronews*, June 16, 2020, <https://www.euronews.com/2020/06/15/brexit-boris-johnson-and-ursula-von-der-leyen-to-hold-high-level-talks-next-week>

¹⁵ "Brexit and United Kingdom-European Union trade negotiations: Summary information for Canadian companies", Trade Commissioner Service, June 23, 2020, <https://www.tradecommissioner.gc.ca/united-kingdom-royaume-uni/information-brexit-renseignements.aspx?lang=eng>

Also to be finalized is how the UK leaves the EU. When the transition period ends, the UK could part with the EU in different ways. In a “hard” Brexit, the UK would no longer be subject to any EU regulations or laws and would be forced to trade with the EU according to terms set by the World Trade Organization (WTO). In practical terms, this would mean the end of all EU-related capacities and the return of tariffs on diverse products. Hard Brexit poses the most disruption to the economy of the UK and its trading partners, including Canada. Accordingly, the current British government is trying to negotiate a “softer” exit from the EU, which might see the UK retain membership in a customs union or a single market with the EU. As of June 6, 2020, negotiations between the two parties appeared to be at an impasse around fisheries, dispute settlements, and security.¹⁶

A third source of uncertainty is the nature of the deal the UK strikes with Canada following Brexit. Regardless of whether Brexit is hard or soft, the Canada-UK trade relationship will no longer be subject to CETA starting in 2021. Canada will thus need to negotiate a new bilateral trade agreement with the UK to avoid losing some of the tariff reductions negotiated under CETA.¹⁷ Possibilities include a separate trade deal between Canada and the UK, or a deal that essentially copies CETA with minor changes. A third option is for the UK to join the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), a Pacific-region trade agreement in which Canada is a signatory.¹⁸ On June 17, 2020, the British government published a policy paper in which it identified admission into the CPTPP as a “key part of [its] trade negotiations program.”¹⁹

The final variable is whether Canada can negotiate a new trade agreement with the UK before it exits the EU. If it is possible to pass a deal before the UK’s departure from the EU, there will be less disruption for the Canada-UK trade relationship than a sharp break. The timing of the new Canada-UK bilateral agreement depends on how fast the UK can conclude a soft Brexit deal with the EU, as well as the nature of the agreement. An agreement that is primarily based on CETA would likely be the fastest and most convenient option, seeing as it would be a reimplementation of the status quo. Allowing the UK to join the CPTPP would take more time, given the larger number of trade partners and the fact that the UK does not have a pre-existing relationship with the bloc. The longest and least convenient option would be a bespoke agreement between Canada and the UK, which would have to be negotiated and written from scratch. As several experts believe, negotiations regarding the UK’s entry into CPTPP would take at least until 2021.²¹ It would appear now that the only way to finalize a Canada-UK deal before Brexit is to go with a CETA-based option.

¹⁶ Joanna Gill, “Post-Brexit deadlock: Four areas threatening to scupper EU-UK deal on trade and future ties”, *Euronews*, June 6, 2020, <https://www.euronews.com/2020/06/05/watch-live-eu-s-brexit-chief-michel-barnier-gives-update-on-uk-negotiations>

¹⁷ Janyce McGregor, “New U.K. tariff list ramps up urgency of Canada-U.K. trade talks”, *CBC News*, May 19, 2020, <https://www.cbc.ca/news/politics/tuesday-canada-uk-trade-tariff-list-1.5575816>

¹⁸ Janyce McGregor, “U.K. wants to join Pacific trade pact as trade deal with Canada approaches its end”, *CBC News*, June 16, 2020, <https://www.cbc.ca/news/politics/cptpp-trade-united-kingdom-nafta-1.5614470>

¹⁹ “An update on the UK’s position on accession to the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)”, *Department for International Trade*, June 23, 2020,

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/892675/UK_position_on_joining_CPTPP.pdf

²⁰ Hayley Woodin, “UK Announces plans to join the CPTPP”, *Business in Vancouver*, June 16, 2020, <https://biv.com/article/2020/06/uk-announces-plans-join-cptpp>

²¹ “Brexit and United Kingdom-European Union trade negotiations: Summary Information for Canadian companies”, *Trade Commissioner Service*, June 23, 2020, <https://www.tradecommissioner.gc.ca/united-kingdom-royaume-uni/information-brexit-renseignements.aspx?lang=eng>

The rapidly approaching deadline for Brexit combined with the global upheaval due to COVID-19 makes it possible, if not likely, that Brexit will occur prior to the negotiation of a Canada-UK trade deal (irrespective of a hard or soft Brexit). In May 2020, the UK government published import tariff rates that will apply to its trade after the UK ceases to do business with the EU (for trade relationships not governed by a standing agreement). At this point, around half of all the UK's exports would remain tariff-free, while none of Canada's top 25 exports to the UK will face significant tariff increases.²²

Given all the uncertainties arising from numerous Brexit scenarios, as well as the potential of continuing COVID-19 supply chain disruption, it is very difficult to make a solid prediction about where the trade relationship in the digital economy between Canada and the UK is headed. To prepare, the federal government suggests that firms consider the possibility of there being no trade agreement and to take steps to mitigate risks by seeking advice from trade experts.²³ Several Canadian companies, particularly those in the tech services sector, have responded by opening "satellite" offices in European countries to maintain their European market access²⁴ and mitigate risks.

While there may be substantial uncertainty for some organizations involved heavily in the digital economy in the UK, the UK represents a small share of Canada's total trade. Canada's exports to the UK as of 2018 were dominated by raw materials and manufactured goods, not ICT.²⁵ Of Canada's service exports, under 10% are ICT services, most of which are destined for the US.²⁶ Although Brexit will affect the Canadian economy, it is unlikely that any Brexit scenario will result in substantial disruption of Canada's digital economy, which has experienced robust and sustained growth in recent years.



Wet'suwet'en Protests

Starting in January 2020, an ongoing dispute between energy pipeline company TC Energy (formerly TransCanada) and the Wet'suwet'en First Nation hereditary chiefs escalated into a national movement of protest.

TransCanada intends to build the Coastal GasLink LNG pipeline from the Dawson Creek area in northeastern BC to Kitimat on the coast. The pipeline is set to pass through 190 kilometres of the unceded traditional territory.²⁷ The project obtained approval from the BC government in 2014 and was approved by several elected band councils in 2018. However, it was not approved by the hereditary government of the Wet'suwet'en nation.²⁸ The hereditary chiefs have vociferously opposed the construction of pipeline projects in Wet'suwet'en territory, going so far as set up barricades and checkpoints along a key road starting in 2010.²⁹

²² Mike Blanchfield, "Trudeau says he's confident Brexit will cause minimal disruption to Canadian economy", *Global News*, January 31, 2020, <https://globalnews.ca/news/6489011/trudeau-brexit-canadian-economy/>

²³ "Brexit and United Kingdom-European Union trade negotiations" Trade Commissioner Service, June 23, 2020, <https://www.tradecommissioner.gc.ca/united-kingdom-royaume-uni/information-brexit-renseignements.aspx?lang=eng>

²⁴ Mike Blanchfield, "Trudeau says he's confident Brexit will cause minimal disruption to Canadian economy", *Global News*, January 31, 2020, <https://globalnews.ca/news/6489011/trudeau-brexit-canadian-economy/>

²⁵ Christian Sivière, "Canada's Merchandise Exports to the UK", *The British Canadian Chamber of Trade and Commerce*, August 9, 2019, <https://www.britishcanadianchamber.com/post/canada-s-merchandise-exports-to-the-uk>

²⁶ "Canada's international trade in services, 2018." Statistics Canada, October 23, 2019, <https://www150.statcan.gc.ca/n1/daily-quotidien/191023/dq191023b-eng.htm>

²⁷ Brett Forester, "The Delgamuukw decision: When the 'invisible people' won recognition", *APTN News*, March 10, 2020, <https://aptnnews.ca/2020/03/10/the-delgamuukw-decision-when-the-invisible-people-won-recognition/>

²⁸ Brett Forester, "Wet'suwet'en sub-chief who supports Coastal GasLink says supporters, elected chiefs aren't being heard", *APTN News*, March 10, 2020, <https://aptnnews.ca/2020/03/10/wetsuweten-sub-chief-who-supports-coastal-gaslink-says-supporters-elected-chiefs-arent-being-heard/>

²⁹ Emma McIntosh, "RCMP breach final Wet'suwet'en camp in the path of Coastal GasLink pipeline", *Canada's National Observer*, February 10, 2020, <https://www.nationalobserver.com/2020/02/10/news/rcmp-breach-final-wetsuweten-camp-path-coastal-gaslink-pipeline>

In 2018, an injunction was granted to allow TransCanada to complete pre-construction work. In 2019, several land defenders were arrested, and barricades were taken down, but there were otherwise few impediments to the completion of pre-construction work. In December of 2019, a Supreme Court ruling let the injunction be extended to allow the completion of construction and permitted RCMP involvement.³⁰

On January 1, 2020, the hereditary chiefs rejected the injunction and ordered the eviction of RCMP and Coastal GasLink personnel from Wet'suwet'en territory. Near the end of January, the RCMP announced they would stand down to allow for talks between relevant parties. By February 4, however, talks had broken down.³¹ On February 6, 2020, the RCMP began removing blockages and arresting land defenders.³²

An immediate outcry among many Canadians transformed a previously marginal story into a nationwide protest movement. Protesters across Canada began blocking railway traffic in solidarity with the Wet'suwet'en hereditary chiefs, and CN Rail and Via Rail were both forced to shut down their operations in Eastern Canada and lay off workers. By the end of February, most blockades and protests had ended, rail service had mostly returned to normal, and Coastal GasLink construction work had resumed. The BC Prosecution Service and Coastal GasLink issued statements in June stating that criminal charges would not be pursued against 22 protesters arrested on Wet'suwet'en territory in February.³³ At present, Coastal GasLink has returned to work and around half of the pipe needed for the pipeline is ready for installation.³⁴

The protests led to slowdown of the Canadian economy, largely because of the accompanying rail blockades. On February 19, 2020, Canadian Manufacturers and Exporters estimated that \$425 million CAD in goods were stranded during each day of the shutdown.³⁵ In January and February 2020, more than 1,070 trips and roughly 165,000 passengers had been disrupted, according to Via Rail.³⁶ CN and Via Rail temporarily laid off a combined 1,450 workers,³⁷ and several other sectors—particularly agriculture, forestry, manufacturing, and mining—were affected. The Parliamentary Budget Office estimated that the blockades reduced Canadian GDP growth by 0.2% in the first quarter, and 0.01% for the entire year.³⁸



COVID-19

Owing to its threat to human life and its potential to severely disrupt supply chains and capital flows in both the short and long term, the onset of COVID-19 has created ripples across the worldwide economy. The character of the outbreak has evolved rapidly in the last few months. Around the beginning of February when relatively few cases were found outside of China, there was a global sense of optimism that a worldwide pandemic could be avoided.

³⁰ "Coastal GasLink lands win against protesters in B.C. Supreme Court", JWN Energy, January 2, 2020,

<https://www.jwnenergy.com/article/2020/1/coastal-gaslink-lands-win-against-protesters-bc-supreme-court/>

³¹ Chantelle Bellrichard, "Talks break down between province, Wet'suwet'en hereditary chiefs over Coastal GasLink pipeline standoff", CBC News, February 5, 2020, <https://www.cbc.ca/news/indigenous/coastal-gaslink-pipeline-wet-suwet-en-province-injunction-rcmp-1.5452355>

³² Amber Bracken and Leyland Cecco, "Canada: protests go mainstream as support for Wet'suwet'en pipeline fight widens", The Guardian, February 14, 2020, <https://www.theguardian.com/world/2020/feb/14/wetsuweten-coastal-gaslink-pipeline-allies>

³³ "Crown, company drop all charges against 22 Coastal GasLink pipeline opponents in B.C.", The Globe and Mail, June 5, 2020, <https://www.theglobeandmail.com/canada/british-columbia/article-crown-company-drop-all-charges-against-22-coastal-gaslink-pipeline/>

³⁴ Betsy Trumpener, "Coastal GasLink ramps up pipeline work, 4 months after Wet'suwet'en land conflict sparked rail blockades", CBC News, June 16, 2020, <https://www.cbc.ca/news/canada/british-columbia/coastal-gaslink-pipeline-ramps-up-after-land-conflict-1.5614446>

³⁵ Rachael D'Amore, "CN Rail layoffs will 'further complicate' tangled supply chain, industries say", Global News, February 19, 2020, <https://globalnews.ca/news/6568323/cn-rail-layoffs-supply-chain-industries/>

³⁶ "Via Rail service resumes on most routes following weeks of disruption", CBC News, March 7, 2020, <https://www.cbc.ca/news/canada/toronto/via-rail-service-resumes-disruption-rail-blockades-1.5489952>

³⁷ "Via Rail to temporarily lay off 1,000 workers amid rail blockades", Global News, February 19, 2020,

<https://globalnews.ca/news/6569418/via-rail-layoffs-service-ontario-quebec/>

³⁸ "Wet'suwet'en solidarity blockades had minimal impact on Canadian economy: PBO", Global News, March 13, 2020, <https://globalnews.ca/news/6672762/wetsuweten-solidarity-blockades-had-minimal-impact-on-canadian-economy-pbo/>

By mid-March, the World Health Organization (WHO) officially declared COVID-19 a global pandemic,³⁹ and many stock indices had plummeted by a third or more as investors recognized the scale of the potential economic damage.⁴⁰ As of mid-June, the number of new cases in China and many Western countries appears to have stabilized and a sense of optimism has returned alongside rising stock markets. However, there are still nearly 4 million known active cases of COVID-19, nearly 500,000 deaths across 160 countries. The question remains whether a second wave will return in the fall alongside the regular flu season.⁴¹ Canada remains in the “middle of the pack” in terms of its success in keeping the virus contained. Currently, with fewer than 30,000 active cases and falling, Canadians are in a much stronger position (including on a per capita basis) than the USA, which has more than 1.5 million cases and rising.

By the time COVID-19 was declared a global pandemic, China had already enacted a range of emergency measures which, while apparently effective for China, are not realistic in most liberal democracies.⁴² For example, in the middle of February, nearly half of the country’s population were living under travel restrictions.⁴³ Despite these measures, the Chinese economy was not spared an economic downturn. According to China’s National Bureau of Statistics, the country’s annualized year-over-year first quarter GDP was down 6.8%.⁴⁴ Business travel and production of tech goods have also fallen, particularly in the Hubei Province, where the virus originated.^{45,46}

The virus has contributed to a widespread sense of economic uncertainty, visible in global and Canadian financial markets. As of late June, global financial markets remain volatile after a series of drops and rallies. The Chicago Board Options Exchange Index of US stock volatility (VIX) remains at its highest pre-COVID levels since 2011.⁴⁷ In April, the IMF predicted that the response to the virus would likely throw the world into the deepest recession since the Great Depression. The Fund predicts that global GDP is expected to shrink by 4.9% in 2020—a further decrease of 1.9% from its previous forecast in April of a 3% contraction.^{48,49} Its forecast for Canadian GDP growth in 2020 has also been revised downwards—from -6.2% in April to -8.4% in June.^{51,52}

Table 1 compiles the latest GDP growth forecasts for Canada from various sources including Canadian banks and international organizations. ICTC’s own forecasts are also included for comparison. The wide range of forecasts illustrates the unprecedented level of uncertainty that economies the world over currently face. This uncertainty is further highlighted by the substantial revisions to economic outlooks that have been made by forecasters. Apart from the IMF’s revisions between April and June, we have also seen Canadian organizations make sizable downward revisions to their forecasts over the last few months.

³⁹ “WHO Timeline - COVID-19”, World Health Organization, April 27, 2020, <https://www.who.int/news-room/detail/27-04-2020-who-timeline---covid-19>
⁴⁰ “Global stocks fall again despite virus rescue efforts”, BBC News, March 23, 2020, <https://www.bbc.com/news/business-52000309>
⁴¹ “COVID-19 Coronavirus Pandemic”, Worldometer, June 23, 2020, <https://www.worldometers.info/coronavirus/>
⁴² Kai Kupferschmidt and Jon Cohen, “China’s aggressive measures have slowed the coronavirus. They may not work in other countries”, *Science*, March 2, 2020, <https://www.sciencemag.org/news/2020/03/china-s-aggressive-measures-have-slowed-coronavirus-they-may-not-work-other-countries>
⁴³ James Griffiths and Amy Woodyatt, “780 million people in China are living under travel restrictions due to the coronavirus outbreak”, CNN, February 17, 2020, <https://edition.cnn.com/2020/02/16/asia/coronavirus-covid-19-death-toll-update-intl-hnk/index.html>
⁴⁴ William Pesek, “China’s GDP Plunge Is A Message That This Is Not A Drill”, April 17, 2020, <https://www.forbes.com/sites/williampesek/2020/04/17/chinas-gdp-plunge-is-a-message-that-this-is-not-a-drill/#643111432311>
⁴⁵ “The new coronavirus could have a lasting impact on global supply chains”, *The Economist*, February 15, 2020, <https://www.economist.com/international/2020/02/15/the-new-coronavirus-could-have-a-lasting-impact-on-global-supply-chains>
⁴⁶ Tom Li, “Coronavirus ‘decimated’ device manufacturing in February, says IDC”, *IT World Canada*, February 28, 2020, <https://www.itworldcanada.com/article/coronavirus-decimated-device-manufacturing-in-february-says-idc/427884>
⁴⁷ “VIX® Index Charts and Data”, Cboe Global Markets, June 23, 2020, <http://www.cboe.com/vix>
⁴⁸ “World Economic Outlook Update, June 2020: A Crisis Like No Other, An Uncertain Recovery”, International Monetary Fund, June 24, 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020>
⁴⁹ “World Economic Outlook, April 2020: The Great Lockdown”, International Monetary Fund, April 14, 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020>
⁵⁰ Nicole Gibillini, “IMF sees 6.2% drop in Canada’s 2020 GDP amid ‘Great Lockdown’”, *BNN Bloomberg*, April 14, 2020, <https://www.bnnbloomberg.ca/imf-sees-6-2-drop-in-canada-s-2020-gdp-amid-great-lockdown-1.1421246>
⁵¹ “World Economic Outlook Update, June 2020: A Crisis Like No Other, An Uncertain Recovery”, International Monetary Fund, June 24, 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020>
⁵² “Monetary Policy Report: April 2020”, Bank of Canada, April 15, 2020, <https://www.bankofcanada.ca/wp-content/uploads/2020/04/mpr-2020-04-15.pdf>

In a striking example, between March 27 and April 30, the Office of the Parliamentary Budget Officer revised its 2020 GDP growth estimate from -5.1% to -12%. The Bank of Canada also departed from convention in its Monetary Policy Report for April by not publishing its usual forecast for the Canadian economy.⁵² The report instead outlines a wide range of possible economic outcomes with Governor Poloz remarking that “it would be false precision to offer [the] usual specific forecast.”⁵³

Table 1: Canadian GDP Forecasts

Organization	Forecast Date	Canada GDP Growth Forecast (%)		
		2020	2021	2022
IMF⁵⁴	24-Jun-20	-8.4	4.9	-
RBC⁵⁵	10-Jun-20	-6.5	4.2	-
TD⁵⁶	18-Jun-20	-6.1	5.2	2.0
PARLIAMENTARY BUDGET OFFICE⁵⁷	27-Mar-20	-5.1	-	-
PARLIAMENTARY BUDGET OFFICE⁵⁸	30-Apr-20	-12.0	-	-
CONFERENCE BOARD OF CANADA⁵⁹	22-Jun-20	-8.2	6.7	4.8
OECD – SINGLE-HIT SCENARIO⁶⁰	10-Jun-20	-8.0	3.9	-
OECD – DOUBLE-HIT SCENARIO⁶¹	10-Jun-20	-9.8	1.5	-
ICTC OPTIMISTIC SCENARIO	13-Jul-20	-8.7	5.5	2.8
ICTC BASELINE SCENARIO⁶²	13-Jul-20	-9.6	5.2	3.1
ICTC PESSIMISTIC SCENARIO	13-Jul-20	-10.7	4.4	4.0

⁵³ Stephen S. Poloz, “Monetary Policy Report Press Conference Opening Statement”, Bank of Canada, April 15, 2020, <https://www.bankofcanada.ca/2020/04/opening-statement-150420/>

⁵⁴ “World Economic Outlook Update, June 2020: A Crisis Like No Other, An Uncertain Recovery”, International Monetary Fund, June 24, 2020, <https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOupdateJune2020>

⁵⁵ “Charting a course for recovery”, RBC Economics, June 10, 2020, <https://royal-bank-of-canada-2124.docs.contently.com/v/charting-a-course-for-recovery-report>

⁵⁶ “Canadian Quarterly Economic Forecast”, TD Economics, June 17, 2020, <https://economics.td.com/ca-quarterly-economic-forecast>

⁵⁷ “Scenario Analysis: COVID-19 Pandemic and Oil Price Shocks”, Office of the Parliamentary Budget Officer, March 27, 2020, https://www.pbo-dpb.gc.ca/web/default/files/Documents/Reports/RP-1920-033-S/RP-1920-033-S_en.pdf

⁵⁸ “Scenario Analysis Update: COVID-19 Pandemic and Oil Price Shocks”, Office of the Parliamentary Budget Officer, April 30, 2020, https://www.pbo-dpb.gc.ca/web/default/files/Documents/Reports/RP-2021-005-S/RP-2021-005-S_en.pdf

⁵⁹ “Canadian Outlook Economic Forecast: Summer 2020”, The Conference Board of Canada, June 22, 2020, <https://www.conferenceboard.ca/topics/economics/canadian/can-otlk>

⁶⁰ “OECD Economic Outlook, Volume 2020 Issue 1: Preliminary version”, Organisation for Economic Cooperation and Development, June 10, 2020, https://www.oecd-ilibrary.org/economics/oecd-economic-outlook/volume-2020/issue-1_0d1d1e2e-en

⁶¹ Ibid.

⁶² See Figure 8 and Figure 9 for all three forecast scenarios.



Oil Price Collapse

The second major shock buffeting the Canadian economy and compounding the economic effects of the COVID-19 pandemic is the collapse in global crude oil prices. Commodity prices, especially for energy commodities and base metals,⁶³ declined significantly in early March because of the sharp drop in demand as the COVID-19 pandemic spread across the globe and lockdowns were enforced in most economies. The oil price decline was further exacerbated by a supply glut, as major oil producing nations were unable to come to an agreement on production cuts at the 8th OPEC and non-OPEC Ministerial Meeting in March.⁶⁴ While an agreement has since been reached among oil producing nations to cut production by a combined 9.7 million barrels per day (bpd),⁶⁵ oil prices remain depressed due to the significant demand destruction caused by global lockdowns, widespread uncertainty regarding the duration and full economic impact of COVID-19, and muted growth prospects for the short to medium term. In April, the average price of Western Canada Select (WCS)—one of the main benchmarks for Canada's oil producers—was 90% lower than its level in January and almost 94% lower than its level at the same time last year.⁶⁶

The WCS price has since rallied a bit but remains at a level that makes extraction and transportation uneconomical for many Canadian producers. In a survey conducted by the Bank of Canada in March,⁶⁷ many firms reported facing serious financing and liquidity constraints. Sustained low prices since have forced a spate of cost-cutting measures, layoffs, and production shut-ins.⁶⁸ This has been coupled with massive cuts to planned investments and capital expenditures.⁶⁹ The latest data shows that capital expenditure spending in the Canadian oil sector for the first quarter of 2020 decreased by over 6% from its level in Q1 2019,⁷⁰ and the drop is expected to be worse in Q2.

The economic impact has, understandably, been most severe in the energy-sector-reliant economies of Alberta, Newfoundland and Labrador, and Saskatchewan. Employment in these provinces, hit by the double whammy of COVID-19 lockdowns and the oil price crash, dropped by 15.5%, 15.7%, and 12.7% respectively between February and April.⁷¹ The budgets for these provinces, all working on similar assumptions of (WTI) oil prices being around US\$60 per barrel (almost double the current level), have come under severe strain. Newfoundland and Labrador, the province with the highest debt to GDP ratio, further strained by a devastating snowstorm earlier in the year, was unable to raise funds in capital markets in March, as there were no buyers for its short- or long-term bonds.⁷²

⁶³ "Monetary Policy Report: April 2020", Bank of Canada, April 15, 2020, Chart 4, <https://www.bankofcanada.ca/wp-content/uploads/2020/04/mpr-2020-04-15.pdf>

⁶⁴ Rania El Gamal, Alex Lawler, and Olesya Astakhova, "OPEC's pact with Russia falls apart, sending oil into tailspin", Reuters, March 6, 2020, <https://www.reuters.com/article/us-opec-meeting/opecs-pact-with-russia-falls-apart-sending-oil-into-tailspin-idUSKBN20T0Y2>

⁶⁵ "The 10th (Extraordinary) OPEC and non-OPEC Ministerial Meeting concludes", Organization of the Petroleum Exporting Countries, April 12, 2020, https://www.opec.org/opec_web/en/press_room/5891.htm

⁶⁶ "Oil Prices", Government of Alberta - Economic Dashboard, May 22, 2020, <https://economicdashboard.alberta.ca/OilPrice>

⁶⁷ "Business Outlook Survey—Spring 2020", Bank of Canada, April 6, 2020, Box 2, <https://www.bankofcanada.ca/2020/04/business-outlook-survey-spring-2020/#box2>

⁶⁸ Kyle Bakx, "It's going to be very difficult and very painful": Oilpatch begins layoffs and oil production cuts", CBC News, April 1, 2020, <https://www.cbc.ca/news/business/bonterra-mullen-wcs-wti-1.5516400>

⁶⁹ Geoffrey Morgan, "Executive salaries, dividends on chopping block as \$10 billion in cuts still not enough for oilpatch to survive", Financial Post, May 15, 2020, <https://business.financialpost.com/commodities/energy/executive-salaries-dividends-on-chopping-block-as-10-billion-in-cuts-still-not-enough-for-oilpatch-to-survive>

⁷⁰ "Table 25-10-0054-01: Capital expenditures, oil and gas extraction industries, Canada (x 1,000,000)", Statistics Canada, June 1, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510005401>

⁷¹ "Table 14-10-0287-03: Labour force characteristics by province, monthly, seasonally adjusted", Statistics Canada, June 1, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410028703>

⁷² David Cochrane and Rob Antle, "Out of time: How a pandemic and an oil crash almost sank Newfoundland and Labrador", CBC News, April 1, 2020, <https://www.cbc.ca/news/politics/newfoundland-labrador-oil-pandemic-covid-coronavirus-dwight-ball-1.5516620>

It was nearly at the point of being unable to pay its public workers before receiving relief from Ottawa in the form of asset purchase programs^{73,74} announced by the Bank of Canada to backstop short- and long-term debt for all provinces. The energy sector in Alberta, Saskatchewan, and BC has been further boosted by the announcement of a \$1.7 billion federal investment program to clean up abandoned oil and gas wells in the western provinces.⁷⁵

While oil prices are expected to recover as global lockdowns ease and economic activity resumes, the recovery will likely be gradual, despite production cuts agreed upon by OPEC+ nations and cost-based supply reduction from other producers. Global demand for air travel and ground travel is likely to remain subdued even once lockdowns are lifted until a vaccine or other successful therapeutic treatment for COVID-19 is widely available.⁷⁶ Given the inevitable recession facing the global economy this year, industrial and business activity will also likely be depressed in the near term. These demand-side headwinds coupled with the current high levels of inventories point to a slow recovery in oil prices,⁷⁷ which could be further derailed if there were to be a prolonged second wave of COVID-19 infections and further lockdowns.

⁷³ "Bank of Canada Announces New Program to Support Provincial Funding Markets", Bank of Canada, March 24, 2020, <https://www.bankofcanada.ca/2020/03/bank-canada-announces-new-program-support-provincial-funding-markets/>

⁷⁴ "Bank of Canada to Introduce a Provincial Bond Purchase Program", Bank of Canada, April 15, 2020, <https://www.bankofcanada.ca/2020/04/bank-canada-introduce-provincial-bond-purchase-program/>

⁷⁵ Drew Anderson, "\$1.7B to clean up orphaned and abandoned wells could create thousands of jobs", CBC News, April 17, 2020, <https://www.cbc.ca/news/canada/calgary/federal-oil-and-gas-orphan-wells-program-1.5535943>

⁷⁶ "Global Energy Review 2020", International Energy Agency, April 2020, <https://www.iea.org/reports/global-energy-review-2020/oil#abstract>

⁷⁷ "Oil Market Report - April 2020", International Energy Agency, April 2020, <https://www.iea.org/reports/oil-market-report-april-2020>

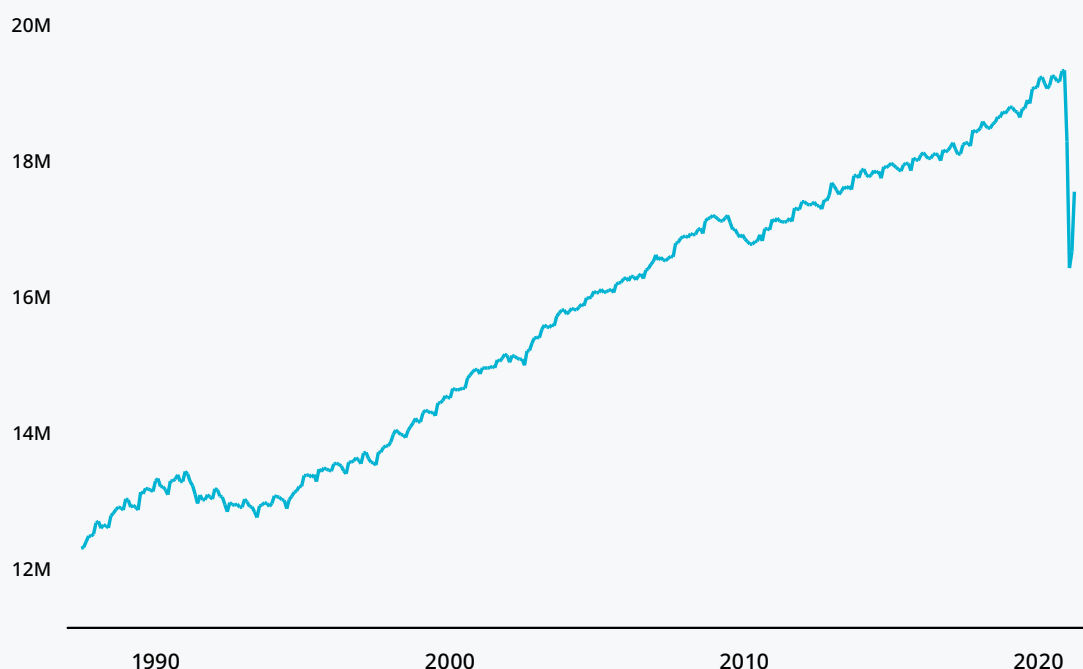
SECTION II

The Impact of COVID-19 on the General Canadian Economy



The global spread of COVID-19—or more precisely, the resulting stay-at-home orders and lockdowns—is believed to have caused the largest shock to the Canadian economy since the end of the Second World War. The situation is evolving rapidly, and each month reveals new and unexpected economic impacts. In March, employment in Canada fell by over 1 million, or about 5% of the workforce (Figure 1). The following month, in April, employment continued to drop, falling by a further 2 million, bringing total job losses to 15%.⁷⁸ In May and June, seasonally adjusted employment grew by about 1,140,000, which reduced the total job loss since February to 9.4%. As of mid-June, the Canada Emergency Response Benefit received over 8 million unique applications in Canada.^{79,80}

Figure 1: Canadian Employment



Source: Statistics Canada LFS data

Proportionally and in absolute terms, both March and April saw the largest one-month drop in employment since Statistics Canada’s modern version of the Labour Force Survey began in 1976⁸¹—and likely since the Great Depression. The May increase of 600,000 is the largest single-month increase in decades, but **Figure 1** shows that the magnitude of the recovery still pales in comparison to the drops in March and April. **Figure 2** shows that Canada’s employment rate (employment as a percentage of total population) plunged from about 51% in February to 43% in May, a level not seen even during the period of austerity measures in the 1990s. In June, it recovered to roughly 46%.

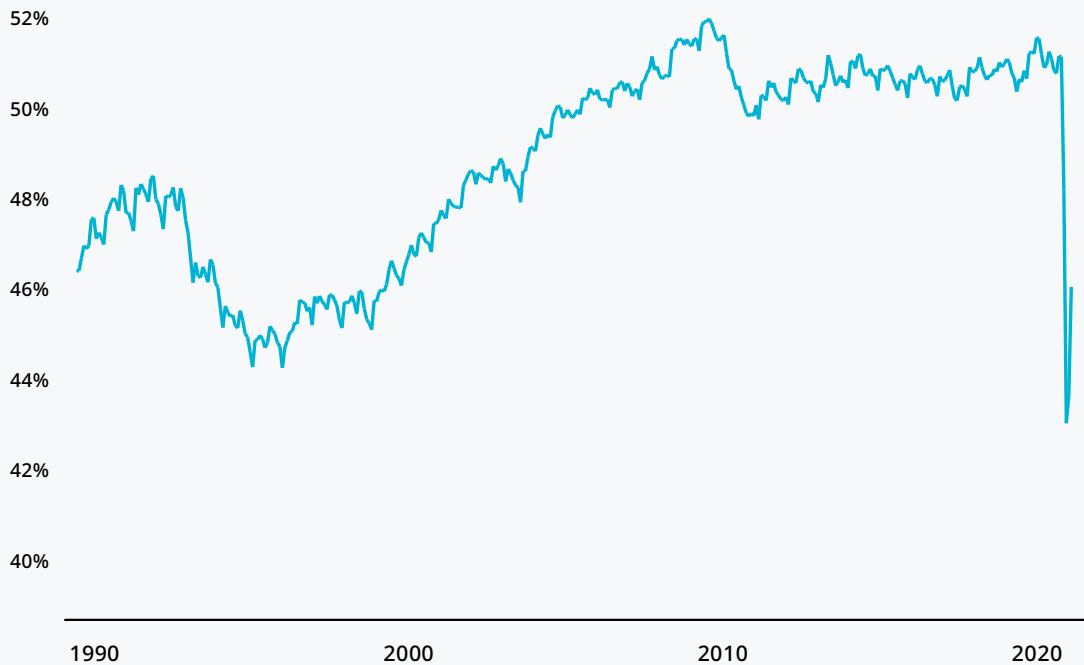
⁷⁸ These figures may underestimate the true impact, as many have had hours reduced, but remain employed.

⁷⁹ Jamie Golombek, “The third phase of CERB is about to start: Here’s what you need to know”, *Financial Post*, May 8, 2020, <https://business.financialpost.com/personal-finance/taxes/the-third-phase-of-cerb-is-about-to-start-heres-what-you-need-to-know>

⁸⁰ Tom Blackwell, “Do not impose a stop pay: Federal workers ordered to ignore cheating in CERB and EI claims”, *National Post*, May 12, 2020,

⁸¹ <https://nationalpost.com/news/do-not-impose-a-stop-pay-federal-workers-ordered-to-ignore-cheating-in-cerb-and-ei-claims>
 Table 14-10-0022-01: Labour force characteristics by industry, monthly, unadjusted for seasonality (x 1,000), Statistics Canada, June 1, 2020, <https://www150.statcan.gc.ca/t1/tb11/en/cv.action?pid=1410002201>

Figure 2: Canadian Employment Rate



Source: Statistics Canada LFS data

Cumulative employment losses over the months of March, April, May, and June were especially concentrated among workers in retail occupations and food services (in March, many provinces mandated the closure of non-essential businesses, including retail,⁸² bars,⁸³ while restaurants were permitted to stay open but only for takeout or delivery).⁸⁴ Although timelines varied by province, in March, daycares^{85,86} and primary schools across the country shut down,^{87,88} and in April, many provinces mandated the closure of gyms and recreational facilities,^{89,90} with some provinces closing provincial parks.⁹¹ These moves had direct impacts on employment of early childcare educators and assistants (seeing a drop of 75 thousand jobs) as well as instructors in recreation, sport and fitness (seeing a drop of 51 thousand during the period).

⁸² "Government Orders Closing Businesses – Province by Province", Fasken, April 1, 2020,

<https://www.fasken.com/en/knowledge/2020/04/1-covid-19-government-orders-closing-businesses/>

⁸³ Richard Zussman, "B.C. nightclubs and bars ordered closed amid coronavirus", Global News, March 17, 2020,

<https://globalnews.ca/news/6692499/health-officials-restaurants-close-coronavirus/>

⁸⁴ Claire Loewen, "Quebec restaurants facing uncertain future due to COVID-19", CBC News, April 3, 2020, restrictions

<https://www.cbc.ca/news/canada/montreal/quebec-restaurants-uncertain-future-covid-19-1.5519948>

⁸⁵ Julie Ireton, "Some daycares closing, some staying open", CBC News, March 13, 2020,

<https://www.cbc.ca/news/canada/ottawa/day-care-closures-response-covid-19-1.5497255>

⁸⁶ Lisa Johnson, "COVID-19: Alberta cancels all school classes, closes licensed daycares", Edmonton Journal, March 16, 2020,

<https://edmontonjournal.com/news/local-news/covid-19-alberta-closes-all-schools-daycares/>

⁸⁷ Sean Davidson, "Ontario's largest school board planning for 'extended closure' amid COVID-19 pandemic", CTV News, March 26,

<https://toronto.ctvnews.ca/ontario-s-largest-school-board-planning-for-extended-closure-amid-covid-19-pandemic-1.4869171>

⁸⁸ "Alberta cancels K-12 classes, closes child-care centres due to COVID-19 pandemic", CBC News, March 15, 2020,

<https://www.cbc.ca/news/canada/edmonton/covid-coronavirus-update-hinshaw-alberta-edmonton-1.5498467>

⁸⁹ Ross McLaughlin "Fraser Health orders all gyms and fitness centres to close", CTV News, April 15, 2020,

<https://bc.ctvnews.ca/fraser-health-orders-all-gyms-and-fitness-centres-to-close-1.4870426>

⁹⁰ Jacquelyn LeBel, "St. Thomas gym ordered closed after ignoring provincial order", Global News, April 1, 2020,

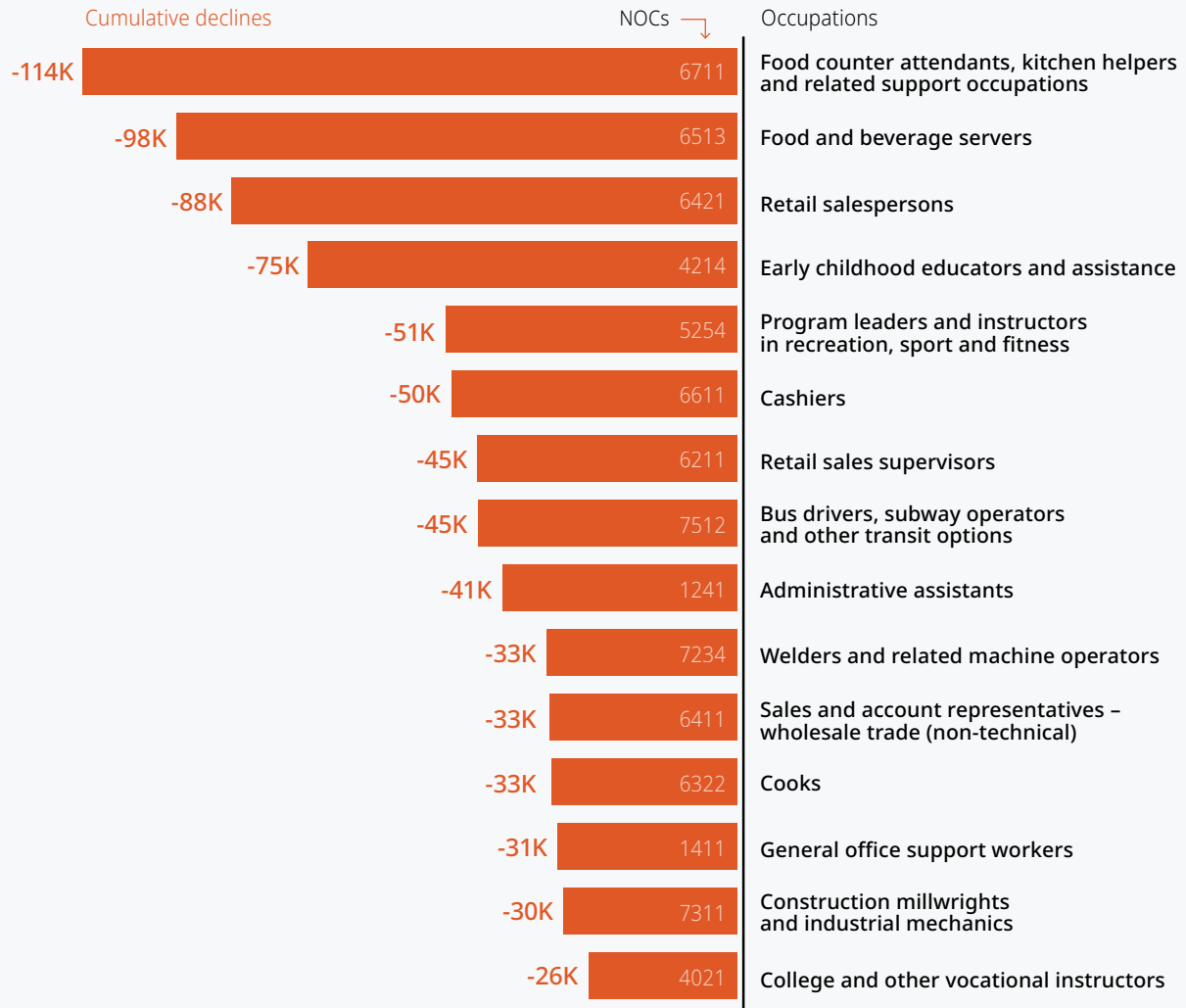
<https://globalnews.ca/news/6761810/st-thomas-gym-ordered-to-close-coronavirus/>

⁹¹ "B.C. government orders closure of all provincial parks due to COVID-19", CTV News, April 8, 2020,

<https://vancouverisland.ctvnews.ca/b-c-government-orders-closure-of-all-provincial-parks-due-to-covid-19-1.4888119>

Figure 3 shows the occupation groupings that saw employment drops of at least 25 thousand jobs since February.

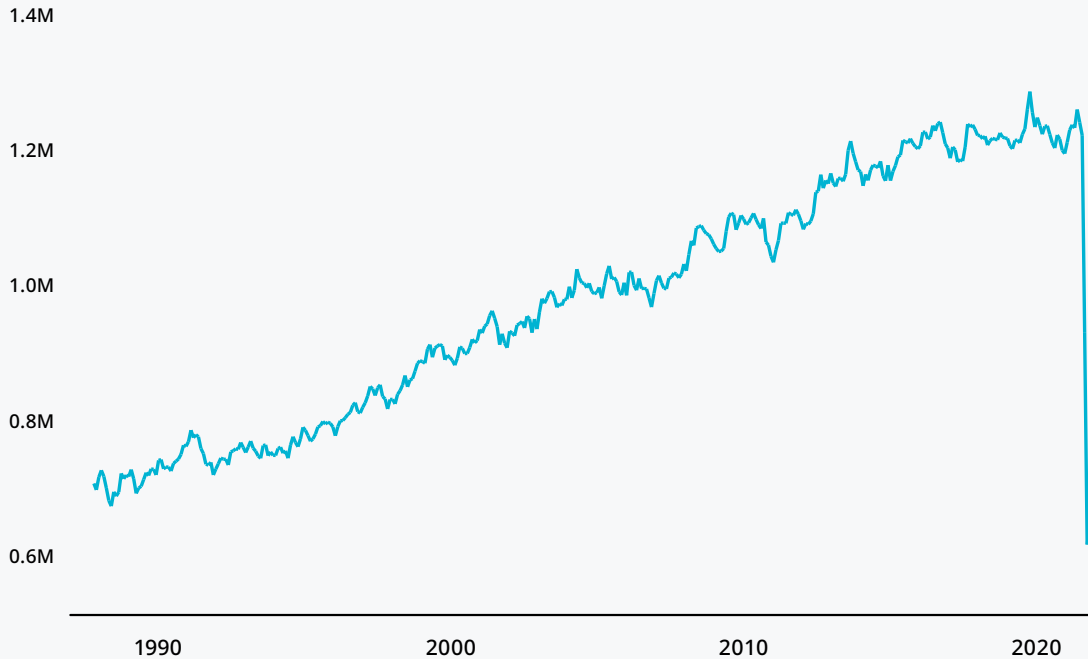
Figure 3: Canadian Employment Change by Occupation, Cumulative Declines through March, April, and May



Source: Statistics Canada LFS data Note: Movements of at least 25 thousand

Figure 4 shows the drops in the most-affected sector—accommodation and food services. In this sector, employment fell by nearly a third since February.

Figure 4: Employment in Food and Accommodation Sector



Source: Canada Labour Force Survey

Figure 5 shows employment in February, March, April, May, and June 2020 for all Canadian workers. Workers are split into three groups according to weekly wage⁹²: the lowest earners, average earners, and highest earners. The figures are then split again by gender. Figure 5 reveals that since February, including the modest recovery in May and June, employment of males in occupations falling under the lowest average weekly earnings have dropped by 8.1%, while the employment of females in occupations that fall under the lowest wage category have dropped 15.7%. In contrast, only 1.7% of the highest-earning third of males have lost their jobs, and the highest-earning third of females actually grew by 0.2%. COVID-19-caused layoffs and job losses are disproportionately affecting the lowest-income segment (and therefore most financially vulnerable portion) of the workforce.

⁹² Weekly wage determined according to average rates prior to the onset of COVID-19.

Figure 5: Employment Level by Month and Wage Percentiles



Source: ICTC

Updated Forecasts and Statistics

Given the economic shocks brought on by COVID-19 and other key developments in early 2020, ICTC has revised previous employment and GDP forecasts in Canada; these new forecasts extend to the fourth quarter of 2022.

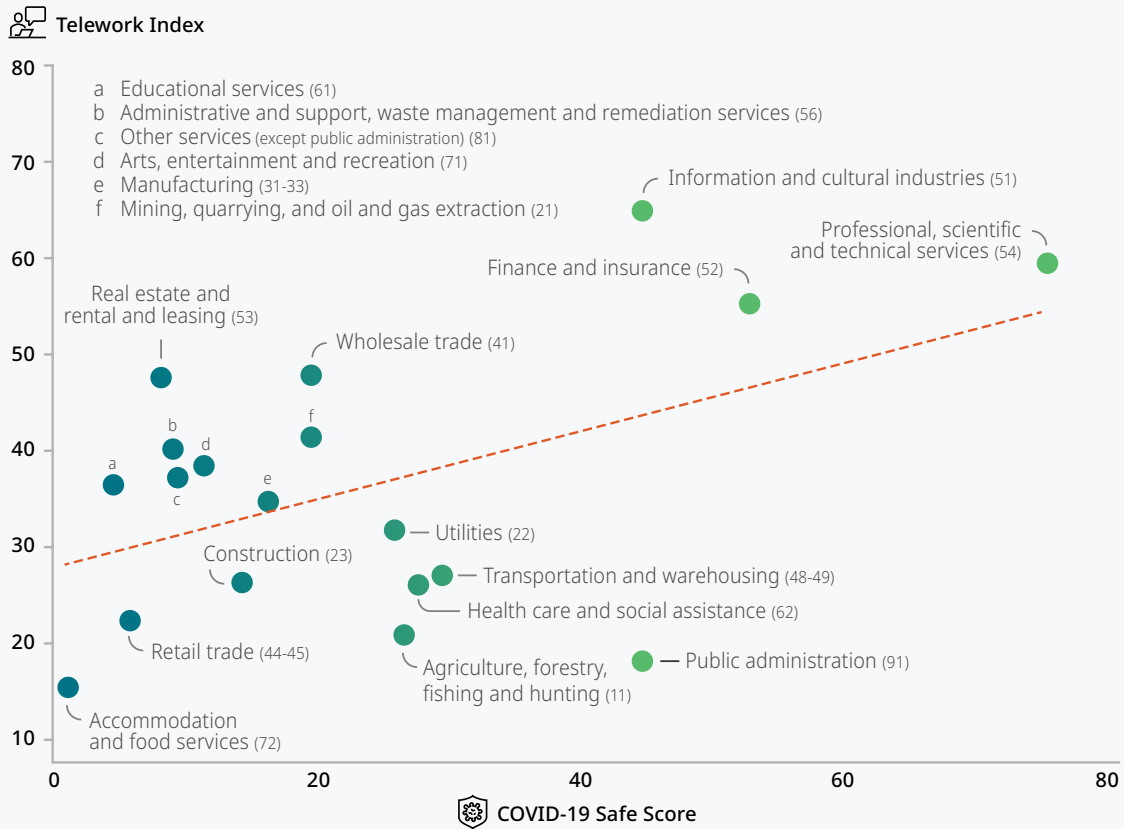
Appendix II provides a detailed description of the econometric methods used to arrive at the revised forecasts, but a short description is offered here. Using O*NET data that breaks down occupations by required skills, tasks, and aptitudes, ICTC created a *COVID-Safe Score* for all 500 national occupation codes (NOCs), and subsequently for each sector based on its respective occupational composition. The *COVID-Safe Score* captures the extent to which an occupation can either be performed remotely (with the use of digital infrastructure and tools) or is an essential service and, therefore, is relatively “safe” from the immediate economic effects of COVID-19. The *COVID-Safe Score* uses information available during the first few months of COVID-19 global lockdowns and, therefore, may change as impacts become more visible (or are altered) throughout the course of the pandemic. ICTC will be monitoring these changes on a monthly basis and adjusting the methodology as needed. **Figure 6** shows the correlation of ICTC’s *COVID-Safe Score* with an index of teleworking^{93,94} in each industry code.⁹⁵ The correlation between these two is strong, suggesting that the two variables are related or picking up the same underlying characteristic. According to ICTC’s *COVID-Safe Score*, workers in sectors like professional services—which often includes a strong representation from the ICT workforce—and finance are more likely to be insulated (or be “safe”) from COVID-19 economic impacts. Those in sectors including retail, food and accommodation, manufacturing, and agriculture are highly impacted.

⁹³ “Table 33-10-0228-01: Percentage of workforce teleworking or working remotely, and percentage of workforce able to carry out a majority of duties during the COVID-19 pandemic, by business characteristics”, Statistics Canada, May 29, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3310022801>

⁹⁴ Teleworking index calculated as 1 minus the percentage of employers that had under 1% of workforce teleworking as of Feb 2020.

⁹⁵ Using 2-digit NAICS.

Figure 6: Index of Teleworking vs COVID-Safe Score



Source: ICTC

Using the *COVID-Safe Score*, future trends in unemployment are estimated for each sector and the general economy. **Figure 7** shows the forecast unemployment rate for the general economy under three scenarios: optimistic, baseline, and pessimistic. With employment data for April and May is already available, all three forecasts predict an average unemployment rate of about 13% in Q2 of 2020. By Q3, the unemployment rate is roughly 12% under the baseline scenario, 10% in the optimistic scenario, and 13% in the pessimistic scenario. The pessimistic scenario assumes a second wave of infections coinciding with the annual flu season and, as a result, the potential reinstatement of lockdowns. Under this scenario, unemployment is assumed to peak at around 13% in Q4 of 2020 before declining in 2021.

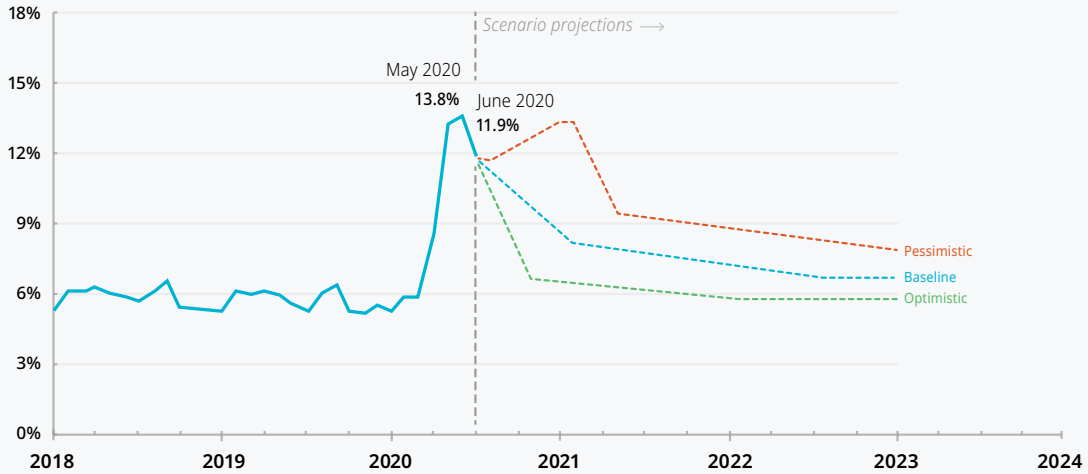
Under all scenarios, the peak unemployment rate of at least 13% is the highest rate of unemployment recorded in Canada since the Great Depression.⁹⁶

One important caveat is that unemployment rates are likely to understate economic impact: people outside of the labour force who are not actively searching for employment do not technically count as “unemployed.” Therefore, with some sectors deliberately shut down and CERB cheques widely distributed, some workers who have lost their jobs are not technically unemployed at the current time.

⁹⁶ Dave Gower, “A note on Canadian unemployment since 1921” *Statistics Canada, Autumn 1992 (Vol. 4, No. 3) Article No. 3*, <https://www150.statcan.gc.ca/n1/en/pub/75-001-x/1992003/87-eng.pdf?st=fXxq-Mmk#page=6&zoom=100,0,0>

Figure 7: Canadian Unemployment Rate Projections

Unemployment Rate: Total Economy



Source: ICTC

Using the unemployment rate assumptions as an input, **Figure 8** shows the historical trend in the GDP of the Canadian economy along with the three scenarios forecast out to the end of Q4 2022. These three scenarios are based on different assumptions about the progression of the COVID-19 outbreak, the severity of quarantines, and other response measures.

Unemployment rate assumptions are made under **three possible scenarios**:

- 1** The baseline forecast scenario assumes that the peak of the COVID-19 outbreak in Canada occurs in Q2 2020 and the epidemic curve is adequately flattened. This forecast also works under the assumption of a gradual, incremental restart of the economy over the summer of 2020. It is assumed that there will not be a large second wave of infections that would force another round of lockdowns across the country. Global supply chain operations and business and consumer confidence are assumed to recover to pre-COVID levels by mid-2022. The unemployment rate gradually returns to near pre-crisis levels by end-2022.
- 2** The optimistic scenario envisions a sharper uptick in the economic outlook and spending, with pent-up demand surging once lockdown restrictions are eased, potentially on the back of the development of a successful therapeutic treatment or vaccine for COVID-19 sooner than expected. This scenario envisions a return to pre-crisis employment levels by mid 2021.
- 3** The pessimistic scenario assumes a second wave of infections that causes lockdowns in the fall and winter of 2020 and pushes unemployment rates to above 13% in the fourth quarter of 2020. The severity of the downturn in this scenario is exacerbated by worsening financial conditions and reduced room for further government stimulus. Under this scenario, even by the start of 2023, unemployment rates are near 8%, well above pre-crisis levels.

Figure 8 and **9** provide three forecasts for GDP on a quarterly and monthly basis through till year end 2022. Under the baseline scenario, Canadian GDP is expected to grow to \$1.954 trillion, after surpassing its lowest point of \$1.631 trillion in Q2 of 2020.

Figure 8: Canadian GDP History and Forecast

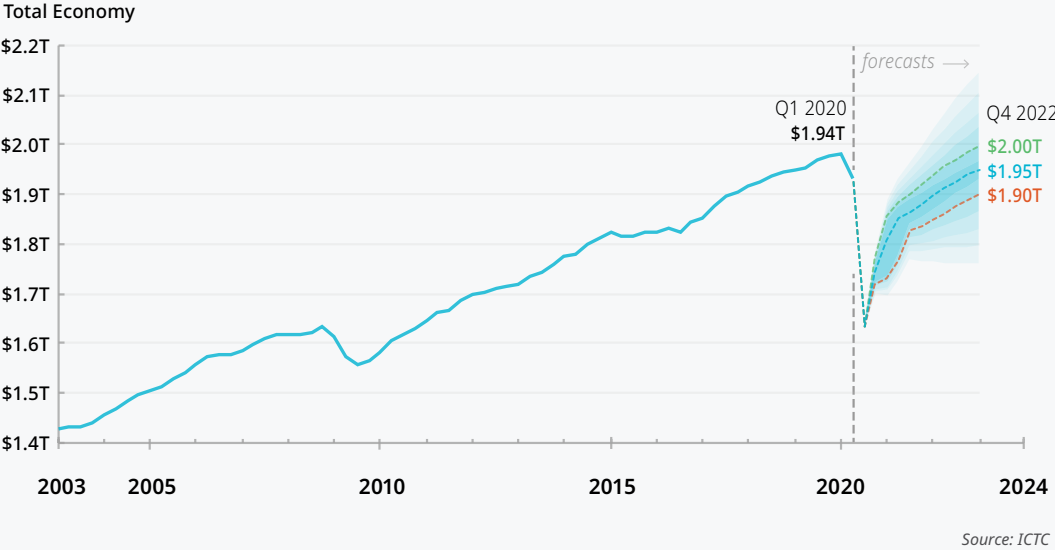
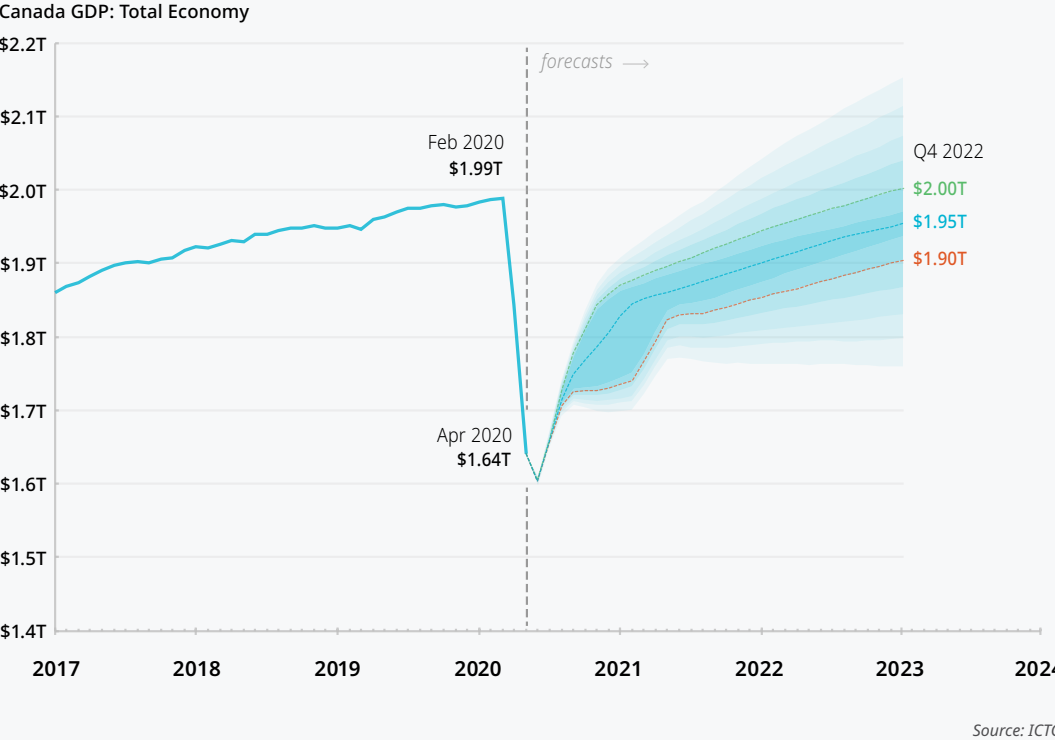
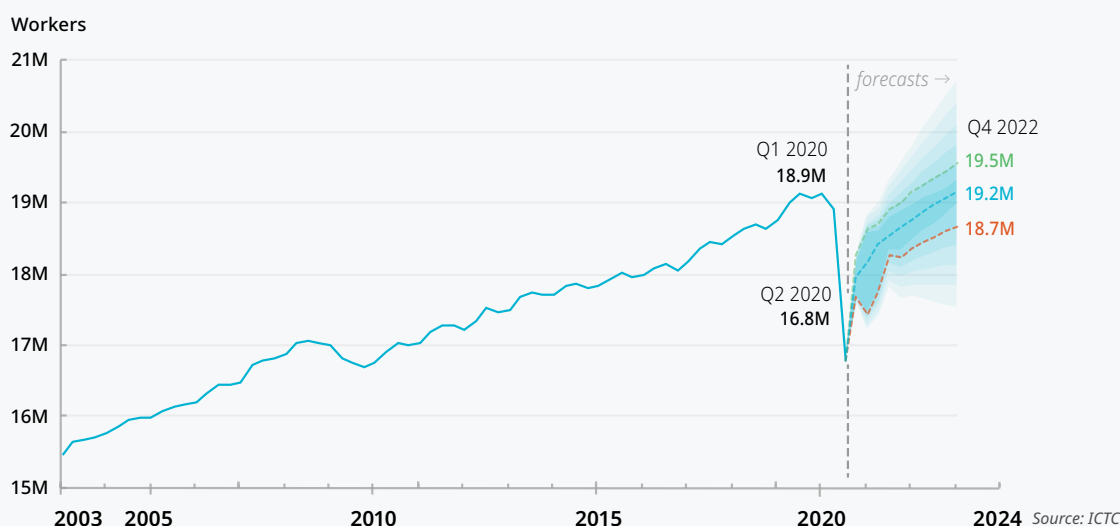


Figure 9: Canadian GDP Forecasts: Closeup by Month



Using existing labour market data and estimates for GDP, **Figure 10** forecasts employment in the general Canadian economy until Q4 of 2022. Under the baseline scenario, a steep decline has its nadir in Q2 2020; this is expected to be followed by a recovery beginning in the fall of 2020, driving total employment to 19.2 million by Q4 of 2022. While lockdown measures are already being eased and provinces are beginning to reopen their economies, many experts believe that full operation of the economy is unlikely to take place until a COVID vaccine is developed (and subsequently mass produced and exported), or until herd immunity is achieved.⁹⁷ Under the pessimistic scenario, a second wave of infections in the fall delays the recovery in employment to 2021. However, even under a pessimistic scenario, employment is expected to recover to about 18.7 million workers by the end of 2022.

Figure 10: General Economy Employment Forecast



The shape of the recovery depends on economic, psychological, and scientific factors, including the pace of vaccine research, the resiliency of international supply chains, the effective management of healthcare capacity and resources, the monetary interventions of domestic and international central banks, and political or moral decisions regarding the timing of re-openings. For these reasons, ICTC has provided three scenarios on potential shape of economic recovery post COVID. These scenarios are also presented for the digital economy, the ICT sector, and the six innovation areas.

Insolvencies in Canada Caused by COVID-19

The coronavirus lockdowns are likely to cause prolonged financial fragility throughout the economy for several years. As the vast majority (98%) of Canadian businesses are small with limited cashflow to weather significant disruptions, unfortunately, a growth in business insolvency is expected in 2020. To forecast the volume of insolvencies⁹⁸ anticipated in Canada as a result of COVID-19 and the associated lockdowns, statistics published by the Office of the Superintendent of Bankruptcy are utilized.^{99,100}

⁹⁷ Kevin Lamarque, "Fed's Powell says full economic recovery may require coronavirus vaccine", *The Globe and Mail*, May 17, 2020, <https://www.theglobeandmail.com/business/international-business/article-feds-powell-says-full-economic-recovery-may-require-coronavirus/>

⁹⁸ Insolvencies are the sum of bankruptcies and proposals, which are arrangements negotiated with creditors.

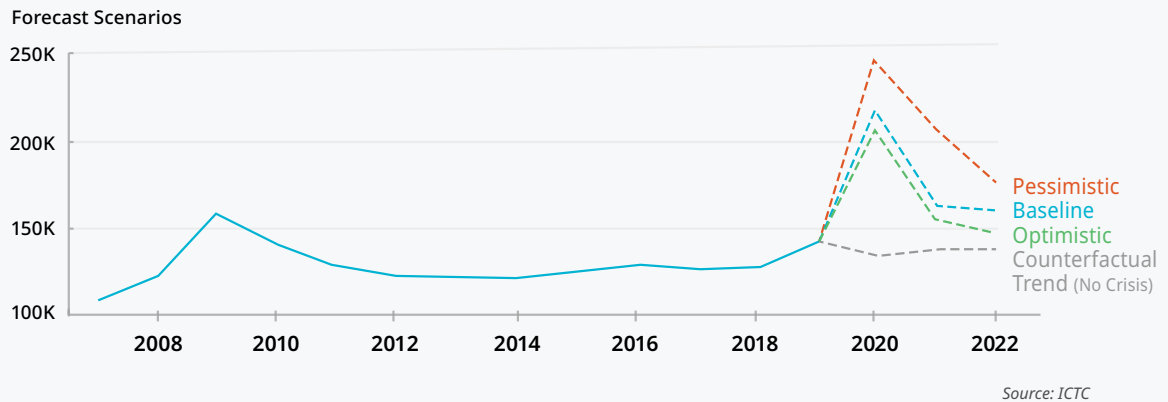
⁹⁹ "Ten-Year Insolvency Trends in Canada 2007-2016", Office of the Superintendent of Bankruptcy, Government of Canada, June 23, 2020, <https://www.ic.gc.ca/eic/site/bsf-osb.nsf/eng/br03805.html>

¹⁰⁰ "Insolvency statistics in Canada (bankruptcies and proposals)", Office of the Superintendent of Bankruptcy, Government of Canada, June 23, 2020, https://www.ic.gc.ca/eic/site/bsf-osb.nsf/eng/h_br01011.html

The dataset studied runs from 2007 to the present and tracks total annual insolvencies. In the dataset, about 97% of existing insolvencies are found among consumers, including sole proprietorships where the liability falls on an individual, while 3% are related to firms. Among business insolvencies over the timespan of the dataset, about 60% are within one of the following five sectors: Construction; Manufacturing; Retail Trade; Transportation and Warehousing; and Accommodation and Food Services.

To estimate the total volume of insolvencies in Canada that are ultimately attributable to COVID-19, ICTC uses a VAR model with assumptions from the optimistic, baseline, and pessimistic GDP and employment forecasts to estimate insolvencies under these three scenarios. ICTC also created a forecast for insolvencies under the counterfactual assumption of no pandemic occurrence in which the unemployment rate remained where it was in February (at roughly 5.3%). These four forecasts are shown in **Figure 11** below.

Figure 11: Total Insolvency Forecast



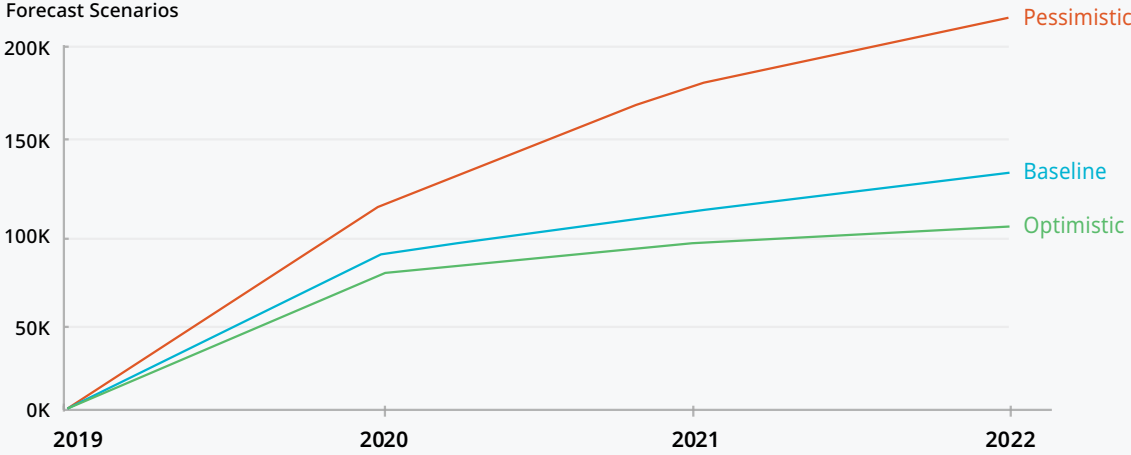
As seen in the figure, annual insolvencies range from 208,000 under the optimistic scenario to 247,000 under the pessimistic scenario in 2020, before tapering in the subsequent years. The spike in insolvencies can be compared to the spike in the year 2009, which was much milder by comparison.

Next, the cumulative additional insolvencies attributable to COVID-19 can be estimated by subtracting total insolvencies under each scenario by the number of insolvencies that ICTC estimates would have occurred under the counterfactual scenario where COVID-19 never occurred. The cumulative insolvencies each year is shown in **Figure 12**.

Under these parameters, the figure reveals that by 2022, COVID-19 is forecast to cause an additional 130,000 consumer and business insolvencies under the baseline scenario.

Under the optimistic scenario, insolvencies total slightly more than 100,000 and under the pessimistic scenario—where a second wave of infections is expected—this figure balloons to over 217,000.

Figure 12: Cumulative Additional Insolvencies



Source: ICTC

SECTION III

Canada's Future Digital Economy



Impact on the Digital Economy

The COVID-19 crisis has had a notable impact on the digital economy in Canada and worldwide. Many tech firms have avoided substantial losses, and some technology subsectors like video gaming and animation have even benefited from the lockdowns as consumers reduce spending but also transition from physical to online expenditures. Technology firms can often more easily shift their “production process” to remote locations and online, compared to other sectors. In the US, tech giants like Google, Microsoft, Facebook, and Amazon have all asked staff to work from home. In early May, Google and a handful of other US-based tech leaders like Facebook and Zillow stated that work from home policies are likely to continue until the end of 2020.¹⁰¹ In Canada, ecommerce leader Shopify moved its workforce remote by the second week of March while also offering employees a \$1,000 stipend to purchase equipment needed for this transition.¹⁰²

Although technology firms are adapting, the impact of COVID-19 and the subsequent lockdown should not be understated. Global supply chains are interrupted, unnecessary travel is restricted, and a sharp recession is forestalling normal business. The freeze in international travel and cancelling of conferences worldwide is an indicator of this threat. The International Air Transport Association forecast that COVID-19 may cost the passenger air industry \$113 billion.¹⁰³ The events industry is also expected to face catastrophic consequences; by March, it was already estimated that around \$500 million USD had been lost in tech conference cancellations, alone.¹⁰⁴ In Canada, *2020 Collision*—a global tech conference recently moved to Toronto from New Orleans—was cancelled, along with *Canadian Blockchain Week* and many other key technology conferences that brought thousands of innovators, investors, venture capitalists and talent to Canada. Naturally, these developments impact the state of the digital economy in Canada and around the world, each playing a considerable role in steering economic prospects and shaping labour demand and growth opportunities. While notable drops are seen in a variety of occupations across the country, many key digital roles appear to be relatively insulated from the economic downturn spurred by COVID-19. Certain digital economy occupations such as computer network technicians, computer programmers, and interactive digital media developers actually grew in number. This aligns with ICTC’s *COVID-Safe Score*, which indicates that the digital economy is at least partially insulated from the effects of COVID-19.

Updated Forecasts and Statistics

As described in *Outlook 2023*, the digital economy is the union of digital occupations and digital industries. In other words, as seen in **Figure 13**, the digital economy comprises tech workers (in all sectors) and (all) workers in the tech sector, without double counting tech workers in the tech sector.

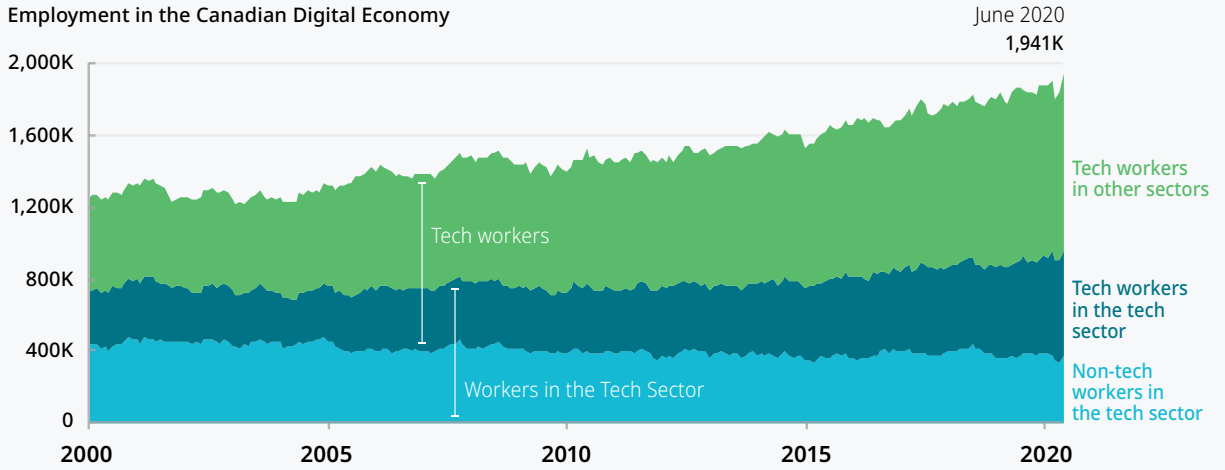
¹⁰¹ Zack Friedman, “Work From Home For Rest Of Year? Some Tech Companies Say ‘Yes’”, *Forbes*, May 8, 2020, <https://www.forbes.com/sites/zackfriedman/2020/05/08/google-facebook-amazon-work-home/#27381928eaea>

¹⁰² Annie Palmer, “Shopify is giving employees a \$1,000 stipend to buy supplies while they work from home during coronavirus pandemic”, *CNBC*, March 12, 2020, <https://www.cNBC.com/2020/03/12/coronavirus-shopify-gives-employees-1000-stipend-to-work-from-home.html>

¹⁰³ “IATA Updates COVID-19 Financial Impacts -Relief Measures Needed”, Press release, IATA, March 5, 2020, <https://www.iata.org/en/pressroom/pr/2020-03-05-01/>

¹⁰⁴ “With E3 and SXSW canceled, the direct losses from major tech events soars beyond \$1 billion”, *Vox*, March 12, 2020, <https://www.vox.com/recode/2020/3/3/21162802/tech-conferences-cancellation-coronavirus>

Figure 13: Digital Economy Components

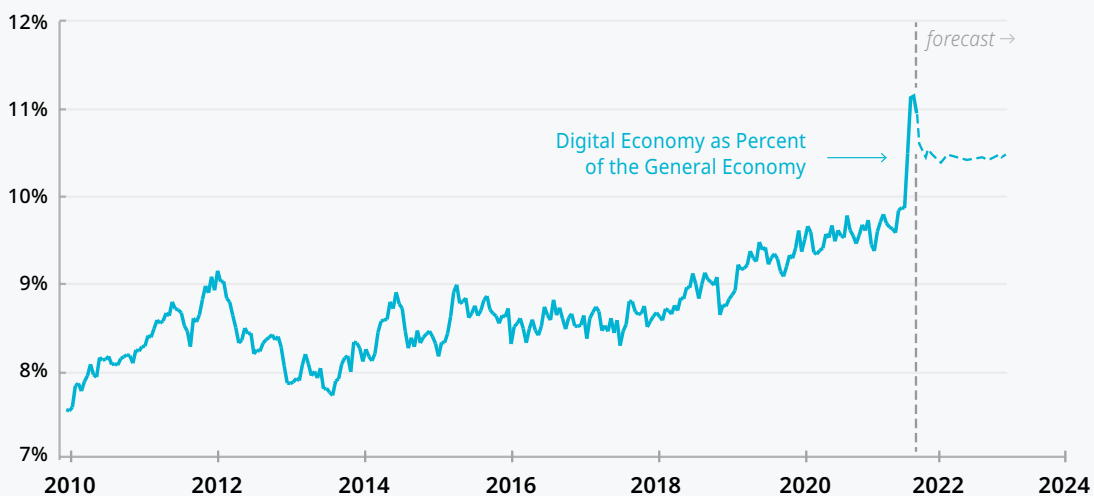


Source: ICTC

The digital economy represents a growing share of Canadian employment, particularly since the 2007-2008 recession. Particularly, employment of digital occupations across all sectors of the economy has been outpacing the employment growth of digital occupations in digital industries. In other words, key tech workers are increasingly found outside of the tech sector. For instance, software developers and data scientists are found in sectors like finance, natural resources, healthcare, among others.

Figure 14 shows employment in the digital economy as a portion of all employment in Canada. The figure reveals that since 2010, the digital economy has grown from 8.5% of all employment, to about 10% of employment in February 2020. In March and April 2020, following mass layoffs in Food and Accommodation, and Education industries, the digital economy jumped by over 1% of the total economy in just two months. Going forward, the forecast anticipates that the digital economy will remain at this newly elevated level of roughly 10.5% of total employment.

Figure 14: Digital Economy as Percent of Total Economy



Source: ICTC

Figure 15 breaks down the components of the above figure into the digital economy and general economy. It reveals that while overall employment in the digital economy is expected to slow, due to the economic downturn brought on by COVID-19, this initial decline is much less steep, and growth resumes quicker and more robustly than the general economy. COVID-19 is expected to adversely impact the digital economy far less than it will the general economy.

Figure 15: Normalized Digital and General Economy

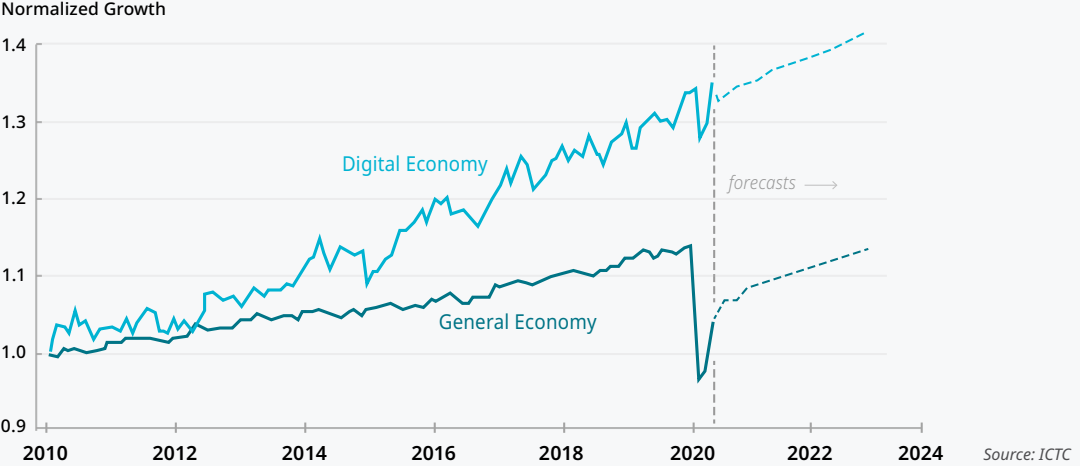


Figure 16 shows ICTC’s forecast for employment in the digital economy under optimistic, baseline, and pessimistic employment assumptions until Q4 of 2022. By this time, it is expected that the digital economy will have recovered from the initial shock, reaching over 2 million workers, or roughly 10.5% of all employment in the Canadian economy at the time. According to the baseline scenario, ICTC forecasts that increased demand for employment in the Canadian digital economy will total 102,000 between Q1 of 2020 and Q4 of 2022.

Figure 16: Digital Economy Employment Forecast

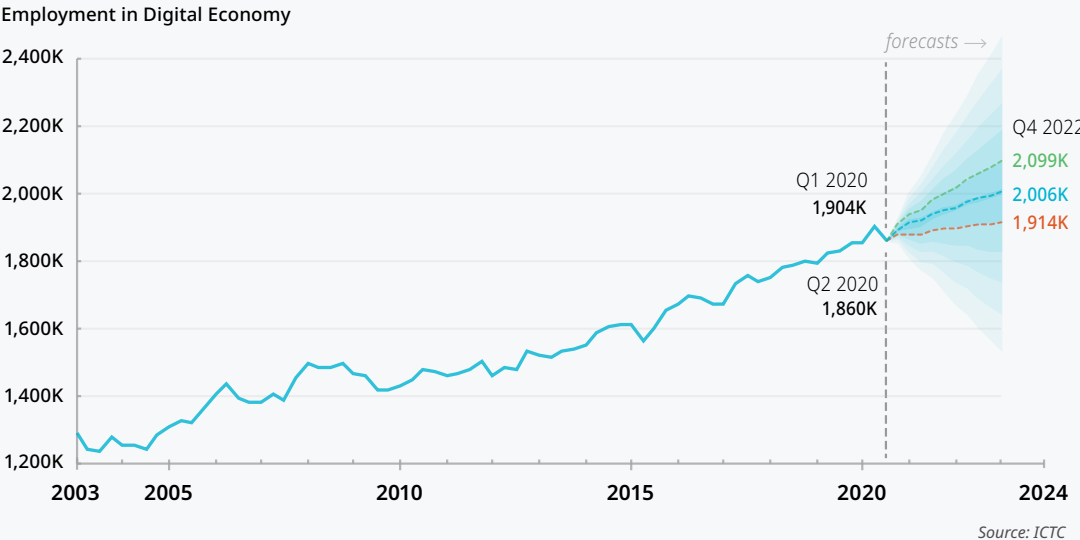
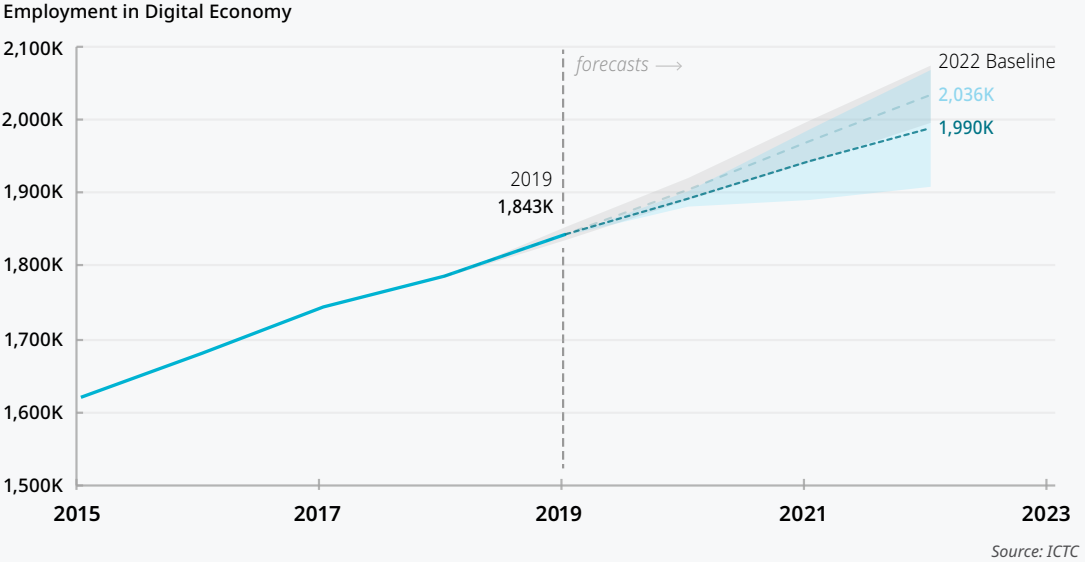


Figure 16 illustrates three ICTC forecast scenarios, with overlapping confidence intervals surrounding the forecasts. These intervals are relatively wide because of the uncertainty of the current economic situation.

Figure 17 compares ICTC’s digital economy forecasts from 2020 in this report with those created in 2019 for *Outlook 2023*. The grey dashed line and area shows the previous forecast and confidence interval, while the blue dashed line and area shows the updated forecast. While the previous forecast—pre-COVID—expected a demand for 193,000 workers in the digital economy between 2019 and 2022, COVID-19 has reduced this demand by nearly 24%. Under the new baseline scenario, the digital economy is expected to see a demand for 147,000 workers by 2022, with total employment reaching nearly 2 million.

Figure 17: Digital Economy Employment Forecasts 2019 vs 2020 Comparison



The ICT sector, while shrinking as a portion of all digital economy employment, is still responsible for slightly over 50% of employment in the digital economy. It is the foundation of the digital economy and will remain a critical sector going forward. **Figure 18** shows the historical GDP and ICTC’s forecast for the ICT sector to Q4 of 2022. **Figure 19** shows ICTC’s forecast for employment in the sector to Q4 2022. GDP is expected to continue to grow to over \$99 billion by end of 2022, employment in the sector is expected to reach 988,000.

Figure 18: Information and Communications Technology Industry GDP

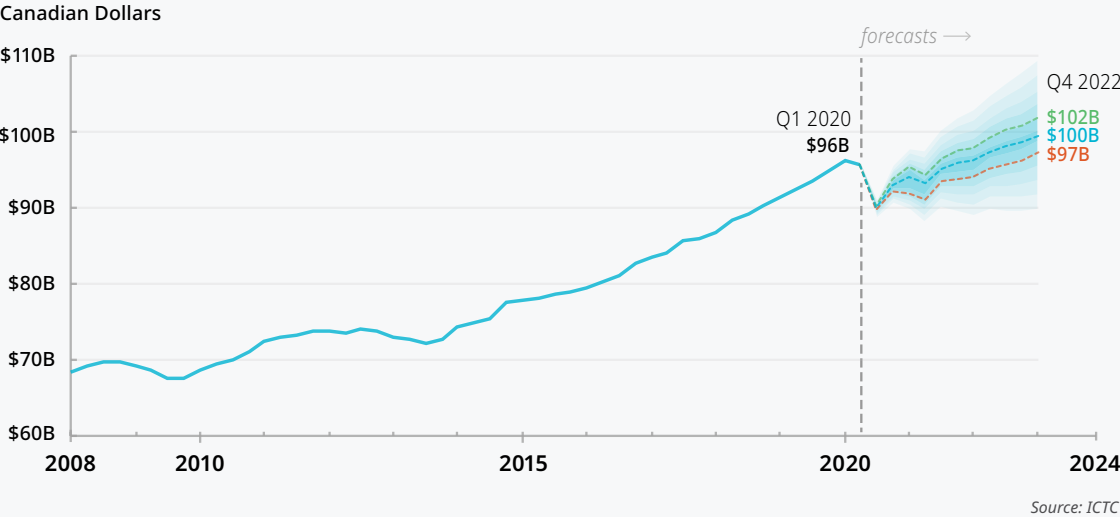
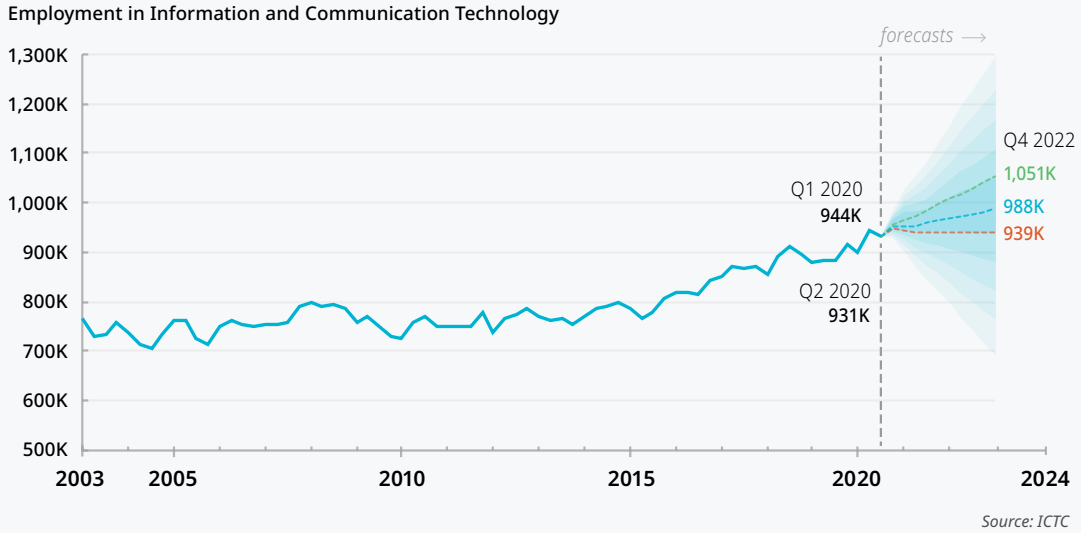
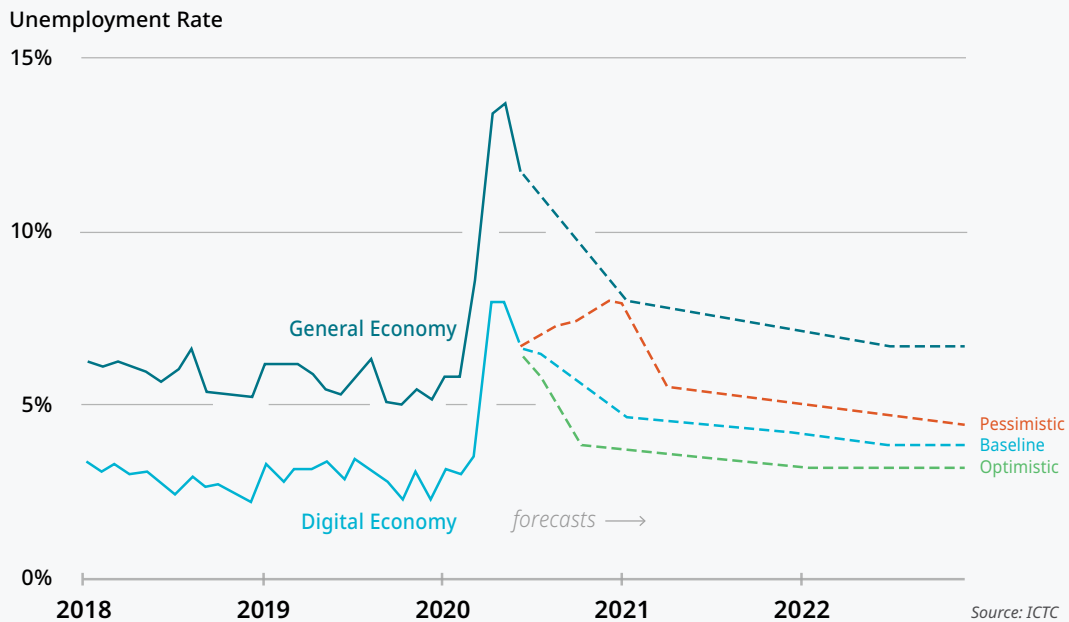


Figure 19: ICT Sector Employment Forecast



While the digital economy will not completely escape damage from COVID-19, its economic and employment impacts are likely to be far less severe than other areas of the economy. The last few months have had dire effects on the global and Canadian economy, yet, from March to May the digital economy was impacted only modestly. As shown in **Figure 20**, ICTC's *COVID-Safe Score* predicts smaller jumps in unemployment for the digital economy going forward, compared to other areas of the economy.

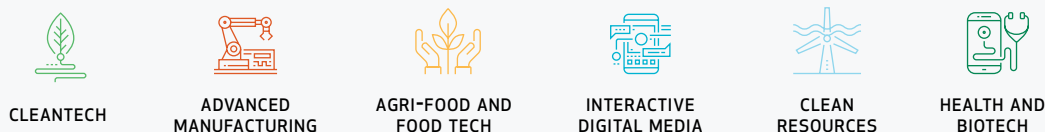
Figure 20: Unemployment Rate in Digital Economy and General Economy



Six Key Innovation Areas: Recent Developments and Employment Forecasts



The following section provides an update on the **six key innovation areas** discussed in *Outlook 2023*, including updated employment forecasts to 2022. In all cases, these areas are expected to perform better—from economic and employment standpoints—than their non-digital counterparts. These areas were already growing faster than non-digital sectors pre-COVID, and as the coronavirus is likely to accelerate digitization trends in more “traditional” areas of the economy (e.g., agriculture, natural resources), this impact will likely also boost these innovation areas.



Cleantech

The cleantech industry is comprised of businesses that are predominantly engaged in the development and sale of environmentally friendly goods and services (e.g. water and wastewater, solid waste management) or environmentally friendly energy alternatives (e.g. bioenergy, hydrogen and fuel cells, smart grids solar, etc.). Cleantech companies focus on generating efficiencies through the use of technology, while simultaneously minimizing the impact on the environment.¹⁰⁵

Developments in Canada

Although Canada is a highly developed, knowledge- and capital-intensive economy, it also relies on its large and rich landmass to support its natural resources sector along with parts of the clean technology sectors. Many nations around the world—including Canada—have made calls for a renewed focus on climate-neutral energy generation and practices following the end of the pandemic. In Canada, clean energy and clean technology tools are quickly becoming a top area for investment in a post-COVID economic recovery.¹⁰⁶ It is not surprising, then, that the cleantech sector, and particularly clean energy generation, is poised for growth.

Canada has the potential to become a global cleantech leader as its position in the global cleantech market continues to advance. In 2019, 12 Canadian companies were named as part of the Global Cleantech 100,¹⁰⁷ compared to just one in 2009.¹⁰⁸ Canada is the fourth highest-ranked country on this measure after the US, the UK, and Germany.¹⁰⁹ Several Canadian organizations on the list rely extensively on AI. For example, Ecobee makes smart thermostats and has cross-over capabilities with a range of AI-based UI platforms, including Microsoft Cortana and Alexa;¹¹⁰ Enbala makes a smart-grid platform that draws extensively on machine learning.¹¹¹

¹⁰⁵ Alexandra Cutean et al., “Canada’s Growth Currency: Digital Talent Outlook 2023,”

<https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf>

¹⁰⁶ Mia Rabson, “Climate, clean tech could take centre stage in federal economic recovery plans”, *The Globe and Mail*, April 9, 2020,

<https://www.theglobeandmail.com/canada/article-climate-clean-tech-could-take-centre-stage-in-federal-economic-2/>

¹⁰⁷ Lynn Côté, “How can Cleantech Canada compete for growing global market share?”, EDC, October 17, 2017,

<https://www.edc.ca/en/blog/cleantech-canada-growing-global-markets.html>

¹⁰⁸ Lynn Côté, “Canada in 4th position on cleantech – Global Cleantech 100 list revealed”, *Canadian Manufacturing*, February 4, 2019,

<https://www.canadianmanufacturing.com/environment-and-safety/canada-in-4th-position-on-cleantech-global-cleantech-100-list-revealed-226229/>

¹⁰⁹ *Ibid.*

¹¹⁰ “Ecobee now works with the Google Assistant”, *TheCanadianTechie*, November 17, 2017,

<https://thecanadiantechie.com/2017/11/14/ecobee-now-works-with-the-google-assistant/>

¹¹¹ “The Enbala Engine”, *Enbala*, June 23, 2020, <https://www.enbala.com/technology/the-enbala-engine/>

¹¹² Derek Malcolm, “Canadian government invests \$1.4 million in Waste Robotics”, *ITBusiness.ca*, March 8, 2019,

<https://www.itbusiness.ca/news/canadian-government-invests-1-4-million-in-waste-robotics/109326>

¹¹³ “Minister Bains announces support for Canada’s next cleantech champions”, *NewsWire*, April 22, 2020,

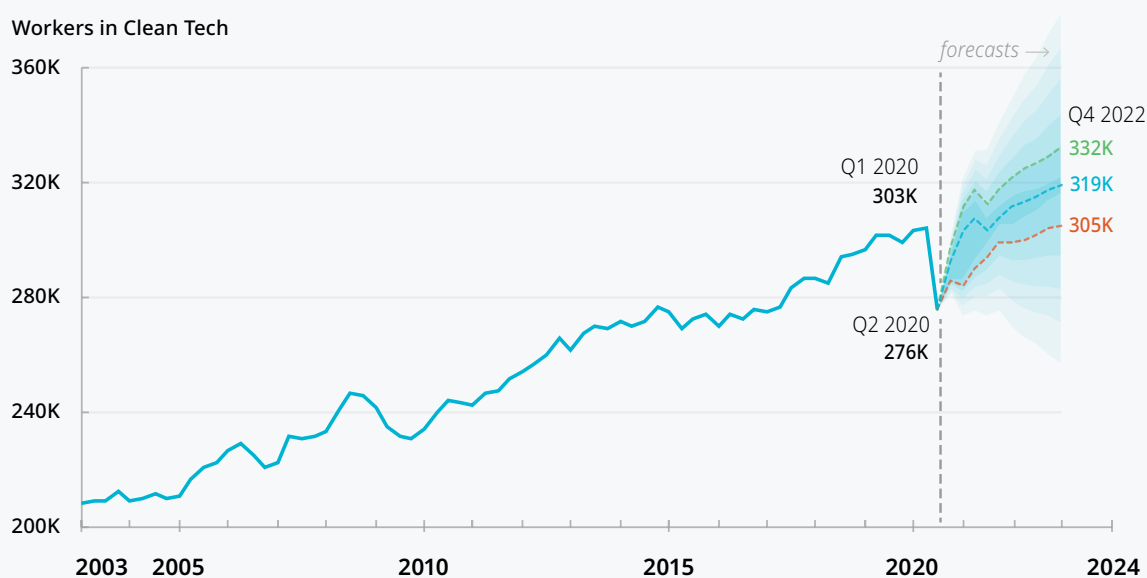
<https://www.newswire.ca/news-releases/minister-bains-announces-support-for-canada-s-next-cleantech-champions-859274391.html>

Much of the Canadian cleantech sector’s recent growth has been through partnerships between business and government. The federal government declared its intention to make cleantech one of Canada’s top five exporting industries and, in its 2017 budget, allocated \$2.3 billion to support cleantech companies.¹¹² Sustainable Development Technology Canada, a foundation created in 2001 by the federal government to support Canadian companies with potential cleantech innovations, supported over 2,000 jobs in 2019.¹¹³ The outlook for future development of the sector is largely dependent on further investments, the solidification of emission policies, Canada’s adoption rate, and the ability of businesses to commercialize their products.¹¹⁴

Forecast

Figure 21 indicates ICTC’s forecast for employment in the cleantech sector. The time series are estimated by ICTC through the amalgamation of industry codes and are similar to Statistics Canada’s estimated values.¹¹⁵ Under the baseline scenario, employment is expected to return to roughly the level seen before the COVID-19 downturn. By Q4 of 2022, Canada’s cleantech sector is expected to employ approximately 319,000 workers. Demand for workers in this sector will total approximately 16,000 between Q1 2020 and Q4 2022 under a baseline scenario.

Figure 21: Cleantech Employment Forecast



Source: ICTC

¹¹² Derek Malcolm, “Canadian government invests \$1.4 million in Waste Robotics”, *ITBusiness.ca*, March 8, 2019, <https://www.itbusiness.ca/news/canadian-government-invests-1-4-million-in-waste-robotics/109326>

¹¹³ “Minister Bains announces support for Canada’s next cleantech champions”, *NewsWire*, April 22, 2020, <https://www.newswire.ca/news-releases/minister-bains-announces-support-for-canada-s-next-cleantech-champions-859274391.html>

¹¹⁴ “Canada’s cleantech sector – growing but needs to be nurtured”, *Energy Exchange*, March 1, 2019, <http://www.energy-exchange.net/canadas-cleantech-sector-growing-needs-nurtured/>

¹¹⁵ “Table 36-10-0632-01: Environmental and Clean Technology Products Economic Account, employment”, *Statistics Canada*, June 23, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610063201>



Advanced Manufacturing

Advanced manufacturing is defined by the development and adoption of technologies (like robotics, 3D printing and other ICT technologies) to create new products, enhance processes and establish more efficient and cost-effective ways of making things.¹¹⁶ Developed countries like Canada have offshored much of their manufacturing of personal protective equipment (PPE) and other medical supplies like antibiotics and antivirals over the past several decades of globalization and trade. Following the worldwide struggle to obtain sufficient quantities of these supplies during the COVID-19 pandemic, a debate has begun regarding whether countries should find ways of onshoring this manufacturing so that they are not caught without supplies (or the capacity to make them) during pandemics and other crises. Canada is a high-wage jurisdiction relative to countries where production was offshored, therefore advanced manufacturing processes that automate aspects of the production process would likely be necessary to achieve cost-effectiveness of domestic manufacturing.

Developments in Canada

Manufacturing has traditionally been a significant contributor to the Canadian economy. As of the end of 2019, the manufacturing sector employed more than 1.7 million people,¹¹⁷ accounted for around 10%¹¹⁸ of the Canadian GDP, and 68% of all of Canada's merchandise exports.¹¹⁹ According to the Canadian Manufacturers and Exporters (CME) 2018 Management Issues Survey, roughly 40% of Canadian manufacturers already use advanced manufacturing technologies, a growth of 2% since 2016. Although this small growth is notable among Canadian manufacturing companies investing in digitization and advanced technologies, Canada is falling behind other industrialized nations on this front.¹²⁰

Investing in advanced technologies to support the manufacturing process can result in a range of benefits to Canadian manufacturers; these include lower operating costs, increased product quality, higher innovation capacity, and increased customer satisfaction.¹²¹ However, one of the barriers identified by the CME is the availability of a skilled workforce that has the knowledge to integrate and to operate the new technology. According to the CME report,¹²² 69% of Canadian manufacturers face labour shortages. This shortage is particularly acute when it comes to talent with the ability to select the right advanced technology, integrate and customize it, and complete troubleshooting, maintenance and repair. These shortages are expected to persist, particularly in a post-COVID world where manufacturing may be difficult to decouple from digitization and automation.

Although Canada ranked relatively well on the *Economist's Automation Readiness Index* (5th out of 25 countries),¹²³ much of this result can be attributed to Canada's 2017 strategy to face the impact of automation and AI on the economy, and other dialogue-based developments related to data protection and ethics. The 2017 strategy focussed specifically on a dialogue between government and businesses regarding their investment in R&D and in the retraining of displaced workers.

¹¹⁶ "Advanced Manufacturing", *Canada's Economic Strategy Tables*, September 2018,

[https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_Table_AM.pdf/\\$file/ISED_C_Table_AM.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_Table_AM.pdf/$file/ISED_C_Table_AM.pdf)

¹¹⁷ "Canadian Manufacturing Sector Gateway", Government of Canada, <https://www.ic.gc.ca/eic/site/mfg-fab.nsf/eng/home>

¹¹⁸ *Ibid.*

¹¹⁹ *Ibid.*

¹²⁰ "Embracing Change: Industry 4.0 and Canada's Digital Future in Manufacturing", *Canadian Manufacturers and Exporters*, 2019, <https://cme-mec.ca/wp-content/uploads/2019/12/CME-MEC-2019-Tech-Adoption-v8.pdf>

¹²¹ *Ibid.*

¹²² *Ibid.*

¹²³ "The Automation Readiness Index", *The Economist*, <https://www.automationreadiness.eiu.com/>

Dialogue and strategy development are two key components of technology and acceleration in the manufacturing sector, but they must be met with follow-through and actions. The areas that Canada fared less favourably in the Automation Readiness Index were financing, knowledge transfer, and policies and regulation. In the last category, Canada placed 23rd out of 25 competitor countries.¹²⁴

COVID-19 has disrupted manufacturing operations in Canada on a large scale. Many businesses were forced to rethink their manufacturing operations, to shift gears, and to explore new ways of doing business in order to keep revenues as stable as possible. As the demand for PPE increased drastically, often exceeding the available supply in Canada, automotive manufacturers converted and repurposed their assembly lines to both help the government meet its healthcare obligations and to also capitalize on this new opportunity for growth. As an example, Kitchener-based Mitchell Plastics, an Ontario producer of plastic centre consoles for vehicles, retooled its machines to make personal face shields.¹²⁵ In May 2020, the Government of Canada contracted General Motors of Canada to provide 10 million face masks over the next year.¹²⁶ The company was able to build and install the mask-making machinery, source materials, and train its workers all in approximately one month. Businesses, including those that do not traditionally manufacture medical equipment such as research and academic institutions, also sought innovative manufacturing approaches to produce PPE. 3D printing technology was quickly mobilized by more than 2,000 Canadian makers to print face shield parts and to fulfill the demand for PPE.¹²⁷ As an example, Burloak Technologies, in collaboration with local health care specialists, colleges, and universities manufactured more than 15,000 face shields per week using 3D printing.¹²⁸

Advanced technology and digital enablement are quickly becoming an essential part of building resilience in the manufacturing sector.¹²⁹ COVID-19 proved that digital solutions and advanced technology mobilizations allow manufacturers to respond faster to a disruption while mitigating its impact. In March of 2020, Next Generation Manufacturing Canada (NGen), which facilitates the country's Advanced Manufacturing Supercluster, invested \$50 million to support manufacturing businesses as they prepare to produce critical technologies, equipment, and medical products in an attempt to provide other businesses with the equipment that they require to operate in this new era.

Forecast

Figure 22 indicates ICTC's employment forecast for the advanced manufacturing sector in Canada. Although advanced manufacturing outperforms traditional manufacturing and represents a growing proportion of all manufacturing to date, the sector is not a large source of employment growth in Canada. The sector is currently negatively impacted by COVID-19, with many factories forced to shutter operations during the pandemic. ICTC predicts that employment is likely to recover to pre-crisis levels by Q4 of 2022. In that time, employment profiles for the sector are likely to see notable shifts.

¹²⁴ *Ibid.*

¹²⁵ Nick Purdon and Leonardo Palleja, "Auto parts factories retool to make medical equipment, while worry grows over sector's future", CBC, May 3, 2020, <https://www.cbc.ca/news/business/auto-parts-factories-ppe-manufacturing-1.5428103>

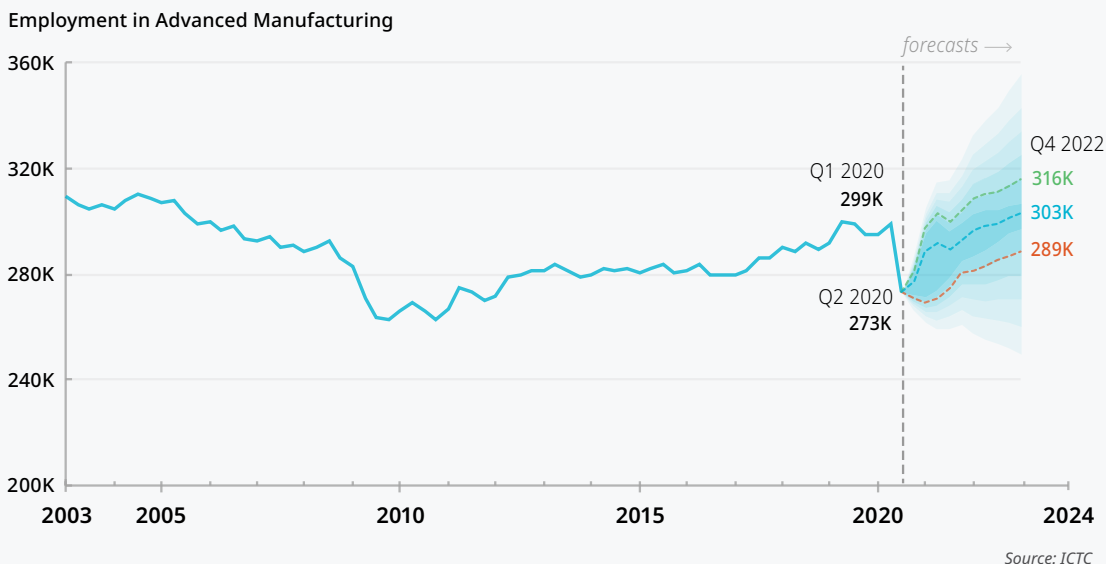
¹²⁶ "Government of Canada Contracts GM Canada to Provide 10 Million Face Masks - Production to Begin Immediately", General Motors Canada, News Release, May 26, 2020, https://media.gm.com/media/ca/en/gm/home.detail.html/content/Pages/news/ca/en/2020/May/0526_Government-of-Canada-Contracts-GM-Canada.html

¹²⁷ Kip Hanson, "Canadian makers 3D-print PPE in response to COVID-19", *TheFabricator.com*, April 16, 2020, <https://www.thefabricator.com/additivereport/article/additive/canadian-makers-3d-print-ppe-in-response-to-covid-19>

¹²⁸ "Partnerships with Canadian industry to fight the COVID-19 pandemic", Justin Trudeau, Prime Minister of Canada, March 31, 2020, <https://pm.gc.ca/en/news/backgrounders/2020/03/31/partnerships-canadian-industry-fight-covid-19-pandemic>

¹²⁹ "COVID-19: Adapting manufacturing operations to new normal", Accenture, April 18, 2020, <https://www.accenture.com/ca-en/insights/consulting/coronavirus-supply-chain-manufacturing-operations>

Figure 22: Advanced Manufacturing Employment Forecast



Agri-Tech and Food Tech

Agri-Food and food-tech industries traverse several subsectors, including animal genetics, industrial bioproducts, regular agriculture, and livestock rearing.¹³¹ Technology plays a fundamental role in the agri-food sector in Canada, and Canada is home to some of the strongest, most prominent, and leading agtech companies.¹³² Agtech companies develop and implement technologies that seek to help producers make food more effectively and efficiently while insuring that processes are sustainable and cost-effective. They also bring value to producers by improving and simplifying the supply chain.

Developments in Canada

The agri-food sector in Canada has a strong global growth opportunity. With the world's population projected to reach 10 billion by 2050, the demand for food is growing. Canada is aiming to seize on this opportunity and become a global leader in the supply of safe and high-quality food products. In the 2017 budget, the Government of Canada set a goal to reach \$75 billion in exports by 2025. In 2018, the government's Agri-Food Economic Table set an even more ambitious goal of \$85 billion in agriculture, agri-food and seafood exports by 2025, which is a 32% increase from \$64.6 billion in 2017.¹³³ By 2025, Canada aims to become one of the top five countries in the agri-food sector. The goal of the Economic Table is for Canada to be recognized as the most trusted, competitive, and reliable supplier of safe, sustainable, high-quality agri-food products, and as an innovator in the digital supply chain.¹³⁴

The agri-food and food-tech sector accounts for approximately 2.9% of Canada's GDP and 12% of the country's exports.¹³⁵

¹³¹ "Canadian agri-food sector intelligence", *Agriculture and Agri-Food Canada*, July 24, 2019, <https://www.agr.gc.ca/eng/canadian-agri-food-sector/?id=1361290241756>

¹³² Remi Schmaltz, "Canada AgriFood Tech Market Map: 166 Startups Growing Canada's Agricultural Sector", *AgFunderNews*, May 2, 2019, <https://agfundernews.com/canada-agrifood-tech-market-map-166-startups-grow-canadas-agricultural-sector.html>

¹³³ "Agri-food", *Canada's Economic Strategy Table*, September 2018, [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_Agri-Food_E.pdf/\\$file/ISED_C_Agri-Food_E.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_Agri-Food_E.pdf/$file/ISED_C_Agri-Food_E.pdf)

¹³⁴ Ibid.

¹³⁵ "Agri-Food: the sector today and opportunities for tomorrow", *Interim Report, Canada's Economic Strategy Table*, February 2018, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00015.html>

Agricultural digital innovation is the key driver of economic growth in the sector. Technologies like digitization, robotics, artificial intelligence, big data analytics have contributed enormously to the transformation of Canada's agricultural sector over the last 50 years.¹³⁶ Adopting technology and advancing digitization is recognized as an enabler of greater competitiveness as well as opportunities to meet food security and sustainability goals that strengthen Canada's competitive position globally.¹³⁷

ICTC estimates that employment in agri-food and food tech represents approximately one quarter of all employment in the agricultural sector, employing 660,000 people in 2020. However, the sector continues to report critical and ongoing labour shortages.

The COVID-19 pandemic caused a sudden shift in food distribution across the Canadian economy. Previously, there was considerable demand for food products in the hospitality sector, but since the pandemic began the vast majority of demand now comes from the retail sector.¹³⁸ COVID-19 has also reemphasized the need for more digitization to reduce hand-to-hand contact and reduce labour requirements within the food processing subsector. In particular, the enclosed spaces, low temperatures, and cramped working conditions of meat-packing plants caused virus outbreaks.¹³⁹ While technologies like machine learning, digital platforms to manage data, and automation (like robotic milking devices and automatic pickers) already exist in the agri-food sector, they are not as common in the agri-food systems for food production, food distribution, safety, and traceability.¹⁴⁰ COVID-19 has provided additional impetus to implement these technologies.

In April 2020, the governments of Canada and the province of Ontario announced plans for the agri-food industry to undergo an E-Business initiative. The "Agri-Food Open for E-Business" initiative is an investment of up to \$2.5 million designed to help the agri-food sector expand online.¹⁴¹ The funding is being provided through the Canadian Agricultural Partnership. This initiative is expected to help food producers, farmers markets, retailers, garden centres, greenhouses, nurseries, and agricultural associations develop online businesses. This will ultimately provide consumers with greater access to a wide variety of food and agricultural products.¹⁴²

In a post-COVID world, access to locally grown food, the use of eco-friendly practices, and a more automated supply chain may become top priorities. ICTC expects that agri-food and food tech will see considerable demand for employment in the near future. The demand is expected to further intensify as markets for Canadian products expand and the skill set required from the workers in the sector evolves.

Forecast

Figure 23 shows ICTC's employment forecast for the agri-food and food tech sector. The sector is forecast to dip slightly in the upcoming quarter before recovering to near pre-crisis employment levels by 2022. ICTC's categorization of employment in this sector includes farmers and others who generate food for domestic consumption and export.

¹³⁶ "An Overview of the Canadian Agricultural Innovation System", Agricultural Institute of Canada, April 2018, http://aic.ca/pdf/AIC20170825_DC_CFI_Contextpiece_Short_version_FINAL_11.2.pdf

¹³⁷ "Agri-Food: the sector today and opportunities for tomorrow", Interim Report, Canada's Economic Strategy Table, February 2018, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00015.html>

¹³⁸ D.C. Fraser, "Researchers predict agri-food technology to grow post-COVID-19", *The Western Producer*, May 8, 2020, <https://www.producer.com/2020/05/researchers-predict-agri-food-technology-to-grow-post-covid-19/>

¹³⁹ Megan Molteni, "Why Meatpacking Plants Have Become Covid-19 Hot Spots", *Wired*, May 7, 2020, <https://www.wired.com/story/why-meatpacking-plants-have-become-covid-19-hot-spots/>

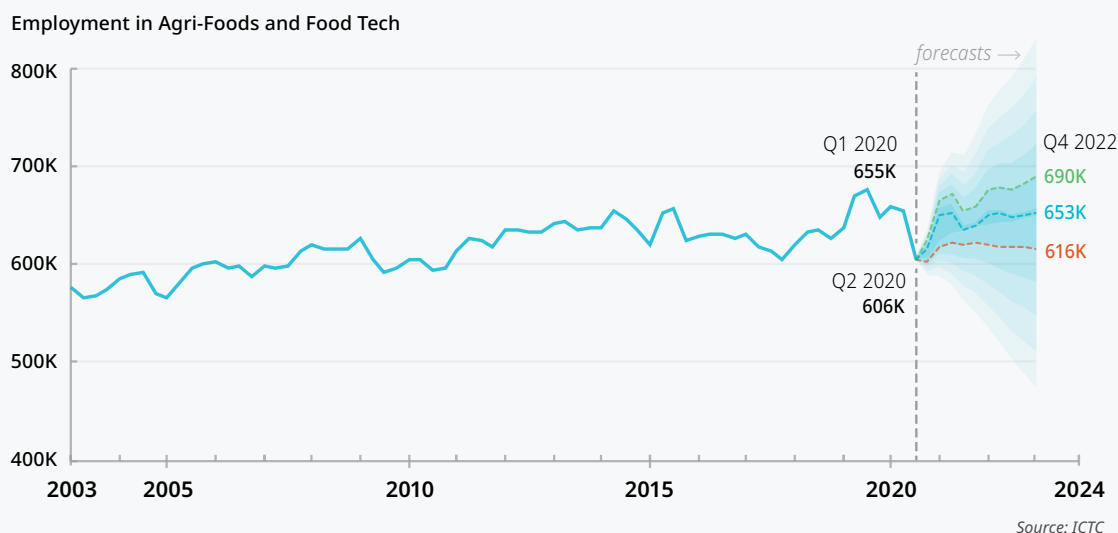
¹⁴⁰ D.C. Fraser, "Researchers predict agri-food technology to grow post-COVID-19", *The Western Producer*, May 8, 2020, <https://www.producer.com/2020/05/researchers-predict-agri-food-technology-to-grow-post-covid-19/>

¹⁴¹ "Governments Invest \$2.5 Million to Grow Agri-food e-Business During COVID-19", Government of Canada, News Release, April 24, 2020, <https://www.canada.ca/en/agriculture-agri-food/news/2020/04/governments-invest-25-million-to-grow-agri-food-e-business-during-covid-19.html>

¹⁴² *Ibid.*

Food production and consumption is likely to be restructured during and following the pandemic and, as a result, may see an immediate contraction in employment. However, food production itself is an “essential activity,” and employment opportunities are expected to shift as automation and digitization reshapes the sector. In the short term, ICTC estimates a small dip in employment, with demand contracting by 2,000 workers from Q1 2020 to Q4 2022. Despite the slight decline, this innovation area will still be responsible for over 650,000 jobs.

Figure 23: Agri-Food and Food-tech Employment Forecast



Interactive Digital Media

The IDM sector is an intersection of ICT, digital and creative industries, and businesses that display data or information in creative or innovative ways.¹⁴³ IDM includes animation, visual effects, video game development, music, and has interactions with other media-related industries like advertising and marketing.

Developments in Canada

The IDM sector is an increasingly important component of the Canadian economy. Canada is particularly recognized as a global leader in creative technology (video game production, visual effects (VFX), and animation). The biggest subsector of the IDM sector is video games. In 2019 the video games industry, which is particularly strong in Quebec, Ontario, and British Columbia, identified 692 active video game companies (16% growth since 2017), which contributed \$4.5 billion to Canada’s economy (20% growth since 2017) and employed over 48,000 people.¹⁴⁴ Additionally, Canada has shown early leadership in the development of virtual and augmented reality (VR/AR) content and technology,¹⁴⁵ with applications extending beyond the gaming sector or even the creative industries. AR and VR are increasingly seen as tools that can be used to bolster digital education. AR and VR are particularly effective in allowing students to visualize information and concepts in new ways, including exploration of objects with superimposed virtual images.¹⁴⁶

¹⁴³ Alexandra Cutean, et al. “Canada’s Growth Currency: Digital Talent Outlook 2023”, Information and Communications Technology Council, October 2019, <https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf>

¹⁴⁴ “The Canadian Video Game Industry 2019”, Nordicity, November 2019, http://theesa.ca/wp-content/uploads/2019/11/CanadianVideoGameSector2019_EN.pdf

¹⁴⁵ “Report from Canada’s Economic Strategy Tables: Digital Industries”, Innovation, Science and Economic Development Canada, September 28, 2018, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00024.html>

¹⁴⁶ Maryna Ivus, Trevor Quan, and Nathan Snider, “Class, take out your tablets: The impact of technology on learning and teaching in Canada”, January 2020, https://www.ictc-ctic.ca/wp-content/uploads/2020/04/ictc_impact-of-tech-on-learning-teaching-canada_final_en.pdf

The IDM sector is recognized as the innovation area¹⁴⁷ with the greatest growth potential for Canada following the COVID-19 pandemic. As the COVID-19 virus spreads across countries, IDM companies have rushed to build apps, services, and systems, including for the process known as contact tracing (identifying and notifying all those who come in contact with the virus carrier).¹⁴⁸ On June 18, 2020, the Prime Minister announced the upcoming launch of a new nationwide mobile app designed to provide notifications of exposure to COVID-19 to all Canadians who download the application.¹⁴⁹ The Canadian Digital Service is leading the development of the app in collaboration with the Ontario Digital Service, Shopify volunteers, and BlackBerry, which is responsible for the security portion of the app.¹⁵⁰

The IDM sector has felt the impact of the COVID-19 pandemic in its own way as the pandemic hit some of the IDM sector areas harder than others. According to the CMF survey,¹⁵¹ smaller IDM studios employing less than five employees are seeing an average of 40% decline in revenue,¹⁵² and one-third of IDM companies with fewer than 20 employees have lost all monthly revenue. However, some of the key areas like animation, video games,¹⁵³ over-the-top (OTT) video (for example Netflix, Amazon, HULU, etc.), social networks (Facebook, Instagram, etc.), and media platforms (TikTok, YouTube, etc.)¹⁵⁴ have emerged as clear winners during the pandemic, as they have seen a surge in demand for digital content during “the lockdown.”¹⁵⁵

Forecast

Figure 24 shows ICTC’s employment forecast for the IDM sector. The forecast slows from *Outlook 2023* expectations as a result of small interruptions due to COVID-19 but, nonetheless, continues relatively robust growth, especially when compared with other sectors. After a small dip in Q2 2020, IDM continues its upward employment growth and reaches 830,000 by 2022. IDM is expected to be one of the least negatively impacted sectors of the economy for a number of reasons. First, following the initial large-scale move to remote work, a very high proportion of workers (over three-quarters) in this sector are “COVID-Safe,” according to ICTC analysis. Second, COVID-19 has already generated increased demand for IDM content like streaming and video games, trends that ICTC expects to persist. Many traditional firms are also quickly switching to online services, educational institutions are administering online exams, and the public sector is exploring effective ways to provide online services and information. All of these activities are expected to continue to support demand for products that the IDM sector creates, and thereby continue to support strong employment growth. The IDM sector is expected to see the strongest demand for employment among all the innovation areas. Between Q1 2020 and Q4 2022, IDM will see a demand for approximately 55,000 workers.

¹⁴⁷ “Report from Canada’s Economic Strategy Tables: Digital Industries”, *Innovation, Science and Economic Development Canada*, September 28, 2018, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00024.html>

¹⁴⁸ Patrick Howell O’Neill, Tate Ryan-Mosley, and Bobbie Johnson, “A flood of coronavirus apps are tracking us. Now it’s time to keep track of them”, *MIT Technology Review*, May 7, 2020, <https://www.technologyreview.com/2020/05/07/1000961/launching-mitr-covid-tracing-tracker/>

¹⁴⁹ “Prime Minister announces new mobile app to help notify Canadians of COVID-19 exposure”, JUSTIN TRUDEAU, PRIME MINISTER OF CANADA, June 18, 2020, <https://pm.gc.ca/en/news/news-releases/2020/06/18/prime-minister-announces-new-mobile-app-help-notify-canadians-covid>

¹⁵⁰ *Ibid.*

¹⁵¹ “Measuring the Impact. Recovering Strong”, *Nordicity*, June 23, 2020, <https://trends.cmf-fmc.ca/wp-content/uploads/CMF-COVID-Survey-Summary-of-Results.pdf>

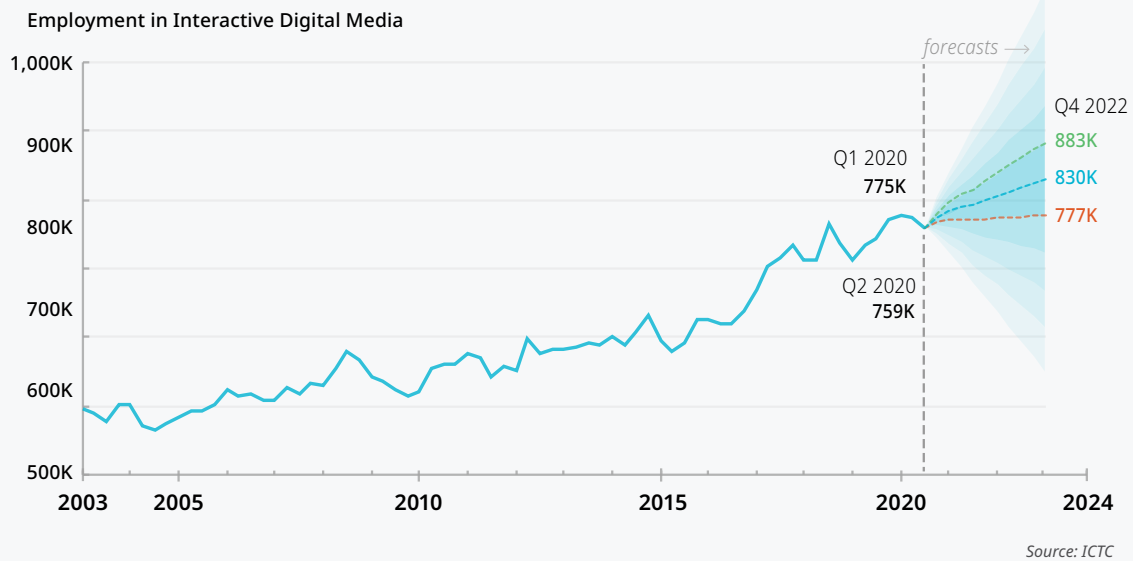
¹⁵² *Ibid.*

¹⁵³ Sean Gleeson, “Online gaming booms as virus lockdowns keep millions at home”, March 28, 2020, <https://www.ctvnews.ca/business/online-gaming-booms-as-virus-lockdowns-keep-millions-at-home-1.4872428>

¹⁵⁴ “4 Ways COVID-19 Could Impact Digital Media and Marketing”, *Business Insider*, June 23, 2020, <https://www.businessinsider.com/intelligence/covid-impact-digital-media>

¹⁵⁵ *Ibid.*

Figure 24: Interactive Digital Media Employment Forecast



Clean Resources

Clean resources refer to the blend of the natural resources sectors and clean technology. Companies in the clean resources sector work in forestry, mining, fisheries, and with those involved in upstream and downstream oil and gas activities. Clean resources companies are often involved in reducing the CO₂-intensity of resource extraction and processes.

Developments in Canada

In 2019, the natural resources sector directly or indirectly accounted for 17% of Canada's GDP.¹⁵⁶ Approximately 1.8 million jobs were directly or indirectly connected to the natural resources sector.¹⁵⁷ Canada's largest extractive sector was energy, which directly accounted for 7.9% of national GDP or \$187 billion. The mining sector was responsible for 3.5% or \$87 billion and forestry accounted for 1.4% or \$23 billion.¹⁵⁸

Canada has the 3rd largest resource endowment per capita in the world; controls the 3rd largest proven oil reserves in the world; is the 5th largest oil producer in the world; has the 3rd largest forested area in the world; is a top destination for non-ferrous mining; has the 2nd lowest household electricity prices of Organisation for Economic Co-operation and Development (OECD) countries; is a global leader in sustainable forest management; and Canada is the only oil and gas producing nation in the world with a cap on greenhouse gas emissions.¹⁵⁹ Canada ranks 25th out of 180 countries in environmental performance¹⁶⁰ and ranks fourth among OECD member countries in environmental policy stringency.¹⁶¹ With all these strengths, Canada has an incredible opportunity to become a global leader in the evolving clean resource market, delivering clean resources with the highest standards of environmental performance, health and safety.

¹⁵⁶ "10 Key Facts on Canada's Natural Resources", Natural Resources Canada, August, 2018, https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/files/pdf/10_key_facts_NatResources_2018_e.pdf

¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

¹⁵⁹ "Resources of the Future", Innovation, Science and Economic Development Canada, March 28, 2018, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00019.html>

¹⁶⁰ "Resources of the Future", Innovation, Science and Economic Development Canada, June 23, 2020, [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_ResourcesFuture.pdf/\\$file/ISED_C_ResourcesFuture.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_ResourcesFuture.pdf/$file/ISED_C_ResourcesFuture.pdf)

¹⁶¹ Ibid.

Yet, Canada's clean resource sector needs to continue to innovate, advance, and adapt to be competitive in the economy of the future. The Government of Canada aims to see Canada as a global competitive force in natural resources. In 2018, in the Resources of the Future Economic Strategy Table, the Government of Canada announced its plan to grow annual natural resource exports to \$350 billion (representing a \$100 billion increase from 2017) through innovation, decarbonization, agile regulations, infrastructure, talent and inclusion.¹⁶²

COVID-19 has highlighted the need for innovation in this sector by greatly reducing the demand for global transportation of all kinds. The virus has grounded air traffic and decreased ground traffic substantially, which in turn has caused the demand for oil to significantly decrease. On April 20th, 2020, the price of a barrel of Western Texas Intermediate crude oil reached an unprecedented negative price point, -\$38.76 USD per barrel. On the same day, Western Canadian Select, Alberta's main oil export, hit a historical low of \$3.96 per barrel.¹⁶³

Canada has traditionally been dependant on fossil fuels to drive large portions of the economy. This economic growth is dependent on the price of oil remaining relatively elevated, primarily to support the cost of extracting oil from the oil sands. The economic damage from the drop in oil prices caused a significant slowdown in the economy and resulted in substantial job losses in the oil and gas industry and its support sectors.¹⁶⁴ However, the collapse in global oil prices can end up being a net positive if it acts as a catalyst to accelerate the transition to cleaner energy.¹⁶⁵ According to an International Labour Organization report, by 2030, the shift to a green economy can result in the loss of 6 million jobs in the oil sector, however, it can also stimulate the creation of 24 million new jobs in the clean energy sector.¹⁶⁶ This transition represents a net gain of 18 million net new jobs because the green energy sector is more labour-intensive than the traditional fossil fuel energy sector, which will ultimately result in a win/win for both job creation and the environment.

Forecast

ICTC's Clean Resources forecast is shown in **Figure 25**. The model predicts a steep decline in the first quarter of 2020, followed by a gradual recovery to pre-crisis employment levels by 2022. The Clean Resources sector contains a large number of natural resources companies (namely oil and gas), which are significantly impacted by suppressed energy demand during the COVID-19 pandemic. As construction projects slow, resources like timber and iron ore are also likely to see decreased demand. Consequently, firms are unlikely to hire extensively, or launch new projects. Reduced demand for resources may mean other projects are cancelled or never proposed to begin with in the coming years. As a result, hiring is expected to freeze for many businesses in this sector in the near term, although a small employment demand increase is likely for businesses focusing on renewables, as countries begin planning their green recovery strategies. ICTC forecasts a demand for approximately 4,000 workers in the clean resources sector from Q1 2020 to Q4 2022, with total employment reaching around 174,000.

¹⁶² "Report from Canada's Economic Strategy Tables: Report - Resources of the Future", Innovation, Science and Economic Development Canada, June 23, 2020, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00026.html>

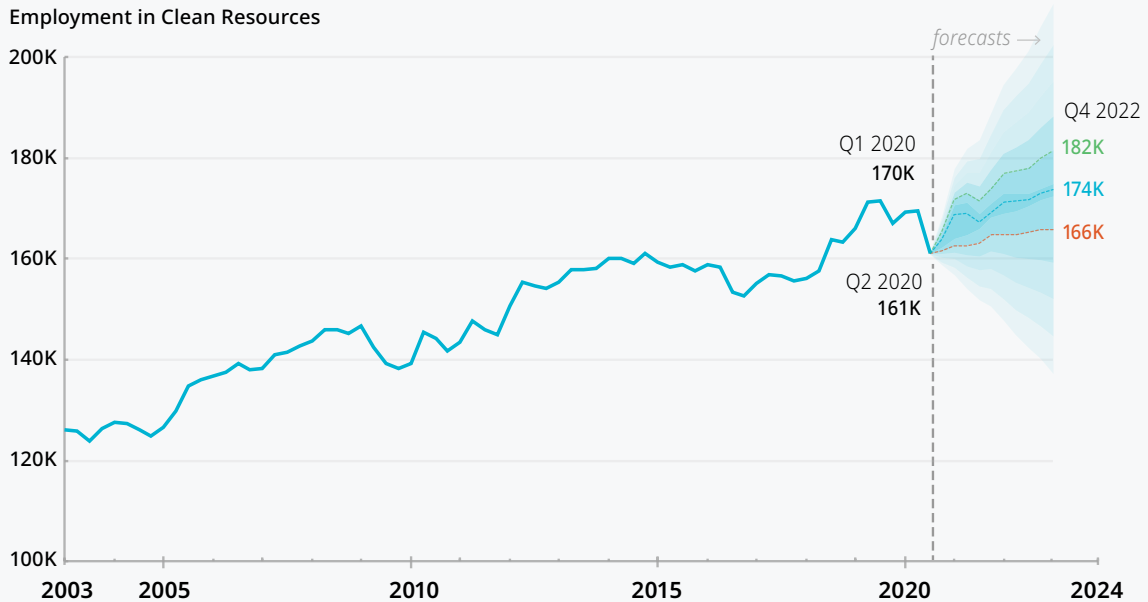
¹⁶³ Nathaniel Dove, "Coronavirus: Oil prices drop below zero as Saskatchewan companies slash budgets", Global News, April 29, 2020, <https://globalnews.ca/news/6845353/coronavirus-oil-prices-drop-below-zero/>

¹⁶⁴ Tony Seskus, "Number of Canadians employed by oil and gas sector falls by 14,000, data shows", CBC News, June 19, 2020, <https://www.cbc.ca/news/business/canadian-oil-and-gas-jobs-1.5619621>

¹⁶⁵ Nathaniel Dove, "Coronavirus: Oil price crash prompts calls for green energy", Global News, April 29, 2020, <https://globalnews.ca/news/6850673/coronavirus-oil-price-crash-green-energy/>

¹⁶⁶ "World Employment and Social Outlook 2018: Greening with jobs", International Labour Organization, 14 May, 2018, https://www.ilo.org/global/publications/books/WCMS_628654/lang--en/index.htm

Figure 25: Clean Resources Employment Forecast



Source: ICTC



Health and Biotech

The health and biotech sector encompasses a wide range of firms, from the developers and manufacturers of pharmaceuticals, medical devices, and biomedical innovations to the producers of digital health solutions and disruptive technologies such as artificial intelligence (AI), big data analytics, 3D printing, robotics and nanotechnologies.¹⁶⁷ The health and biosciences sector in Canada encompasses over 900 firms. This includes pharmaceutical multinational enterprises, generics firms, biopharmaceutical SMEs, contract research and manufacturing organizations, and medical technology manufacturers. The sector contributes 0.45% to Canada's annual GDP as part of the broader health care ecosystem that represented 11% of Canada's annual GDP.¹⁶⁸

Developments in Canada

With demographic trends such as a rapidly aging population and low birth rates likely to persist in Canada, the cost of healthcare is on the rise. In 2018, government expenditures on healthcare totalled 10.7% of GDP¹⁶⁹ and was forecast to rise. The COVID-19 pandemic has created unprecedented demand for healthcare services and employment. Existing research analyzing early impacts of the pandemic on the costs of in-patient hospitalization amounted to expenditures of between \$4,000 to nearly \$4,500 per patient in 65-80+ age category¹⁷⁰ (those most likely to need extensive in-patient care due to COVID). Advanced digital technologies like virtual care, precision medicine, consumer health, the Internet of (health) Things (IoT), cloud computing, and blockchain¹⁷¹ can help make the health system more efficient, effective, and sustainable.

¹⁶⁷ "Health/Bio-sciences Table", Innovation, Science and Economic Development Canada, June 23, 2020, <https://www.ic.gc.ca/eic/site/098.nsf/eng/00016.html>

¹⁶⁸ Ibid.

¹⁶⁹ "Health spending", OECD Data, June 23, 2020, <https://data.oecd.org/healthres/health-spending.htm>

¹⁷⁰ Gabriel Tremblay, "The Economic Impact of COVID-19 in Canada: A Health Economist's Perspective", Purple Squirrel Economics, March 27, 2020, https://www.id-hub.com/wp-content/uploads/2020/04/The-Economic-Impact-of-COVID-19-in-Canada-A-Health-Economist%E2%80%99s-Perspective-V2_0.pdf

¹⁷¹ "Accelerating the Adoption of Digital Health Technologies in Canada", ITAC

To strengthen the health system, Canada must accelerate its digital adoption journey in the healthcare sector—an area where it currently lags behind other comparable countries.¹⁷²

As of 2018, Canada ranks fourth (behind the US, UK and Germany) in global health and biosciences hubs, according to the UK BioIndustry Association.¹⁷³ In 2018, the Health and Biosciences Economic Table set an ambitious goal to grow the sector by 2025 with the goal of reaching \$26 billion in exports and become one of the top three hubs in the world. Moreover, by 2025, plans included doubling the number of companies in the sector to 1,800 firms, and doubling the number of health and bioscience high-growth firms to 80.¹⁷⁴ With an action plan that eliminates barriers and drives growth, much of this progress depends on advancing innovation in the sector, attracting and retaining capital, skills and talent, and ensuring a vibrant ecosystem that will unleash the full potential of the sector and lead to improved health outcomes.¹⁷⁵

The COVID-19 virus has had a tremendous impact on the health and biotech sector. In March of 2020, the federal government announced funding for efforts designed to combat COVID-19, including potential vaccines and treatments.¹⁷⁶ \$275 million in funding was allocated to advance projects that were already underway. These companies include AbCellera, a Vancouver-based biotech company that is developing antibody-based drugs to treat and prevent COVID-19; Medicago, a Quebec City-based company developing plant-based vaccines; the University of Saskatchewan's Vaccine and Infectious Disease Organization; the National Research Council of Canada; and BlueDot, a Toronto-based digital health firm, with a first-of-its-kind global early warning technology for infectious diseases.¹⁷⁷ While some companies are working on vaccine development and anti-viral drugs, others are working on the technology to support a broader healthcare response. As such, biopharmaceutical company PlantForm is working on the development of one of Canada's first tests to determine if a patient is immune to COVID-19.¹⁷⁸

Forecast

Figure 26 indicates ICTC's employment forecast for the health and biotech sector in Canada. The sector is forecast to dip in the coming months, before returning to close to its pre-crisis trend, by end of 2022 reaching 119,000 workers. A dip in health and biotech employment following COVID-19 may seem counterintuitive, but various aspects of the healthcare sector have seen declines in activity as a result of the virus. Many elective surgeries have been cancelled, and hospitals were largely empty in April. Healthcare activities like dentistry have been almost entirely postponed. In the United States, hospitals required support from the federal government, and many are closed to bankruptcy.¹⁷⁹ In time, the precise impacts of the virus, and the resulting behavioural and demand changes, will become clear in terms of its impact on the health and biotech sector, but ICTC's current forecasts predict that employment prospects for this sector will remain steady, with a small uptick in the near term. From Q1 2020 to Q4 2022, the health and biotech innovation area is expected to see a modest demand for approximately 5,000 workers.

¹⁷² *Ibid.*

¹⁷³ "Canada's Economic Strategy Tables: Health and Biosciences", *Innovation, Science and Economic Development Canada*, June 23, 2020, [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_HealthBioscience.pdf/\\$file/ISED_C_HealthBioscience.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_HealthBioscience.pdf/$file/ISED_C_HealthBioscience.pdf)

¹⁷⁴ *Ibid.*

¹⁷⁵ *Ibid.*

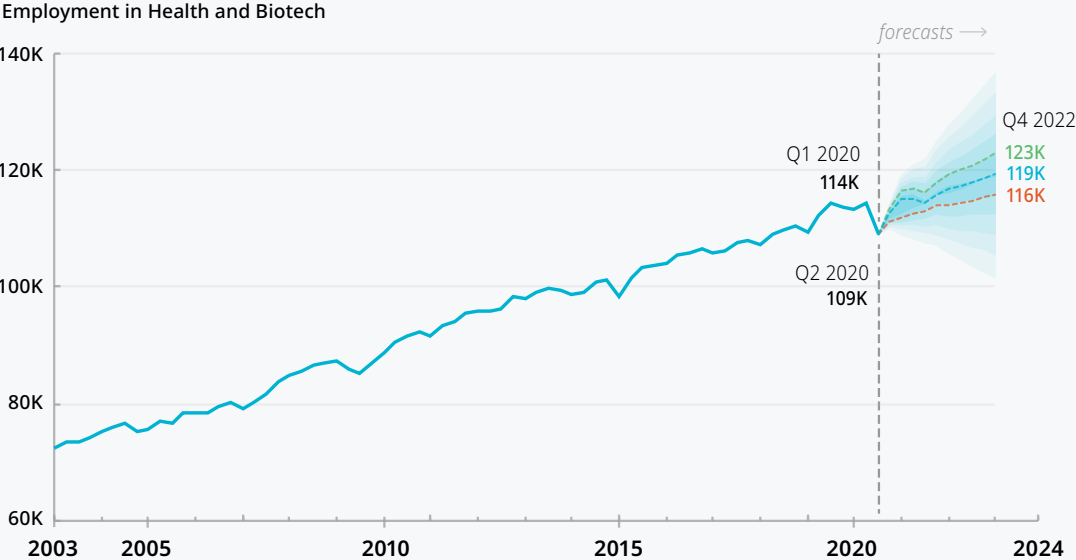
¹⁷⁶ "Canada's plan to mobilize science to fight COVID-19", *Prime Minister's Office*, March 23, 2020, <https://pm.gc.ca/en/news/news-releases/2020/03/23/canadas-plan-mobilize-science-fight-covid-19>

¹⁷⁷ *Ibid.*

¹⁷⁸ Barry Chong, "Amazing ways Canadian startups are tackling the COVID-19 crisis", *MaRS*, June 1, 2020, <https://www.marsdd.com/magazine/how-canadian-startups-are-tackling-the-covid-19-crisis/>

¹⁷⁹ Shawn Baldwin, "Why US Hospitals Are Going Bankrupt", *NBC Connect*, May 11, 2020, <https://www.nbcconnecticut.com/news/national-international/why-us-hospitals-are-going-bankrupt/2269464/>

Figure 26: Health and Biotech Employment Forecast



Source: ICTC

Conclusion

This paper has provided an important update and analysis of major events that have taken place since ICTC's *Outlook 2023* report, released in 2019. This trend report recreates the content of *Outlook 2023* during and post-COVID, and offers methodological improvements to forecasts, such as increased granularity. Section I outlines several of the key economic shocks that have and will continue to impact employment prospects across the Canadian digital economy, including the oil price crash, Brexit, and the Wet'suwet'en protests. The impacts of COVID-19 on the general economy are analyzed, including for employment and GDP. Forecasts are provided for the overall economy, along with analyses of shocks on occupations, different wage earners, and statistics on impacts by gender. The report also considers the impacts on the digital economy in particular, and highlights ICTC's updated forecast under various scenarios. Finally, this report offers updates on all of the six innovation areas previously identified as key drivers of Canada's growing digital economy: cleantech, advanced manufacturing, interactive digital media, agri-food and food tech, clean resources, and health and biotech.

COVID-19 and the economic downturn that it has precipitated is likely to represent the largest economic shock in Canada since the Second World War. The impacts of the virus, resulting quarantines and other economic and labour market disruptions will ripple through every sector, including the digital economy, for years, and may even have unforeseeable consequences. However, while the situation must be continually monitored over time, the digital economy has proved resilient to these changes, to date. While not untouched, the digital economy is likely to emerge from this crisis much stronger than other sectors. Current signs point to sustainable and even boosted demands for content, services, and in some cases even employment. Coupled with the greater ability of many digital roles to be performed remotely, the digital economy is likely to continue to prove resilient in a future where remote work may very well be considered the norm.

Although still early in the course of the pandemic, previous predictions about the elasticity and resiliency of the digital economy and digital roles in times of crisis appear to be accurate. Cognizant of the hazards of predicting the future, ICTC will continue to monitor the situation as it evolves and as the Canadian economy moves from crisis to recovery. Undoubtedly, even digital businesses have suffered loss and challenges. Yet, in the face of unforeseen circumstances, many have re-configured operations and adjusted to the new reality with agility and a true desire to innovate. Now more than ever, it becomes clear that the digital economy will be a key pillar of the post-COVID Canadian economy, and the driver of the new economy.

Appendices

Research Methodology

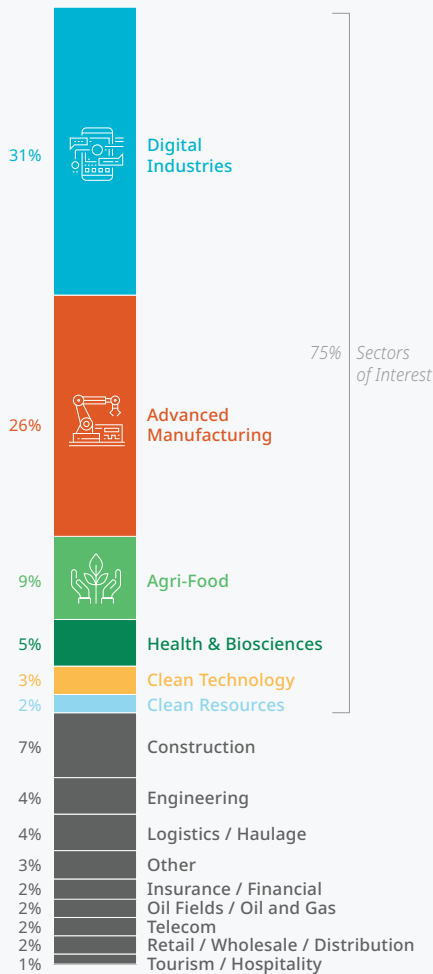
The analysis underpinning this report (first *Outlook 2023* Trend Report) is based on a combination of **primary** and **secondary** research.

Primary Research

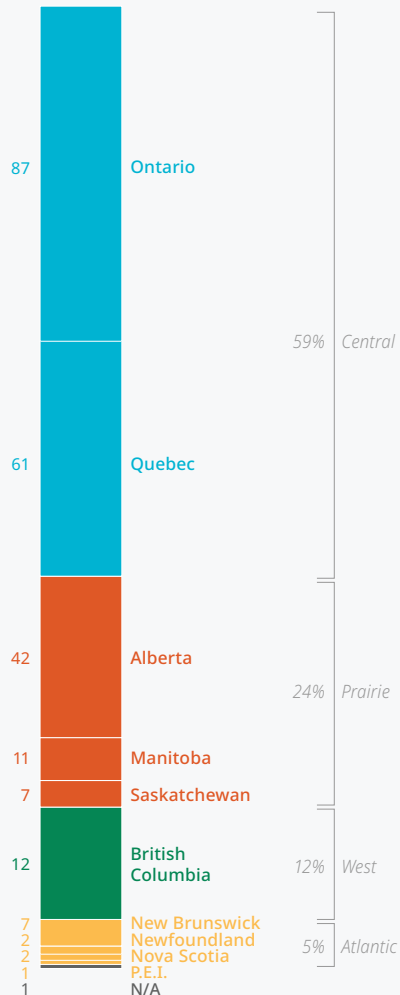
Completed in the fall of 2019, the primary research portion of this study was informed by a nationwide employer survey. While the survey targeted businesses across a variety of sectors in Canada, the key focus was on the following sectors: IDM, cleantech, clean resources, health and biotech, agri-foods and food tech, advanced manufacturing.

The survey was completed by representatives from 250 employers that self-identified as “Industry 4.0 companies”, with over 75% being in the main sectors of interest. All respondents were either proprietors or senior executives with significant influence on key decisions related to hiring and business strategy.

Respondents by Sector

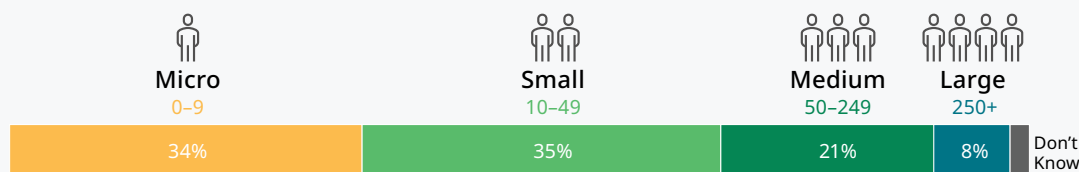


Province with Majority of Employees



The respondents were spread across all provinces, reasonably in line with their respective shares of national population and GDP.

Enterprise Size (by # of employees)



Although the results of this survey were intended to be used more extensively throughout this Trend Report, the onset of COVID-19 rapidly made many of the findings from the fall of 2019 obsolete. Therefore, the survey was used primarily to support insights related to the types of employment that underpin the digital economy and six innovation areas. Additionally, it helped highlight important trends in areas including: employee churn, workforce expansion plans including plans to outsource services abroad or hire foreign skilled workers, in-demand roles and skills, talent attraction strategies, key technologies used and the perceived importance of transformative technologies like AI, blockchain, and others.

Secondary Research

The secondary research includes literature and qualitative reviews of sectors under consideration, as well as key events taking place in the global and Canadian economy from fall 2019 to spring 2020. This research also relies heavily on secondary data obtained from Statistics Canada Labour Force Survey, and other surveys. O*NET data assembled by the US Department of Labour informed our assumptions regarding the trend in the unemployment rate for each sector. OECD, IMF, Canadian banks, and other public forecasts informed assumptions in our economic models and forecasts.

Forecast Methodology

ICTC uses monthly Statistics Canada Labour Force Survey data, split by NAICs and NOCs, to forecast employment levels for the various sectors under consideration in the *Outlook 2023* initial trend report. Since these data are monthly series, and are unadjusted for seasonality, the following macroeconomic data series from Statistics Canada was used for analysis:

- **Real GDP:** Gross domestic product (GDP) at basic prices, monthly (chained 2012 dollars)¹⁸⁰
- **Unemployment:** Labour force characteristics, monthly, unadjusted for seasonality¹⁸¹

Vector Autoregressive (VAR) models are used to perform the forecasting. VAR is a stochastic process model used to capture the linear interdependencies among multiple time series. In a VAR model, each variable has an equation explaining its evolution as a function of its own lagged values, the lagged values of other endogenous and exogenous variables, and the error term.

¹⁸⁰ "Table 36-10-0434-01: Gross domestic product (GDP) at basic prices, by industry, monthly (x 1,000,000)", Statistics Canada, June 23, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610043401>

¹⁸¹ "Table 14-10-0022-01: Labour force characteristics by industry, monthly, unadjusted for seasonality (x 1,000)", Statistics Canada, June 23, 2020, <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002201>

VAR models do not require an understanding of the causal relationship between the variables within the model, merely the knowledge that the variables are interrelated. Model specification (variables, lags) are chosen based on minimization of the Akaike and Schwarz-Bayesian Information Criteria (AIC and SBC).

The employment forecast for each sector is a function of assumptions regarding the trend in the unemployment rate for that sector, which is in turn, a function of its COVID-Safe Score. The COVID-Safe Score is calculated for each sector based on the proportion of workers who are either essential or can work remotely. This ratio informs the assumptions on the trend of the unemployment rate for each sector.

Unemployment rate forecasts for each sector enter exogenously into the VAR models to predict output (GDP) and employment trends. Other variables like prices, interest rates, stock indices, oil prices, manufacturing output, population, and wages sometimes enter the model depending on whether they optimize the information criteria. Confidence intervals output by the VAR model are used in the figures to provide a sense of the statistical uncertainty of model forecasts.

Limitations of Research

While every effort was made to ensure that the research underlying this report was as exhaustive as possible, a few limitations exist.

Low survey response rate for certain regions and sectors

While the survey garnered over 200 responses, there were no participants from the three territories. Furthermore, only four provinces, and three sectors had sample sizes large enough to conduct meaningful analysis of their respective trends. That being said, the quality of survey responses was very high, with most respondents completing all questions in detail.

Measuring “size” of innovation areas

Because the innovation areas (e.g. advanced manufacturing, health and biotech, agri-foods and food tech, etc.) worked with in this report are not documented by historical data, ICTC utilized a combination of secondary and primary research to estimate the size of these areas (subsectors) in Canada. While ICTC will continue to track these over time, it is possible that the overall size of these areas may be smaller or larger than the initial estimates.

The Limits of Forecasts

Forecasting is not a crystal ball – it is a statistical process mixed with a fair amount of subjective judgment. Every investor will hear the phrase “past performance is not indicative of future results”, but in time series forecasts past trends (or lagged variables, in the VAR) are indeed, statistically-speaking, the best predictor of future trends. Add onto that some simple assumptions about the relationship between variables, and the VAR will produce a forecast. In the best of times, these forecasts are wrong a substantial portion of the time. For instance, one often finds media stories of economists “surprised” by economic numbers coming in different “than expected”.

In the era of COVID-19, predictions are even more challenging to make. In this report, ICTC has been relatively transparent about processes, assumptions, and the results of the model. The reader can observe how varying the unemployment rate scenarios from optimistic to pessimistic changes the forecast. On top of that, confidence intervals provide an idea of the range of statistically likely outcomes, given just one scenario is true. In other words, ICTC showcases two distinct sources of uncertainty, and these sources are significant. ICTC considers the point estimate for baseline forecasts to be the most likely outcome for Canada's economy, but there are wide confidence intervals. This is an unavoidable feature of any forecast, particularly in high-flux periods like the present.