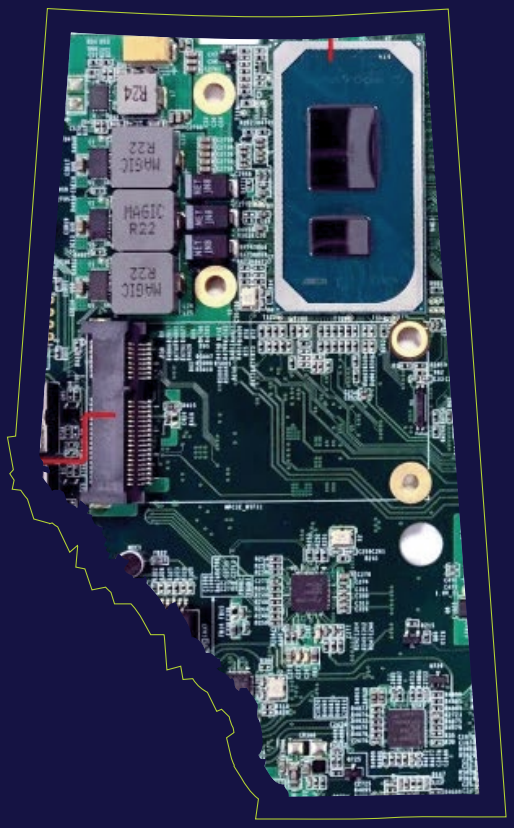

A RESILIENT RECOVERY

ALBERTA'S DIGITAL-LED POST-COVID FUTURE

ICTC CTIC

Research by

The Information and Communications
Technology Council

Canada Alberta

The Province of Alberta is working in partnership with
the Government of Canada to provide employment
support programs and services

Preface

The Information and Communications Technology Council (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 an expansive network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 30 years.

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The opinions and interpretations in this publication are those of the authors and do not necessarily reflect those of the Government of Alberta.

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Executive Summary

In Alberta and across Canada, the economic and labour market impact of the COVID-19 pandemic was felt unevenly across sectors. As traditional in-person activities like shopping, work, and school shifted to the online world, sectors like retail, hospitality, tourism, manufacturing, and construction bore the brunt of that change and were subject to rapid and deep declines in output and employment. Although the digital economy was not completely spared of that disruption in consumer activity and supply chain integrity, by early summer 2020, tech employment and output almost immediately began an upward trajectory.

Despite the notable impact of the pandemic on Alberta's economy, the province's digital economy remained resilient and thrived. From February 2020 to May 2022, participation in Alberta's digital economy grew by nearly 18%, and employed an additional 30,000 Albertans. In-demand jobs that experienced this growth included software-related roles like full stack developers, back end developers, and DevOps; data-related roles like data engineers, data analysts, and machine learning engineers; design-related roles like UX and UI designers, and product designers; and other roles such as operations and business, including cybersecurity specialists, product managers, and digital marketers.

The pandemic also accelerated the permeation of digital technology across sectors. A recent study by McKinsey found that the pandemic accelerated global technology adoption by several years. As a result, more "traditional" sectors are adopting, implementing, and even developing technological services and solutions to solve local and global challenges.

This study highlights four key subsectors that are poised to drive significant employment disruption and the growth of high-quality jobs for Albertans: fintech, health tech, clean technology, and agtech.

Financial technology witnessed a surge of new users as COVID-related health measures led more Albertan consumers and businesses to adopt digital banking services; health tech received a major boost as health professionals turned to telehealth and online consultations (related streams such as biotechnology also advanced). While Alberta is a national leader in cleantech, renewed national and international focus on net-zero goals led to a growth spurt in cleantech companies, alongside a boost in the procurement of cleantech products and services by oil and gas companies. Lastly, the pandemic—along with disruptions related to climate change—spotlighted sustainability and food security, putting a finer point on agricultural technology.

Most digital economy employers in this study are bullish about post-pandemic growth prospects; many had weathered the storm of COVID-19 and emerged with revenues and employment numbers exceeding pre-pandemic levels. Nearly three-quarters of employers believe that their companies' revenues would stay above pre-pandemic levels going forward. However, realizing this potential requires a steady supply of talent; while the digital economy proved resilient to the most devastating economic and labour market impacts of COVID-19, the talent crunch also accelerated over the last few years. Employers surveyed in this study identified a lack of digitally skilled talent as the biggest threat to the success of the province's digital economy going forward. This challenge is compounded by wage inflation and the "brain drain" of workers finding work in other jurisdictions.

Alberta plays an important role in the Canadian and global market rebound. Addressing accelerated demand for energy, agricultural goods, and technology products and services, TD Economics expects GDP growth in Alberta to reach 5.8%, surpassing that of all other the provinces and the Canadian average. A provincial focus on talent development, attraction, and retention is key to continued and sustainable prosperity.

Introduction

This report, an update to ICTC's 2019 study, A Digital Economy for Alberta, uses mixed methods to unravel the changes and labour market opportunities in the province's digital economy during COVID-19 and beyond. In so doing, the report highlights labour force and market impacts, the perceptions of business needs and opportunities by digital economy employers, and the critical labour force needs required for Alberta companies to scale the province's national and global digital-economy footprint. In addition to a review of existing literature and relevant secondary data, this report leverages insights from 35 interviews and engagements with industry leaders, regional representatives, and other subject matter experts; a survey of 81 employers in the province's core digital sector and four key subsectors; and two meetings of the project's advisory committee, comprising 20 people representing critical stakeholder groups, including industry, academia, government, industry associations, and equity-deserving groups.

Section I offers a brief history of Alberta's general economy, its recent past and present. It discusses the impact of COVID-19 and discusses Alberta's economic recovery.

Section II provides an overview of Alberta's digital economy, with a focus on business challenges and post-pandemic opportunities.

Section III discusses employment in Alberta's digital economy, including an overview of critical labour force needs, in-demand jobs, and skill profiles (including "hard" and "soft" skills).

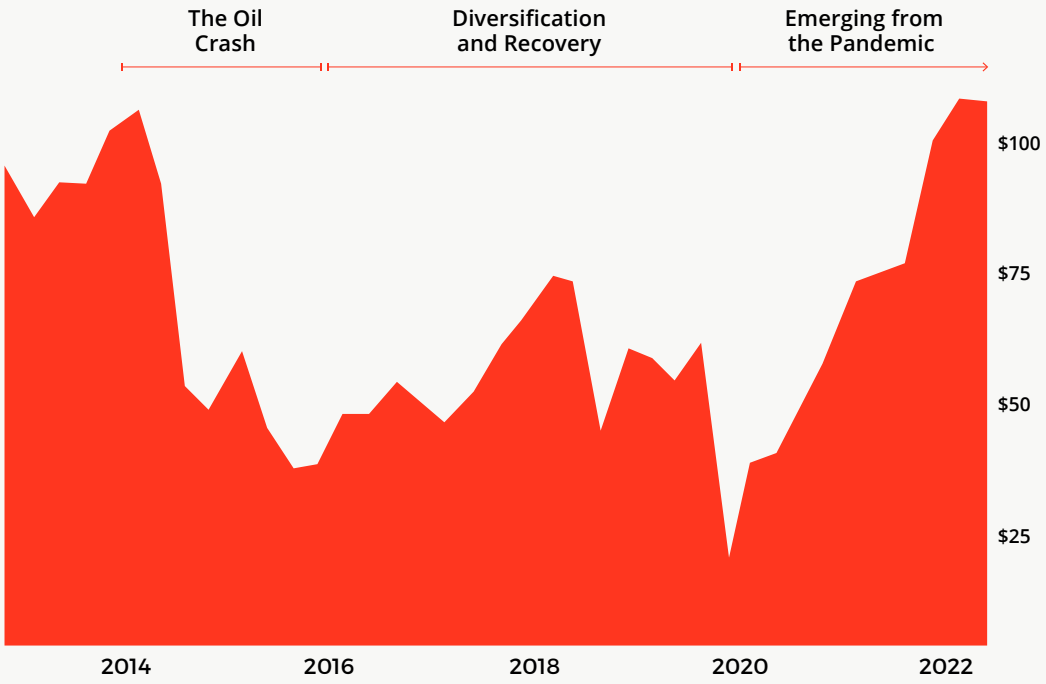
Section IV highlights Alberta's key cities driving economic and labour market growth during the pandemic: Calgary, Edmonton, and Lethbridge. Regional profiles are presented, including investments, in-demand roles, and hiring trends.

Section V offers an overview of the four digital economy subsectors that have emerged, or are emerging, from the pandemic with strong economic and labour market prospects: health tech, clean technology, financial technology (fintech), and agricultural technology (agtech). Each is discussed along with an overview of strengths, weaknesses, opportunities, and challenges (SWOT).

SECTION I

Alberta's Economy: A recent history

WTI Crude Price



2014-2015: The Oil Crash

Alberta is Canada's largest energy-producing province, with oil and gas production playing a central role. At its height in 2014, exports from the oil and gas extraction sector (including mining, quarrying) totalled over $70.5 billion, more than half (56%) of the value of all provincial exports.[1] From 2011 to 2014, a barrel of WTI traded for over $100. Yet, years before the 2014 peak, major forces also foreshadowed disruption. After the Great Recession of 2008, the US "shale oil revolution" (multi-stage hydraulic fracture stimulation of shale formations to produce oil and natural gas) created new and steady hydrocarbon supply, but oil prices remained high from 2011 to 2014, as other factors weighed in, such as the Arab Spring (and notably the civil war in energy-rich Libya), continued strong demand from emerging markets like China and the Middle East,[2] and sanctions on Iran.

1 Statistics Canada. Table 12-10-0098-01 Trade in goods by exporter characteristics, by industry of establishment (x 1,000)

2 https://www.eia.gov/todayinenergy/detail.php?id=4550

Oil supply began to catch up when the global economy eased—largely marked by slowdown in China. Oil-producing countries needed to adapt to dramatically lower oil prices. Western producers responded by reducing output, however, OPEC (Organization of the Petroleum Exporting Countries) leaders did not follow suit. Some OPEC members, including Saudi Arabia, the organization's largest producer, declined to adjust production and instead continued to sell as previously planned. The resulting excess oil supply further depressed oil prices.

The impact of this shift was felt immediately in Alberta. Not only did the price of a barrel of oil drastically decline (WTI traded below $40 in 2015), total oil and gas exports plunged as well (at the time, Alberta exports represented $43.8 billion, or 46% of all exports). By 2016, the oil crash was in full swing, and exports fell to $33.8 billion (42% of all exports). In two years, the value of Alberta's oil and gas exports contracted by 30%. With the sector playing such a large role, the decline impacted the entire Alberta economy: from 2014 to 2016, the value of total exports in Alberta plunged by 20% (from $124.3 billion to $77.8 billion)[3]; GDP declined by 7.4%, and the province shed nearly 20,000 jobs, the most substantial job loss since 1982.[4]

In 2016, despite numerous previous attempts to diversify the economy, Alberta redoubled its efforts, seeking new ways to attract investment, boost employment, and generate prosperity. A large part of this push for diversification focused on the province's quickly emerging tech sector.

2016-2019: Diversification and Recovery

By 2016, Alberta's recession troughed and, by 2017, GDP began its slow upward trajectory. In 2017, Alberta GDP grew by nearly 5%, and in 2018 it continued to climb at 2%.[5] By 2019, growth began to slow, but remained positive, at 0.7%.[6]

3 Statistics Canada. Table 12-10-0098-01 Trade in goods by exporter characteristics, by industry of establishment (x 1,000)

4 Parkinson, D., "Alberta ensures most annual job losses since early 1980s recession", January 26, 2016, *The Globe and Mail*, https://www.theglobeandmail.com/report-on-business/economy/jobs/alberta-job-losses-last-year-worst-since-early-1980s-recession-statscan/article28393681/

5 Idem.

6 Largely due to production slow-down in oil and gas.

Key developments took place in Alberta from 2016 to 2019 to coax a recovery from the recent oil crash and bring labour market opportunities to Albertans. First, a concerted effort was undertaken to promote Alberta as a favourable destination for investment. A robust and well-educated talent base, affordable real estate, and access to well-known training institutions like the University of Alberta and the Southern Alberta Institute of Technology (SAIT) were just a few factors that resonated with investors. In 2016, after years of economic downturn, Alberta reported $14,606 per capita investment, over twice the national average ($6,576).[7] During this period, technology played a central role. In 2016, over 1,300 technology companies were based in Alberta, more than a 40% increase from 2012.[8] Moreover, several subsectors showed the promise of strong growth; by 2016, there were over 60% more software companies in Alberta than in 2012, and the number of energy tech companies calling Alberta home more than doubled. Although a few years later, in 2018, the total number of Alberta-based tech companies dipped by 10% (to 1,238 companies), the loss was largely among the micro-sized ventures that employed fewer than five people. Conversely, the presence of companies with five or more employees all grew; for example, compared to 2016, the presence of companies with 10–24 employees grew by 10%, companies with 50–99 employees grew by 2%, and companies with 100+ employees grew by 3%.[9]

Digital Economy Companies in Alberta

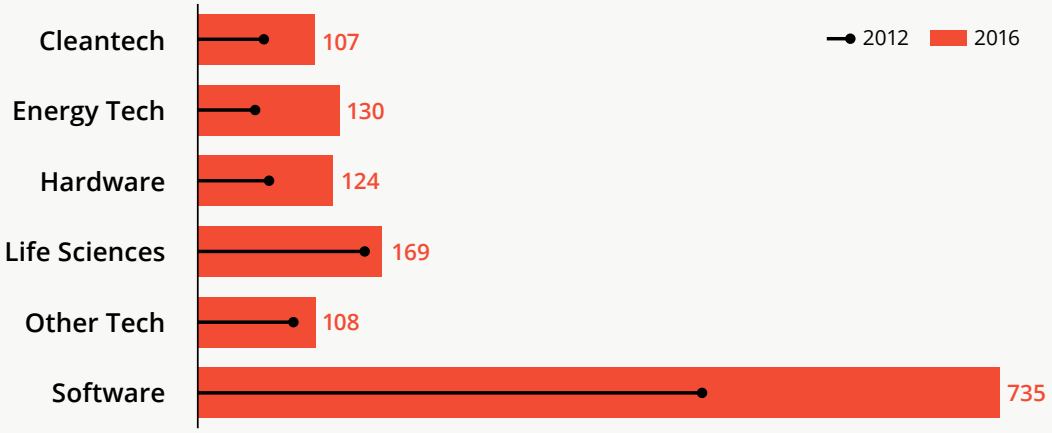


Figure 1. Change in number of digital economy companies headquartered in Alberta, 2012-2016.
Source: Alberta Technology Deal Flow Study, 2016.[10]

7 "Highlights of the Alberta Economy, 2017", *Government of Alberta*, https://open.alberta.ca/dataset/10989a51-f3c2-4dcb-ac0f-f07ad88f9b3b/resource/513eef5f-aa53-4cde-888d-8e52822b6db4/download/sp-eh-highlightsabeconomypresentation.pdf

8 "Alberta Technology Deal Flow Study September 2016", *Alberta Enterprise*, https://www.alberta-enterprise.ca/wp-content/uploads/2018/03/2016-Deal-Flow-Study-Report.pdf

9 "2018 Alberta Technology Deal Flow Study", February 2019, *Alberta Enterprise*, https://www.alberta-enterprise.ca/wp-content/uploads/2019/02/2018_DealFlowReportFeb.pdf

10 "Alberta Technology Deal Flow Study September 2016", *Alberta Enterprise*, https://www.alberta-enterprise.ca/wp-content/uploads/2018/03/2016-Deal-Flow-Study-Report.pdf

Other prominent digital economy investments were also important to Alberta's economic recovery:

- In 2017, Alberta announced a Screen-based Production Grant (now closed). The program offered a grant of up to 30% of eligible production expenditures for Albertan-owned companies (26% for those not owned by Albertans).[11] The purpose of this grant was to promote economic diversification in the province by leaning into Calgary's established reputation as a global centre for film and television production. The grant was later replaced by the Film and Television Tax Credit (FTTC).

- A second key milestone was the Interactive Digital Media Tax Credit, launched in 2018. This program provides a 25% refundable tax credit on qualifying labour expenses for companies operating in Alberta whose primary business is the development of digital media and games.[12] In 2018, Alberta's interactive digital media (IDM) sector employed over 63,000 people. Employment in the sector has since grown by another 6%. Although the credit was a welcome development, IDM industry representatives in this study note that the credit still pales in comparison to what is offered in other Canadian IDM clusters (for example, the Quebec Tax Credit for Film Production Services [QPSTC] offers a 20% flat rate on all eligible expenses, with another 16% "top up" for animation and visual effects expenses).[13]

- In 2018, a bilateral agreement was made with the federal government for a $3.3 billion investment into infrastructure, including public transit, green infrastructure, community infrastructure, and rural communities.[14] Key objectives of this investment included a reduction in greenhouse gas emissions, smarter and more efficient cities, and improved and sustainable water management.

- In 2019, the province announced an investment of $100 million over five years to boost the homegrown artificial intelligence (AI) industry, to boost its commercialization, attract foreign investment, and create more than 6,000 jobs.

11 "Alberta Media Fund: Screen-Based Production Grant, Program Guidelines", October 25, 2017, *Government of Alberta*, https://albertafilm.ca/funding/docs/spg-guidelines.pdf

12 "Interactive Digital Media Tax Credit", *Government of Alberta*, https://open.alberta.ca/dataset/36e518f5-26e7-4384-9b21-5c6267099fbb/resource/db70ee1d-85fd-4e8c-9bdd-78a770250eb9/download/idmtc-program-information-sheet-final.pdf

13 "Refundable Tax Credit for Film of Television Production Services", *Government of Quebec*, https://www.sodec.gouv.qc.ca/wp-content/uploads/guidelinesrefundable-tax-credit-for-film-production-services.pdf?v=3a01f99c868d26dd5460b112fab78d8d8e

14 "Canada and Alberta make significant investments that will improve the lives of Canadians", April 3, 2018, *Infrastructure Canada*, https://www.canada.ca/en/office-infrastructure/news/2018/04/canada-and-alberta-to-make-significant-investments-that-will-improve-the-lives-of-canadians.html

With three years of back-to-back growth following the recession, by 2019, Alberta employers were largely optimistic about business and revenue opportunities that lay ahead. A survey of Alberta's digital economy employers conducted by ICTC in 2019 found that nearly half (44%) expected to see strong or very strong revenue growth in the coming 12 months. Notably, nearly no employers expected to see a decline in their revenue or business prospects.

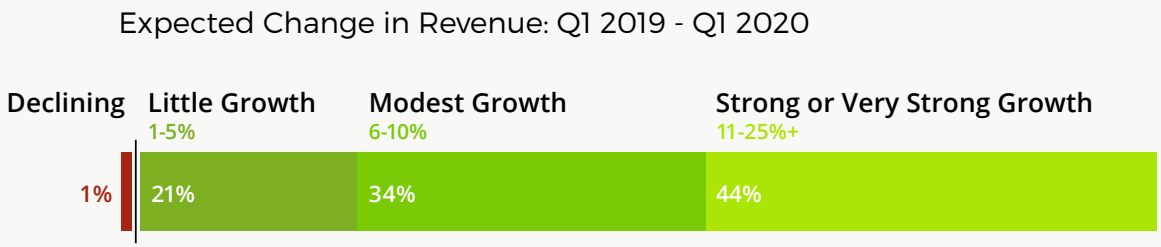


Figure 2. Alberta digital economy employers' perception of revenue growth 2019-2020.
Source: ICTC 2019.

A Bumpy Road: Entering and Emerging from the Pandemic

The COVID-19 pandemic marked the most severe public health and economic crisis to hit Canada in recent history. Although necessary to slow the spread of the disease and curtail loss of life, public health measures and lockdowns in Q2 2020 caused employment and economic output to steeply decline, creating the biggest shock since the Second World War. Millions of Canadians lost their jobs during this period, leading to the largest decline in employment since the Labour Force Survey was launched in 1976.[15] In Alberta alone, nearly 150,000 jobs were shed from 2019 to 2020; some of the biggest sector employment losses were in Accommodation and Food Services (-21.3%), Agriculture (-13.3%), Oil and Gas (-9.3%), and Retail (-8.5%).[16]

15 Statistics Canada, Labour Force Survey, Table: 14-10-0023-01
16 Ibid.

Unsurprisingly, 2020 was a significant year for business exits (closures of more than six months) in Alberta: more than 22,300 businesses exited the economy, compared to just over 18,300 that opened (net deficit of just over 4,000).[17] However, business exits were neither unique nor especially pronounced in the context of Alberta's population and the size of its economy. For example, net employment deficits were recorded across all major provinces: neighbouring British Columbia recorded a net deficit of just over 1,000, Quebec recorded approximately 7,200, and Ontario recorded slightly more than 8,000.

Business Entrants and Exits: 2020

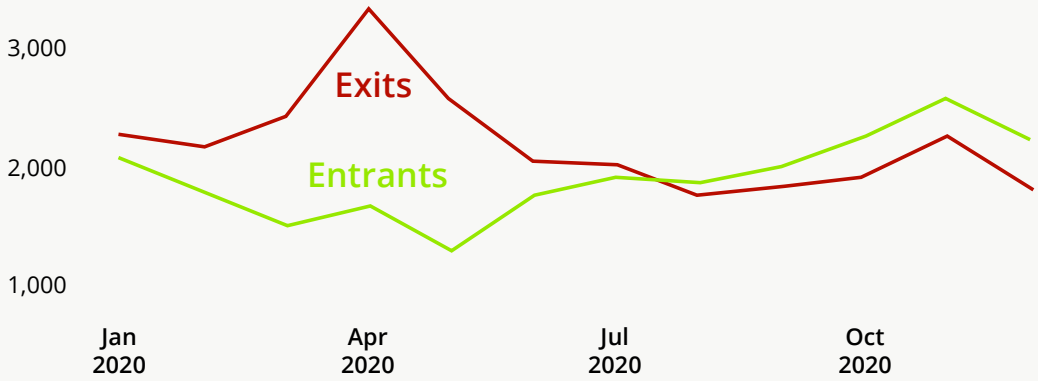


Figure 3. Business entrants and exits (estimates), Alberta 2020.
Source: Statistics Canada. Table 33-10-0270-01 Experimental estimates for business openings and closures for Canada, provinces and territories, census metropolitan areas, seasonally adjusted.

The combination of slowing business activity and steep drops in employment caused GDP to nosedive in 2020. Across all industries in Canada, GDP fell by over 5%. In Alberta, the impact was even more pronounced: GDP contracted by nearly 8% in 2020, a decline second only to the Northwest Territories (-10%).[18] With the confluence of two recessions, Alberta faced some of the slowest GDP growth from 2012 to 2021 (less than 1%). Yet, despite some economic instability, Alberta has consistently maintained the third largest GDP of all Canadian provinces, in 2021 totaling more than $323 billion.

17 Statistics Canada. Table 33-10-0270-01 Experimental estimates for business openings and closures for Canada, provinces and territories, census metropolitan areas, seasonally adjusted

18 Statistics Canada. Table 36-10-0402-02 Gross domestic product (GDP) at basic prices, by industry, provinces and territories, growth rates (x 1,000,000)

Forecasts for 2022 and 2023 are also promising for the province. The digital economy continues to expand, and exogenous factors like the rising global demand for energy (in part fuelled by the conflict in Ukraine), and bottlenecked supply chains still impact nearly all nations. According to TD Economics, Alberta's economy will especially benefit from additional demand for energy, potentially leading to "soaring" oil prices and elevated prices for natural gas.[19] Other contributing factors include a strong real estate market and government offsets (such as the recent fuel tax break, suspending the collection of provincial tax on gasoline and diesel), the latter functioning to maintain healthy household discretionary spending capabilities.[20]

Real GDP Forecast: 2022 & 2023

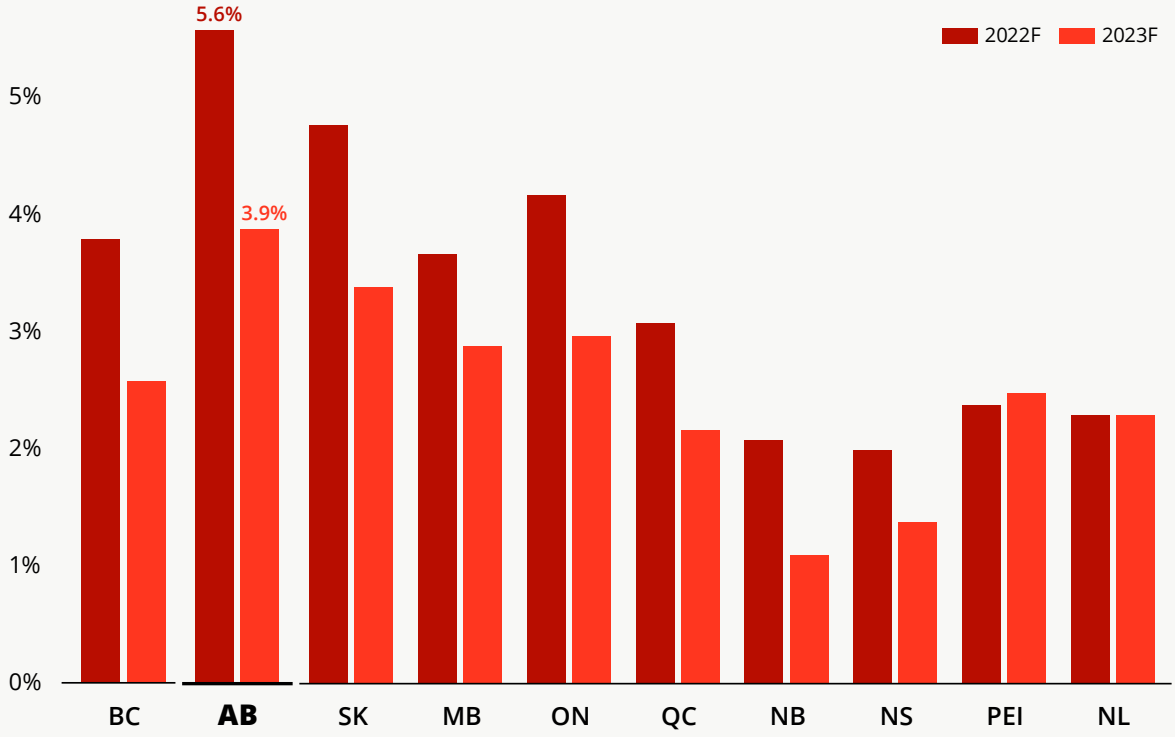
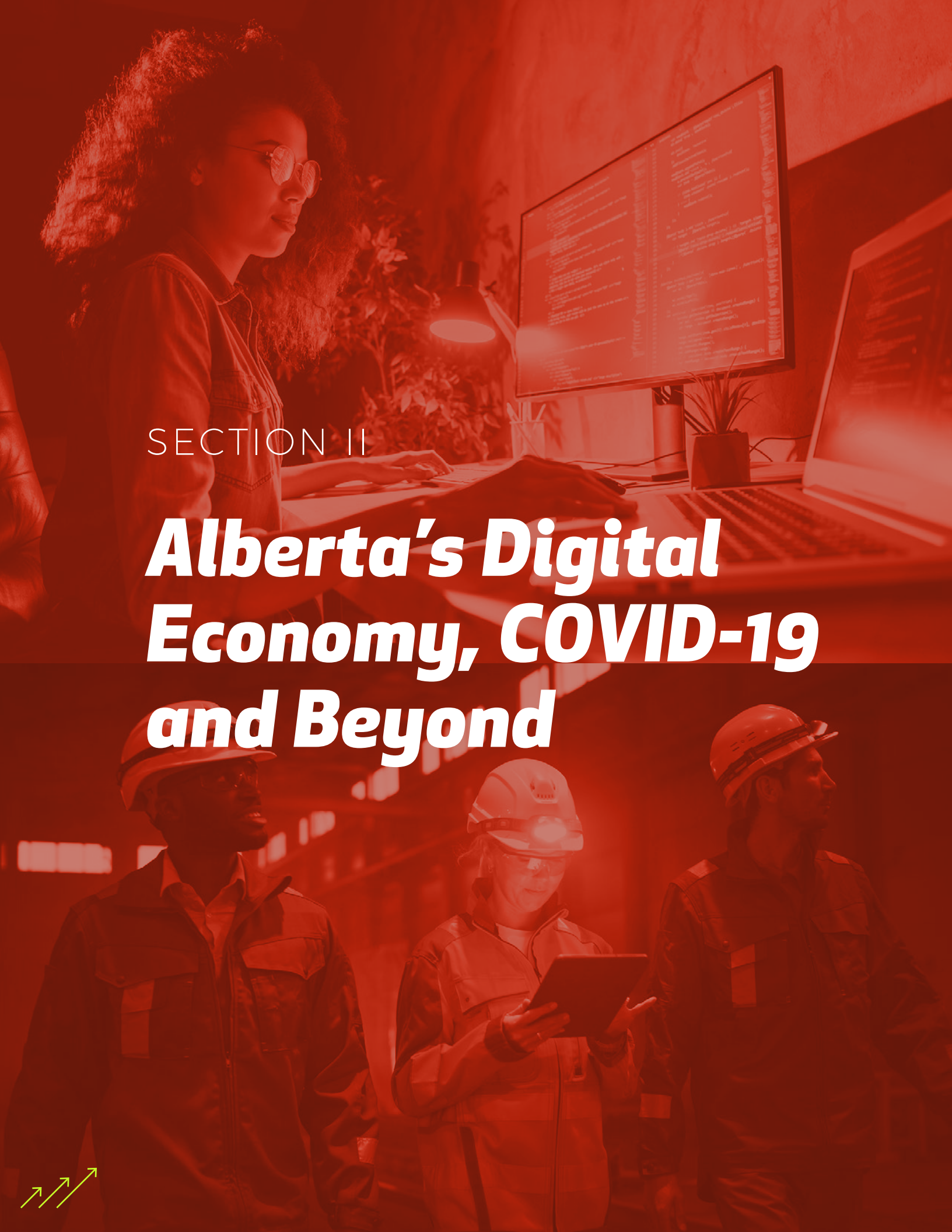


Figure 4. Real GDP forecasts, 2022 & 2023.
Source: CREA, CMHC, Statistics Canada, TD Economics. Forecasts by TD Economics as at March 2022. National forecasts for 2022 and 2023: 3.9%, 3%.

19 Caranci, B., "Provincial Economic Forecast: Alberta and Saskatchewan to Top Growth Leaderboard This Year", June 22, 2022, *TD Economics*, https://economics.td.com/provincial-economic-forecast

20 Ibid.



SECTION II

Alberta's Digital Economy, COVID-19 and Beyond

Weathering the Storm: The Digital Economy Over the Last Two Years

Although Alberta is positioned for the strongest growth of all provinces in 2022 and 2023 (it also saw the second-strongest recovery in 2021 at 5.3% GDP growth, after Quebec at 6.2%),[20] in 2020, the general economy faced steep declines, which created cascading employment impacts. Employment growth in the province's digital economy had largely surpassed that of the general economy since 2014, but the onset of the pandemic in March 2020 marked a significant inverse correlation: as employment in the general economy steeply declined, employment in the digital economy sharply rose.

Normalized employment growth in Alberta's digital economy and its overall economy

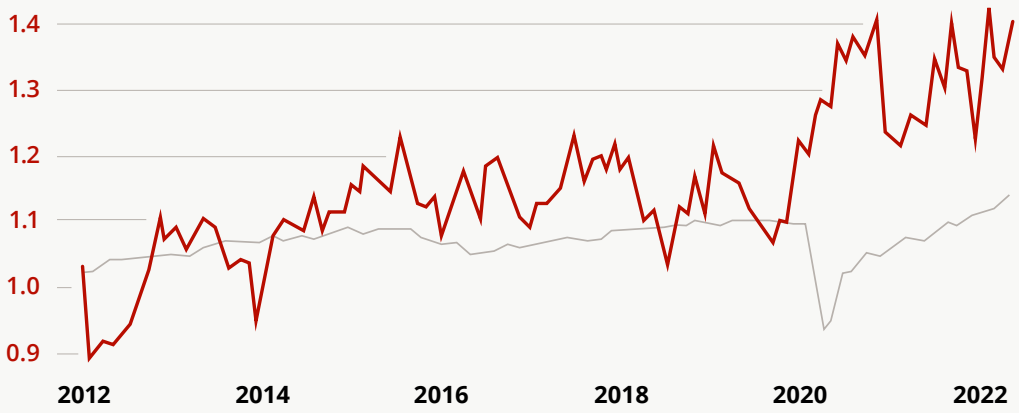


Figure 5. Normalized employment growth: Alberta digital vs. general economy, Jan 2012-May 2022. **Source:** Stats Canada, ICTC.

At the sector level, employment impacts varied. Knowledge sectors like technology, finance, and professional, scientific, and technical services were able to transition easily to the digital new normal. The popularity of online shopping and unyielding demand for goods and services also created a steady growth path for the wholesale and retail trade sector. Sectors that provide essential services, such as healthcare and education, also quickly adapted and saw employment growth in 2021.

20 Ibid.

Conversely, other sectors like accommodation and food services (hospitality), manufacturing, and agriculture continued to face notable challenges, including cash-flow, and talent attraction. Although agricultural technology promises sector-wide efficiencies and advancements, the agriculture sector of today is still largely "traditional," comprising workers tasked with crop production, animal and aquaculture production, and support activities. Moreover, the presence of foreign workers in the sector is significant: one in five people employed in crop production in Canada during 2017 are foreign workers.[21] Travel restrictions[22] thinned the supply of agricultural workers that could enter Canada during the pandemic. Constricted supply chains made parts and machinery difficult to access and caused prices to soar.[23] The greater frequency of climate disasters, such as fires, droughts, and floods, also threatened, damaged, or destroyed yield, which caused food shortages in some regions (and employment in the agriculture sector remains 25% below pre-pandemic levels).

Throughout the pandemic, the digital economy did not see employment drop below February 2020 levels, and by 2021, it was on a strong growth path while other signs of recovery began to take hold. In 2021, FDI inflows to Canada rebounded significantly, up 140% since 2020, reaching $74.8 billion (the highest since 2007).[24] A significant contributor to this growth was the Software & IT services sector, which Canada's Revealed Comparative Advantage (RCA) index ranked the highest among all sectors, at 3.99 points.

General investment resurgence, recovery across the broader global economy, and sustained consumer demand were among the factors that also contributed to strong and continued employment growth in Alberta's digital economy. From February 2020 to May 2022, employment in the province's digital economy grew by nearly 18%, adding more than 30,000 jobs. One industry representative participating in this study referred to the digital economy as "*a beacon of hope—growing while many other industries struggled*." Given the relative resilience of digital economy businesses, ICTC's tech employer survey found that more than half (51%) of employers identified no change to their business as a result of the pandemic, while another 38% experienced only minimal and temporary disruption, often resulting from the transition to remote or hybrid work.

21 Ibid.

22 Zhang, Y, Ostrovsky, Y., Arsenault, A., "Foreign workers in the Canadian agriculture industry", April 28, 2021, *Statistics Canada*, https://www150.statcan.gc.ca/n1/pub/36-28-0001/2021004/article/00002-eng.htm

23 Lupton, A., "COVID-19 restrictions on migrant workers will be devastating, Ontario farmers warn" March 17, 2020, *CBC News*, https://www.cbc.ca/news/canada/london/covid-19-restrictions-on-migrant-workers-will-be-devastating-ontario-farmers-warn-1.5500269

24 "Parts Supply Chains, Farm Equipment and What's Next", August 9, 2021, *DLL*, https://www.dllgroup.com/en/blogs/blogsoverview/Parts-supply-chains-farm-equipment-and-whats-next

Alberta: Employment by Sector

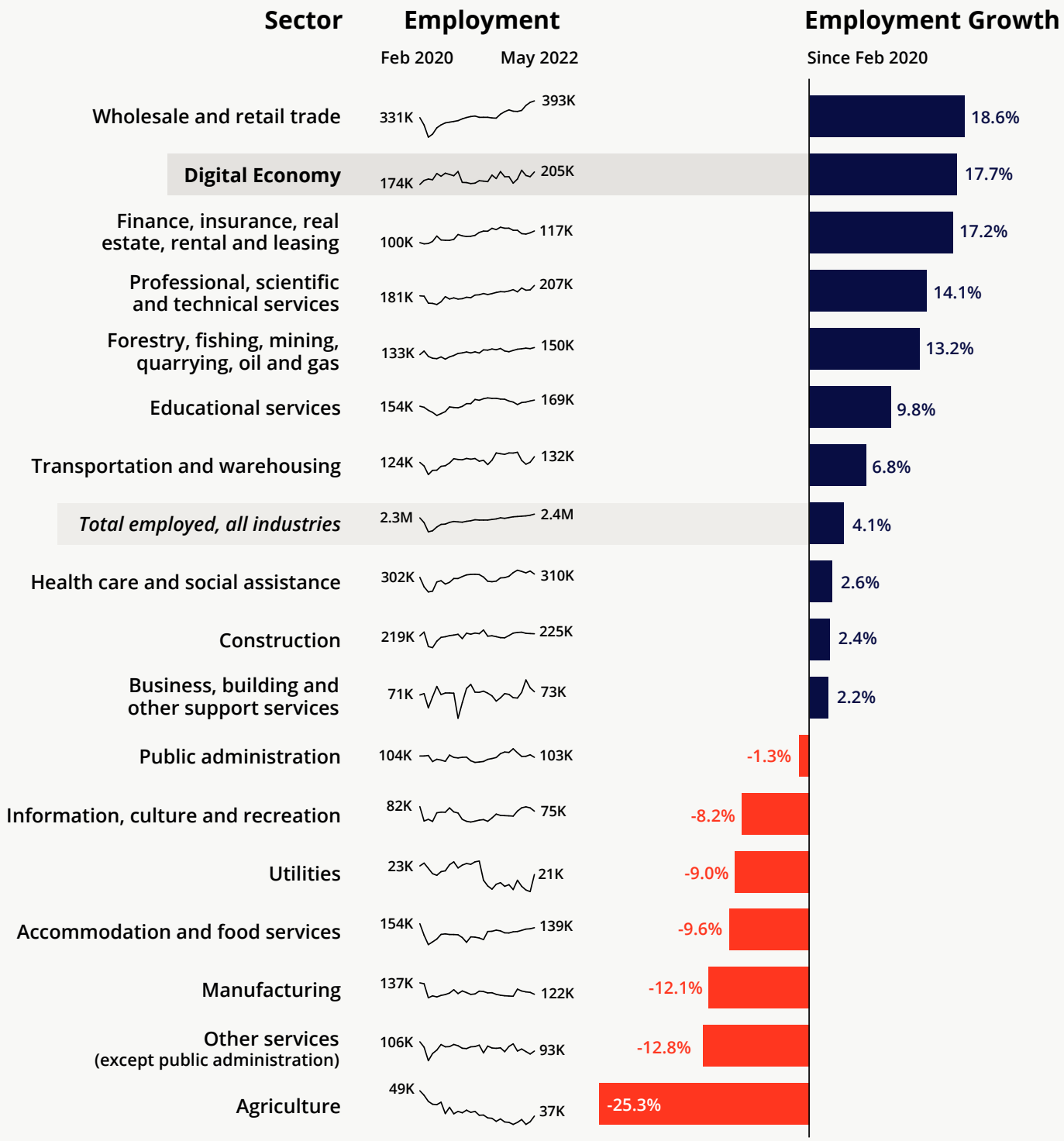


Figure 6. Employment trends, February 2020 – May 2022; Alberta, all sectors. **Source:** Stats Canada, ICTC.

Coinciding with the strong growth in employment, more companies now call Alberta home. Research by PwC identified the presence of 2,806 tech companies in Alberta in 2021. This is a 127% increase from 2016 (1,568 companies), and more than a 200% increase from 2012. Moreover, while technology companies based in Alberta in between 2012 and 2018 were largely software, hardware, or energy related, by 2021, two other subsectors saw notable growth: health tech, and agtech. From 2018, the representation of health tech and agtech companies in Alberta grew by 130% and 275%, respectively.[25] Energy tech (a central vertical of clean technology) has always been a key component of Alberta's digital economy. However, according to the same research by PwC, it too saw significant growth despite the pandemic; by 2021, 349 energy tech companies called Alberta home, an increase of 35% from 2018.[26]

The same 2021 report identifies that nearly 40% of Alberta-based technology companies have annual revenues of at least $1 million, some even reporting revenues of $15 million or more.[27] Another 43% raised at least $1 million in seed funding. These trends align with broad data captured by the Canadian Venture Capital Association (CVCA). CVCA notes that in Q1 2022, nearly every province experienced an increase in investment activity. Although Ontario received the largest total investment, raising $2.3 billion, Alberta experienced its highest quarterly investment on record, with 26 companies raising $466 million.[28] Over 90% of these investments were directed to Calgary-based companies, and nearly half of these investments (11) were made in the technology sector. Calgary fintech darling, Neo Financial, received a $185 million Series C investment, earning it a valuation of over $1 billion and a seat at the "unicorn" table.[29] An additional three investments were made into companies in the agribusiness subsector, representing the highest concentration of quarterly investments in this area of any province.

25 "2021 Alberta Technology Deal Flow Study", July 2021, *Alberta Enterprise*, https://www.alberta-enterprise.ca/wp-content/uploads/2021/08/AEC-Deal-Flow-Report-2021-FINAL-2021-08-19.pdf

26 Ibid.

27 Ibid.

28 "Q1 – 2022 – VC & PE Canadian Market Overview", *CVCA Intelligence*.

29 Stephenson, A., "Neo Financial becomes Calgary's latest $1b tech 'unicorn'", May 5, 2022, *CBC News*, https://www.cbc.ca/news/canada/calgary/neo-financial-unicorn-calgary-venture-capital-1.6442174

When the pandemic ends...

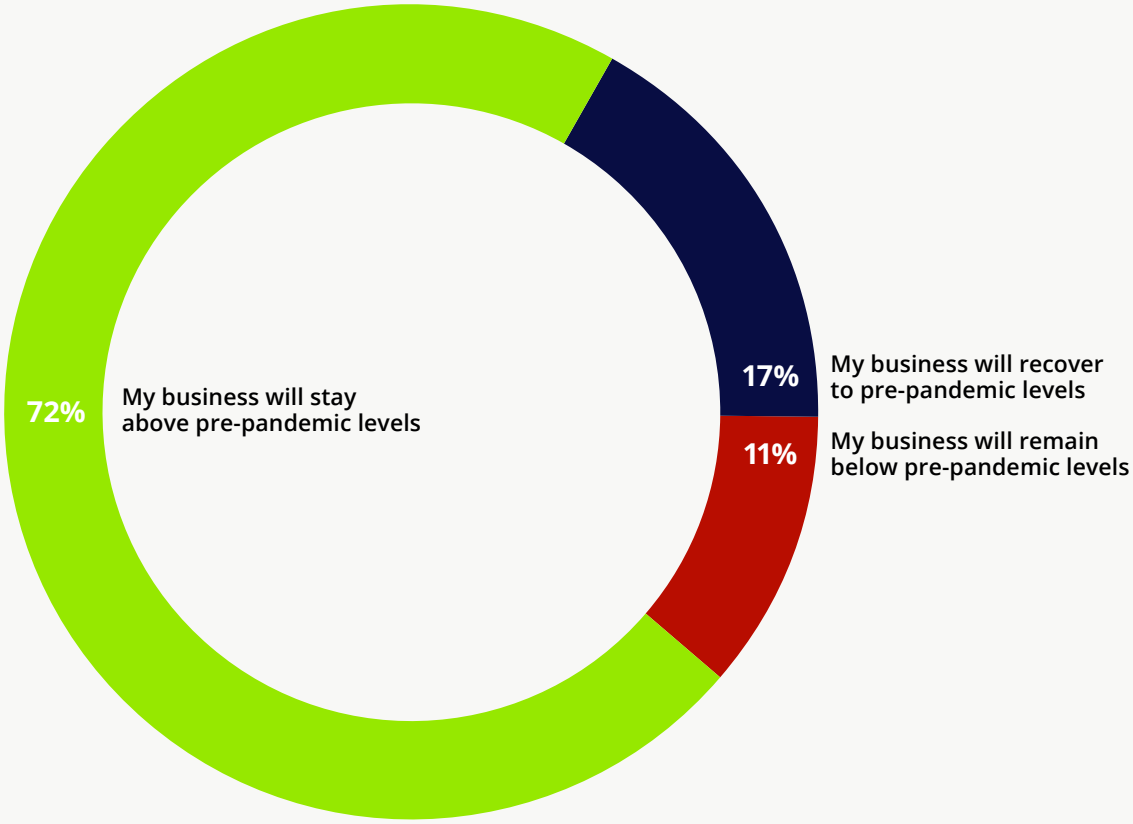


Figure 7. Perceptions of the lasting impact of COVID on digital economy employers.
Source: Alberta Digital Economy Employer Survey, ICTC, 2020-21 (survey ran from October 2020-March 2021).

My revenue doubled, and my team grew during the pandemic… We were able to thrive in the chaos of COVID. ”

– Digital economy employer

"Labour shortage" or work quality issue? Hospitality, construction, healthcare

While other sector employment soared, Alberta's hospitality sector employment remained nearly 10% below pre-pandemic levels in May 2022. Healthcare and construction recorded positive but very modest employment growth (2.6%, and 2.4% respectively), far below the strong increase in sectors like education, forestry, and finance.

Although the reason for the recovery of some sectors is often attributed to "labour shortages," research by Statistics Canada suggests other factors are at play. The 2018 study, *Assessing Job Quality in Canada*, compared work quality across sectors and concluded that healthcare, hospitality, and construction "did poorly in multiple job quality dimensions."[30] Some of the biggest detractors for the hospitality sector were poor prospects for career advancement and the inability to take time off. For construction, the biggest challenges were job security (as the work tends to be seasonal or short-term in nature), and a lack of flexible hours.

Although healthcare workers are in high demand in Canada and around the world, the sector received among the lowest scores for work quality: Statistics Canada found that healthcare workers are often subject to unmanageable workloads, involuntary schedule irregularities, a lack of flexibility, and an inability to take time off.[31] These factors, combined with the added stress and workload during the pandemic, threaten lasting and difficult-to-reverse impacts for Canada. In fact, Statistics Canada's *2022 Survey on Health Care Workers' Experiences During the Pandemic* (SHCWEP) found that 85% of healthcare workers are more stressed, and one in four nurses intend to leave their job in the next three years, often citing burnout as the reason.[32] Addressing work quality is key to avoiding further labour shortages in this critical sector. While technology is in no way a panacea, the integration of staff management tools, electronic records, and virtual health services can help alleviate the burden on healthcare workers and maintain high-quality care for Canadians.

30 Chen, W., Mehdi, T., "Assessing Job Quality in Canada: A Multidimensional Approach", December 10, 2018, *Statistics Canada*, https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2018412-eng.htm

31 Ibid.

32 "Experiences of healthcare workers during the COVID-19 pandemic, September to November 2021", June 3, 2022, *Statistics Canada*, https://www150.statcan.gc.ca/n1/daily-quotidien/220603/dq220603a-eng.htm

Pandemic as a catalyst

A 2020 study by the OECD suggests that the pandemic acted as a catalyst for government transformation. While countries and citizens around the world were forced to rethink "what is normal or what should be normal," the report posits that the crisis also "re-emphasized the role of the state as an enabler of economic and social robustness," responsible for acting quickly, responsibly, and effectively.[33] The crisis was also a turning point because it required governments to use new tools and technologies to engage and work with citizens, and find novel solutions to complex problems.

The same is arguably true for the private sector. A 2020 survey by McKinsey of global executives found that COVID-19 sped up technology adoption and implementation by several years.[34] In fact, respondents to the survey identified that they moved 20–25 times faster to implement key changes in their organizations as a result of the pandemic (in the context of remote work, many believed that their companies moved 40 times faster).[35] In large part, this was because of the imminent threat to the health and safety of employees and the notable increase in customer engagement via digital means. Executives from companies around the world noted that roughly 58% of all customer interactions were digital in July 2020, compared to just 36% in December 2019.[36] In North America, online engagement jumped to 65% from 41%.

While all sectors had to adapt to the "new normal" that was largely digital, in many ways, digital economy businesses had a head start. From February 2020 to May 2022, the digital economy added more than 400,000 jobs nationally, representing the fastest growth of any sector (21.2%) and far surpassing growth across the entire economy (2.6%). The resilience of the digital economy and its ability to effectively weather the storm of the pandemic provided employers with an opportunity to be bold and expand, revamp, or recalibrate their businesses. According to ICTC's survey of Alberta digital economy employers, the majority (72%) saw the pandemic as an opportunity to grow or change their business for the better.

33 "The COVID-19 Crisis: A catalyst for government transformation?", November 10, 2020, *OECD*, https://www.oecd.org/coronavirus/policy-responses/the-covid-19-crisis-a-catalyst-for-government-transformation-1d0c0788/

34 "How COVID-19 has pushed companies over the technology tipping point – and transformed businesses forever", October 5, 2020, *McKinsey & Co.* https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever

35 Ibid.

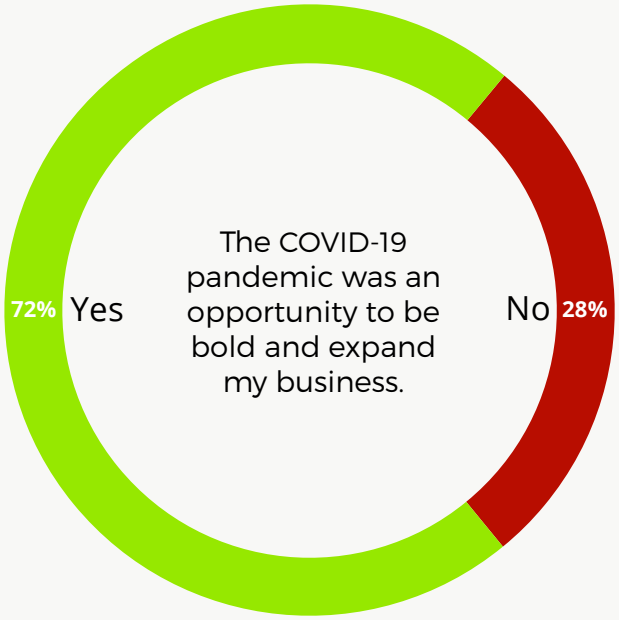
36 Ibid.

Survey respondents highlighted making some of the following changes during the pandemic:

R&D investment: Companies invested in research and development to support new or complementary products or services. Seeing the largescale move to remote working and learning, some companies pivoted to offer additional digital content and avenues for interaction. Others found new niches and developed services to accommodate growing demand in key industries that suffered labour shortages during the pandemic. Examples include the development of new video games, home streaming content, and health services to accelerate patient access to consultations and specialists.

Commercialization: Companies invested in taking their products to market. Key activities undertaken include user testing, marketing and promotion, mass production, and sales.

International market entry or expansion: Companies sought methods to get their products into international markets or expand access to customers within markets. A key example, in 2021, Calgary-based Benevity expanded its footprint in Europe with the acquisition of Swiss-based employee-engagement firm, Alaya.[37] (Alaya has offices and employees in Spain, Germany, the UK, France, and Singapore.)



COVID-19 allowed us to work remotely beyond our typical geographic boundaries and grow our client base outside of Alberta. ❞

– Digital economy employer

Figure 8. COVID impact on business expansion. **Source:** Alberta Digital Economy Employer Survey, ICTC, 2020–21 (survey ran from October 2020–March 2021).

37 "Benevity Expands Global Footprint with Acquisition of Alaya", December 9, 2021, *Benevity* https://benevity.com/press-releases/benevity-alaya

The Battle for Talent

As of May 22, 2022, 80% of Albertans had received at least one dose of a COVID-19 vaccine.[38] In March 2022, the Alberta government removed most pandemic restrictions, and on June 14, 2022, with suggestions that the province had passed the "sixth wave" of infection, it removed the remaining restrictions.[39] In many ways, life has returned to a kind of pre-pandemic normalcy, with some workers heading back to their offices, and employers seeking more talent to fill necessary roles.

By May 2022, following months of decreases, Alberta's unemployment rate dropped to 5.1%,[40] and the labour market continued to tighten. Although many provinces saw consistent declines in the unemployment rate, employment growth in Alberta was almost completely among the long-term unemployed that month.[41] Long-term unemployment varies by province: Newfoundland and Labrador had the highest rate of long-term unemployment in May 2022 (25.3%), while Alberta was in third place, behind Nova Scotia, at 23.2%. The Canadian average for long-term unemployment that month was 19.7%.[42] This important distinction speaks to the relative health of the labour market and economy; low rates of long-term unemployment are indicative of population well-being, and high rates of long-term unemployment can create fiscal instability and eventually lead to "labour market scarring." Labour market scarring occurs where those who are unemployed for long periods of time stop seeking employment.

Employment growth is now visible across many sectors of the economy, but Alberta digital economy employers revealed that there was a consistent demand for talent throughout the pandemic. The degree of competition for skilled workers has only amplified over the last months, as other sectors recover or start to implement technology in their day-to-day operations. The Business Council of Alberta suggests that talent competition will only increase as sectors such as oil and gas, agriculture, and forestry digitize and seek technical or digital talent "with the right skills to fill vacant positions."[43] In this study, Alberta digital economy employers cite "lack of digitally skilled talent" as the top talent-based challenge facing Alberta's digital economy post-pandemic. The talent crunch is felt most acutely at the mid and senior levels, and has amplified with growing wage inflation (some employers participating in this study note wage inflation of 20-40% for key in-demand digital roles).

38 "COVID-19 vaccination in Canada", *Government of Canada*, https://health-infobase.canada.ca/covid-19/vaccination-coverage/

39 "Everything you need to know about COVID-19 in Alberta on Wednesday, June 15", June 15, 2022, *CBC News*, https://www.cbc.ca/news/canada/calgary/everything-you-need-to-know-about-covid-19-in-alberta-june-15-1.6489299

40 "Labour Force Survey, May 2022", June 10, 2022, The Daily, *Statistics Canada*, https://www150.statcan.gc.ca/n1/daily-quotidien/220610/dq220610a-eng.htm

41 Defined as individuals searching for employment for 27 weeks or more.

42 Labour Force Survey (3701), table 14-10-0342-01

43 "Alberta Priorities for the Next Government Of Canada", September 10, 2021, Business Council of Alberta, https://www.businesscouncilab.com/work/albertas-priorities-for-the-next-government-of-canada/

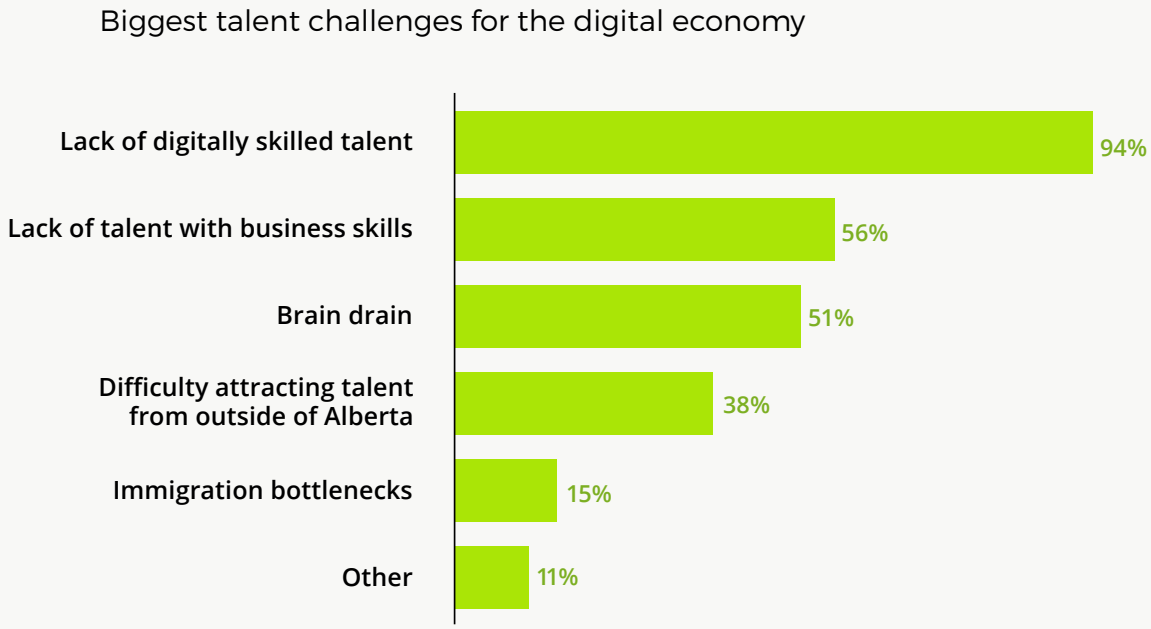
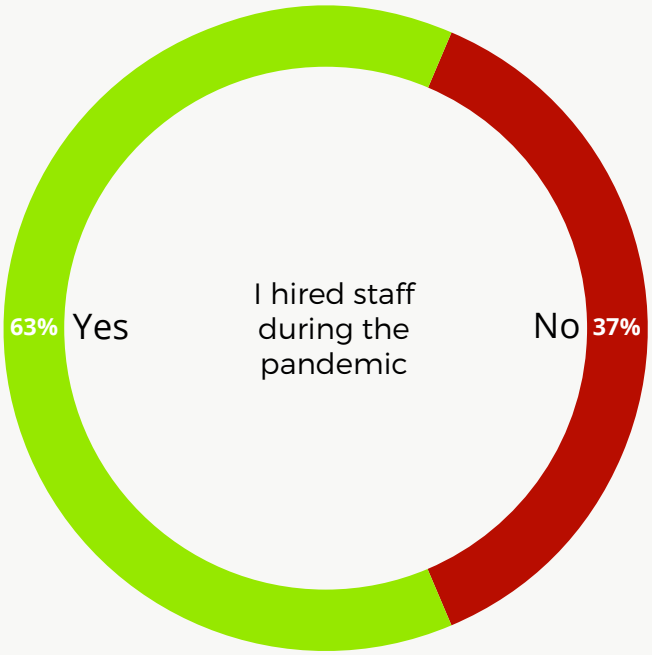


Figure 9. Top talent challenges for Alberta's digital economy.
Source: Alberta Digital Economy Employer Survey, ICTC, 2020-21 (survey ran from October 2020-March 2021).

Hiring during the pandemic

Despite the broader impacts of the pandemic on employment, most digital economy employers (63%) in the province were still able to hire staff during the pandemic. Approximately half of hiring employers said that they surpassed their pre-pandemic employment growth plans for 2020 and 2021, some stating a need for 50% to 100% more workers than they had planned for in January 2020. A recent study by Brookings found that tech-sector employment slowed temporarily in the most well-known US tech hubs (San Francisco, Los Angeles, New York, etc.) during 2020, but at the same time, half of other large US metropolitan areas saw notable employment growth, compared to 2015–2019. The most significant uptick in hiring took place in cities including Philadelphia, Minneapolis, Cincinnati, Charlotte, and New Orleans.[44]

44 Muro, M., Yu, Y., "Superstars, rising stars, and the rest: Pandemic trends and shifts in the geography of Tech", March 8, 2022, *Brookings Institute,* https://www.brookings.edu/research/superstars-rising-stars-and-the-rest-pandemic-trends-and-shifts-in-the-geography-of-tech/



We need more staff because of the pandemic. ❞

– Alberta digital economy employer

IT Staffing contracted for the first 8 months of pandemic and then grew back to pre-covid levels over the remaining months. ❞

– Alberta digital economy employer

Figure 10. Hiring during the pandemic in Alberta's digital economy.
Source: Alberta Digital Economy Employer Survey, ICTC, 2020-21 (survey ran from October 2020-March 2021).

Among the one-third of employers who were not able to hire new staff, less than half experienced a need to cull their employee base. A small handful of employers noted laying off technical or digital staff, but nearly all tried to hire them back four to six months later, once business picked up again. However, previously laid-off staff tended to be employed with other companies, and other key digital talent was difficult to acquire. As stated by one employer, "*[When the business] contracted, we laid off some software developers…we're now trying to hire back this kind of staff and finding it very difficult to do.*"

The digital media subsector experienced some initial layoffs among roles such as producers and visual effects specialists. This coincided with the temporary suspension of live-action film and resulting delayed production schedules; hiring picked up again by fall 2020, once restrictions on live-action film were removed and appropriate safety protocols were in place. Overall, most layoffs seen in Alberta's digital economy during this period were in "support roles."

The following occupational categories were most impacted:

- **Administration:** including administrative assistants, executive assistants, office managers, receptionists.
- **Finance & Accounting:** including accountants, controllers, financial assistants, financial analysts.
- **Operations:** including operations assistants, coordinators, operations managers.
- **Human Resources:** including human resources specialists, human resource managers.
- **Sales:** including sales specialists, business development officers, sales managers.

In-demand jobs

Alberta digital economy employers continue to express a strong need for digital talent in core roles. Software development continued to see demand throughout the pandemic, with roles like full stack developers, back end developers, and AI developers and architects most often cited. Other in-demand digital roles were largely split between those data-based and design-based. For the former, roles like data scientists, data analysts, data engineers, and machine learning engineers remained high in demand. For design-based roles, UX and UI designers were key, as were product designers. Other key roles include those related to operations, such as cybersecurity specialists, quality assurance (QA) testers, and DevOps, and business-related roles such as product managers, business analysts, and digital marketers.

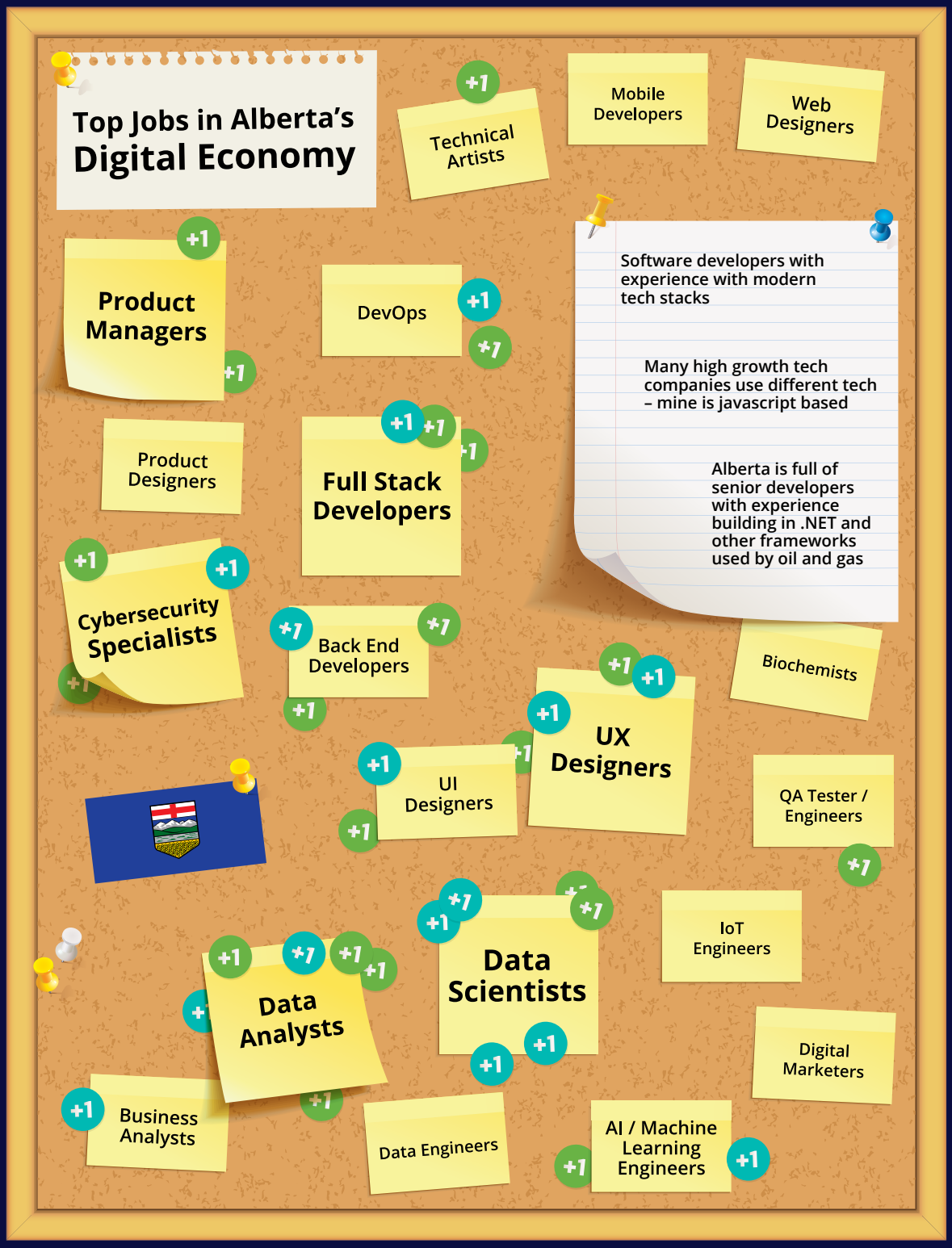


Figure 11. Top jobs in Albera's digital economy.
Source: Alberta Digital Economy Employer Survey, ICTC, 2020-21 (survey ran from October 2020-March 2021).

Full stack developer

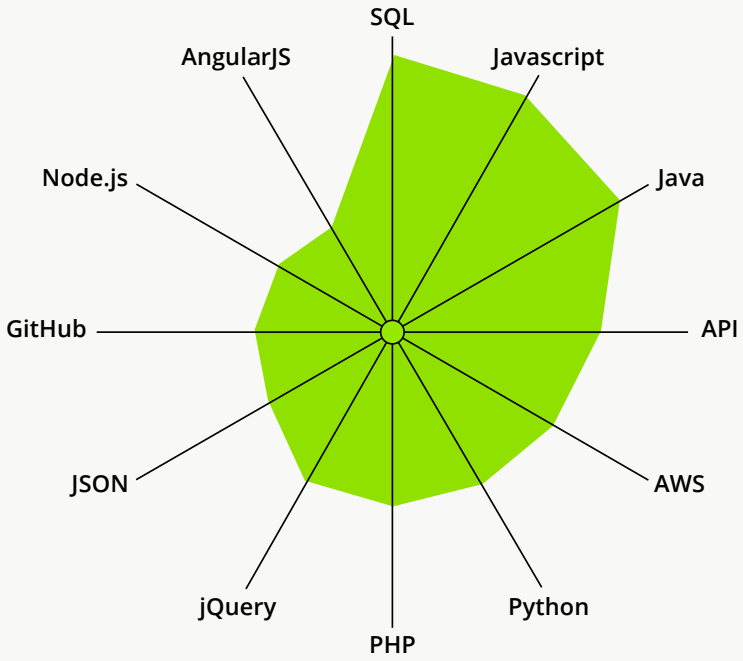


Figure 12. Top skills and skill importance, full-stack developer. **Source:** ICTC eTalent, 2022.

Back end developer

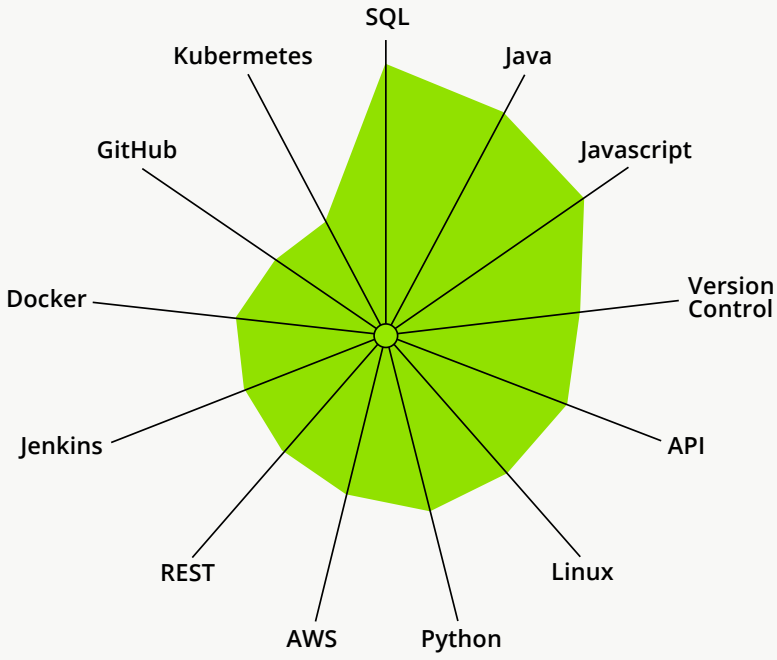


Figure 13. Top skills and skill importance, back-end developer. **Source:** ICTC eTalent, 2022.

AI architect

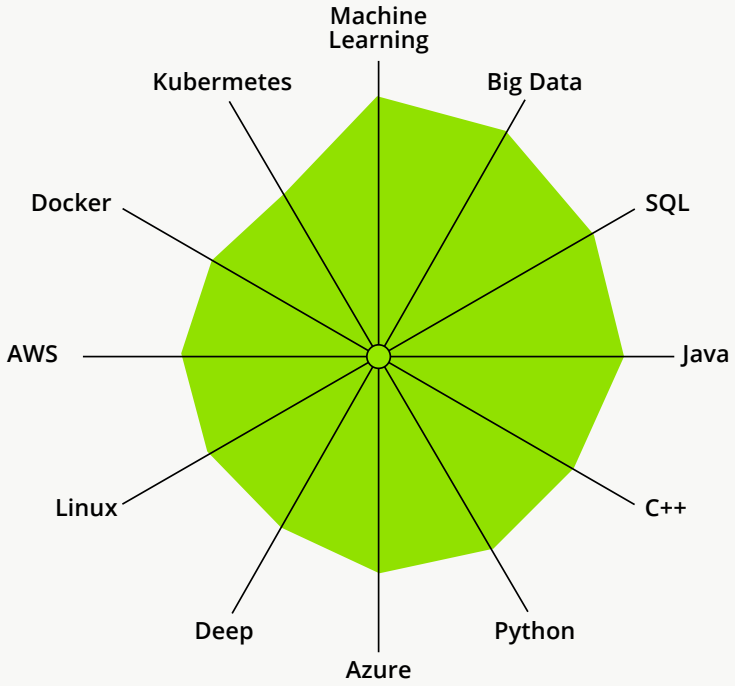


Figure 14. Top skills and skill importance, AI architect. **Source:** ICTC eTalent, 2022.

Data scientist

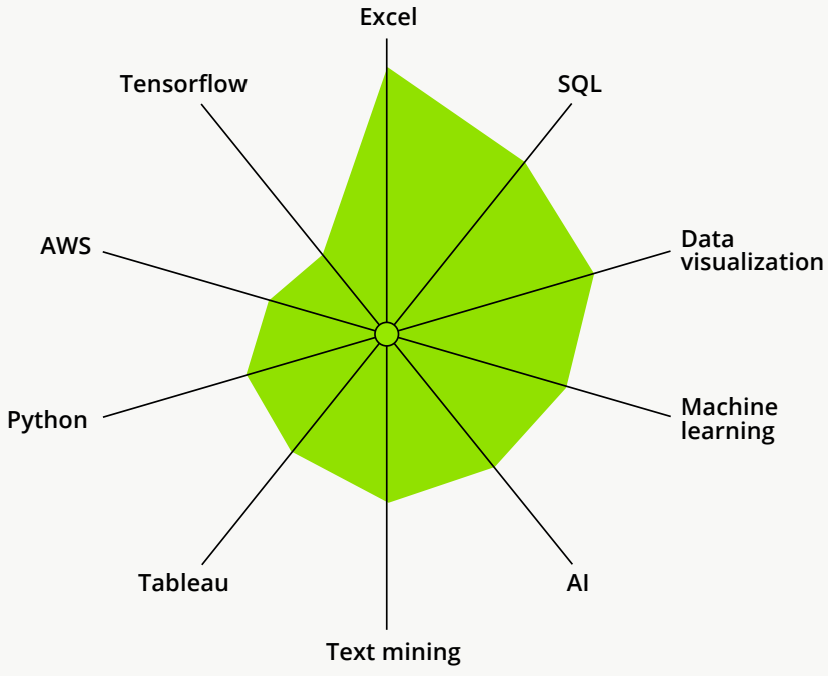


Figure 15. Top skills and skill importance, data scientist. **Source:** ICTC eTalent, 2022.

Data analyst

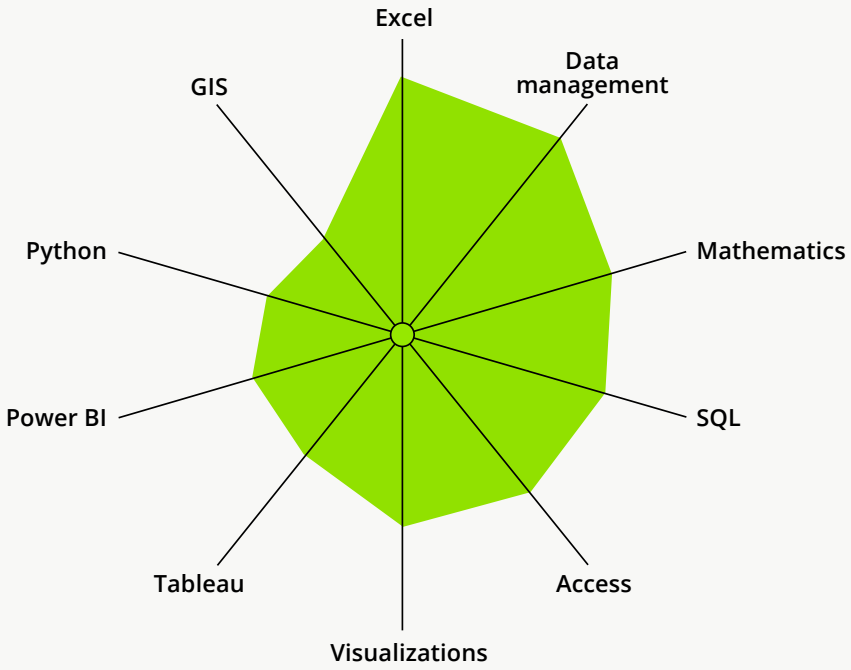


Figure 16. Top skills and skill importance, data analyst. **Source:** ICTC eTalent, 2022.

Machine learning engineer

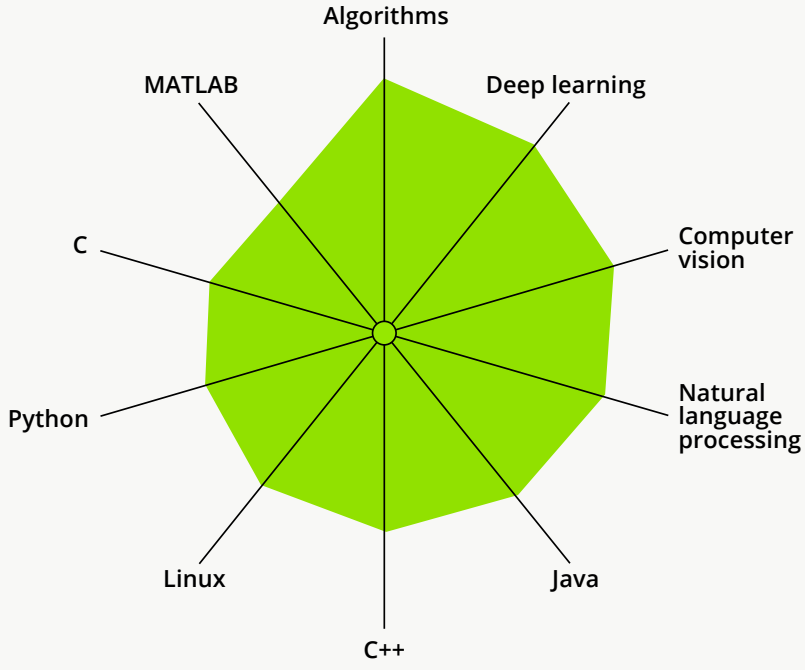


Figure 17. Top skills and skill importance, Machine learning engineer. **Source:** ICTC eTalent, 2022.

Employer perceptions of in-demand roles are aligned with broader-scale trends seen at the provincial level. According to Statistics Canada, from February 2020 to May 2022, Alberta experienced a 142% employment increase among web designers and developers (National Occupational Classification [NOC] 2175), a 135% increase among computer and information systems managers (NOC 0213), a 90% increase among computer programmers and interactive media developers (NOC 2174), a 59% increase among graphic designers and illustrators (NOC 5241), and a 55% increase among database analyst and data administrators (NOC 2172).

Local job postings relay a similar picture of strong and sustained demand. Data collected by ICTC from job boards identifies over 20,000 jobs postings in Calgary and Edmonton across 10 key roles from January 2021 to March 2022.

Calgary

Job	# of job postings
Software engineer	4,574
Business analyst	2,597
Cybersecurity	1,990
Full stack developer	1,693
Data analyst	827
IT support	715
Data engineer	610
Back end developer	474
Automotive service technician	474
Data scientist	360
	14,314

Edmonton

Job	# of job postings
Software engineer	2,420
Business analyst	1,568
Cybersecurity	784
Automotive service technician	624
Full stack developer	587
Data analyst	448
IT support	428
Data engineer	204
Data scientist	185
Backend developer	138
	7,386

Table 1. : Job counts, top 10 jobs, Calgary and Edmonton, January 2021 to March 2022. **Source:** ICTC eTalent.

The growing importance of "soft" skills

Increasingly, Alberta's digital economy employers place a great deal of importance on "soft," or transferable, skills. As one interviewee noted, "*[technical] skills can be taught... companies are looking for [candidates with] strong soft skills.*"

According to ICTC's employer survey, creative problem solving is the most in-demand soft skill that employers seek, followed by the ability to relay and present complex information and work in multi-disciplinary teams. Many employers ranked leadership and strategy skills, as well as people management skills, as less important across the board. Although these skills are required for individuals in senior positions, employers felt they were not equally needed for employee experience levels.

Rank of in-demand transferable skills

Figure 18. Survey Respondents ranked in-demand transferable skills.
Source: Alberta Digital Economy Employer Survey, ICTC, 2020-21 (survey ran from October 2020-March 2021).

Interestingly, some employers felt that previous experience in sales or customer service roles was a great way for candidates to build critical soft skills. Because these roles prioritize interpersonal engagement, on-the-spot thinking, and empathy, employers believed that such experience helped candidates become more emotionally intelligent, more aware of different perspectives and beliefs, and helped them build better communication skills.

Some of the best training I ever had was [when] I worked in sales for a few years. Because I had to get in front of people, get comfortable talking and communicating effectively, and understand people's perspectives. ❞

– Alberta digital economy employer

Empathy and emotional intelligence are increasingly referenced as critical skills, especially for leaders. A study by Yale University identified several emotional intelligence characteristics as prevalent in supportive leaders.[45] Others have identified core skill sets within the category of "emotional intelligence" as not only key to successful leaders, but all workers. According to a Dan Goleman's book *Emotional Intelligence: Why It Can Matter More Than IQ*, the following five skills define emotional intelligence:

- **Self-awareness:** The ability to understand and acknowledge one's own emotions; the ability to honestly assess one's strengths and weaknesses and work on areas in need of improvement.
- **Self-regulation:** The ability to control one's emotions or impulses; comfort with change and ambiguity, and ability to regulate one's workload.
- **Motivation:** The ability to defer or postpone immediate results for long-term value by embracing productivity, tackling challenges, and creating efficiencies.
- **Empathy:** The ability to understand the needs and viewpoints of others, even when they differ from one's own. This can include recognizing the feelings of others, even when they are not obviously displayed. Empathetic people tend to be highly capable of managing relationships and relating to others.
- **Social skills:** The ability to be a team player, helping others to succeed and grow, managing disputes, and communicating clearly and effectively.

45 Ivcevic, Z., et al. "Supervisor Emotionally Intelligent Behavior and Employee Creativity", *Journal of Creative Behavior*, https://onlinelibrary.wiley.com/doi/epdf/10.1002/jocb.436

SECTION III

Regional Snapshots

Trends in Alberta's digital economy differ by region, city, and community. This section of the report provides further information about the digital economy in three Alberta cities: **Calgary**, **Edmonton**, and **Lethbridge**.

Calgary

With the largest population and contribution to provincial GDP and employment, Calgary is Alberta's largest city. In 2021, the Calgary census metropolitan area (CMA) was home to 35% of Alberta's population, a slight increase over 2016.[46] On average, from 2014 to 2018, Calgary accounted for 33% of Alberta's annual GDP,[47] including activity in the sectors of energy, financial services, film and television, transportation and logistics, technology, manufacturing, aerospace, health and wellness, retail, and tourism.[48] In 2021, Calgary accounted for roughly 36% of provincial employment, led by employment in wholesale and retail trade, healthcare and social assistance, construction, and professional, scientific, and technical services.[49]

Calgary's low cost of living and affordable office rental space makes it an economical place to set up a business.[50] In 2021, Calgary was named one of the most affordable tech labour markets in North America[51] and one of the top 20 most affordable startup ecosystems in the world.[52] Calgary is home to Canada's "second-highest number of corporate head offices among the country's 800 largest corporations."[53] Participants in this study considered Calgary's entrepreneurial spirit, in addition to its affordability, one of its greatest assets. As one interviewee noted, Calgary has "*a critical mass of entrepreneurs who are willing to take chances, start new tech companies, and drive [innovation] forward*." Another interviewee highlighted Calgary's "amazing startup culture," driven by the growing number of companies emerging outside the traditional oil and gas industry. For instance, Calgary has made a name for itself in the financial technology and clean tech industries: 80% of Alberta's fintech firms are located in Calgary,[54] and Calgary is ranked among the top 15 clean tech ecosystems globally.[55]

46 Statistics Canada. 2022. (table). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released April 27, 2022. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

47 Statistics Canada Table 36-10-0468-01 Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000), https://doi.org/10.25318/3610046801-eng

48 "Regional Dashboard – Calgary", *Government of Alberta*, https://regionaldashboard.alberta.ca/region/calgary/#/

49 Statistics Canada Table 14-10-0384-01 Employment by industry, census metropolitan areas, annual (x 1,000), https://doi.org/10.25318/1410038401-eng

50 "2021 Scoring Tech Talent", July 14, 2021, *CBRE*, https://www.cbre.com/insights/reports/scoring-tech-talent-in-north-america-2021#introduction

51 Ibid.

52 "The Global Startup Ecosystem Report: GSER 2021", *Startup Genome*, https://startupgenome.com/reports/gser2021

53 "Regional Dashboard – Calgary", *Government of Alberta*, https://regionaldashboard.alberta.ca/region/calgary/#/

54 "Collaborating to win in Canada's Startup Ecosystem", 2021, *Accenture*, https://www.accenture.com/_acnmedia/PDF-149/Accenture-Fintech-report-2020.pdf

55 "Calgary": GSER 2021", *Startup Genome*, https://startupgenome.com/ecosystems/calgary

COVID-19 and Calgary's Economy

In 2019, prior to the onset of COVID-19, Calgary's GDP was already forecast to contract due to growing weakness in the province's energy sector.[56] Following a brief period of optimism in early 2020, Calgary and the rest of Canada experienced a devastating economic downturn. Repeated lockdowns and ongoing volatility in the oil and gas sector caused Calgary's GDP to decline an estimated 5.7% to 7.4% in 2020.[57] Since then, oil prices have seen outstanding growth, and in March 2022, the Alberta government lifted nearly all COVID-19 restrictions.[58] As a result, recovery forecasts for the city improved substantially: Calgary's GDP grew by an estimated 6.5% in 2021 and returned to pre-pandemic levels by the year's fourth quarter.[59] Looking forward, Calgary's GDP is projected to grow by 6.6% in 2022[60] and 4.7% in 2023,[61] led by strong demand and high prices for oil, as well as strong growth in the retail and distribution, finance and real estate, and business services sectors.[62]

Like GDP, employment in Calgary was already declining prior to the onset of the pandemic. From its high in July 2019 to the beginning of the pandemic in March 2020, employment declined 6% to 798,000.[63] From March onward, employment in Calgary continued to decline, reaching a low of 722,500 in June 2020 (see Figure 18). Employment recovered briefly in November 2020 but fell again in January of the following year and did not recover fully until September 2021. By April 2022, employment in Calgary had reached 857,100, a staggering 18.6% higher than its mid-pandemic low. The unemployment rate in Calgary followed an inverse trend to employment over the course of the pandemic: in March 2020, Calgary's unemployment rate was 9%; it reached a high of 15.6% in June 2020 and by April 2022, had fallen to 7.2%. Looking forward, Calgary employment is projected to grow at a faster pace than Edmonton, Lethbridge, and the rest of Canada.[64]

56 Arcand, A., McIntyre, J., "Metropolitan Outlook 1: Calgary – Autumn 2019", *Conference Board of Canada*, https://www.conferenceboard.ca/e-Library/abstract.aspx?did=10497

57 Ibid.

58 "COVID-19 public health actions", *Government of Alberta*, https://www.alberta.ca/covid-19-public-health-actions.aspx

59 Arcand, A., McIntyre, J., "Metropolitan Outlook 1: Calgary – Autumn 2019", *Conference Board of Canada*, https://www.conferenceboard.ca/e-Library/abstract.aspx?did=10497

60 Ibid.

61 Ibid.

62 Adams, S., " Canadian Metros Outlook – Recovery continuing despite bumps in the road", December 2021, *Oxford Economics*, https://resources.oxfordeconomics.com/hubfs/Content%20Hub%20RBs/Canadian%20Metros%20Outlook%20%7C%20Recovery%20continuing%20despite%20bumps%20in%20the%20road.pdf

63 Statistics Canada Table 14-10-0380-02 Labour force characteristics, three month moving average, seasonally adjusted (x 1,000), https://doi.org/10.25318/1410038001-eng

64 Adams, S., " Canadian Metros Outlook – Recovery continuing despite bumps in the road", December 2021, *Oxford Economics*, https://resources.oxfordeconomics.com/hubfs/Content%20Hub%20RBs/Canadian%20Metros%20Outlook%20%7C%20Recovery%20continuing%20despite%20bumps%20in%20the%20road.pdf

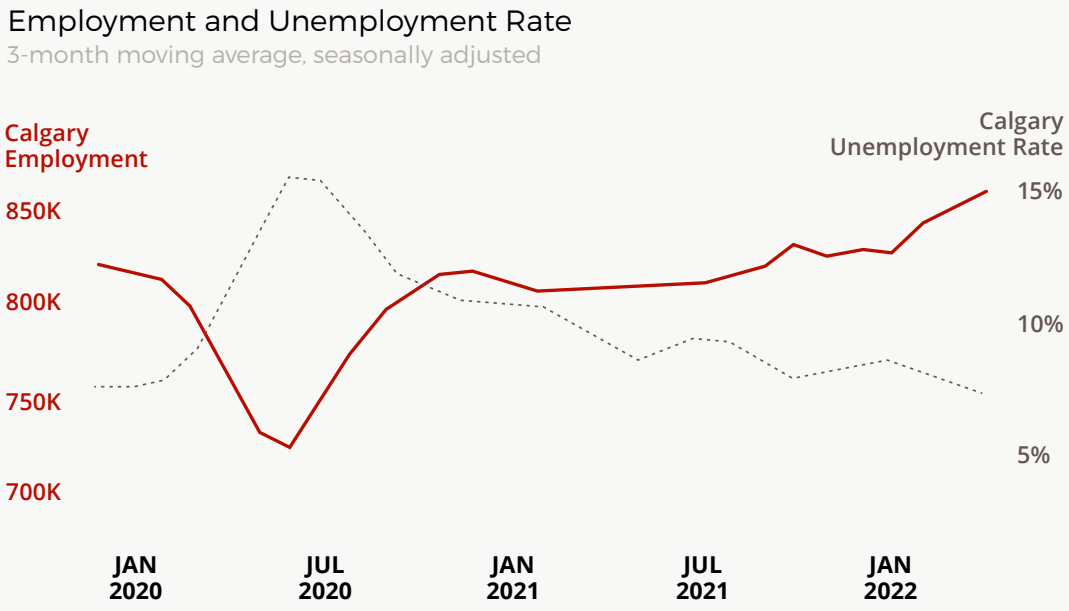


Figure 19. Employment and unemployment rate for Calgary, Alberta.
Data source: Statistics Canada Table 14-10-0380-02 Labour force characteristics, https://doi.org/10.25318/1410038001-eng

The pandemic did not impact employment in all of Calgary's industries equally. Some industries experienced a more severe contraction in employment following the onset of the pandemic in March 2022, while others experienced growth. Although employment in some industries has fully recovered, losses in other industries persist. From March to June 2020, the greatest loss in employment was in accommodation and food services (-40%), educational services (-20%), wholesale and retail trade (-14%), and transportation and warehousing (-12%). Meanwhile, the following industries saw employment growth: business, building, and other support services (+18%), utilities (+12%), manufacturing (+8%), and finance, insurance, real estate, and leasing (+6%).

Employment gain or loss since the onset of the pandemic

Unadjusted for seasonality

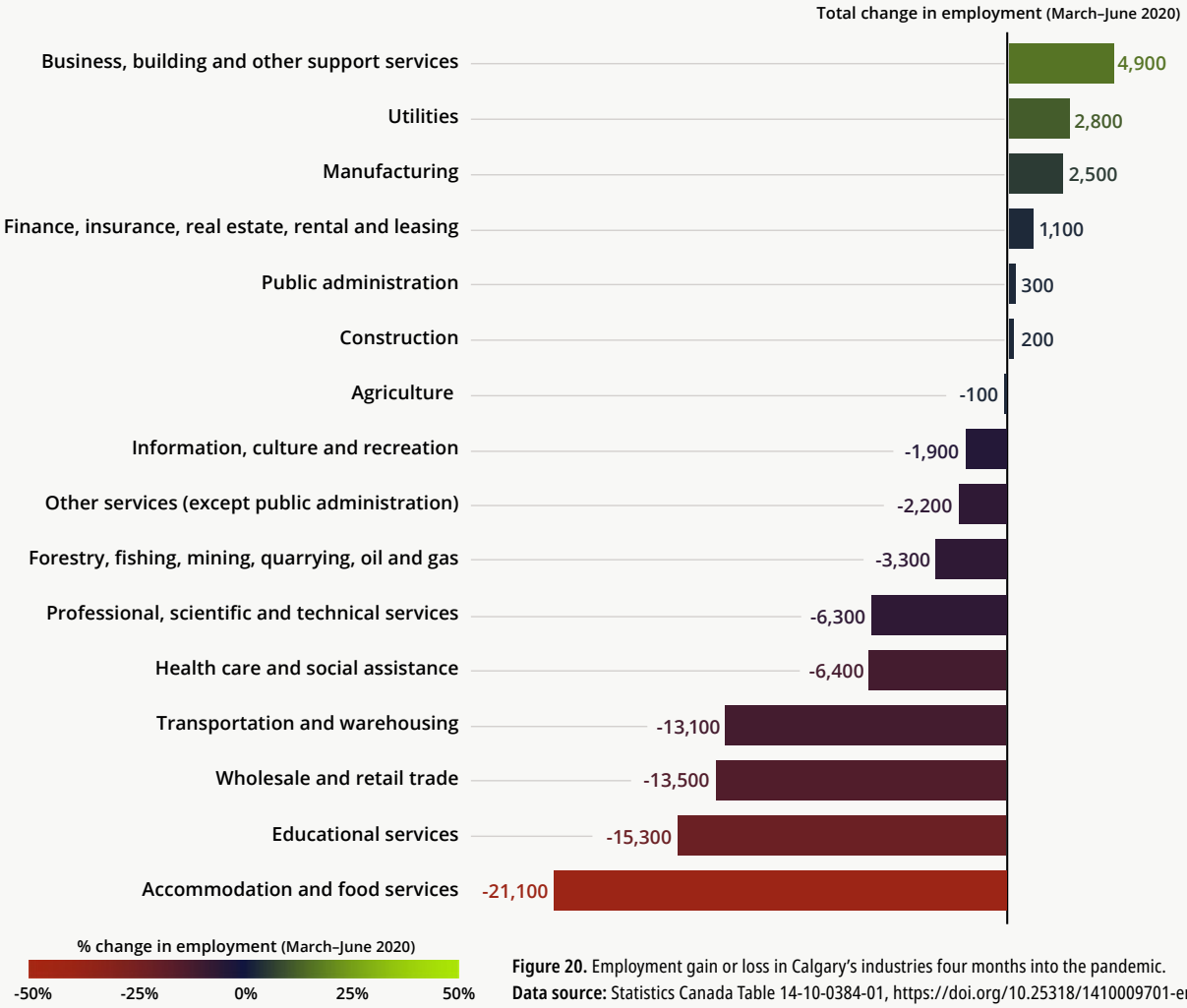


Figure 20. Employment gain or loss in Calgary's industries four months into the pandemic.
Data source: Statistics Canada Table 14-10-0384-01, https://doi.org/10.25318/1410009701-eng

Digital Economy Labour Market Trends

Calgary's digital economy talent pool is the largest in Alberta. In 2016, there were roughly 40,038 individuals with a minimum bachelor's degree in STEM (science, technology, engineering, and mathematics) in Calgary, compared to 24,815 in Edmonton.[65] That year, STEM graduates accounted for approximately 31.8% of individuals in Calgary who were between the ages of 25 and 64 and held a bachelor's degree or higher (compared to 26.7% in Edmonton and 20% in Lethbridge).[66]

65 Only includes individuals aged 25 to 64. Calculated using Statistics Canada data (the following tables):
https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/hlt-fst/edu-sco/Table.cfm?Lang=E&T=22&Geo=00&view=3&age=2&sex=3&SO=11A&SP=3
https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=825
https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=835

66 "Focus on Geography Series, Census 2016", *Statistics Canada*, https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=835; https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=825

Similarly, CBRE (a global commercial real estate services and investment consultancy) estimates that Calgary had more tech workers than Edmonton in 2020, at 46,700 and 34,500 respectively.[67] Nonetheless, finding skilled talent continues to be a core challenge for digital economy employers. From 2020 to 2021, software engineers were by far the most in-demand digital economy occupations in Calgary, followed distantly by business analysts, project managers, cybersecurity specialists, and full stack developers (see Figure 20).[68] In 2021, these 10 roles accounted for more than 10,000 job postings. Participants in this study highlighted the severe shortages in digital economy occupations such as these, resulting in high competition between employers for talent and, in turn, severe wage inflation. For many businesses, wage inflation poses a significant threat to overall business health.

Top ten digital economy jobs in Calgary

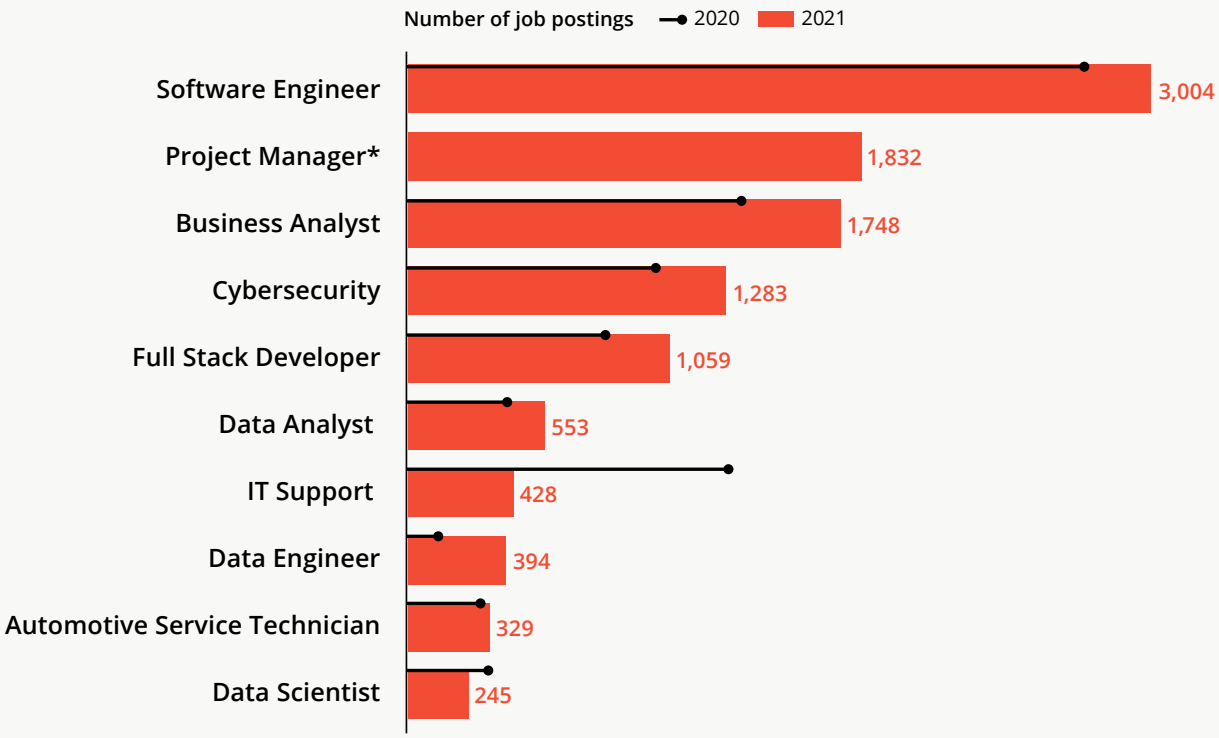


Figure 21. Top ten digital economy jobs in Calgary in 2021 and 2022. *Project Manager role was added to the data list as of 2021, as such there is no available data on the number of jobs for 2020. **Data source:** ICTC's e-talent data.

67 "2021 Scoring Tech Talent", July 14, 2021, *CBRE*, https://www.cbre.com/insights/reports/scoring-tech-talent-in-north-america-2021#introduction

68 ICTC etalent Canada, https://www.etalentcanada.ca/

Strong demand for digital economy talent and limited supply means that immigration and upskilling programs are vital for Calgary's labour market. In 2020, Calgary added more tech jobs to the local economy than there were available tech graduates, highlighting the necessary role immigration plays.[69] Participants in this study also mentioned immigration as a strategy for filling tech roles. As one participant noted, "*There's a limited pool of people in Calgary to draw from,*" meaning high-tech companies need to be able to look beyond Calgary and "*bring in staff from wherever they can find.*" Participants were hopeful about the recently announced Alberta Accelerated Tech Pathway, calling it a "huge win" for the Alberta's digital economy.[70]

Calgary employers seek talent with a blend of technical and transferable (or soft) skills. According to digital economy job postings posted in Calgary from 2021 to 2022, the most-cited skill required by candidates is digital design (2,549 job postings requiring this skill), followed by verbal communication (1,421 mentions). Other in-demand skills include being able to interview others, show organizational leadership, and effectively plan, adjust, and execute projects.

Top transferable skills in Calgary job postings

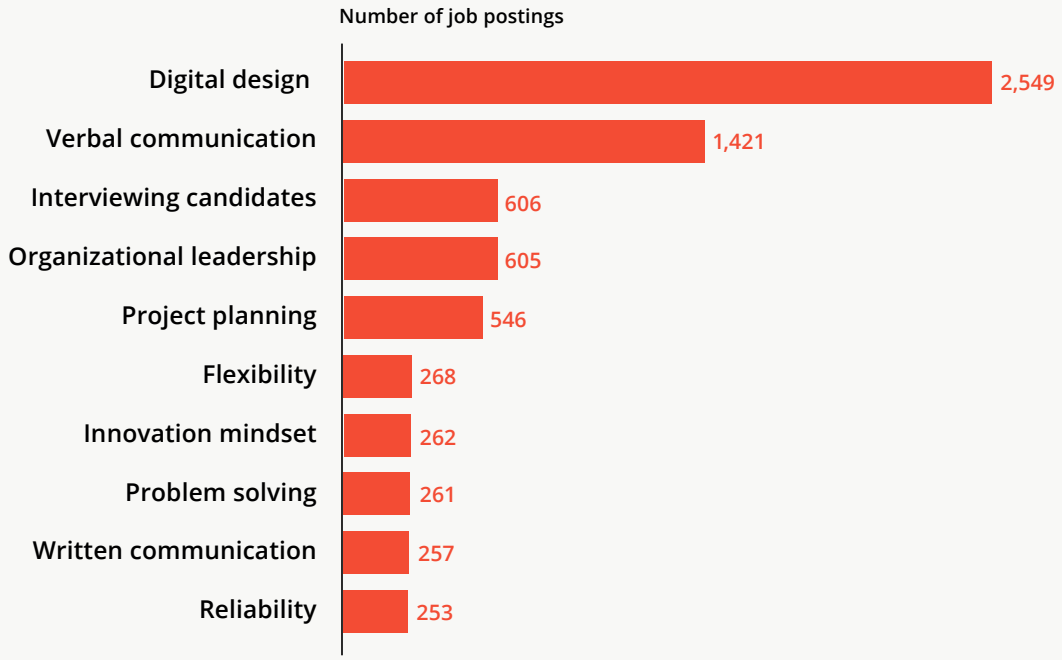


Figure 22. Top ten transferable skills in digital economy job postings, Calgary, 2021 and 2022. **Data source:** ICTC's e-talent data.

69 "2021 Scoring Tech Talent", July 14, 2021, *CBRE*, https://www.cbre.com/insights/reports/scoring-tech-talent-in-north-america-2021#introduction

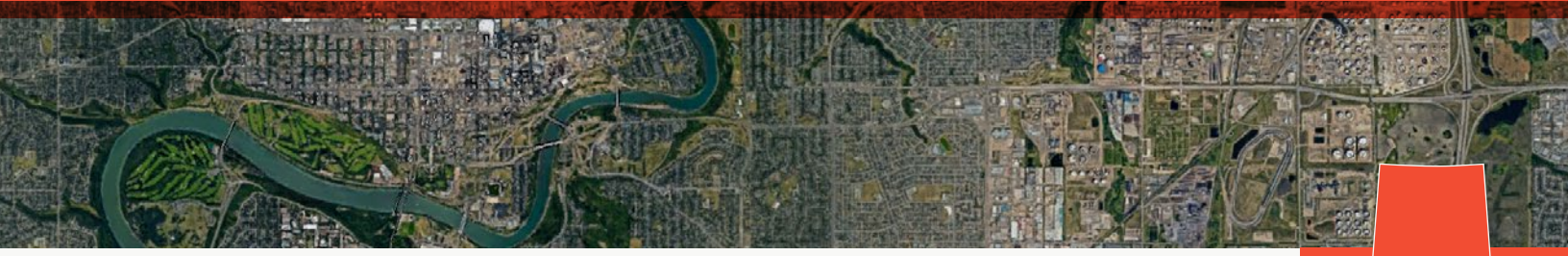
70 "Alberta Express Entry Stream", *Government of Alberta* https://www.alberta.ca/aaip-alberta-express-entry-stream-accelerated-tech-pathway-form.aspx

The Calgary CMA has the highest proportion of immigrants in Alberta, at 29.4%.[71] More than half (56.4%) of immigrants to Calgary are economic immigrants, and the most common birthplace among immigrants in Edmonton is Asia (54.3%). In comparison with other cities in Alberta, Calgary receives the greatest share of interprovincial migrants to Alberta and intraprovincial migrants within Alberta. In terms of domestic migration, Calgary receives the greatest share of its migrants from elsewhere in Alberta (41%), followed by British Columbia (19%), Ontario (17%), Saskatchewan (9%), and Manitoba (5%). Within Alberta, Calgary receives an equal share of migrants from Edmonton and "areas outside Alberta's CMAs and census agglomerations" (28%), and an equal share of migrants from Red Deer and Lethbridge (6%). Notably, more migrants have moved from Edmonton and Lethbridge to Calgary than vice versa.

In addition to immigration, there has been a significant effort in Calgary to retrain and upskill highly educated workers, such as engineers and geoscientists, who are transitioning from the oil and gas sector. The EDGE UP program, for example, has trained mid-career students in areas including data analytics, full stack software development, and IT project management, and will soon focus on digital product marketing, cybersecurity, IT network engineering, and Amazon Web Services (AWS) cloud computing.[72] In this study, participants were open to hiring workers transitioning from the oil and gas industry, but some cautioned that it can be difficult to onboard workers who are unfamiliar with or not accustomed to tech culture, and especially startup culture. An advisory committee member, for instance, shared that "*you can retrain people fairly quickly, as a lot of the skills from oil and gas are fairly transferable, but it's more the cultural shift [that is difficult].*"

71 "Focus on Geography Series, 2016", *Statistics Canada*, https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=7&LANG=Eng&GK=CMA&GC=825

72 "Calgary Upskill", *Calgary Economic Development*, https://edgeupyyc.com/



Edmonton

Edmonton is Alberta's second-largest CMA and provides the second-largest contribution to provincial GDP and employment. In 2021, the Edmonton CMA was home to 1,418,118 people, an increase of 7.3% over 2016.[73] On average, from 2014 to 2018, Edmonton accounted for 27% of Alberta's annual GDP,[74] including economic activity in the energy, manufacturing, food and agriculture, and healthcare industries. In 2021, Edmonton accounted for roughly 34% of provincial employment, led by wholesale and retail trade, construction, healthcare and social assistance, and professional, scientific, and technical services.[75]

COVID-19 and Edmonton's Economy

Like Calgary, Edmonton's economy was projected to contract in 2019 due to decreasing oil production.[76] While early 2020 projections were more positive (Edmonton's GDP was expected to grow by 2.4% in 2020),[77] local GDP was ultimately constrained by the pandemic, falling by as much as 7.7% to 10% in 2020. During this time, the hardest-hit sectors were accommodation and food services, other private services, transportation and warehousing, forestry, fishing, mining, and oil and gas.[78] Edmonton's GDP rose by an estimated 4.8% in 2021, but unlike Calgary, did not fully return to pre-pandemic levels, partially due to limited growth in the primary and utilities sector.[79] As a result of high oil prices and ongoing strength in the energy sector, local GDP is expected to grow by 5.6% in 2022—fully recovering from its pandemic low by the year's second quarter—and by an additional 4.2% in 2023.[80]

73 Statistics Canada. 2022. (table). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released April 27, 2022. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

74 Statistics Canada. Table 36-10-0468-01 Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000), https://doi.org/10.25318/3610046801-eng

75 Statistics Canada. Table 14-10-0384-01 Employment by industry, census metropolitan areas, annual (x 1,000), https://doi.org/10.25318/1410038401-eng

76 Arcand, A., McIntyre, J., "Metropolitan Outlook 1: Edmonton – Autumn 2019", *Conference Board of Canada*, https://conferenceboard.ca/e-library/abstract.aspx?did=10498

77 Heschl, C., McIntyre, J., "Metropolian Outlook 1 – Edmonton: Winter 2019", *Conference Board of Canada*, https://conferenceboard.ca/e-library/abstract.aspx?did=10644

78 Mutheardy, F., "Spring 2021 Forecast Update", *City of Edmonton*, https://www.edmonton.ca/sites/default/files/public-files/assets/Spring2021ForecastUpdate.pdf

79 "Major City Insights: Edmonton - May 2022", *Conference Board of Canada*, https://www.conferenceboard.ca/e-library/abstract.aspx?did=11619

80 Adams, S., " Canadian Metros Outlook – Recovery continuing despite bumps in the road", December 2021, *Oxford Economics*, https://resources.oxfordeconomics.com/hubfs/Content%20Hub%20RBs/Canadian%20Metros%20Outlook%20%7C%20Recovery%20continuing%20despite%20bumps%20in%20the%20road.pdf

Like GDP, employment in Edmonton was already declining prior to the onset of the pandemic: from its 2019 high in January to the beginning of the pandemic in March 2020, employment declined by 4.1% to 745,500. It continued to decline during the first four months of the pandemic, reaching a low of 655,500 in June 2020, and then recovered steadily, fully recouping its pandemic losses by July 2021. In April 2022, employment in Edmonton reached 786,800, a staggering 20% higher than its mid-pandemic low. Like in Calgary, the unemployment rate in Edmonton followed an inverse trend to employment over the course of the pandemic: in March 2020, Edmonton's unemployment rate was 8.2%; it reached a high of 15.9% in June 2020 and by April 2022, had fallen to 6.9%. Looking forward, Edmonton employment is projected to grow at a slightly slower pace than Calgary and Lethbridge, but faster than the rest of Canada.[81]

Employment and unemployment rate

3-month moving average, seasonally adjusted

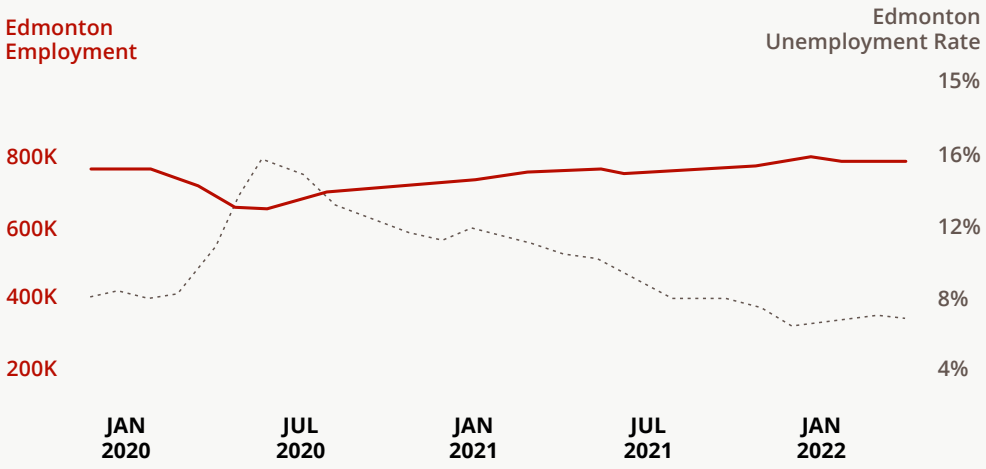


Figure 23. Employment and unemployment rate in Edmonton over time.
Data source: Statistics Canada Table 14-10-0380-02, https://doi.org/10.25318/1410038001-eng

The pandemic had a varied impact on Edmonton's industries. From March to June 2020, the greatest loss in employment was in accommodation and food services (-44%), other services except public administration (-31%), forestry, fishing, mining, quarrying, oil, and gas (-28%), and utilities (22%). Meanwhile, public administration (9.2%) and agriculture (8.8%) saw employment growth.

81 Ibid.

Employment gain or loss four months into the pandemic

Unadjusted for seasonality

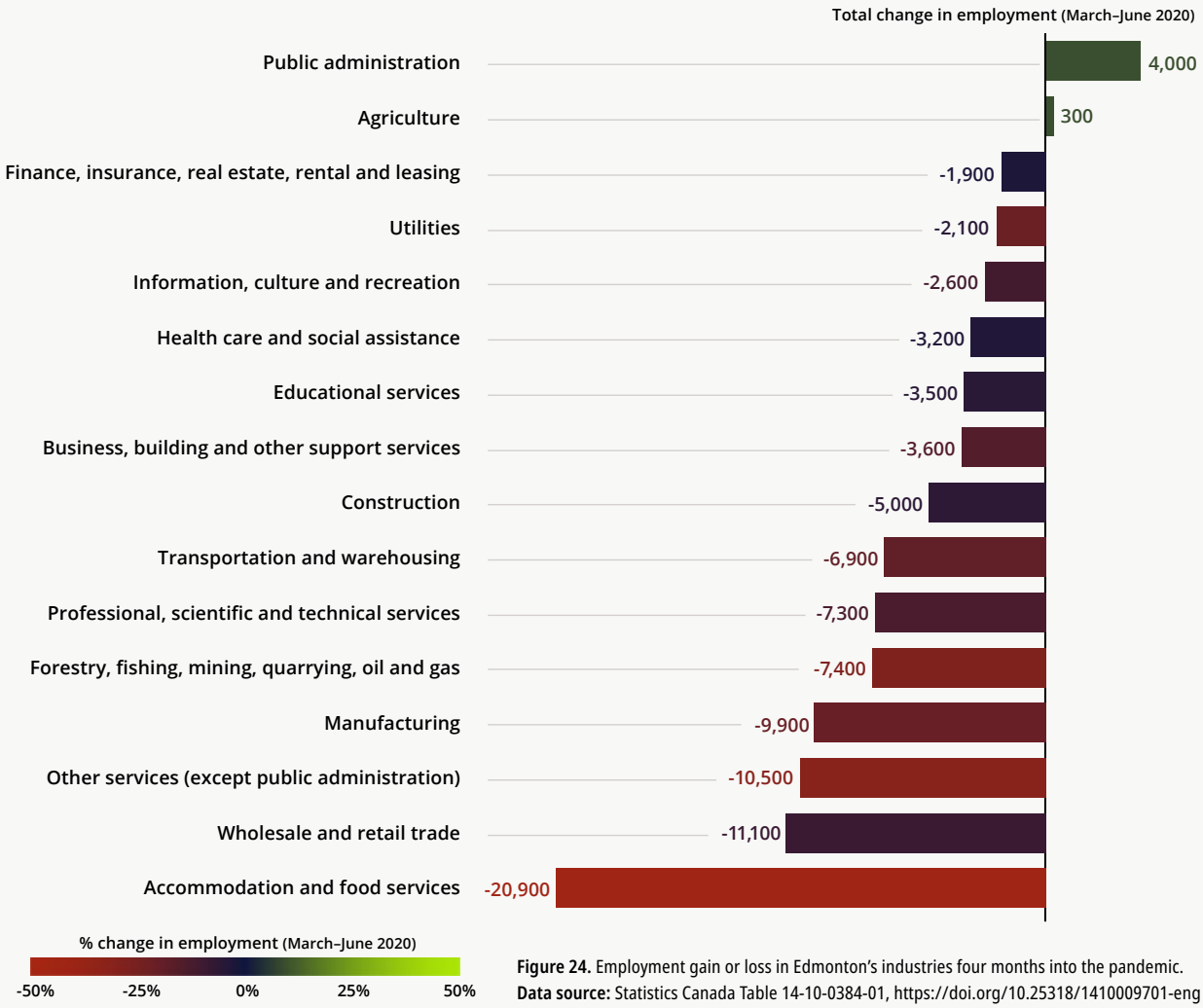


Figure 24. Employment gain or loss in Edmonton's industries four months into the pandemic.
Data source: Statistics Canada Table 14-10-0384-01, https://doi.org/10.25318/1410009701-eng

Digital Economy Labour Market Trends

According to job postings analysis, software engineers were the most in-demand digital economy occupations in Edmonton in 2020 and 2021, followed by project managers, business analysts, and cybersecurity professionals. In a year-over-year comparison of 2020 and 2021, demand for business analyst roles increased, jumping from 671 in 2020 to 1,160 postings in 2021. Project managers were the third-most-posted roles in 2021, with 1,704 unique job postings. Unfortunately, 2020 data is unknown.[82] The biggest positive change between 2020 and 2021 was for software engineers (801 unique job postings), business analysts (489 unique job postings), cybersecurity professionals (349 unique job postings), and automotive service technicians (315 unique job postings). IT support was the only job posting to drop significantly, with a loss of 384 unique job postings. In 2021, the below 10 roles accounted for more than 7,000 job postings.

Top ten digital economy occupations in Edmonton

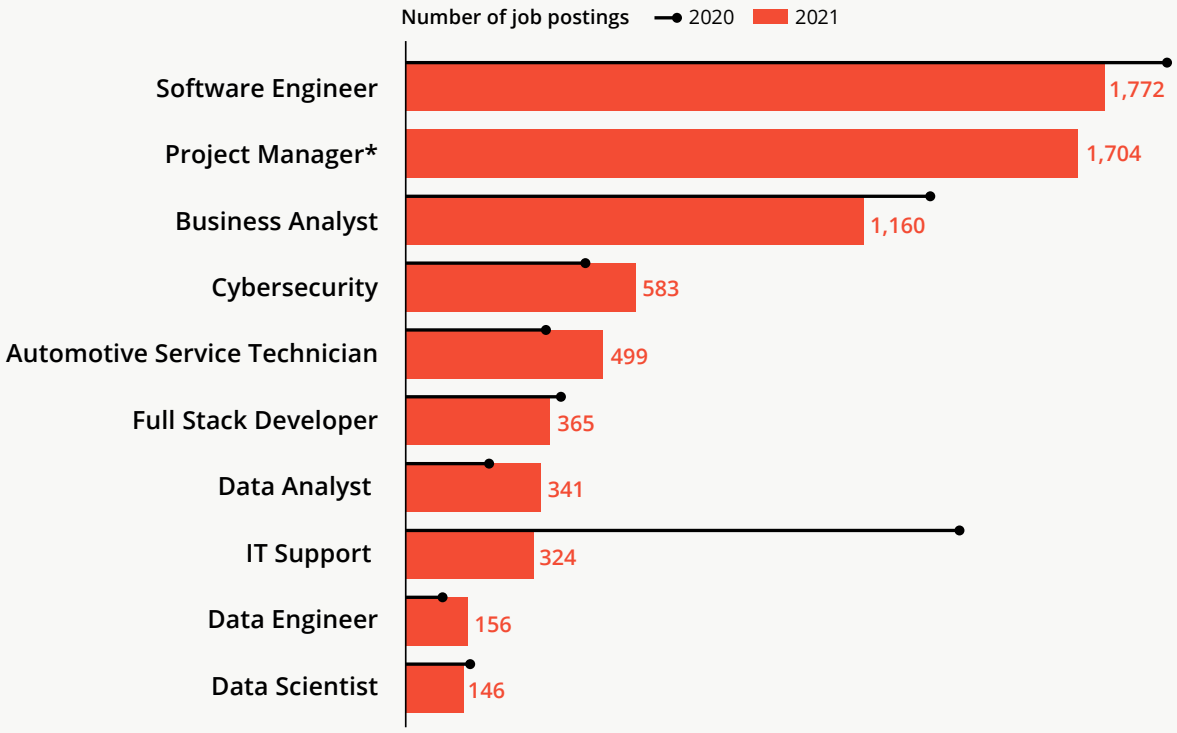


Figure 25. Top ten digital economy jobs in Calgary in 2021 and 2022. Project manager role was added to the data list as of 2021; thus, there is no available data on the number of jobs for 2020. **Data source:** ICTC's e-talent data.

82 Under ICTC's Smart Cities data collection, prior to 2021, ICTC did not collect project manager data.

In terms of transferable skills, interviewees noted a major skills gap in the skills needed to both design innovative products and "*translate between the 'tech' and 'business' sides of companies.*" This is echoed in Figure 25, wherein the top skill required by Edmonton employers is design (1,320 mentions), followed by communications (692 mentions). Business-enabling competencies like design and planning are important to employers, who are looking for candidates who can both apply their digital skills and effectively communicate digital technology solutions to clients and stakeholders.[83] Based on data derived from job postings from 2020 and 2021, employers in Edmonton are searching for candidates who can demonstrate their leadership, planning, and flexibility.

Top transferable skills in Edmonton job postings

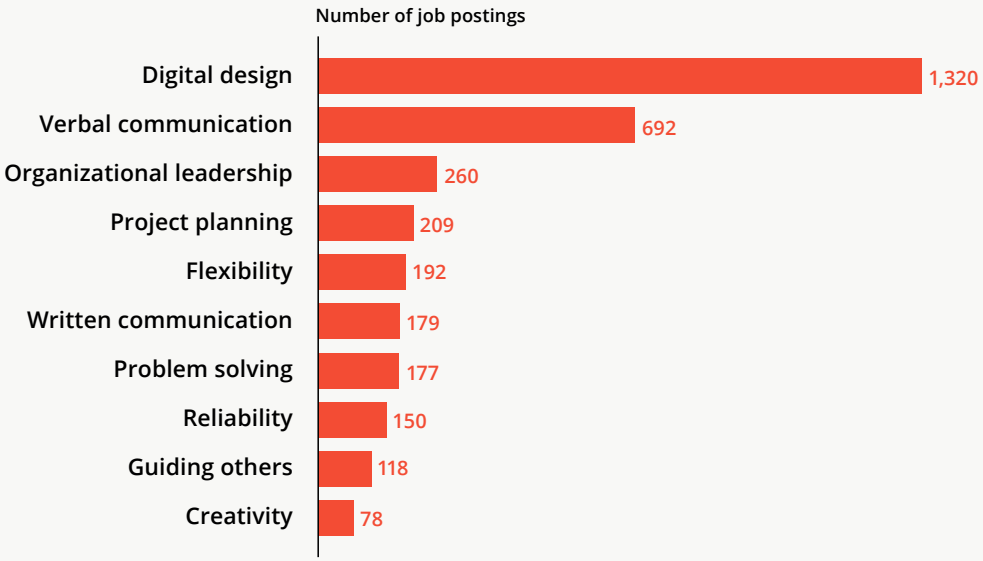


Figure 26. Top ten transferable skills in digital economy job postings, Edmonton, 2021 and 2022. **Data source:** ICTC's e-talent data.

Edmonton's digital economy talent pool is growing quickly but remains slightly smaller than Calgary's. In 2016, there were roughly 24,815 individuals with a minimum bachelor's degree in STEM in Edmonton, compared to 40,038 in Calgary.[84] Similarly, there were roughly 34,500 tech workers in Edmonton in 2020, compared to 46,700 in Calgary. That said, CBRE estimates that more tech jobs and degrees were added to Edmonton's labour market than Calgary's from 2015 to 2019, suggesting Edmonton's talent pool is growing at a faster rate.[85]

83 Bridging the Gap in the Labour Force", *Burning Glass*, https://www.burning-glass.com/wp-content/uploads/New_Foundational_Skills.pdf

84 Only includes individuals aged 25 to 64. Calculated using Statistics Canada data (the following tables):
https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/hlt-fst/edu-sco/Table.cfm?Lang=E&T=22&Geo=00&view=3&age=2&sex=3&SO=11A&SP=3
https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=825
https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=10&LANG=Eng&GK=CMA&GC=835

85 2021 Scoring Tech Talent", July 14, 2021, *CBRE*, https://www.cbre.com/insights/reports/scoring-tech-talent-in-north-america-2021#introduction

Interviewees in this study expressed that attracting and retaining talent—particularly new graduates and young professionals—is a key challenge for Edmonton employers. According to one interviewee, there is a "*misconception among students is that there are no companies in Edmonton to work for once they graduate.*" Others agreed, suggesting employers and universities can do a better job advertising local opportunities to students. According to CBRE's scoring tech-talent report, approximately 12,000 tech jobs and 5,522 tech degrees were added to Edmonton's labour market from 2015 to 2020, meaning that if all 5,522 tech graduates remained in Edmonton following graduation, new graduates could have filled roughly 44% of new roles.[86]

What Edmonton employers can't get from the local talent pool, they must source through other channels, including access to immigrant professionals and leveraging career transitioners. At 23.8%, the Edmonton CMA has the second-highest proportion of immigrants in Alberta, and a higher proportion than Alberta generally.[87] More than half (53.8%) of immigrants to Edmonton are economic immigrants, and the most common birthplace among immigrants in Edmonton is Asia (51.4%). In terms of domestic migration, Edmonton receives the greatest share of its migrants from elsewhere in Alberta (52%), followed by British Columbia (14%), Ontario (13%), Saskatchewan (8%), and Manitoba (4%).[88] From within Alberta, Edmonton receives nearly half of its migrants from areas outside CMAs or CAs (46%), followed by Calgary (20%), and Wood Buffalo (9%). While more migrants have moved from Edmonton to Calgary versus Calgary to Edmonton, Edmonton sees more incoming migrants from Lethbridge than vice versa.

With a relatively young population and growing clean tech industry, Edmonton is on a positive growth path. Edmonton has a spirit of collaboration that continues to set it apart from other major metropolitan areas. However, employers in the region note the need for further collaboration among industry, governments, and academia to fill employment needs and to help find first clients and customers to validate and grow their technology.

87 Ibid.

88 "Focus on Geography Series, 2016 Census", Statistics Canada, https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=7&LANG=Eng&GK=CMA&GC=835

89 Statistics Canada. Table 17-10-0141-01 Interprovincial and intraprovincial migrants, by census metropolitan area and census agglomeration of origin and destination, 2016 boundaries

Lethbridge

Lethbridge is Alberta's third largest CMA, accounting for roughly 3% of provincial population[89] and employment,[90] and 2% of the province's GDP.[91] Lethbridge has enjoyed significant employment and GDP growth in recent years: from 2014 to 2021, employment in Lethbridge grew by 56%, led by growth in the healthcare and social assistance, educational services, and construction sectors.[92] In 2021, healthcare and social assistance (13.4%), wholesale and retail trade (8.9%), manufacturing (5.8%) contributed the most to local employment.[93] Meanwhile, from 2014 to 2018, Lethbridge's GDP grew by a staggering 19% to $6.5 billion.[94]

COVID-19 and Lethbridge's Economy

In April 2020, the Lethbridge Region Economic Recovery Task Force conducted a survey of 256 local businesses to determine the impact of COVID-19 on Lethbridge's economy.[95] The survey found that 51% of businesses had reduced staff, 78% had seen a reduction in sales, and 62% felt they would only survive another one to six months "in the current climate." Additional research from September 2020 reported that among Lethbridge's key industries, accommodation and food services, retail, and truck transportation were the hardest hit.[96] Meanwhile, agriculture, food manufacturing, and manufacturing remained in a more positive position despite the pandemic.[97] Indeed, the total value of Lethbridge exports increased by 10% from 2019 to 2020, driven mainly by the manufacturing, wholesale trade, and agriculture industries.[98] Manufacturing exports increased 19% year over year, while agricultural exports increased 12%.[99]

89 Statistics Canada. 2022. (table). *Census Profile*. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released April 27, 2022.

90 Statistics Canada. Table 14-10-0384-01 Employment by industry, census metropolitan areas, annual (x 1,000)

91 Statistics Canada. Table 36-10-0468-01 Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000)

92 Statistics Canada. Table 14-10-0384-01 Employment by industry, census metropolitan areas, annual (x 1,000)

93 Ibid.

94 Statistics Canada. Table 36-10-0468-01 Gross domestic product (GDP) at basic prices, by census metropolitan area (CMA) (x 1,000,000)

95 "Year in Review: 2020", *Lethbridge Economic Development*, https://chooselethbridge.ca/userfile/file/Year%20In%20Review%202020_Final_WEB.pdf

96 "Economic and Industrial Impact of the Coronavirus", May 27, 2020, *Lethbridge Region Economic Recovery Taskforce*, https://edac.ca/wp-content/uploads/2020/09/LRERTF-Presentation-of-CAI-Study-V4.pdf

97 Ibid.

98 "Year in Review: 2021", *Lethbridge Economic Development*, https://chooselethbridge.ca/userfile/file/Year%20In%20Review%202021%20Final%20Web.pdf

99 Ibid.

By 2021, the local business outlook in Lethbridge was more positive: in response to Economic Development Lethbridge's annual Brighter Together Survey, 54% of respondents reported that their business had seen moderate-to-substantial growth in the last 12 months, up from 31% in 2020.[100] At the same time, just 25% had experienced a moderate-to-substantial decline in their business, down from 42% the previous year. Finally, 74% of local businesses reported their overall business health was positive, up from 63%."[101]

Unlike Calgary and Edmonton, employment in Lethbridge was relatively stable prior to the onset of the pandemic, fluctuating between a low of 618,000 and a high of 638,000 from January 2019 to March 2020. Employment reached its 2020 peak in February before declining rapidly until June. From March to June 2020, employment declined a staggering 9.5%. By June 2021, employment in Lethbridge had fully recovered to pre-pandemic levels; however, it dropped again for several months from August 2021 to January 2022. In April 2022, employment in Lethbridge was 11.2% higher than its mid-pandemic low. Looking forward, Lethbridge employment is projected to grow at a slightly slower pace than Calgary, but faster than Edmonton and the rest of Canada.[102] Economic Development Lethbridge projects that the City of Lethbridge, located within the Lethbridge CMA, will require 4,517 new workers by 2025.[103]

Employment and unemployment rate

3-month moving average, seasonally adjusted

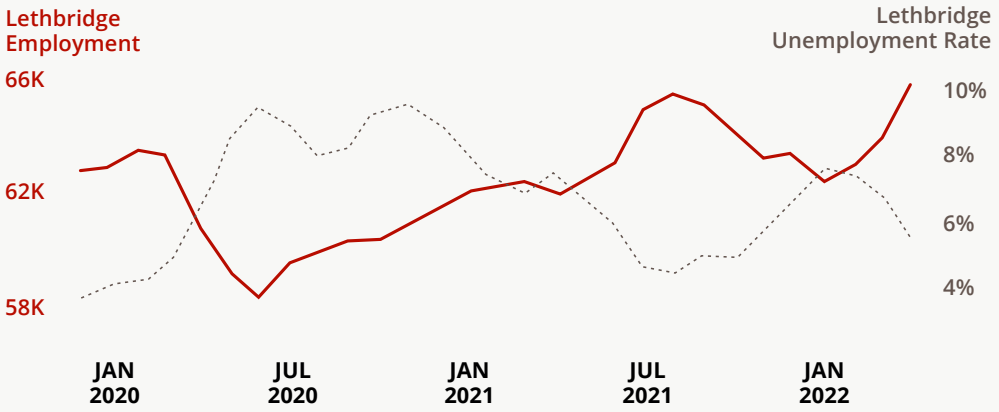


Figure 27. Employment and unemployment rate in Lethbridge.
Data source: Statistics Canada Table 14-10-0380-02, https://doi.org/10.25318/1410038001-eng

100 Ibid.

101 The Brighter Together survey is an annual survey that "probes local organizations to provide feedback about their current sentiments and overall business health." See: https://chooselethbridge.ca/userfile/file/2021%20Brighter%20Together%20Survey%20-%20Summary%20of%20Results.pdf

102 Adams, S., "Canadian Metros Outlook: Recovery continuing despite bumps in the road", December 2021, *Oxford Economics*, https://resources.oxfordeconomics.com/hubfs/Content%20Hub%20RBs/Canadian%20Metros%20Outlook%20%7C%20Recovery%20continuing%20despite%20bumps%20in%20the%20road.pdf

103 "Southwest Alberta Regional Skills Study: Regional Report: City of Lethbridge", *Economic Development Lethbridge*, https://chooselethbridge.ca/userfile/file/Southwest%20Alberta%20Regional%20Skills%20Study%20Regional%20Report%20City%20of%20Lethbridge.pdf

As seen in Figure 28, the impact of COVID-19 on employment in Lethbridge varies by sector. During the first year of the pandemic, from 2019 to 2020, the finance, insurance, real estate, rental, and leasing sector saw the greatest decline in employment (-36%), followed by agriculture (-22%), educational services (-21%), wholesale and retail trade (-18%), and construction (-14%). However, agriculture, rebounded quickly, and by 2021 had seen employment gains. By the second year of the pandemic, the hardest-hit sectors had changed, and employment losses were now the greatest in accommodation and food services (-34%), construction (-31%), and other services (-18%). Finally, four sectors saw strong growth in both 2020 and 2021: healthcare and social assistance, professional, scientific and technical services, transportation and warehousing, and manufacturing.

Employment gain or loss 2019 to 2020 and 2019 to 2021

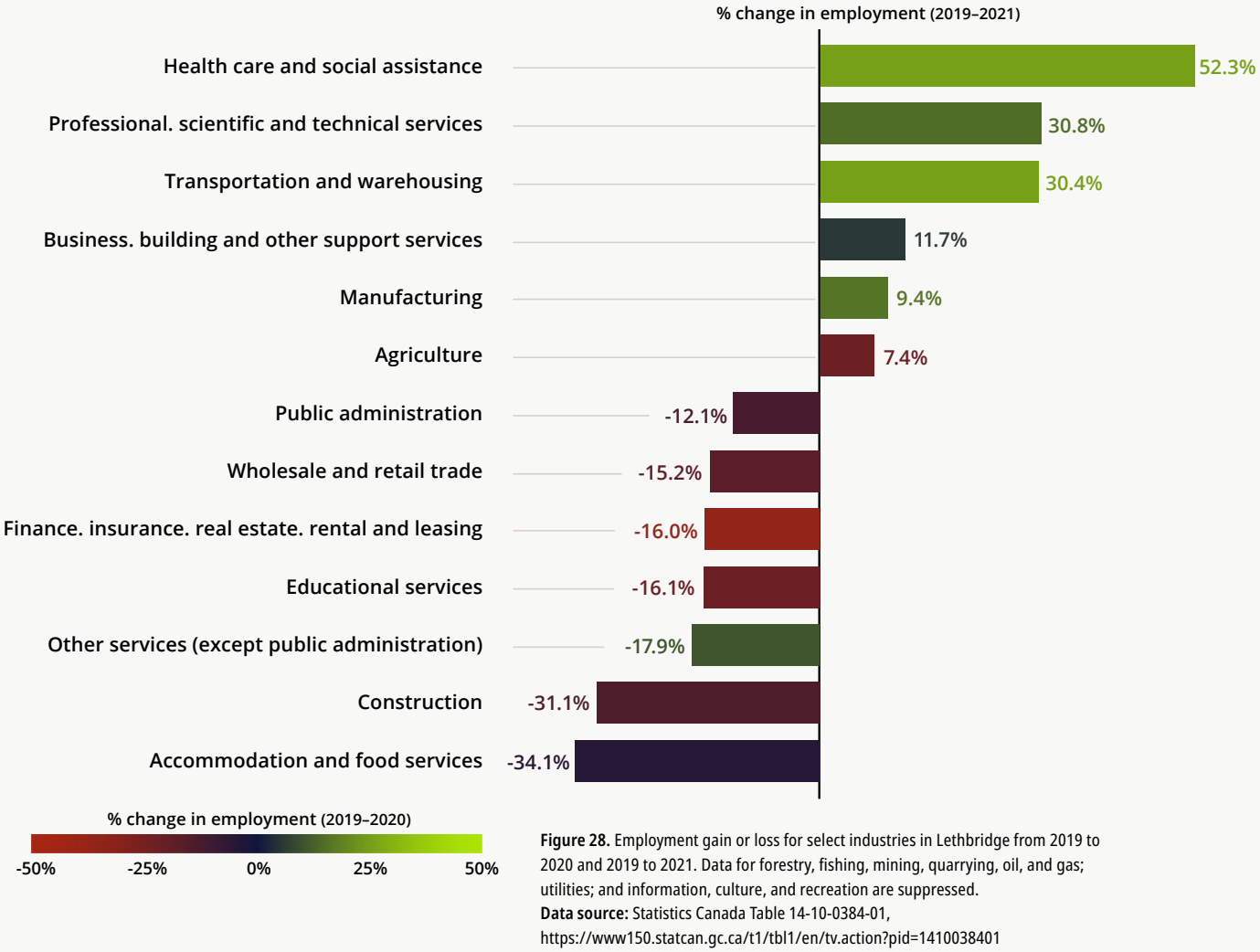


Figure 28. Employment gain or loss for select industries in Lethbridge from 2019 to 2020 and 2019 to 2021. Data for forestry, fishing, mining, quarrying, oil, and gas; utilities; and information, culture, and recreation are suppressed.
Data source: Statistics Canada Table 14-10-0384-01, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410038401

Digital Economy Labour Market Trends

Core digital economy roles, such as software developers, cybersecurity professionals, and data analysts, account for a much smaller share of employment and GDP in the Lethbridge CMA than in Calgary and Edmonton. For instance, ICTC analysis of Statistics Canada data finds that there were approximately 1,770 people employed in digital economy roles in Lethbridge in 2022. Over the last few years, digital economy roles have accounted for about 2.5% to 5% of Lethbridge employment.[104] A 2020 report for the Lethbridge Region Economic Recovery Task Force similarly found that engineering and related services, computer systems design and related services, and power generation represent about 2.3% of the Lethbridge region's gross regional product and a low number of jobs.[105] Nonetheless, digital economy roles in the region are forecast to grow over the next five years and are valuable, as they provide residents with high-paying jobs.[106] According to job postings from 2020 to 2021, the most in-demand digital economy roles in Lethbridge are corporate sales managers, followed by mathematicians, statisticians, and actuaries; information systems analysts and consultants; and electricians (see Figure 28). Additional analysis of job postings comparable to Calgary and Edmonton has also been completed by ICTC. Although the results display the beginning of a possible growth trajectory for these roles in the city, additional information over time is needed for trend analysis.

Top ten digital economy occupations in Lethbridge

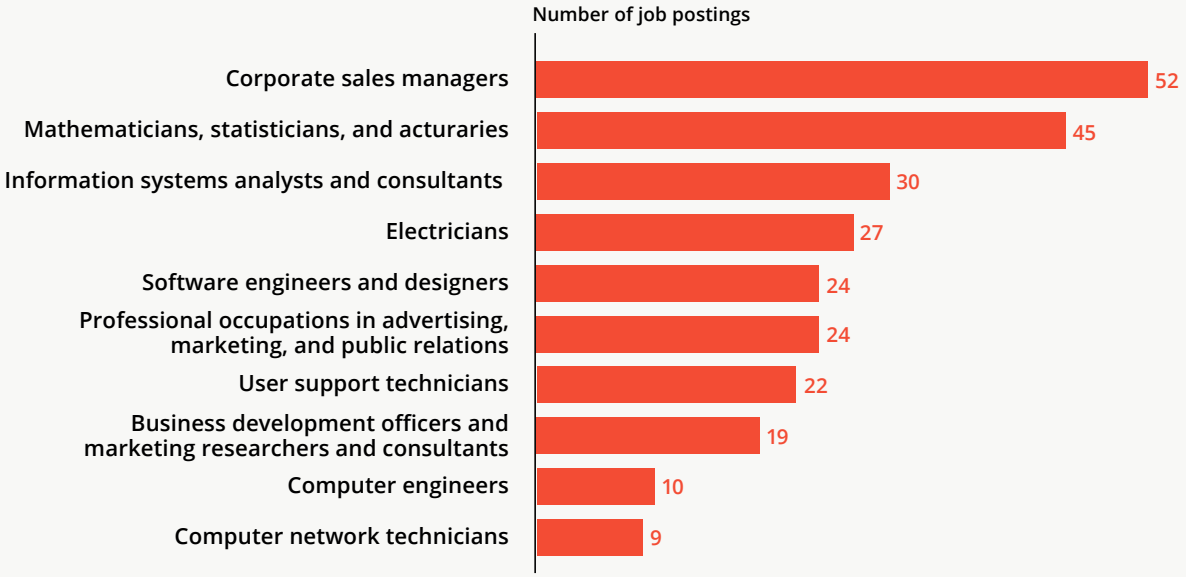


Figure 29. Top 10 digital economy NOC codes in Lethbridge based on job postings posted on select websites from January 2020 to December 2021. **Data source:** EMSI.

104 Statistics Canada Labour Force Survey data.

105 "Economic and Industrial Impact of the Coronavirus", May 27, 2020, *Lethbridge Region Economic Recovery Taskforce*, https://edac.ca/wp-content/uploads/2020/09/LRERTF-Presentation-of-CAI-Study-V4.pdf

106 Ibid.

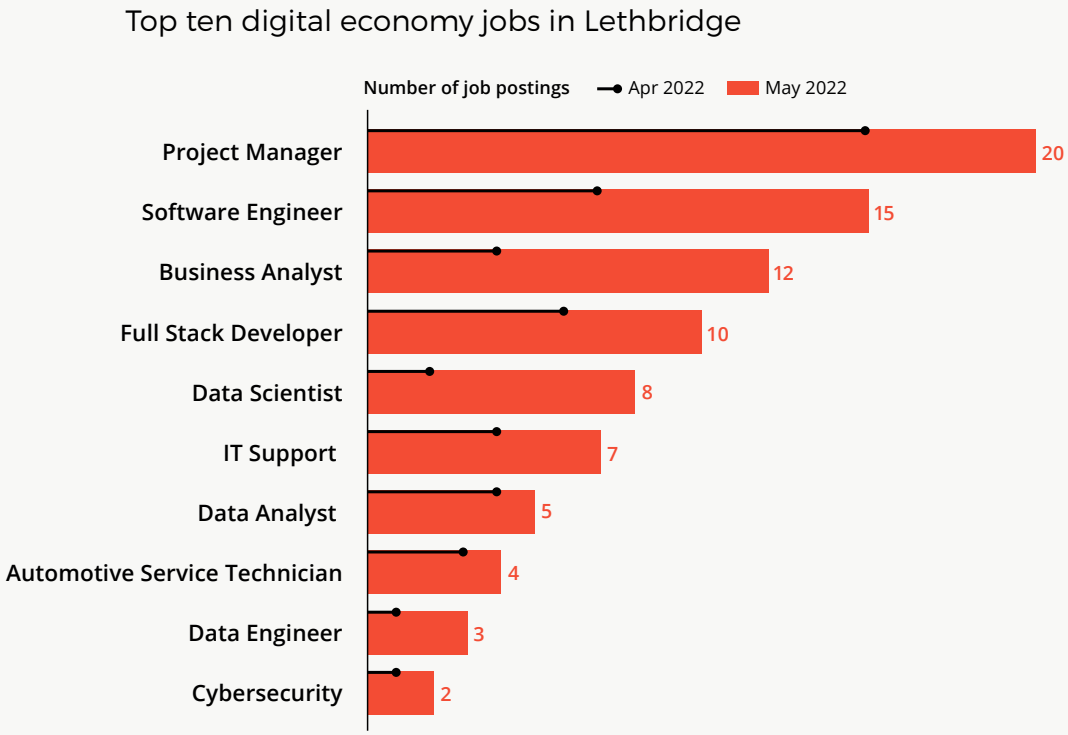


Figure 30. Top ten digital economy jobs in Lethbridge in April and May 2022. **Data source:** ICTC.

Despite low numbers of core tech workers, digital adoption has increased as a result of the pandemic, introducing new digital competencies to traditionally non-digital roles. According to the Brighter Together Survey, 39% of businesses in Lethbridge were implementing or leveraging new technology in 2021; 46% were likely to increase their online sales capacity; 33% were likely to invest in cybersecurity systems; 28% were likely to incorporate more remote work; and 27% were likely to automate certain tasks.[107] A 2020 study for Economic Development Lethbridge similarly determined that COVID-19 caused businesses to adopt new technology and inspired "a re-evaluation of the skills required to support future operations."[108] For instance, participants in that study referenced "*new projects [that] are appearing in agriculture that require technical skills for higher-paid roles.*"

107 The Brighter Together survey is an annual survey that "probes local organizations to provide feedback about their current sentiments and overall business health." See: https://chooselethbridge.ca/userfile/file/2021%20Brighter%20Together%20Survey%20-%20Summary%20of%20Results.pdf

108 "Southwest Alberta Regional Skills Study: Regional Report: City of Lethbridge", *Economic Development Lethbridge*, https://chooselethbridge.ca/userfile/file/Southwest%20Alberta%20Regional%20Skills%20Study%20Regional%20Report%20City%20of%20Lethbridge.pdf

In a previous study, firms reported difficulties hiring both core digital economy workers and non-digital economy workers with digital skills.[109] In terms of core workers, firms found it difficult to source programmers and web developers, technologists, engineers, and skilled trade workers and equipment operators. Firms also found it challenging to find technology-ready production staff and individuals who are digitally literate and competent using computers and computer software. In this study, web scraping was used to identify the most in-demand transferable skills in Lethbridge's digital economy from January 2020 to December 2021. According to job postings data, the most in-demand transferable skill was communication, followed closely by management and customer service, and then distantly by research, sales, attention to detail, problem solving, operations, planning, and time management (see Figure 30).

Most in-demand transferable skills in Lethbridge's digital economy

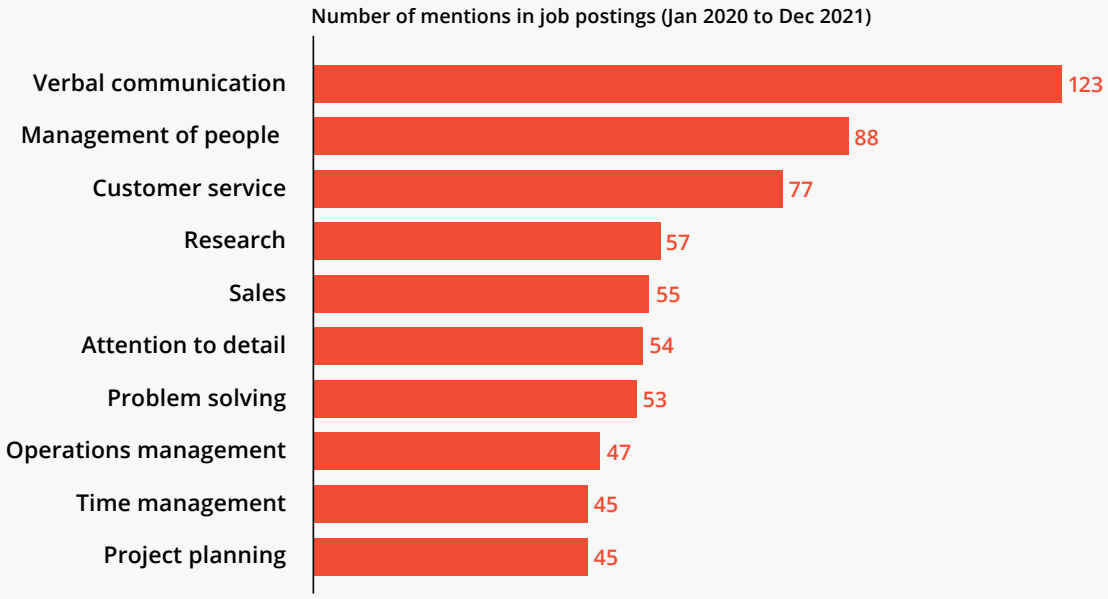


Figure 31. Top ten most in-demand transferable skills in Lethbridge's digital economy according to job postings data. To be included in the dataset, jobs had to be posted on select websites between January 2020 and December 2021.
Data source: EMSI data, ICTC analysis.

109 Ibid.

In the regional focus groups for this study, participants noted that digital economy companies located in Lethbridge have a more difficult time securing investment than those located in larger cities, such as Calgary and Edmonton. Therefore, companies will "*often go elsewhere because [finding] investment is easier*." Retaining local talent, such as recent graduates, was also identified as a hurdle. As one participant in this study noted, "*Students do come through the university and college but move away [after graduating].*" Notably, more intraprovincial migrants have moved from Lethbridge to Edmonton and Calgary than vice versa.[112] Talent retention was also highlighted as a major obstacle for Lethbridge businesses in the Brighter Together Survey[111] and in a study for Economic Development Lethbridge.[112] According to the latter study, there are limited mid- and senior-level positions available in Lethbridge, which makes it difficult for the region to retain this type of talent. Notably, 53% of surveyed job seekers were considering moving out of Lethbridge to secure suitable employment. Meanwhile, 35% of surveyed employers indicated that difficulties with skilled labour retention or recruitment were somewhat likely, likely, or very likely to influence their decision to remain in Lethbridge.

Newcomers are an underutilized source of talent in Lethbridge. A lower percentage of Lethbridge's population are immigrants (13.5%) when compared to Edmonton's (23.8%) and Calgary's (29.4%). Additionally, Lethbridge is less ethnoculturally diverse. The vast majority (76%) of immigrants in Lethbridge were born in the Americas or Europe, whereas more than half of Calgary's and Edmonton's immigrant population were born in Asia.[113] Additionally, Lethbridge receives a much greater share of intraprovincial migrants (72%) than Calgary (41%) and Edmonton (52%).[114] In response to Lethbridge's Brighter Together Survey, half of surveyed businesses felt there were barriers preventing them from hiring newcomers, and language and concerns about professional qualifications were the most commonly identified barriers.[115] Newcomers to southwest Alberta also identified language as a barrier to employment, in addition to requirements for Canadian work experience and references and recognition of credentials.

111 The Brighter Together survey is an annual survey that "probes local organizations to provide feedback about their current sentiments and overall business health." See: https://chooselethbridge.ca/userfile/file/2021%20Brighter%20Together%20Survey%20-%20Summary%20of%20Results.pdf

112 "Southwest Alberta Regional Skills Study: Regional Report: City of Lethbridge", *Economic Development Lethbridge*, https://chooselethbridge.ca/userfile/file/Southwest%20Alberta%20Regional%20Skills%20Study%20Regional%20Report%20City%20of%20Lethbridge.pdf

113 Calculated using Stats Canada data (the following tables): https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=7&LANG=Eng&GK=CMA&GC=810; https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=7&LANG=Eng&GK=CMA&GC=825; https://www12.statcan.gc.ca/census-recensement/2016/as-sa/fogs-spg/Facts-CMA-Eng.cfm?TOPIC=7&LANG=Eng&GK=CMA&GC=835

114 Statistics Canada. Table 17-10-0141-01 Interprovincial and intraprovincial migrants, by census metropolitan area and census agglomeration of origin and destination, 2016 boundaries

115 "Southwest Alberta Regional Skills Study: Regional Report: City of Lethbridge", *Economic Development Lethbridge*, https://chooselethbridge.ca/userfile/file/Southwest%20Alberta%20Regional%20Skills%20Study%20Regional%20Report%20City%20of%20Lethbridge.pdf

SECTION IV

Top Digital Economy Growth Subsectors

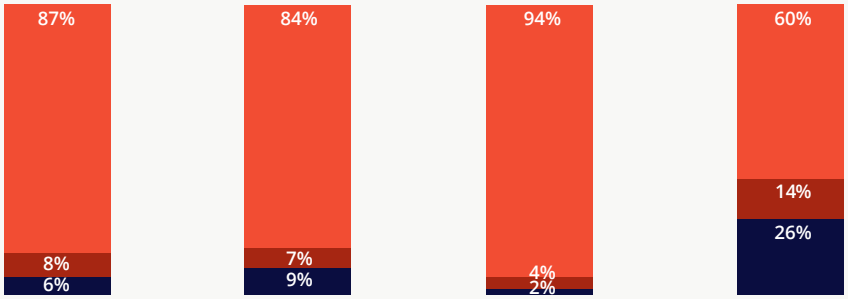
Digital transformation and innovation are changing the face of many industries in Alberta, including the creative industries, healthcare, agriculture, energy, and financial services. While there are many interesting and high-growth digital technology subsectors in Alberta, such as interactive digital media, this section looks at four: healthcare technology, clean technology, financial technology, and agriculture technology. It identifies what types of companies are present in the subsectors and what products and services they provide; which jobs and skills are most in demand; where companies and job postings in the subsectors are located; and what strengths, weaknesses, opportunities, and threats define the subsector post-COVID. A summary of this section is provided in the table below.

	Healthcare Technology	Clean Technology	Financial Technology	Agriculture Technology
Contribution to provincial GDP	Healthcare and social assistance contributed 6% of Alberta's GDP in 2020.	Clean technology contributed 1.7% to Alberta's GDP in 2020.	Finance and insurance contributed 4% to Alberta's GDP in 2020.	Agriculture contributed 2.2% to Alberta's GDP in 2020.
Contribution to employment	Healthcare and social assistance accounted for 13.6% of Alberta's employment in March 2022.	Clean technology accounted for 1% of Alberta's employment in 2020 (data not available for March 2022).	Finance and insurance accounted for 3.1% of Alberta's employment in March 2022.	Agriculture accounted for 1.3% of Alberta's employment in March 2022.
Most common verticals among companies	Biotechnology Enterprise software and information systems Medical devices Decision and risk analysis	Energy efficiency Digitization Renewable energy production and storage Sustainable fuel development Carbon capture, utilization, and storage	Blockchain and cryptocurrency Payments Capital markets Accounting and expense management Lending Insurance	Precision farming High-tech farming equipment Animal-focused technologies Enterprise services Controlled growing environments Crop protection and nutrition

	Healthcare Technology	Clean Technology	Financial Technology	Agriculture Technology
Most in-demand jobs (job postings, March 2020 to March 2022)	Software developers Business development managers Marketing coordinators Sales managers Full stack developers	Electrical apprentices Electrical engineers Business development managers Journeyman electricians Project engineers	Software developers Full stack developers Business development managers Graphic designers Project managers	Sales managers Technology specialists Instrumentation specialists Software developers Agriculture and agricultural science specialists
Most in-demand skills (job postings, March 2020 to March 2022)	Computer science SQL Agile methodology Software development Automation	Electrical engineering Business development Construction Commissioning Automation	Computer science Finance Agile methodology SQL Accounting	Agriculture Computer science Forestry SAP applications Business development

Location of job postings (job postings, March 2020 to March 2022)

Large population centres
Medium population centres
Small population centres



Location of companies

Large population centres
Medium population centres
Small population centres

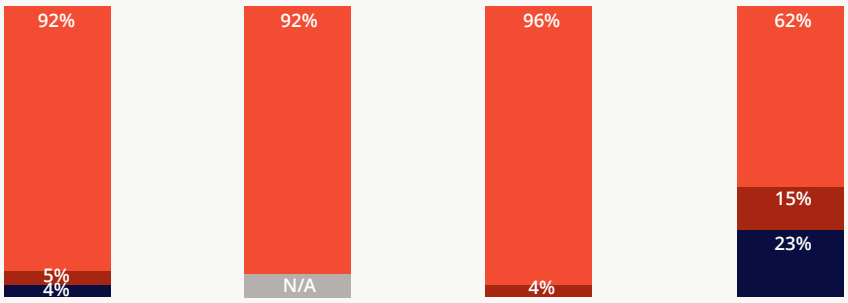
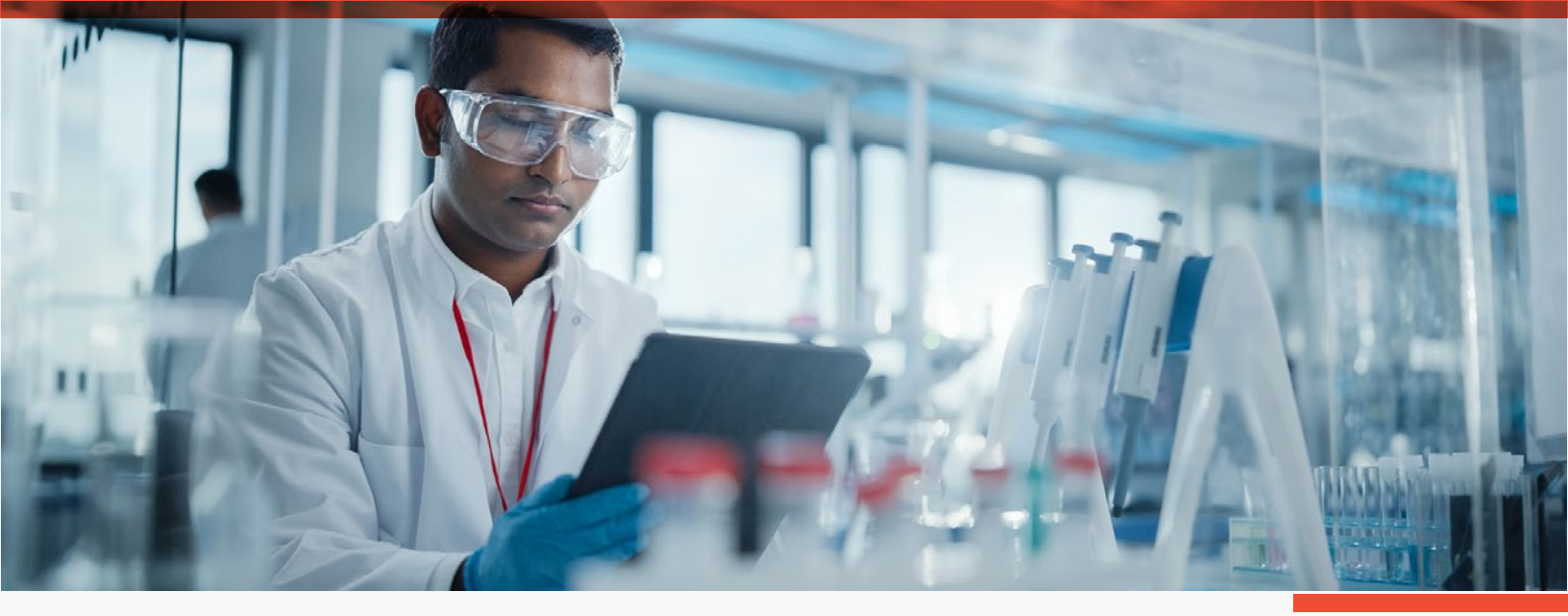


Table 2. Summary of subsector data. Large population centres are communities with more than 99,999 people; medium population centres are communities with between 30,000 and 99,999 people; and small population centres are communities with between 1,000 and 29,999 people.



Healthcare Technology

What is Healthcare Technology?

Healthcare technology is diverse and includes the use of information communications technology to provide telemedicine services, co-ordinate care, share health data, and prevent, diagnose, and treat illness; the use of big data to identify correlations between gene sequences and diseases, aid in the design of novel drugs, and tailor treatments to individual patients based on their DNA; and the use of biotechnology for medical purposes, including the engineering of genetic cures or designing organisms that create antibiotics.[116]

Health Tech and Alberta's Economy

Healthcare is a key component of Alberta's economy: total healthcare expenditure fluctuates between 8% and 10% of provincial GDP,[117] while the healthcare and social assistance sector accounts for about 6%.[118] This makes healthcare and social assistance Alberta's fifth-largest sector after mining, quarrying, and oil and gas extraction; real estate, rental, and leasing; manufacturing; and construction. In March 2022, 313,400 people in Alberta were employed in the healthcare and social assistance sector. This represents 13.6% of Alberta's total employment and an 11.7% increase since the start of the pandemic (March 2020).[119]

116 Hamoni, R., Matthews, M., Watson, M., "Digital Transformation: The Next Big Leap in Healthcare", August 2021, *Information and Communications Technology Council,* https://www.ictc-ctic.ca/wp-content/uploads/2021/08/ICTC_Report_DigitalTransformation_August-12.pdf

117 CIHI National Health Expenditure Trends 2021 Data Tables

118 Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000), https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610040201

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

Alberta generally spends more on healthcare per capita compared to the other Canadian provinces and territories; however, due to Alberta's high GDP, the province maintains a low healthcare-spending-to GDP ratio. According to the Canadian Institute for Health Information, Alberta spent an estimated $37,117 million, or $8,230 per capita, on healthcare in 2021.[120] Of this, approximately 27% was private healthcare spending, while 73% was public.[121] Hospitals and other institutions (35%), healthcare professionals (24%), and drugs (13%) are the province's largest expense categories, and account for the greatest increase in healthcare spending over the last 20 years.[122] Generally, the cost of healthcare has risen in Alberta over time, mostly due to inflation, population growth, and Alberta's aging population, trends that are likely to continue in the short and medium term.[123] The provincial government faces pressure to improve Alberta's healthcare system, expand access to healthcare services, and adopt new technologies, all while keeping healthcare spending in check. Health technology is therefore both an additional spending pressure, and—through big data and AI, telehealth, and automation—a way to mediate spending.[124]

As shown in Figure 32, based on a dataset of 108 companies, health tech companies in Alberta focus mainly on biotechnology (for example, pharmaceuticals and drug discovery), followed distantly by software and information systems (for example, medical records systems and enterprise systems), medical devices (for example, surgical devices, therapeutic devices, monitoring equipment, and diagnostic equipment), and decision and risk analysis (for example, care planning and clinician decision support). Among the companies in the dataset, the most common technology verticals are life sciences, digital health, health tech, and AI and machine learning.

Alberta-based Health Tech Companies by Type

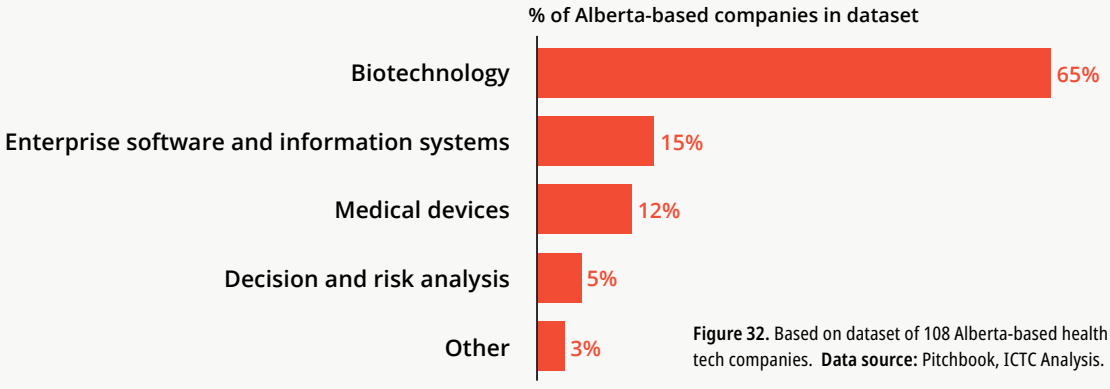


Figure 32. Based on dataset of 108 Alberta-based health tech companies. **Data source:** Pitchbook, ICTC Analysis.

120 "How do provinces and territories compare?", *CIHI*, https://www.cihi.ca/en/how-do-the-provinces-and-territories-compare

121 CIHI National Health Expenditure Trends 2021 Data Tables

122 CIHI National Health Expenditure Trends 2021 Data Tables; https://www.cbc.ca/news/canada/calgary/alberta-health-spending-history-1.5289747

123 https://www.ifsd.ca/web/default/files/Presentations/Reports/Alberta%2017009.pdf

124 Hamoni, R., Matthews, M., Watson, M., "Digital Transformation: The Next Big Leap in Healthcare", August 2021, *Information and Communications Technology Council*, https://www.ictc-ctic.ca/wp-content/uploads/2021/08/ICTC_Report_DigitalTransformation_August-12.pdf

Alberta's health tech industry is mostly located in its large urban population centres: 52% of the companies in the dataset are based in Calgary and 40% are based in Edmonton, while just 9% are based in small or medium population centres. Job-postings data for health tech roles in Alberta reveals similar trends: among a dataset of 12,244 unique job postings, 87% were for large urban centres (communities with more than 99,999 people), 8% were for medium population centres (communities with between 30,000 and 99,999 people), and 6% were for small population centres (communities with between 1,000 and 29,999 people).[125] Job postings for health tech roles are highly correlated with healthcare facilities: 98.5% of the job postings were for population centres with a hospital, 0.75% were for population centres with no hospital but a community care centre, and 0.75% were for population centres with neither of these.[126]

Health Tech and Alberta's Labour Market

The ICTC's *Digital Transformation: The Next Big Leap in Healthcare* report finds that, like the agriculture and food sector, Canada's healthcare system is facing a shortage of digitally skilled talent, as governments face increasing pressure to innovate, modernize health systems, and adopt new health technologies. Figure 33 shows that in 2021, employment in Alberta's health and biotech sector reached 14,440. This includes core software roles, such as software engineers and full stack developers, machine learning and data roles, such as machine learning engineers, data scientists, and computational scientists, and product roles, such as product managers and designers. In addition to core technical roles, the health tech industry has a critical need for interdisciplinary talent involving a core technical team and domain-specific talent or advisors. For example, domain-specific scientific and/or medical roles may include scientific or medical advisors, research scientists, and lab technicians.

125 Using EMSI, ICTC generated a dataset of 12,244 unique job postings for roles in Alberta's health tech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: healthcare, health, health technology, health information system, medical, medical device, biotechnology, biotech, physician, physician support, nurse, public health, primary care, urgent care, hospital, surgery, drug discovery. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

126 Based on data from Alberta Health Services: See: https://www.albertahealthservices.ca/findhealth/search.aspx

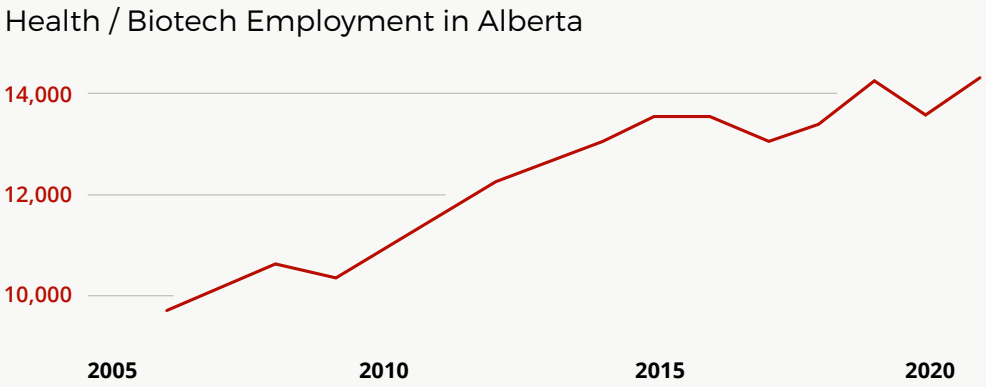


Figure 33. Health and Biotech employment in Alberta, 2006-2020. **Data source:** Stats Canada, ICTC.

Alberta's Health Tech Industry: In-demand Roles and Skill sets

Local job-postings data can provide further insight into the most in-demand roles and skill sets in Alberta's health tech industry. ICTC analyzed 12,244 job postings that were posted in Alberta from March 2020 to March 2022.[127] Table 3 identifies the top 10 most common occupations (NOC codes), job titles, and specialized and common skills. From the data, it is evident that there is high demand for core ICT roles, such as software developers, full stack developers, web developers, and system administrators, in addition to sales and business development roles.

Top Occupations (NOC Codes)	Top Job Titles	Top Specialized Skills	Top Soft Skills
Software Engineers and Designers	Software Developers and Engineers	Computer Science	Communications
Information Systems Analysts and Consultants	Business Development Managers	SQL (Programming Language)	Management
Corporate Sales Managers	Marketing Coordinators	Agile Methodology	Customer Service
Business Development Officers and Marketing Researchers and Consultants	Sales Managers	Software Development	Problem Solving

127 Using EMSI, ICTC generated a dataset of 12,244 unique job postings for roles in Alberta's health tech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: healthcare, health, health technology, health information system, medical, medical device, biotechnology, biotech, physician, physician support, nurse, primary care, urgent care, hospital, surgery, drug discovery. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Top Occupations (NOC Codes)	Top Job Titles	Top Specialized Skills	Top Soft Skills
User Support Technicians	Full Stack Developers	Automation	Leadership
Professional Occupations in Advertising, Marketing and Public Relations	Web Developers	Business Development	Sales
Mathematicians, Statisticians and Actuaries	Territory Managers	Project Management	Operations
Computer and Information Systems Managers	Digital Marketing Specialists	Customer Relationship Management	Detail Oriented
Database Analysts and Data Administrators	Business Systems Analysts	Data Analysis	Planning
Computer Engineers (Except Software Engineers and Designers)	System Administrators	Python (Programming Language)	Marketing

Table 3. Most in-demand occupations (NOC Codes), job titles, specialized skills, and common skills according to job postings data.
Data source: ICTC analysis, EMSI data.[128]

Our company was in the forefront of combating COVID-19 and discovering a treatment that became standard of care. The company added more employees and became really busy throughout the pandemic. ❞

– Health employer

128 Using EMSI, ICTC generated a dataset of 12,244 unique joFullb postings for roles in Alberta's health tech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: healthcare, health, health technology, health information system, medical, medical device, biotechnology, biotech, physician, physician support, nurse, primary care, urgent care, hospital, surgery, drug discovery. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Finding a Local Customer Base

A key challenge for health tech companies based in Alberta is finding local customers (as is the case for health tech companies based in other Canadian provinces). Several interviewees or focus-group members noted difficulty finding a sufficient customer base in Canada, let alone within the Canadian public healthcare sector. In comparison with healthcare providers from other countries, Canadian healthcare providers are slow adopters of healthcare innovation, such as telehealth services or online booking tools. Participants in this study felt the healthcare sector's procurement practices make it challenging for health tech companies to find public sector customers locally. Some participants noted that the healthcare sector can be reluctant to work with private companies on healthcare problems and would prefer to work with foundations or not-for-profits instead. Others were disheartened by how often they feel government contracts are given to larger companies in place of local innovators. The following quotes help shed additional light on how participants felt about healthcare procurement:

We need a procurement policy that's friendlier to new innovations [and] gives opportunities to SMEs to improve the health care system. ❞

– Participant, Digital Health Focus Group

One of the biggest threats to Canada, not just to Alberta, is that if we are not able to engage our startup companies—in any sector, but health being a key one—we'll have to outsource everything, and we and that's what we currently do. We outsource everything. If you want to talk about supply chain issues, whether it's respirators, imaging devices, consumables, we are at the mercy of multinationals around the world and we're going to continue to be. We have tier-one, world class companies right here in Canada that, based on what I'm seeing, have to sell around the world. ❞

– Participant, Digital Health Focus Group

Think about the [local healthcare system], and how tough is for a local company to sell to [them]. We just had our first contract with them, which was tiny, and it'll probably have cost us way more money to get that tiny contract than we'll make from the contract, [but we're doing it] just to try to build a relationship. ❞

– Participant, Digital Health Focus Group

We have to change [procurement, healthcare] policy and we have to become more fluid in how we innovate in our healthcare system. And that means taking advantage of people outside the healthcare system. ❞

– Digital Health Roundtable

SWOT Analysis: Alberta's Healthcare Technology Industry

Strengths	Weaknesses
Health tech companies based in Alberta responded quickly to demand for telehealth and other healthcare services during the pandemic, and have been able to establish their position in the market.	Many local health tech companies are forced to seek business and clients abroad, as opposed to in Canada, which risks them moving key operations abroad. Overreliance on international data sources and funding may result in healthtech solutions that are less relevant to Alberta's local context.
Opportunities	**Threats**
The COVID-19 pandemic has made patients and healthcare providers more comfortable using healthcare technology and more interested in the types of products and services available. The pandemic increased the pace of adoption for some healthcare technologies within the public healthcare system, providing a clear example of how to innovate quickly. Post-COVID-19, there is an opportunity for Alberta's healthcare system to assess how healthcare technology procurement changed during the pandemic and adopt beneficial practices.	It can be difficult for health tech companies in Alberta to sell to and work with the provincial healthcare system, in addition to other healthcare systems in Canada. It can be difficult for health tech companies and researchers to access Canadian health data sources, which limits innovation.

Clean Technology

What is Clean Technology?

Clean technology (any good or service that corrects or prevents environmental damage, pollutes less, or is more resource-efficient than a similar good or service[129]) is central to many government and business sustainability plans. In an effort to be more sustainable, government and private industry are adopting a range of clean technologies: this includes renewable energy solutions such as geothermal, solar, or wind; energy-efficient building solutions such as smart heating or cooling; and carbon capture, utilization, and storage.

Clean Technology and Alberta's Economy

Statistics Canada collects and publishes information about Canada's clean technology sector, which it separates into environmental goods and services (for example, clean and renewable electricity, biofuels, waste management and remediation, and waste goods) and clean technology goods and services (for example, manufactured goods such as solar panels, services related to R&D, and sustainable construction).[130] Together, the clean technology and environmental sectors accounted for approximately 1.7% of Alberta's GDP in 2020: clean technology contributed $2.92 billion, while the environmental sector contributed $2.38 billion (see Figure 33).[131]

129 "Clean Technology Data Strategy", *Government of Canada,* https://www.ic.gc.ca/eic/site/099.nsf/eng/h_00019.html

130 Ibid.

131 "GDP and trade", *Government of Canada*, https://www.ic.gc.ca/eic/site/099.nsf/eng/00047.html

In terms of employment, the clean technology and environmental sectors accounted for 1% of Alberta's total employment in 2020.[132] Alberta has the fourth-largest clean technology and environmental workforce in Canada, behind Ontario, Quebec, and British Columbia (see Figure 33).[133] Employment in these industries has grown significantly over time, and over the past 10 years, has outpaced employment in the economy generally.[134] Clean technology employment grew 16% from 2012 to 2020, while environmental employment increased by 58%. During this same time period, total employment in Alberta grew by just 5.8%.

Employment and GDP in the clean tech and environmental sectors (2020)

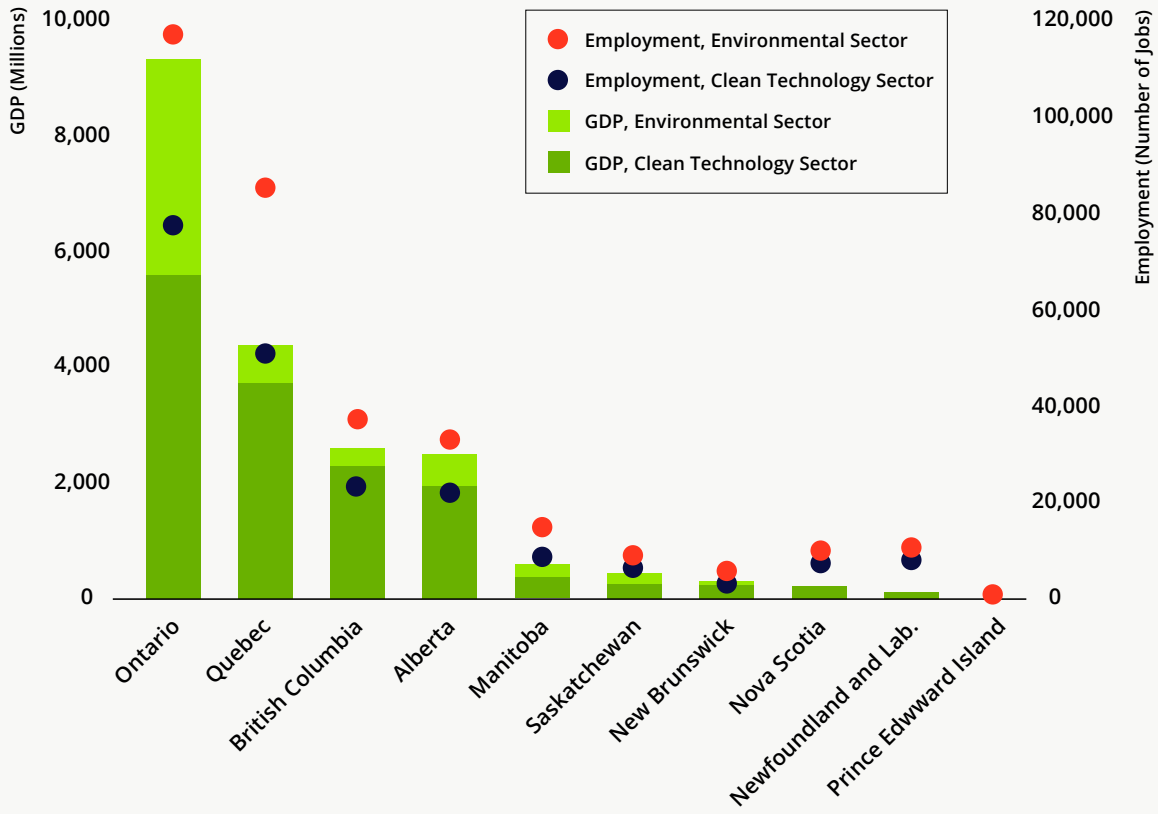


Figure 34. Employment and GDP in clean technology sector. **Data source:** Statistics Canada data, ICTC analysis.

132 Based on average monthly employment (2,130,100)E. Source: https://www.ic.gc.ca/eic/site/099.nsf/eng/00046.html

133 https://www.ic.gc.ca/eic/site/099.nsf/eng/00046.html

134 Statistics Canada. Table 14-10-0023-01 Labour force characteristics by industry, annual (x 1,000), https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301;

https://www.ic.gc.ca/eic/site/099.nsf/eng/00046.html; Cutean, A. et al., "Canada's Growth Currency Digital Talent Outlook 2023," 2019, *Information and Communications Technology Council*, https://www.ictc-ctic.ca/wp-content/uploads/2019/11/canada-growth-currency-2019-FINAL-ENG.pdf

As shown in Figure 35, nearly three-quarters (71%) of Alberta's clean-technology companies sell to the oil and gas sector (mining, quarrying, and oil gas is Alberta's largest industry, accounting for approximately 26% of Alberta's GDP[135] and 6.3% of Alberta's total employment).[136] Nearly half (44%) of Alberta's clean-technology companies sell to the power and utilities sector, and more than one-third sell to manufacturing, agriculture and food processing, and mining.[137] In terms of product offering, 22% of clean-technology companies in Alberta focus on energy efficiency, 14% on digitization, 13% on renewable energy production and storage, 13% on sustainable fuel development, and 8% on carbon capture, utilization, and storage.[138] Finally, most of Alberta's cleantech companies are based in Calgary (70%) and Edmonton (22%), with just 6% based elsewhere.[139]

Alberta-based Clean Tech Companies by Target Market

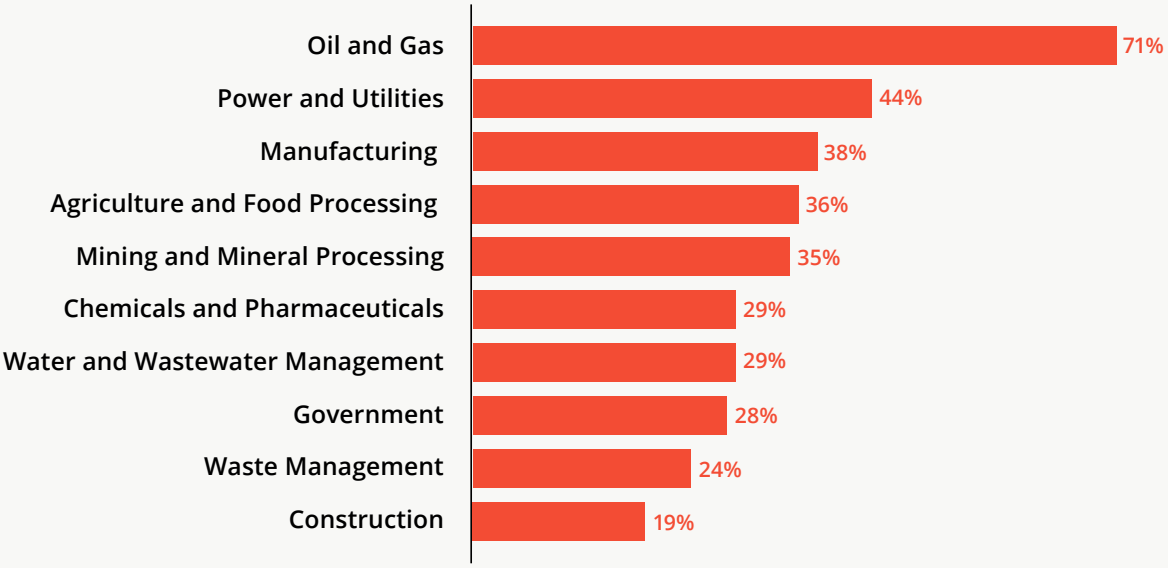


Figure 35. Clean tech companies by sector. **Data source:** Foresight Canada.

137 Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000), https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610040201

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

139 "Alberta Clean Tech Report: 2021", *Foresight Canada*, https://foresightcac.com/learn/alberta-cleantech-report-2021-introduction/

140 Ibid.

141 "Alberta Clean Technology Sector 2019", *ACTIA*, https://secureservercdn.net/198.71.233.31/237.01d.myftpupload.com/wp-content/uploads/2019/11/ACTia-Report_V1.8.pdf

Cleantech and Alberta's Labour Market

Employment in Alberta's cleantech sector totalled 37,800 in 2021. As the digital economy expands, the environmental sector will become increasingly digital. Many of the sector's occupations will require increased need for core digital workers.[141] For example, Environmental Careers Organization of Canada forecasts a growing need for digital occupations in the buildings sector, including web/application developers, software developers, cybersecurity specialists, data analysts, data engineers, data operations engineers, integration specialists, and business intelligence developers.[142]

Cleantech Employment in Alberta

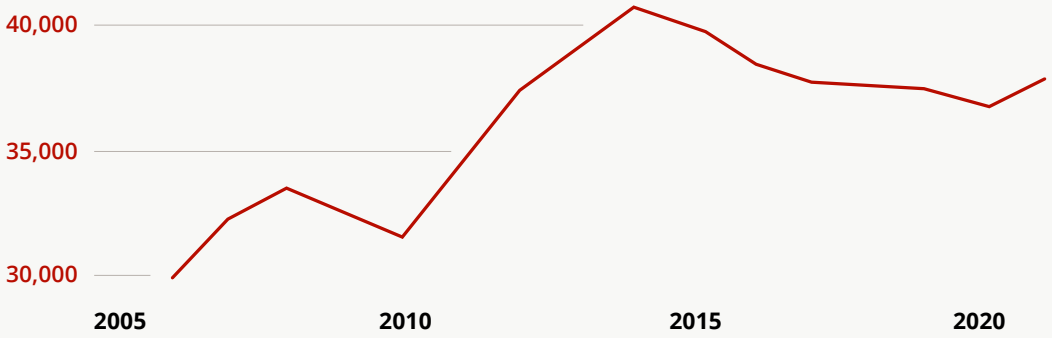


Figure 36. Cleantech employment in Alberta, 2006-2020. **Data source:** Stats Canada, ICTC.

Job-postings data can provide further insight into the most in-demand roles and skill sets in Alberta's cleantech industry. To identify these roles and skill sets, ICTC analyzed 484 job postings that were posted in Alberta from March 2020 to March 2022.[142] Table 4 identifies the top 10 most common occupations (NOC codes), job titles, and specialized and common skills. The data shows that in comparison with the other technology subsectors, there is a greater demand for electricians, electrical apprentices, and engineers in Alberta's cleantech industry. In terms of location, 84% of the job postings were for roles in large population centres, 7% were for medium population centres, and 9% were for small population centres.

140 "Assessment of Occupational and Skills Needs and Gaps for the Energy Efficient Buildings Workforce," 2021, *Eco Canada*, https://info.eco.ca/acton/attachment/42902/f-00111b67-483c-42e6-8060-fc13be56709f/1/-/-/-/-/Energy%20Efficiency%20in%20Buildings%202021.pdf

141 "Assessment of Occupational and Skills Needs and Gaps for the Energy Efficient Buildings Workforce," 2021, *Eco Canada*, https://info.eco.ca/acton/attachment/42902/f-00111b67-483c-42e6-8060-fc13be56709f/1/-/-/-/-/Energy%20Efficiency%20in%20Buildings%202021.pdf

142 Using EMSI, ICTC generated a dataset of 484 unique job postings for roles in Alberta's cleantech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: clean tech, clean technology, renewable energy, energy efficiency, carbon capture, carbon utilization, carbon storage, carbon capture utilization and storage, CCUS, sustainable fuel, hydrogen, solar energy, renewable energy. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Top Occupations (NOC Codes)	Top Job Titles	Top Specialized Skills	Top Soft Skills
Electrical and Electronics Engineers	Electrical Apprentices	Electrical Engineering	Communications
Information Systems Analysts and Consultants	Electrical Engineers	Business Development	Leadership
Corporate Sales Managers	Business Development Managers	Construction	Management
Electricians (Except Industrial and Power System)	Journeyman Electricians	Commissioning	Problem Solving
Software Engineers and Designers	Project Engineers	Automation	Valid Driver's Licence
Business Development Officers and Marketing Researchers and Consultants	Business Systems Analysts	Electrical Wiring	Operations
Engineering Managers	Systems Integration Engineers	Switchgear	Presentations
Mathematicians, Statisticians and Actuaries	Solar Electricians	Computer Science	Troubleshooting (Problem Solving)
Industrial Electricians	Full Stack Developers	Engineering Design Process	Detail Oriented
Other Professional Engineers, n.e.c.	Software Engineers	Electrical Equipment	Interpersonal Communications

Table 4. Most in-demand occupations (NOC Codes), job titles, specialized skills, and common skills according to job postings data.
Data source: ICTC analysis, EMSI data. [143]

143 Using EMSI, ICTC generated a dataset of 484 unique job postings for roles in Alberta's cleantech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: clean tech, clean technology, renewable energy, energy efficiency, carbon capture, carbon utilization, carbon storage, carbon capture utilization and storage, CCUS, sustainable fuel, hydrogen, solar energy, renewable energy. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Many cleantech companies in Alberta sell to or collaborate closely with oil and gas firms, and there is a high degree of overlap between the competencies needed in oil and gas and clean-technology firms. A lot of Alberta's cleantech R&D activity also takes place within traditional oil and gas firms. Interviewees in this study felt this makes the clean-technology sector a natural fit for displaced oil and gas workers, yet they also noted it can be difficult to compete with the traditional oil and gas sector for labour.[144] Oil and gas companies in Alberta are able to offer higher-than-average salaries, which for many cleantech startups are unaffordable. Notably, some workers may face a significant pay cut when transitioning to cleantech from oil and gas. Because of these trends, some interviewees opted to source talent from abroad, as opposed to locally, when addressing labour needs.

Industry Challenges

In 2018, the Government of Canada's Clean Technology Economic Strategy Table forecast that the global clean technology industry would exceed $2.5 trillion by 2022 and set a goal to nearly triple Canada's clean technology exports by 2025.[145] Several barriers to achieving this goal were identified: low adoption rates, low access to scale up capital, a disconnect between environmental regulation and policy goals, and a lack of strategic expertise among smaller firms. At the national level, one of the main challenges for clean technology companies is that the costs their products and services address (e.g., carbon emissions, water pollutions, etc.) "are not explicitly valued in the marketplace except through regulation."[146] In other words, regulation is needed to drive their adoption. A 2019 report by Alberta Clean Technology Industry Alliance (ACTia) similarly highlights the lack of adoption drivers, alongside access to capital and the ability to prove technologies at commercial scale, as a key challenge facing clean technology companies in Alberta.[147] Moreover, following the onset of the COVID-19 pandemic, clean technology companies reported "ongoing revenue shortfalls, a pressing need for capital, a stop or strong slowdown in export activity, and impacts on supply chains."[148]

144 "Alberta Energy Transition", November 2021, *Calgary Economic Development*, https://www.calgaryeconomicdevelopment.com/assets/Reports/Sectors/Energy-Environment/CED-2021_EnergyTransition_Report.pdf

145 "Reform of Canada's Economic Strategy Tables: Clean Technology", *ISED*, https://www.ic.gc.ca/eic/site/098.nsf/eng/00023.html

146 "Clean Technology: Targeted Regulatory Review – Regulatory Roadmap", June 21, 2021, *Natural Resources Canada*, https://www.nrcan.gc.ca/transparency/acts-and-regulations/forward-regulatory-plan/clean-technology-targeted-regulatory-review-regulatory-roadmap/23714

147 "Alberta Clean Technology Sector 2019", *ACTIA*, https://secureservercdn.net/198.71.233.31/237.01d.myftpupload.com/wp-content/uploads/2019/11/ACTia-Report_V1.8.pdf

148 "Clean Technology: Targeted Regulatory Review – Regulatory Roadmap", June 21, 2021, *Natural Resources Canada*, https://www.nrcan.gc.ca/transparency/acts-and-regulations/forward-regulatory-plan/clean-technology-targeted-regulatory-review-regulatory-roadmap/23714

In a 2021 survey of clean technology companies in Alberta, more than half (55%) of respondents had experienced a 50%-or-more decline in fundraising due to the pandemic, while 40% had experienced a 25-to-50% decline in revenue.[149] These challenges are particularly pressing for Alberta's clean technology industry, which is often involved in "deep innovation plays" with "longer commercialization cycles and higher capital costs" than other tech startups.[150]

SWOT Analysis: Alberta's Clean Technology Industry

Strengths

Alberta's oil and gas sector is a global leader in certain areas of clean tech innovation, such as carbon capture, utilization, and storage and land and water management.

Job-postings data suggests that Alberta's environmental sector has rebounded from its 2020 downturn in employment.[151]

Weaknesses

Many of Alberta's clean-technology companies are involved in deep innovation plays that necessitate longer commercialization cycles and require more capital.[152] Without sustained financial support, access to late-stage capital, and the ability to test products at commercial scale, companies risk not being able to survive.

Cleantech startups and SMEs in Alberta are in direct competition with large oil and gas firms for talent and customers. Interviewees also report a lack of collaboration between these two groups.

Opportunities

Proximity to Alberta's oil and gas sector and Canada's agri-food and forestry sectors provides local cleantech companies a potential domestic market.

Canada's oil sands producers are striving to achieve net zero by 2050, presenting an opportunity for greater collaboration between cleantech startups and legacy oil and gas companies.

The global clean-technology market is growing rapidly, as governments and industry seek to reduce their environmental impact: rapid growth presents an opportunity for Alberta's cleantech companies to export and scale.

While projections vary, there is an opportunity for the cleantech and environmental sectors to help absorb job losses in the oil and gas sector over the next 10 years.[153]

Threats

Approximately 14,000 workers in Alberta's environmental sector (which clean technology is a part of) may need to be replaced by 2025, due to age-related attrition.[154] In order to meet growing demand for environmental workers in the province, Alberta will need to incentivize more robust knowledge transfer from senior to junior workers while investing in and training the future workforce.

Alberta, and Canada in general, lacks targeted regulation and incentives at the federal, provincial, and municipal levels to drive cleantech adoption: lacking a market within Canada, some companies may be deterred from investing in Alberta or encouraged to move operations abroad.

149 "Alberta Clean Tech Report: 2021", *Foresight Canada*, https://foresightcac.com/learn/alberta-cleantech-report-2021-introduction/

150 "Clean Technology: Targeted Regulatory Review – Regulatory Roadmap", June 21, 2021, *Natural Resources Canada*, https://www.nrcan.gc.ca/transparency/acts-and-regulations/forward-regulatory-plan/clean-technology-targeted-regulatory-review-regulatory-roadmap/23714

151 "Alberta's Mid-2021 Environmental Recruitment Trends", 2021, *Eco Canada*, https://eco.ca/new-reports/albertas-mid-2021-environmental-recruitment-trends%e2%80%8b/

152 "Alberta Clean Technology Sector 2019", *ACTIA*, https://secureservercdn.net/198.71.233.31/237.01d.myftpupload.com/wp-content/uploads/2019/11/ACTia-Report_V1.8.pdf

153 "Tracking the Energy Transition 2021", June 2021, *Clean Energy Canada*, https://cleanenergycanada.org/wp-content/uploads/2021/06/Report_CEC_CleanJobs2021.pdf

154 "Advancing Green Jobs and Supporting Workforce Resiliency in Canada", *Eco Canada*, https://eco.ca/research-and-resources/alberta-environmental-job-market-trends/

Financial Technology

What is Financial Technology?

Financial technology is software and other technology used by the financial services sector. In Canada, the financial services sector encompasses banking and finance, asset and wealth management, credit, and insurance. While some technology subsectors, such as health tech and agtech, are closely related to machinery, equipment, and devices, financial technology mainly involves software, data, and algorithms. For instance, many financial-technology companies specialize in the use of software to automate financial processes or the use of AI to make predications and inform decision making. Common applications for AI in the financial services industry include algorithmic trading, assessing trends (time series analysis), and making predictions (such as predicting defaults, credit worthiness, fraud, or cash flows).[155]

Fintech and Alberta's Economy

The finance and insurance sector accounts for approximately 4% of Alberta's GDP[156] and 3.1% of Alberta's total employment.[157] Approximately 72,500 people in Alberta were employed in the finance and insurance sector in March 2022: this represents 3.1% of Alberta's total employment and a 12.2% increase since the start of the pandemic.[158] Alberta's financial services sector has developed over time in parallel with the oil and gas industry: according to Invest Alberta, "the concentration of capital-intensive industries has created strong demand for a robust, innovative financial services sector in Alberta," and "as a result, the province has developed world-class expertise in niche sectors, such as asset management, trading, mergers and acquisition, corporate banking and equity issuance."[159]

155 Hamoni, R. et al., "Building Canada's Future AI Workforce," March 2021, The Information and Communications Technology Council, https://www.ictc-ctic.ca/wp-content/uploads/2021/03/ICTC_Report_Building_ENG.pdf

156 On average, from 2016 to 2020, finance and insurance accounted for about 4 percent of Alberta's GDP See: Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000), https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610040201

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

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

159 "Alberta's finance sector is strong, stable, and on the rise," 2022, Invest Alberta, https://investalberta.ca/key-sectors/financial-services/

Figure 37 shows what type of companies make up Alberta's financial technology industry and is based on a dataset of 86 local startups. Companies in the dataset are highly concentrated in the blockchain and cryptocurrency industry (33%), with additional clusters in the payments industry (12%), capital markets (12%), accounting and expensing management (11%), lending (10%), and insurance (9%). Possibly due to regulatory restrictions, there is a low concentration of startups in areas traditionally served by banks, such as lending or banking and financial services. In line with the data, interviewees in this study spoke highly of Alberta's large and growing blockchain and cryptocurrency ecosystem. In the dataset, 96% of the companies are located in Alberta's large population centres: 80% are located in Calgary, while 17% are located in Edmonton. Meanwhile, just 4% of the companies are based in medium population centres, and none are based in small population centres.

Alberta-Based Fintech Companies by Type

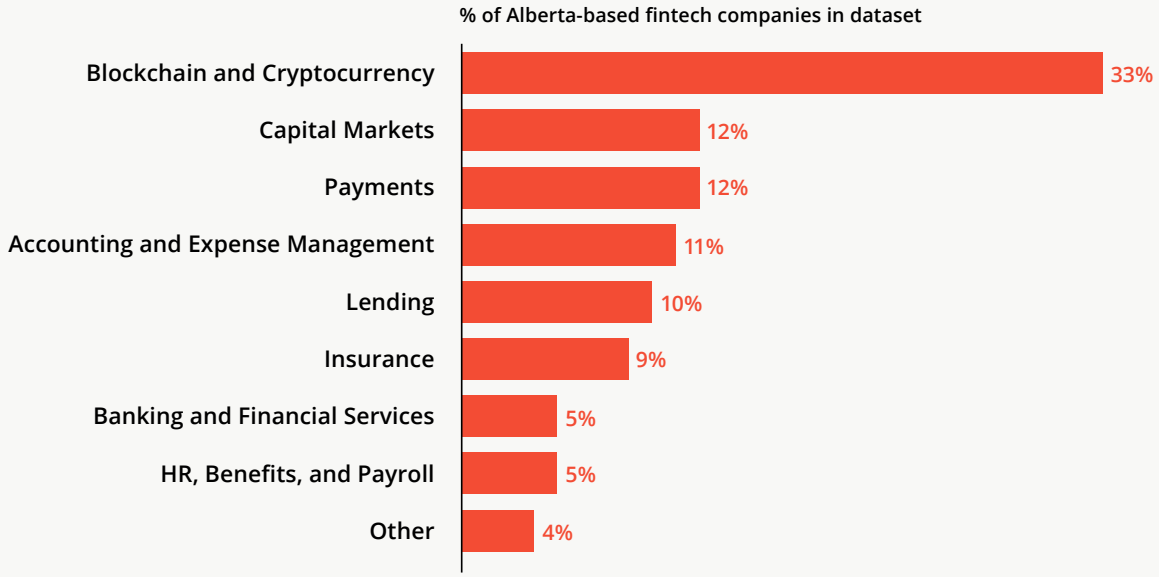


Figure 37. Based on dataset of 86 Alberta-based fintech companies. **Data source:** Pitchbook, ICTC Analysis.

Fintech and Alberta's Labour Market

Employment in Alberta's fintech sector reached 13,800 by 2021. Although other sectors like health and biotech and cleantech saw a dip in employment in 2020, fintech employment saw uninterrupted growth from 2018 onward.

Fintech Employment in Alberta

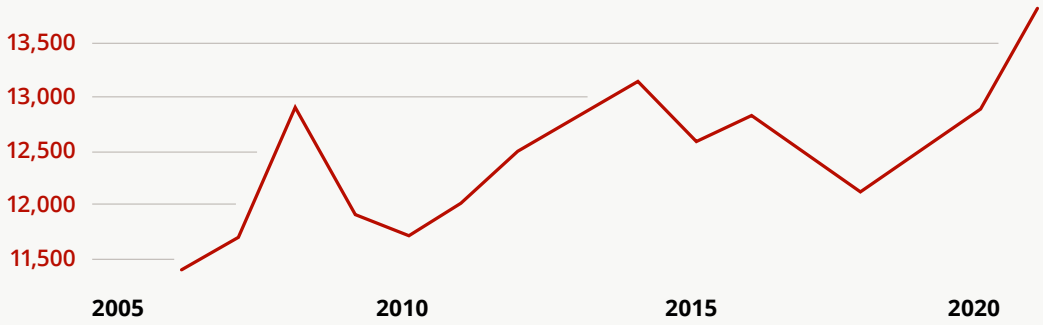


Figure 38. Fintech employment in Alberta, 2006-2020. **Data source:** Stats Canada, ICTC.

Local job-postings data can provide further insight into the most in-demand roles and skill sets in Alberta's fintech industry. ICTC analyzed 13,911 job postings that were posted in Alberta from March 2020 to March 2022.[160] Table 5 identifies the top 10 most common occupations (NOC codes), job titles, and specialized and common skills. The data reinforces that the financial-technology industry is heavily focused on software and data products. The top 10 job titles include software developers and engineers, full stack developers, data analysts, systems administrators, data scientists, and DevOps engineers. Similarly, the top 10 specialized skills include various programming languages, computer science, software development, and automation. The job postings were mainly for large population centres (94%), followed by medium population centres (4%), and small population centres (2%). Calgary accounted for 80% of the job postings, while Edmonton accounted for 15%.

160 Using EMSI, ICTC generated a dataset of 12,244 unique job postings for roles in Alberta's fintech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: finance, financial services, financial technology, fintech, wealth management, wealth, investment management, investing, payments, banking, bank, lending, credit, blockchain, cryptocurrency, cryptocurrencies. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Top Occupations (NOC Codes)	Top Job Titles	Top Specialized Skills	Top Soft Skills
Software Engineers and Designers	Software Developers and Engineers	Computer Science	Communications
Information Systems Analysts and Consultants	Full Stack Developers	Finance	Management
Corporate Sales Managers	Business Development Managers	Agile Methodology	Customer Service
Business Development Officers and Marketing Researchers and Consultants	Graphic Designers	SQL (Programming Language)	Problem Solving
Computer and Information Systems Managers	Project Managers	Accounting	Detail Oriented
User Support Technicians	Marketing Analysts	Accounting	Detail Oriented
Professional Occupations in Advertising, Marketing and Public Relations	Data Analysts	JavaScript (Programming Language)	Leadership
Web Designers and Developers	Systems Administrators	Site Security	Sales
Database Analysts and Data Administrators	Data Scientists	Project Management	Marketing
Computer Engineers (Except Software Engineers and Designers)	DevOps Engineers	Automation	Planning

Table 5. Most in-demand occupations (NOC Codes), job titles, specialized skills, and common skills according to job postings data.
Data source: ICTC analysis, EMSI data.[161]

161 Using EMSI, ICTC generated a dataset of 12,244 unique joFullb postings for roles in Alberta's fintech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of key words: finance, financial services, financial technology, fintech, wealth management, wealth, investment management, investing, payments, banking, bank, lending, credit, blockchain, cryptocurrency, cryptocurrencies. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

SWOT Analysis: Alberta's Financial-Technology Industry

Strengths	Weaknesses
The finance and insurance sector in Alberta is strong and growing quickly. Having benefited from the oil and gas industry's early interest in blockchain, Alberta has a significant blockchain and cryptocurrency industry.	Possibly due to regulatory restrictions, there is a low concentration of fintech startups in areas traditionally served by banks, such as lending and banking services. Alberta's fintech ecosystem is mainly located in Calgary and Edmonton, with very little involvement of small and medium population centres.
Opportunities	**Threats**
The federal government is working to establish an open banking system,[162] which will create new opportunities in lending, credit, and banking services. The pandemic has made consumers more familiar and comfortable with the use of fintech, such as digital payments, online shopping, and online banking.[163] Collaboration between traditional banking institutions and fintech firms is growing and anticipated to continue.[164] Participants in this study regarded Alberta's securities regulators as a forward-thinking, open-minded enabler of fintech innovation.	Canada has been slow to adopt open banking legislation, which has given other jurisdictions a head start in some fintech verticals. While there is a high concentration of blockchain and cryptocurrency companies in Alberta's fintech ecosystem, blockchain and cryptocurrency face high regulatory risk, particularly in comparison with other fintech verticals. Fintech workers require extensive domain knowledge in addition to technical skills, which can be difficult to find.

162 "Consumer Protection through Contact Centres", *Deloitte LLP* https://www2.deloitte.com/ca/en/pages/financial-services/articles/bank-contact-centres.html

163 Cheung, B., "Consumer Adoption of FinTech During the Pandemic", *Environics Research*, https://environics.ca/article/consumer-adoption-of-fintech-during-the-covid-19-pandemic/

164 "The future of fintechs: Risks and regulatory compliance", *Deloitte LLP*, https://www2.deloitte.com/us/en/pages/regulatory/articles/future-of-fintechs-risk-and-regulatory-compliance.html

Agriculture Technology

What is Agriculture Technology?

Competitive markets, climate change, and population growth are putting pressure on agri-food producers to adopt technologies that will help them produce more food using less energy, water, and other inputs.[165] Global markets are demanding more reliable data about food safety and food supply chains, while consumers are demanding more affordable, sustainably produced food. Agriculture technology companies provide numerous technologies to help producers meet new demands: AI and big data; sensors and other IOT (internet of things) technologies; GIS (geographic information systems), GPS (global position systems), and aerial images; connected and autonomous vehicles and robots; renewable energy; and biotechnology and bioinformatics.[166] Agriculture technology encompasses these and any other advanced technologies used by the agri-food sector in food production, such as making production safer, more efficient, or environmentally friendly, or to create novel types of food.

Agtech and Alberta's Economy

Alberta is well positioned to excel in the agriculture-technology industry. The province has agri-food domain expertise and a strong local customer base for agtech companies in Alberta, Saskatchewan, and Manitoba, in addition to the United States.

165 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

166 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

Alberta is home to many large agri-food producers, high-caliber agtech programs[167], one of the largest independent agtech companies in the world, and a growing number of agtech investors. Agtech innovation can help drive operational efficiencies in the local agriculture sector, making the province more competitive in global trade: on average, from 2016 to 2021, farm, fishing, and intermediate food products accounted for 7.8% of Alberta's domestic exports, while Alberta accounted for 20% of Canada's farm, fishing, and intermediate food exports.[168] During this time, Alberta's top agricultural exports were beef, wheat, canola, and live cattle.[169] Interviewees in this study felt that Alberta has a "*very progressive agriculture business community…that is willing to adopt and integrate new technologies…and be some of the earlier adopters around the globe.*"

Agriculture accounts for about 2% of Alberta's GDP[170] and about 1.3% of Alberta's total employment.[171] Approximately 30,700 people in Alberta were employed in agriculture in March 2022, which represents a 28.2% decrease since the start of the pandemic.[172] One interview attributed this decrease to the COVID-19-related loss of drivers and the shutdown of beef plants that "*were really significant in the world of agriculture, and [brought] more awareness overall to how food is developed.*" Like exports, the top three crop and livestock commodities in Alberta are cattle and calves, canola, and wheat.[173] With grain crops playing such a large role in the province's agriculture sector, it is no surprise that many of Alberta-based agri-food tech companies specialize in crop management solutions: according to data from ICTC's *Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow* report, agri-food tech companies in Alberta are primarily focused on crop management solutions, including precision farming technologies, high-tech farming equipment, and crop protection and nutrition (see Figure 39).[174] Other solutions provided by agri-food tech companies in Alberta focus on livestock management, enterprise services, and controlled growing environments.[175]

167 "Olds College Smart Farm – Advancing Canada's Ag Industry", *Olds College*, https://www.oldscollege.ca/olds-college-smart-farm/index.html

168 Domestic exports are goods grown, produced, extracted, or manufactured in Canada, including goods of foreign origin that have been materially transformed in Canada. See: Statistics Canada. Table 12-10-0119-01 International merchandise trade by province, commodity, and Principal Trading Partners (x 1,000), https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1210011901

169 Chen, J., "Alberta Agri-Food Exports 2010 to 2020," August 2021, *Government of Alberta*, https://open.alberta.ca/dataset/b92e9a1b-2a1b-4e10-9f46-431edb53cf1a/resource/3668ae68-08da-46d6-b376-4ec63c35d83d/download/af-irtb-alberta-agri-food-exports-2011-2020.pdf

170 On average, from 2016 to 2020, agriculture accounted for about 2 percent of Alberta's GDP. See: Statistics Canada. Table 36-10-0402-01 Gross domestic product (GDP) at basic prices, by industry, provinces and territories (x 1,000,000), https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=3610040201

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

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

173 "Overview of Canada's agriculture and agri-food sector," November 5, 2021, *Government of Canada*, https://agriculture.canada.ca/en/canadas-agriculture-sectors/overview-canadas-agriculture-and-agri-food-sector

174 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

175 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

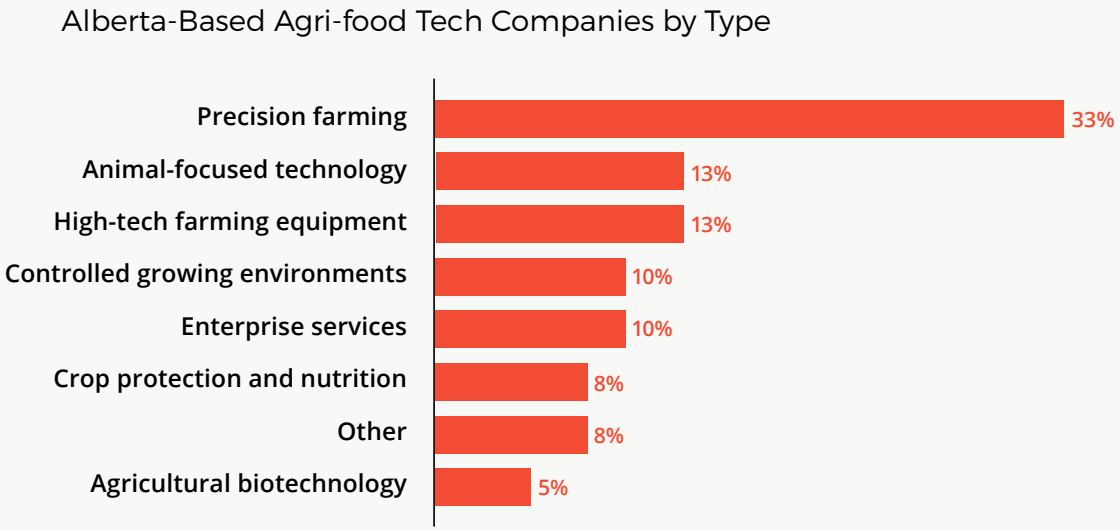


Figure 39. Based on dataset of 39 Alberta-based agri-food tech companies. **Data source:** Pitchbook Data, ICTC analysis, 2021.

Agtech and Alberta's Labour Market

Numerous reports have identified talent shortages as a critical challenge facing Canada's agri-food sector, and this applies to both agri-food labourers and technology talent.[176] A 2021 report by Calgary Economic Development (CED) estimates that by 2030, the agtech industry alone could employ up to 2,400 people in Alberta while adding $229 million to the province's GDP.[177] ICTC's labour market analysis shows that over the last 10 years, employment in the agtech industry has grown at a faster rate than many other areas of the economy, a trend likely attributable to increased technology adoption.[178] Further, over the last five years, four occupations (that is, NOC codes) relevant to agri-food tech saw exceptionally high growth, with an average annual growth rate of 20% or more: this includes database analysts and data administrators (NOC 2172), agricultural representatives, consultants, and specialists (NOC 2123), software engineers and designers (NOC 2173), and industrial engineering and manufacturing technologists and technicians (NOC 2233).[179]

176 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf; "Farmer 4.0: How the coming skills revolution can transform agriculture," August 2019, RBC Though Leadership, http://www.rbc.com/economics/economic-reports/pdf/other-reports/Farmer4_aug2019.pdf; "How Labour Challenges Will Shape the Future of Agriculture: Agriculture Forecast to 2029," 2019, CAHRC-CCRHA, https://cahrc-ccrha.ca/sites/default/files/National%20Report_Final%20-%20EN%202019%20reduced%20size.pdf; "Restart, recover, and reimagine prosperity for all Canadians," A Report from Canada's Industry Strategy Council, November 2020, https://www.ic.gc.ca/eic/site/062.nsf/vwapj/00118a_en.pdf/$file/00118a_en.pdf

177 "Alberta Energy Transition", November 2021, *Calgary Economic Development*, https://www.calgaryeconomicdevelopment.com/assets/Reports/Sectors/Energy-Environment/CED-2021_EnergyTransition_Report.pdf

178 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

179 Ivus, M. et al., "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow," September 2021, *ICTC*, https://www.ictc-ctic.ca/wp-content/uploads/2021/11/canadian-agrifood-tech-2021.pdf

Taking into account the notable impacts of the pandemic on the agricultural sector at large, ICTC estimates that the broader agri-food tech industry will reach approximately 49,000 workers by the end of 2025, bringing the total potential employment to 683,000 in Canada.[180] Due to data suppression and sector volatility during the pandemic, ICTC is not able to produce a reliable estimate for employment in Alberta's agricultural technology sector at this time.

Alberta's Agtech Industry: In-Demand Roles and Skill Sets

Job-postings data can provide useful insight into the most in-demand roles and skill sets in a given industry. To identify the most in-demand roles and skill sets in Alberta's agtech industry, ICTC analyzed 1,019 job postings that were posted in Alberta from March 2020 to March 2022.[181] Table 6 identifies the top 10 most common occupations (NOC codes), job titles, and specialized and common skills. From the data, it is evident that sales and business development teams play a central role in Alberta's agtech industry, and this was confirmed by interviews in this study. Success in the agtech industry also requires a high degree of entrepreneurial and business experience: as one Alberta-based agri-food entrepreneur noted, "There are some amazing agtech startups in Canada with the best technology but one of the main challenges in agriculture is building out and executing on a robust go-to-market plan."[182]

As Alberta's agri-food tech industry matures, more experienced entrepreneurs, investors, and industry organizations will be needed to help grow the ecosystem, develop local talent, and mentor and invest in local startups. One example is TELUS Agriculture, based in Calgary, which connects the local ecosystem to customers in more than 50 countries and agri-food tech experts across Canada and in the United States, Mexico, Brazil, United Kingdom, Slovakia, Armenia, Germany, China, and Australia.[183] The company acquired two Alberta-based agri-food tech startups in recent years—Decisive Farming and Feedlot Health Management Services—which have gone on to mentor local startups and invest further in the agri-food tech ecosystem.[184]

180 Ivus, M; Kotak, A., "Onwards and Upwards - Digital Talent Outlook 2025," Information and Communications Technology Council (ICTC), August 2021, https://www.ictc-ctic.ca/wp-content/uploads/2021/08/digital-talent-outlook-for-2025.pdf

181 Using EMSI, ICTC generated a dataset of 1,019 unique job postings for roles in Alberta's agtech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of nine key words: agriculture, farming, farm, precision farming, crop, wheat, canola, cattle, and beef. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

182 Kiernan-Stone, L., "Koan Capital to Back Canadian Agtech Statrups With Launch of Koan Agtech Fund", January 26, 2022, *Global AgInvesting*, https://www.globalaginvesting.com/koan-capital-back-canadian-agtech-startups-launch-koan-agtech-fund/

183 "TELUS launches fresh new TELUS Agriculture business to digitally transform the global food system", Telus, https://www.telus.com/en/about/news-and-events/media-releases/telus-launches-fresh-new-telus-agriculture-business

184 Kiernan-Stone, L., "Koan Capital to Back Canadian Agtech Statrups With Launch of Koan Agtech Fund", January 26, 2022, *Global AgInvesting*, https://www.globalaginvesting.com/koan-capital-back-canadian-agtech-startups-launch-koan-agtech-fund/

Top Occupations (NOC Codes)	Top Job Titles	Top Specialized Skills	Top Soft Skills
Electrical and Electronics Engineers	Sales Managers	Agriculture	Communications
Information Systems Analysts and Consultants	Technology Specialists	Computer Science	Management
Mathematicians, Statisticians and Actuaries	Instrumentation Technicians	Forestry	Sales
Software Engineers and Designers	Software Developers and Engineers	SAP Applications	Operations
Business Development Officers and Marketing Researchers and Consultants	Agriculture and Agricultural Science Specialists	Business Development	Leadership
Professional Occupations in Advertising, Marketing and Public Relations	Journeyman Electricians	Customer Relationship Management	Problem Solving
Computer and Information Systems Managers	Marketing Coordinators	Automation	Planning
Electrical and Electronics Engineering Technologists and Technicians	Territory Managers	Agile Methodology	Marketing
Computer Engineers (Except Software Engineers and Designers)	Results Managers	Fertilizers	Customer Service
User Support Technicians	Business Development Managers	Selling Techniques	Research

Table 6. Most in-demand occupations (NOC Codes), job titles, specialized skills, and common skills according to job postings data.
Data source: ICTC analysis, EMSI data. [185]

185 Using EMSI, ICTC generated a dataset of 1,019 unique job postings for roles in Alberta's agtech industry. ICTC used a list of 30 ICT NOC codes to query the EMSI database, in addition to a list of nine key words: agriculture, farming, farm, precision farming, crop, wheat, canola, cattle, and beef. To be included in the dataset, the roles had to have been posted for the province of Alberta from March 2020 to March 2022.

Rural Economic Development

While much of Alberta's tech sector is based in Alberta's larger cities, such as Calgary and Edmonton, the agri-food tech industry provides a unique opportunity for rural communities in Alberta. Notably, nearly one-quarter (23%) of Alberta-based companies in ICTC's agri-food tech dataset are headquartered in small population centres, while 15% are headquartered in medium population centres.[186] The job-postings data similarly reveals a strong rural presence: 14% of the job postings were for medium population centres, while 26% were for small population centres. The strong rural presence of Alberta's agri-food tech industry is a trend not seen in many other tech industries, such as health tech or fintech, which makes agtech a unique opportunity for rural economic development. Yet, having a strong rural presence can also be a challenge. For instance, interviewees in this study highlighted the challenges they face finding adequate talent in rural locations:

If you're a leading-edge farm located in the middle of nowhere, you have almost no chance of finding qualified people unless you pay them big money. That's the real challenge—farming is becoming more industrialized, but it's still a family-run business. ❞

– Ag-tech employer

186 Communities classified according to Statistics Canada 2021 Census data. See: https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=9810001101

SWOT Analysis: Alberta's Agriculture Technology Industry

Strengths

- Alberta is a leading exporter of beef, wheat, canola seed, canola oil, and live cattle, making agri-food producers in the province a potential first buyer for agtech innovation.
- There is extensive collaboration between the public, private, and academic sectors.
- There is a high supply of domain expertise thanks to Alberta's long history in agri-food production.
- Alberta is home to several colleges with highly innovative agtech programs.

Weaknesses

- It can be difficult to find digital and business development talent with appropriate domain expertise.
- Agtech products and services involve a long sales cycle, creating a need for scale-up funding, good sales talent, and an effective go-to-market plan.
- Employment in agriculture has declined since the onset of the pandemic.

Opportunities

- There is significant provincial and federal support for agtech innovation, creating funding opportunities.
- Alberta is home to several large and successful agtech companies, creating opportunities for mentorship and re-investment.
- Alberta is home to a strong cleantech industry, which could help address issues related to sustainability in agriculture.
- The agtech industry presents a valuable opportunity for rural economic development.

Threats

- Alberta's agtech industry relies heavily on investors from the United States.
- Poor rural connectivity and broadband infrastructure are barriers to local agtech adoption.
- High financial risk and uncertainty about return on investment can be a barrier to local agtech adoption.

Conclusion

Despite the disruptive impact of the COVID-19 pandemic on the Alberta economy, the province's digital economy remained resilient and thrived throughout the government's lockdowns and other health measures to protect Albertans. In fact, from February 2020 to May 2022, Alberta's digital economy grew by nearly 18% and employed an additional 30,000 Albertans. Much of this hiring was for roles related to software development (full stack developers, back end developers, and DevOps); data (data engineers, data analysts, and machine learning engineers); design (UX and UI designers and product designers); and operations and business (cybersecurity specialists, product managers, and digital marketers, etc.).

Various studies estimate that the pandemic accelerated global technology adoption by several years. Many traditional sectors turned to technology to forge new channels for their goods and services and to create new revenue streams. Alberta tech employers emerged from the pandemic with higher revenues and employment numbers than prior to the pandemic, and the majority anticipate continued growth in company revenues.

Alberta's digital economy saw notable employment growth during the pandemic. Growing by nearly 18%, the digital economy added 30,000 high quality jobs for Albertans from February 2020 to May 2022. However, the continued success of Alberta's digital tech sectors depends on a steady stream of talent. The growth spurt in tech during the pandemic further exacerbated an existing talent crunch in Alberta and other parts of Canada. The employers consulted for this study state that the biggest threat to the sustained growth of the tech sector in Alberta is a lack of digitally skilled workers. This challenge is especially acute in the four key tech subsectors that are expected to drive significant employment growth of high-quality jobs or Albertans: health tech, clean technology, fintech, and agtech.

Appendices

Research Methodology

This report relied on a combination of primary and secondary research methods, described below.

Secondary Research

Secondary Literature Review

ICTC conducted a scan of existing literature about Alberta's digital economy. The literature review helped shape the research questions and identify potential interviewees, advisory committee members, and engagement and focus group participants. It also helped identify relevant secondary data sources.

Secondary Data Sources

Labour Market Data

Secondary labour-market data was used by ICTC to assess current labour-market trends. This included ICTC's eTalent Canada data, Statistics Canada's Labour Force Survey data, and EMSI job postings data. ICTC's eTalent Canada data uses job postings to identify the most in-demand roles and skill sets in the digital economy. eTalent Canada data was available for the cities of Calgary, Edmonton, and Lethbridge. Job-posting data from EMSI was used to supplement or reaffirm the eTalent Canada data, and Statistics Canada's Labour Force Survey data was used to assess labour market trends, such as employment in the digital economy. A total of 30 NOC Codes were used by ICTC to define the digital economy. They are the following:

0015	Senior managers – trade, broadcasting and other services, n.e.c.
211	Engineering managers
213	Computer and information systems managers
601	Corporate sales managers
1123	Professional occupations in advertising, marketing, and public relations
1253	Records management technicians
2133	Electrical and electronics engineers

2147	Computer engineers (except software engineers and designers)
2148	Other professional engineers, n.e.c.
2161	Mathematicians, statisticians and actuaries
2171	Information systems analysts and consultants
2172	Database analysts and data administrators
2173	Software engineers and designers
2174	Computer programmers and interactive media developers
2175	Web designers and developers
2241	Electrical and electronics engineering technologists and technicians
2281	Computer network technicians
2282	User support technicians
2283	Information systems testing technicians
4163	Business development officers and marketing
5223	Graphic arts technicians
5224	Broadcast technicians
5241	Graphic designers and illustrators
7241	Electricians (except industrial and power system)
7242	Industrial electricians
7243	Power system electricians
7244	Electrical power line and cable workers
7245	Telecommunications line and cable workers
7246	Telecommunications installations and repair workers
7247	Cable television service and maintenance technicians

Industry-Level Data

Pitchbook's company-level data was used to assess what types of companies make up Alberta's health technology and agriculture technology ecosystems, and to identify the technology verticals that companies in these industries operate in. ICTC also used Pitchbook's investor-level data to identify the top 100 most active investors in Alberta.

Primary Research

ICTC convened an advisory committee, which met two times over the course of the project, and conducted 35 key-informant interviews and engagements with regional and subsector groups. The advisory committee members, key informants, and regional engagement and subsector focus group participants held senior-level roles throughout Alberta's digital economy. ICTC also conducted a survey of digital economy employers based in Alberta.

Key-Informant Interviews and Engagements

The interviews were semi-structured and examined sector and subsector trends, identified in-demand and emerging jobs and skills, and assessed challenges to subsector growth. Engagement sessions included followed regional and subsector strengths and challenges, hiring difficulties, in-demand roles, soft and technical skills, investments, and planned expansion. Interviews lasted from 45 to 60 minutes and were conducted virtually; other engagements (with representatives from the four subsectors and three regions) were 1.5 hours in length and conducted virtually. Interviews and engagement sessions were transcribed and coded for thematic analysis using NVIVO.

Resilient Recovery Survey

ICTC conducted a survey of digital economy employers based in Alberta using Survey Monkey. ICTC received 81 responses. The survey included approximately 45 questions that focused on the impact of COVID-19 on Alberta's digital economy, labour market trends, and technical- and soft-skills demand.

Limitations

As with all research in a fast-changing pandemic environment, a number of limitations exist. First, reaching a diverse representation of digital economy players from all major Alberta regions is a key limitation of this study—this challenge was most pressing when it came to engagement with companies from outside Calgary or Edmonton. A second and notable limitation is related to outreach and engagement in this study's activities: survey responses were lower than intended, and subsector focus groups and regional engagement sessions were more so. Despite numerous outreach methods and various engagement attempts (including rescheduling for more suitable dates/times), engagement with employers during a pandemic and exclusively via online means remained challenging. Although COVID restrictions at the time of this study made in-person gatherings (i.e., focus groups) impossible to host, previous experiences with similar in-person engagement activities suggest a stronger likelihood of better turnout. As such, where possible, ICTC used secondary research to fill gaps. Lastly, there is no reliable employment estimate available for the agtech sector in Alberta.

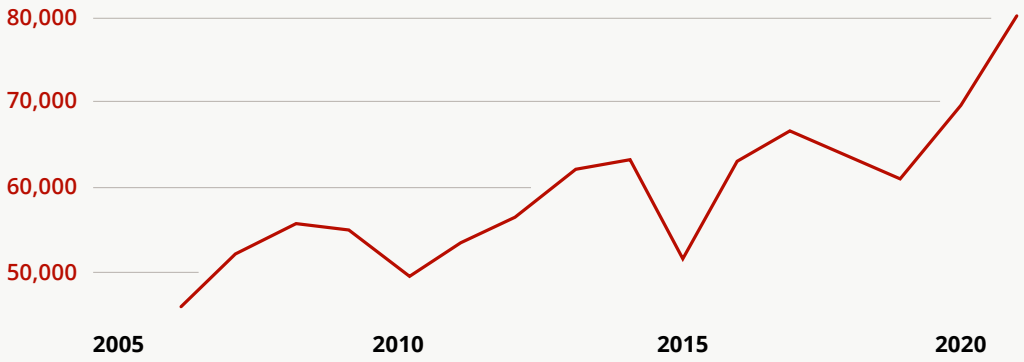
The broader agriculture sector continues to experience decline as a result of the pandemic; while agtech is a fast-growing industry with significant potential to drastically shift agricultural processes and improve efficiency and yield, the sub-industry represents a small part of the broader agricultural sector, making its employment difficult to accurately estimate at the provincial level.

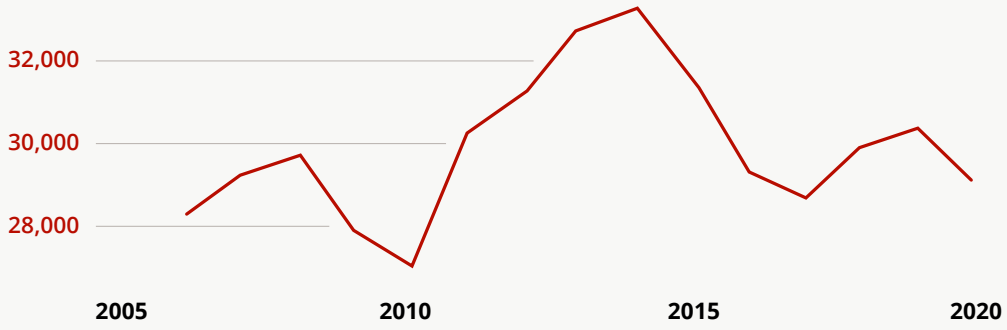
Additional Figures

For comparability with ICTC's previous study, *A Digital Future for Alberta*, additional figures have been provided for Interactive Digital Media (IDM), and Advanced Manufacturing (AM).

Since 2019, IDM has seen continuous growth in Alberta. In 2021, it employed 80,200 people, a significant growth from 60,700 in 2019.

Interactive Digital Media Employment in Alberta



In 2019, AM employment reached a high and employed 30,900; in 2020 and 2021, the sector remained constant and employment levelled out at 29,100.

Advanced Manufacturing Employment in Alberta