THE DIGITAL TALENT IMPERATIVE

CALGARY'S ECONOMIC EDGE

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PREFACE

The Information and Communications Technology Council (ICTC) is a neutral, not-for-profit national center of expertise with the mission of strengthening Canada's digital advantage in the global economy. For over 30 years, and with a team of 110 experts, ICTC has delivered forward-looking research, practical policy advice, and capacity-building solutions for individuals and businesses. The organization's goal is to ensure that technology is utilized to drive economic growth and innovation and that Canada's workforce remains competitive on a global scale.

Calgary Economic Development is a conduit, connector, catalyst, and storyteller for the City of Calgary. Promoting Calgary as the location of choice for people, investment and business, Calgary Economic Development's work is rooted in positioning Calgary for long-term economic success and shared prosperity for all. Calgary Economic Development delivers services and initiatives focused on growing and developing across our key sectors.

TO CITE THIS REPORT

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Researched and written by Alexandra Cutean (Chief Research Officer, ICTC) with generous support from Rob Davidson (Director, Data Science, ICTC) and Jeanette Sutherland (Director, EDGE UP, Calgary Economic Development).

ABSTRACT

In 2018, ICTC and Calgary Economic Development released the report *Mapping Calgary's Digital Future: Tech Employment Opportunities for Displaced Workers*. This first-of-its-kind analysis showcased employment pathways for workers displaced from the city's energy sector to in-demand jobs in tech. With economic growth historically dependent on the energy sector, the 2015 oil crash caused a downturn for the city that left many highly skilled workers in need of new opportunities. Simultaneously, the city's tech sector was beginning to scale. This report, *The Digital Imperative: Calgary's Economic Edge*, leverages a skill mapping methodology like *Mapping Calgary's Digital Future* to identify employment pathways for a new set of displaced to in-demand occupations. Although the focus of *Mapping Calgary's Digital Future* was displaced engineers and scientists from the energy sector, this report adds to that body of work with five new displaced or shrinking energy sector occupations (accounting professionals, finance professionals, human resources professionals, marketing professionals, and logistics professionals), and four new in-demand digital economy roles (back-end developers, site reliability engineers, marketing specialists, and product managers). Employment crosswalks are defined, and specific skill matches and gaps are articulated. Important considerations—such as the role of soft skills, skill importance, employer perceptions, and relevant macroeconomic trends—are also offered in this report. This research is leveraged to inform and support the second phase of the EDGE UP program.

ACKNOWLEDGEMENTS

The contributions made to this report by our partner, Calgary Economic Development, are greatly appreciated. ICTC would also like to acknowledge and thank the interviewees, employers, focus group attendees, business development professionals, the EDGE UP advisory committee, and the other subject matter experts that contributed to this study and to the success of the EDGE UP program.

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EXECUTIVE SUMMARY

Over the last decade, the Canadian digital economy has grown rapidly, bringing with it a wealth of economic and labour market opportunities. While the COVID-19 pandemic ushered in global turmoil, the shift to online life accelerated the digital economy. Today, industry and workers increasingly leverage technology to work, learn, and conduct business; this bolsters the resilience of digital economy output, productivity, and labour market demand. In December 2022, employment in sectors like transportation, accommodation and food services, and agriculture remained below pre-pandemic levels, while employment growth in the digital economy eclipsed that of all other sectors. At the end of 2022, the Canadian digital economy employed more than 2.2 million people—a growth of nearly 20%.

In Alberta, digital economy employment in December 2022 was nearly 27% above pre-pandemic levels. Although impressive, the surge is not entirely surprising: ICTC's employer surveys and interviews note scaling levels of digital adoption among "traditional" sectors like energy, agriculture, manufacturing, and forestry. The pandemic and resulting lockdowns, shutdowns, and scale-downs created economy-wide uncertainty. In this environment, technology quickly became a critical lifeline for business continuity. With this came the growing need for digitally skilled talent.

Coupled with sustained demand for energy products, 2022 was a year of strong economic activity for Alberta. According to TD Economics, the province saw a GDP growth of 5.1%, second only to Saskatchewan. Continued prosperity is on the horizon for 2023; TD Economics estimates that Alberta and Saskatchewan will post GDP growth of 2% (higher than all other provinces), despite the onset of a global recession.

Calgary represents a large portion of the province's economic footprint. This hub of economic activity has steadily recovered from the pandemic. In 2023, Calgary placed among the top 60 startup ecosystems globally. In addition to its global rank, Calgary's startup ecosystem received North American recognition as a Top 10 Ecosystem for Performance, a Top 30 Ecosystem for Funding, and a Top 40 Ecosystem for Talent & Experience. Calgary is increasingly seen as an attractive place to live and do business; in fact, interprovincial and international migration pushed annual population growth to 3% in 2023. This study's employer survey identifies positive outlooks, especially for the city's digital future. Over 80% of respondents regarded the pandemic as an opportunity to be bold and change or expand their businesses, and another 80% are confident that their businesses will continue to thrive and exceed pre-pandemic levels going forward.

The growth outlook is mirrored in the labour force. Looking back to spring 2022, research by LinkedIn crowned Calgary Canada's fastest-growing tech talent pool. Rounding out the year, in December 2022, Calgary's digital economy employed more than 114,7000 people—a 30% increase from February 2020. Fields like artificial intelligence, cloud computing, software development, and data analytics are expected to see continued employment demand, despite macroeconomic forces that are likely to cool growth in the broader economy. Even recent layoffs in the global technology ecosystem are unlikely to have notable consequences for digitally skilled workers. According to the founder of Layoff.fyi, layoffs are largely concentrated in customer-facing roles, while IT departments are the least likely to experience downsizing. In Q1 2023, Calgary employers posted nearly 750 jobs for software developers alone.

During the first phase of EDGE UP, seven in-demand jobs were identified across the digital economy. This was coupled with five core occupations experiencing significant layoffs in Calgary's energy sector. Geoscientists, electrical engineers, engineering managers, chemical engineers, and petroleum engineers were mapped to the in-demand roles, outlining skill matches and gaps. These pathways allowed job seekers to better understand their skill overlaps and chart career transition plans. An additional 18 in-demand jobs have since been identified, including four from this study: back-end developers, site reliability engineers, marketing specialists (digital), and product managers. This study also identifies five new occupations within the energy sector that have seen displacement, shrinking employment, or no employment growth over the last few years: accounting, finance, human resources, marketing, and logistics professionals. Although these roles fall outside of typical STEM (science, technology, engineering, mathematics) disciplines, they possess key technical and business skills that are highly mappable to in-demand roles.

For example, factoring in existing skill sets and competencies, the average accounting professional is a 52% match for a business analyst role and a 45% match for a product manager role. Similarly, the average finance professional is a 50% match for a data analyst role and a 41% match for DevOps. Marketing professionals possess critical skill overlaps as well and, on average, are a 65% match for business development roles and a 43% match for cloud administrator roles. The website www.CalgaryUpskill.ca offers detailed skill mapping for 10 displaced occupations in Calgary's energy sector to 21 in-demand jobs in the digital economy.

The notion of workforce transition and upskilling has become both well-known and accepted in recent years. Calgary was one of the first locations in Canada to design, test, and deploy a successful upskilling program that facilitated impactful career transitions to retain skilled local talent. The success of programs like EDGE UP has made a noteworthy contribution to Calgary and the broader Canadian economy. They are especially pertinent today, in a period of rapid labour market change and heightened demand for talent. Some 85% of surveyed employers in this study indicated an openness to hiring career transitioners; 60% have hired career transitioners in the past; and 95% of those that have engaged career transitioners view the experience positively, praising their transferable soft skills and commitment to lifelong learning.

To further support Calgary's growing digital economy, the second phase of EDGE UP trained more than 300 displaced energy-sector workers from the 10 above occupations. By leveraging their existing skill sets and filling skill gaps with short-duration training, career transitioners support and elevate Calgary's diverse and resilient digital economy. Calgary increasingly plays an important role for Canada in attracting investment, growing homegrown businesses, and creating prosperity—a strong, skilled talent base will allow that momentum to continue.

INTRODUCTION

Calgary is one of the nation's most populous cities, a growing Canadian technology hub, and a key economic engine. A global survey conducted by the Brookings Institute in 2014 named Calgary among the world's 20 richest cities (the only Canadian city to make the list).[1] That year, GDP per capita topped nearly $65,000 USD—at the top of the list was Zurich at nearly $84,500.[2]

However, much of the city's strength has historically been rooted in the energy sector. As such, Calgary has faced significant impacts stemming from the boom-and-bust cycles of oil and gas. In summer 2014, Alberta began to enter a period of economic downturn as oil prices began to decline. By March 2015, West Texas Intermediate (WTI) traded at $42 USD a barrel, compared to nearly $100 USD just one year prior.[3] Oil prices continued to plunge over the following months, eventually landing at $25 a barrel in February 2016.[4] Some minor gains were made in the latter part of 2016, and prices remained relatively steady in the years following—until 2020. By April 2020, the price of oil nosedived once more, landing at its lowest point in over 15 years: $15 USD a barrel.[5] Although oil prices began to pick up in the latter part of 2020 and have continued to rise, more than four years of low prices caused thousands of highly skilled professionals to be displaced from the sector and, often, the broader labour market. Many of these individuals were previously employed in high-demand fields, such as petroleum engineering or geoscience. ICTC's 2019 report *Mapping Calgary's Digital Future* illuminated employment pathways between displaced engineers and scientists from the energy sector to in-demand jobs in Calgary's growing tech sector. Fields like data analysis, data science, and software development were growing and needed skilled talent; since many displaced engineers and scientists possess strong digital and technical foundations, they could potentially transition to these roles if provided with short-duration training to fill their knowledge gaps.

1 Joseph Parilla, Jesus Leal Trujillo, Alan Berube, Tao Ran, "Global Metro Monitor 2014: An Uncertain Recovery," Brookings Institute, January 2015, https://www.brookings.edu/wp-content/uploads/2015/01/bmpp_gmm_final.pdf

2 Ibid.

3 "U.S. Crude Oil First Purchase Price," U.S. Energy Information Administration, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=f000000__3&f=m

4 Ibid.

5 Ibid.

For example, research from *Mapping Calgary's Digital Future* identified that the average geoscientist was already a 55% match for a data science role.

This research and skill mapping formed the foundation of the EDGE UP program. Led by Calgary Economic Development with funding from the Future Skills Centre and the Government of Canada and in partnership with ICTC and local academic institutions, the first phase of the program trained nearly 100 people from five displaced engineering and scientific occupations to enter fields like data analysis, project management, and software development. The results of this training were impactful: 75% of participants that completed the training received employment or undertook additional education to continue their career transition. Phase two of the EDGE UP initiative expanded on this work by adding new occupations to the skill mapping journey and trained an additional 300 workers for in-demand jobs in the city's digital economy.

Mixed methods were used to support this research and develop this report: a literature review and analysis of secondary data from credible sources like Statistics Canada and O*NET; an employer survey (n=105); key informant interviews with local staffing agencies; a focus group with displaced Calgary workers from identified occupations; monthly web scraping of in-demand jobs and skills; and consultations with employers, business development representatives from the Calgary ecosystem, and academic and training institutions. For more information on research methods, please see Appendix I, Research Methodology.

Part I of this report provides an overview of the evolving Canadian digital economy. It includes an analysis of key economic and labour market changes, developments encountered prior to and during the pandemic, and the changing workforce needs going forward.

Part II summarizes the state of Alberta's economy and labour market before, during, and "after" (2023) the pandemic. It includes sector growth comparisons, business impacts, and future considerations.

Part III discusses economic and labour market changes in Calgary during and "after" the pandemic. It provides sector growth comparisons, investment trends and future growth estimates. It also highlights emerging in-demand roles across the digital economy and identifies business trends, in the areas like economic recovery, hiring, and displacement.

Part IV provides an in-depth understanding of in-demand roles and job volumes across Calgary's digital economy. It also articulates newly identified in-demand roles along with their overall responsibilities, critical skills—hard and "soft"—evaluation of skill importance, and experience levels most often sought.

Part V concludes by showcasing detailed skill crosswalks between newly displaced or shrinking energy sector occupations to in-demand roles in the Calgary digital economy. This includes an overview of total "fit" (%) and information on specific skill matches and gaps between occupations.

PART I

THE INCREASINGLY DIGITAL CANADIAN ECONOMY

BROAD SHIFTS AND ECONOMIC AND LABOUR MARKET IMPACT: A RECENT HISTORY

The Canadian digital economy has been growing for over 10 years, steadily increasing its GDP and labour market footprint. Comprising a talent base with versatile skill sets, the digital economy offers avenues for accelerated productivity, new business ventures, and cross-sectoral innovation. Opportunities to proactively enhance business models, spur R&D and business scale-up, and attract investment increasingly emerge as all sectors of the economy leverage and implement technology. With this, the nature of the labour market also shifts and evolves. Although technical occupations like software developers, data scientists, or machine learning engineers remain in demand across the board, other roles in areas like business analysis, customer care and sales, design, marketing, and product management are increasingly needed.

Undoubtedly, the COVID-19 pandemic created numerous adverse impacts on the economy and human well-being. Yet, it also accelerated innovation. For example, fields like biotech[6] and advanced manufacturing[7] leveraged technology to fill immediate needs (e.g., acceleration of vaccine development, personal protective equipment [PPE] manufacturing, etc.), while retailers developed and expanded online platforms, and the energy sector further dug into automation and artificial intelligence to reduce costs and improve safety.[8]

Although lockdowns and restrictions led to deep declines across the Canadian economy and labour market in 2020 and into 2021, employment in the digital economy saw steady growth.

6 Bryan Abrahams, Kennan MacKay, Luca Issi, Greg Renza, "Biotech Outlook 2021: Innovation, IPOs and COVID-19," RBC Capital Markets, February 23, 2021, https://www.rbccm.com/en/gib/biopharma/episode/biotech-outlook-2021-innovation-ipos-and-covid-19

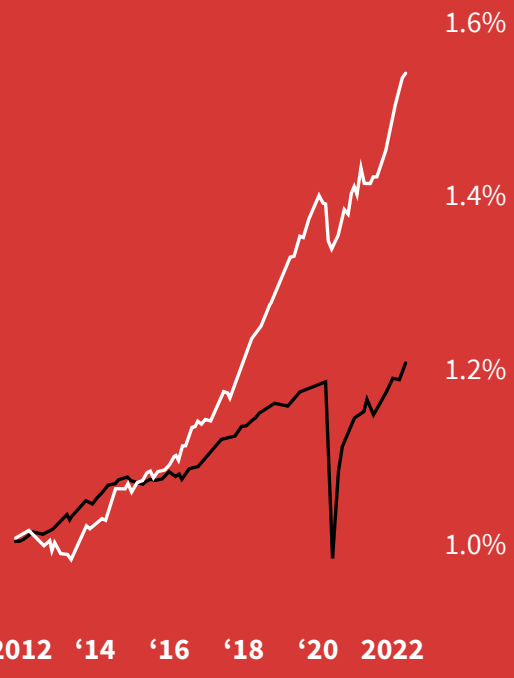
7 Mark Schmidt, "COVID-19 – The Disease That is Reshaping Manufacturing," NIST, December 9, 2020, https://www.nist.gov/blogs/manufacturing-innovation-blog/covid-19-disease-reshaping-manufacturing

8 "Energy industry and COVID-19 (coronavirus): strategising for the 'new normal'," PwC, https://www.pwc.com/gx/en/issues/crisis-solutions/covid-19/energy-utilities-resources-coronavirus.html

Navigating numerous waves of infection and corresponding measures and mandates, technology ensured that Canadians could work[9] and learn[10] from home, shop,[11] receive healthcare services,[12] and conduct other day-to-day activities online with relative ease.[13] Although digitally savvy businesses were more adept at rapidly transitioning to the new normal of online work, digital adoption grew as most businesses adapted to serve and retain customers in a changing world.[14] The varied challenges presented by the pandemic illuminated the role of technology as not just a driver of economic growth but as a tool to solve broader societal challenges.

A core component of the digital economy, the Canadian technology sector has grown steadily, and largely without interruption, over the last decade; this trajectory was only briefly—and minimally—disrupted during the pandemic. While the overall economy faced a sharp decline in GDP in March 2020, the technology sector declined slightly before it continued its climb. Two years after the start of the pandemic, in March 2022, GDP growth in the tech sector far exceeded that of the general economy.

FIGURE I GDP growth since 2012: Canadian ICT sector vs overall economy



GDP data adjusted for seasonality and inflation.
Source: ICTC, Statistics Canada, 2023.

While many sectors saw ups and downs during the early stages of the pandemic, the digital economy[15] remained strong and produced significant employment opportunities for Canadians. From February 2020 to December 2022, digital economy employment grew by nearly 20%, adding over 360,000 high-quality jobs to the Canadian labour market. Moreover, the portion of digital economy employment (as a percentage of total employment across industries) jumped from 9.5% to nearly 12% during this period. By contrast, employment growth across industries (in the overall economy) grew by less than 3.5% since February 2020. Heightened demand during this period is also echoed by job postings—take the example of the versatile role of full-stack developer: from February 2020 to December 2023, Toronto alone saw nearly 17,500 job postings for just this one role.

9 Tahsin Mehdi, Rene Morisette, "Working from home in Canada: What have we learned so far?" Statistics Canada – Economic and Social Reports, October 27, 2021, https://www150.statcan.gc.ca/n1/pub/36-28-0001/2021010/article/00001-eng.htm

10 Maryna Ivus, Nathan Snider, "Unchartered Waters: A World-class Canadian E-learning Paradigm," Information and Communications Technology Council, December 10, 2021, https://www.digitalthinktankictc.com/reports/uncharted-waters

11 "Online shopping during the COVID-19 pandemic," Statistics Canada, February 5, 2021, https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020088-eng.htm

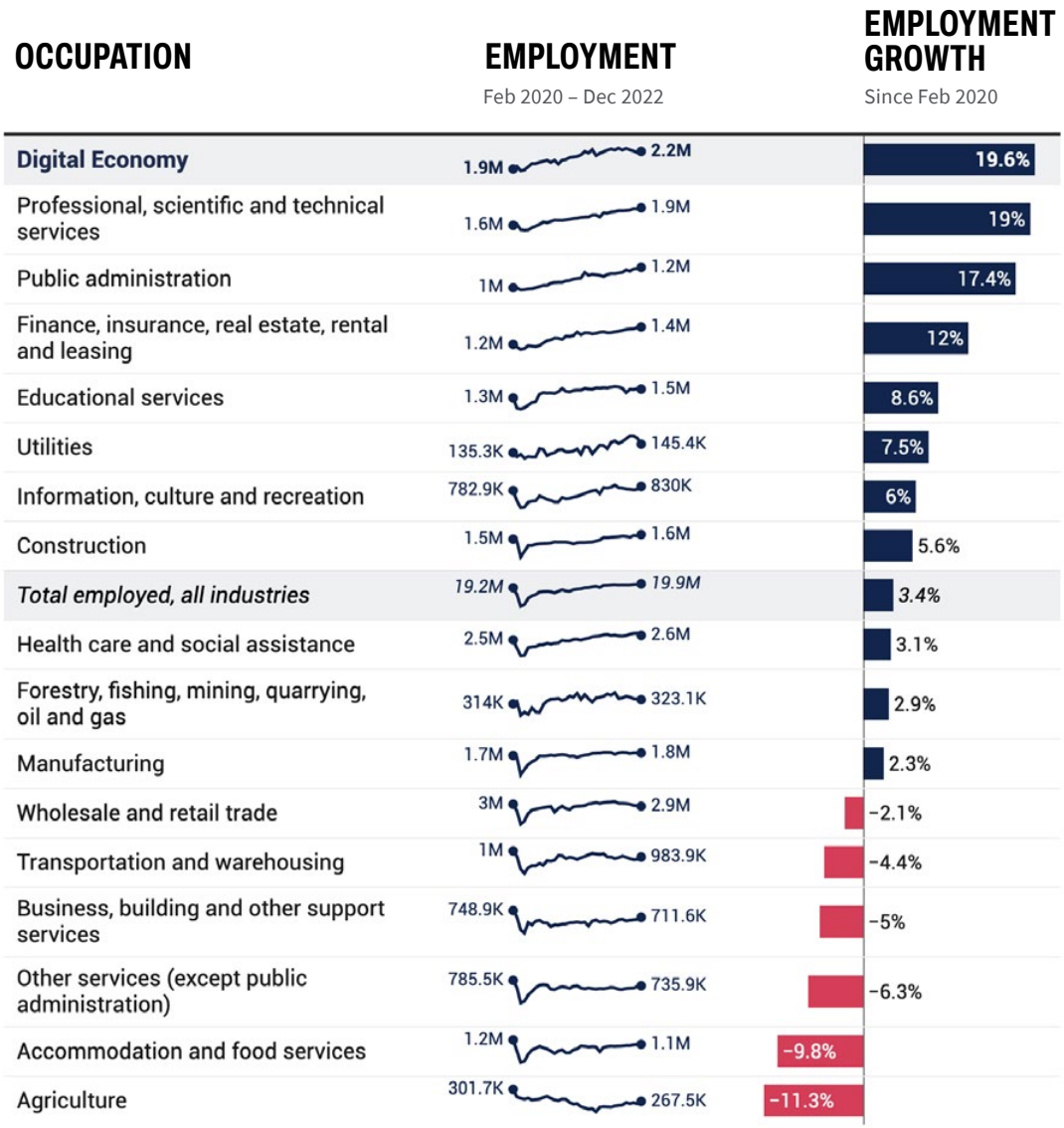
12 Mary Sanagan et. al, "COVID-19: Virtual care is here to stay," Deloitte, 2021, https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/life-sciences-health-care/ca-covid-19-digital-health-and-virtual-care-aoda-en.pdf

13 "The Daily — Canadian Internet Use Survey, 2020," Statistics Canada, June 22, 2021, https://www150.statcan.gc.ca/n1/daily-quotidien/210622/dq210622b-eng.htm

14 Jason Aston, Owen Vipond, Kyle Virgin, Omar Youssouf, "Retail E-Commerce and COVID-19: How Online Shopping Opened Doors While Many Were Closing." Statistics Canada, July 24, 2020, https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00064-eng.htm

15 NAICS : 3333, 3341, 3342, 3342, 3344, 3345, 3346, 4173, 5112, 5121, 5174, 5179, 5182, 5191, 5415, 8112, 5173, 7115 ; NOCS : 2174, 2173, 2147, 2283, 7246, 2175, 2171, 2281, 2282, 2133, 0213, 7245, 7247, 2172, 2241, 2148, 2161 5241, 5223, 0211, 1253, 0015, 0601, 1123, 3163, 5224, 7241, 7242, 7243, 7244.

FIGURE 2 **Employment by sector in Canada: February 2020 to December 2022**



Employment data adjusted for seasonality. Source: ICTC, Stats Canada, 2023.

AFTER THE PANDEMIC:
LABOUR MARKET 2023 ONWARD

Some of the economic and labour market changes introduced and/or accelerated by COVID-19 appear to be enduring. For example, Statistics Canada finds that as of May 2023, nearly one-quarter of Canadian workers either worked exclusively from home or in a hybrid work arrangement.[16] Pre-pandemic, it is estimated that just over 10% of Canadian workers engaged in such arrangements.[17] Other changes, like shifts in consumer behaviour, the increase in cross-sectoral digital adoption, and the popularity and pervasiveness of new technologies, are expected to impact and influence productivity,[18] innovation,[19] and labour market needs and evolution.[20]

Although recent data from Statistics Canada points to minor dampening of the broader labour market and economy, namely for younger workers,[21] employment and output remain relatively strong—this is despite deliberate measures, such as interest rate increases introduced to cool the economy over the last year. Since GDP growth is partially driven by growth in employee compensation, wage inflation will continue to influence GDP. As of May 2023, wages increased for both hourly and salaried workers. For hourly workers, wages were more than 5% higher, year-over-year.

Although wage growth is influenced by several factors—including rising costs of goods, materials, or tools that businesses need—labour market demand or "tightness" is a key contributor. That is, where demand for talent is high, and supply does not meet demand, wage inflation becomes more prevalent as employers compete for a limited pool of workers. Although wage inflation has cooled since the heights of 2022, demand remains strong for digitally skilled workers. In fact, according to Lee Rogers, founder of Layoff.fyi, recent layoffs in the tech sector have been largely in sales and other customer-facing roles, as well as HR and recruiting, the latter being "the most disproportionately affected departments." By contrast, Rogers notes that IT departments are least likely to be impacted by downsizing.[22]

Compared to before the pandemic (used as a baseline, representing "standard" employment demand), hiring for in-demand digital roles remains elevated. The years 2021 and 2022, in many ways, were exceptional for the digital economy; businesses across sectors raced to adopt technology to stay afloat, keep consumers engaged, and attract (or at least sustain) investment—unsurprisingly, this reality supercharged the demand for digitally skilled talent.

16 "Labour Force Survey, May 2023," Statistics Canada, June 9, 2023, https://www150.statcan.gc.ca/n1/daily-quotidien/230609/dq230609a-eng.htm

17 "The shift to remote work: How workers in Canada are adapting to working from home," Future Skills Centre, 2021, https://fsc-ccf.ca/research/the-shift-to-remote-work/

18 "Why a dawn of technological optimism is breaking," The Economist, January 16, 2021, https://www.economist.com/leaders/2021/01/16/why-a-dawn-of-technological-optimism-is-breaking

19 Derek Thompson, "World War II's Lesson for After the Pandemic," The Atlantic, June 28, 2021, https://www.theatlantic.com/ideas/archive/2021/06/covid-19-pandemic-golden-age-innovation/619300/

20 Susan Lund et al., "The Future of Work after COVID-19," McKinsey & Company, accessed June 30, 2021, https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19

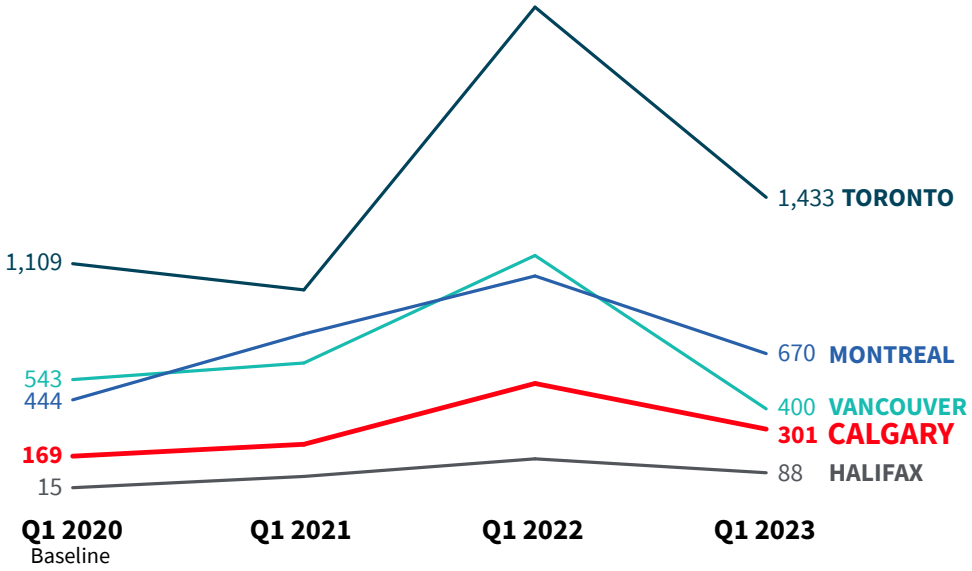
21 "Labour Force Survey, May 2023," Statistics Canada, June 9, 2023, https://www150.statcan.gc.ca/n1/daily-quotidien/230609/dq230609a-eng.htm

22 Jared Lindzon, "Who is getting laid off in Canada's tech industry?" Globe and Mail, February 20, 2023, https://www.theglobeandmail.com/business/article-who-is-getting-laid-off-in-canadas-tech-industry/

Recent research by the International Monetary Fund (IMF) finds that in advanced countries, digitization increased by an average of 6%; rates were even higher in countries that previously lagged in this space.[23] Since the pandemic accelerated digitization, hiring followed in lockstep. In other words, the demand for digital workers scaled during this period to facilitate and support the digital transition that reached unprecedented heights; as such, the relative "cooling" seen today (compared to unprecedented levels in 2021 and 2022) is expected.

Digital workers continue to support digital transformation, help drive efficiencies, develop and scale new products and services, and support commercialization. While life today in many ways resembles pre-pandemic times, the demand for digital workers continues to exceed those levels. Consider, for example, full-stack developers in five Canadian tech hubs. Apart from Vancouver, demand for this role in Q1 2023 significantly exceeded demand in Q1 2020 and, in some cases, even exceeded Q1 2021 levels.[24] Comparing job postings for full-stack developers in Q1 2023 versus Q1 2020, Toronto saw an increase of 30% (and 46% increase compared to Q1 2021); Montreal saw more than a 50% increase; Calgary saw a 78% increase (and a 33% increase compared to Q1 2021); and Halifax saw a 487% increase (and a 26% increase compared to Q1 2021).

FIGURE 3 **Full Stack Developer Job Postings**



Full stack developer job postings, Q1 2020, 2021, 2022, 2023: Toronto, Montreal, Vancouver, Calgary, Halifax. Source: eTalent Canada, accessed June 12, 2023.

23 Florence Jaumotte, Myrto Oikonomou, Carlo Pizzinelli, Marina M. Tavares, "How Pandemic Accelerated Digital Transformation in Advanced Economies," International Monetary Fund, March 21, 2023, https://www.imf.org/en/Blogs/Articles/2023/03/21/how-pandemic-accelerated-digital-transformation-in-advanced-economies

24 "Canada's Smart Cities," eTalent Canada, May 2023, https://etalentcanada.ca/for-job-seekers/employment-data

PART II

GOING DIGITAL IN ALBERTA

ECONOMIC OUTPUT: PANDEMIC AND BEYOND

The third largest contributor to national GDP behind Ontario and Quebec,[25] Alberta's economy saw the second-steepest decline in output during 2020. Ahead of just Newfoundland and Labrador, it contracted by 8% from 2019 to 2020; large losses were seen in sectors including arts, entertainment, and recreation (-39.2%); accommodation and food services (-26.9%); transportation and warehousing (-17.7%); and mining, quarrying and oil and gas (-12.2%).[26] Comparatively, Ontario and Quebec saw a total decline of 5% and 5.4%, respectively, and BC had a decline of 3.4% during this period.[27] Despite a difficult start to the new decade, 2021 ended with signs of recovery, and exogenous factors that emerged and proliferated in 2022 pushed the province further into a period of growth.

Today, the demand for energy and agricultural goods—two areas of strength for Alberta—is clear across Canada and the world. According to analysis from the International Energy Agency, the growing demand for electricity over the years increasingly strains global power systems; combined with growing consumer demand driven in part by geopolitical tensions and extreme weather events (leading to colder winters and hotter summers), energy prices were pushed to what were then referred to as "unprecedented" levels in 2021.[28] Globally, prices saw further upward momentum in 2022, especially following the Russian invasion of Ukraine in February 2022, which significantly disrupted supply chains and further tightened access, amplifying demand for energy resources from Alberta. A chief executive from MEG Energy noted "tremendous demand" for Alberta oil due to the war and the collateral damage of the energy crisis in Europe,[29] with prices of Alberta's key export, Western Canadian Select (WCS), trading at more than $100 USD. A year later, on June 11, 2023, WCS dropped to just over $50 USD a barrel.

25 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)

26 Statistics Canada, 2021.

27 Ibid.

28 "Surging electricity demand is putting power systems under strain around the world," IEA, January 14, 2022, https://www.iea.org/news/surging-electricity-demand-is-putting-power-systems-under-strain-around-the-world

29 Amanda Stephenson, «MEG chief executive sees 'tremendous demand' for Alberta oil due to Ukraine," Global News, March 4, 2022, https://globalnews.ca/news/8659261/meg-energy-alberta-oil-demand-ukraine-invasion/

Moreover, recent ICTC research finds that the pandemic, coupled with accelerated climate change, has placed significant strain on the agricultural sector; heightened demand, choked supply chains, and worsening yields have caused farmers around the world to turn to technology to "produce more with less."[30] The upswing in energy and agricultural demand are just two components of Alberta's growth story, however. Other subsectors, including digital health, clean technology, and financial technology (fintech) saw strong growth during the pandemic. According to data from Calgary Economic Development, Alberta is forecasted to spend $20 billion on digital transformation between 2021 and 2024. Moreover, energy and environment (including oil and gas) and financial services are expected to take two of the top three spots for the most substantial investments, totalling $5.8 billion and $1.5 billion, respectively.[31]

The province's healthcare system faces a shortage of technically and digitally skilled talent, causing pressure to innovate, modernize health systems, and adopt digital health technologies. Although nearly all provinces sought methods, including online consultations, to address labour shortages and cope with the evolving health needs of citizens during the pandemic, Alberta spends more on healthcare per capita compared to other Canadian provinces and territories. According to data from the Canadian Institute for Health Information, Alberta spent an estimated $37,117 million, or $8,230 per capita, on healthcare in 2021.[32] In 2021, nearly 14,500 people worked in the fast-growing health and biotech sub-sector, and in-demand jobs included core software and data roles (e.g., software developers, data scientists, etc.) and technical roles that blend healthcare domain knowledge and training with technology (e.g., medical advisors, research scientists, lab technicians).[33]

Fintech is another example of a digital economy sub-sector seeing strong growth, in part because the province's financial services sector has developed 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... [creating] world-class expertise in niche sectors, such as asset management, trading, mergers and acquisition, corporate banking and equity issuance."[34]

The makeup of Alberta's fintech sector is diverse. Roughly one-third of companies specialize in blockchain and cryptocurrency, with additional clusters, each representing roughly 10%, focusing on payments, capital markets, accounting and expensing management, lending, and insurance. In 2021, the fintech sub-sector employed over 13,000 workers, 80% of whom are in Calgary.

30 Maryna Ivus, Mairead Matthews, Maya Watson, "Canadian Agri-Food Technology: Sowing the Seeds for Tomorrow",," Information and Communications Technology Council, November 3, 2021, https://www.digitalthinktankictc.com/reports/canadian-agri-food-technology

31 Hubba Khatoon, "Digital Transformation (DX) spending statements," Calgary Economic Development, April 2021.

32 National Healthcare Expenditure Trends, CIHI, https://www.cihi.ca/en/how-do-the-provinces-and-territories-compare

33 Alexandra Cutean, Mairead Matthews, « A Resilient Recovery: Alberta's Digital-Led Post-COVID Future," Information and Communications Technology Council, June 30, 2022, https://www.digitalthinktankictc.com/reports/a-resilient-recovery

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

Top fintech jobs lean heavily toward automation, as well as software and data-related roles (e.g., full-stack developers, data analysts, data scientists, and DevOps engineers), followed by business-related roles, like business development managers and business analysts.[35]

During the pandemic, the province focused on attracting private-sector investment to reboot the economy. Although investment shrank notably during the early days—tumbling to $48 billion in 2020 from $59 billion in 2019—it began to recover in 2021, reaching more than $54 billion.[36] Investment scaled further in 2022, reaching over $63 billion.[37] During 2021 and 2022, several large investments flowed into Alberta. These included funds that were leveraged to support local companies on their scaling and expansion journeys, as well as international investments from foreign multinationals. A healthy and efficient economy requires both forms of investment to thrive. A few key examples over the period include the following:

Infosys	Expanded operations in Canada via Calgary; 500 new jobs projected.
Amazon	Commitment to developing a cloud computing hub in the Calgary region; 950 new jobs projected.
Mphasis	Opens North American delivery centre in Calgary; 1,000 new jobs projected.
Neo Financial	Completes $185 million fundraising round; earns coveted “unicorn” status.
Jobber	Raises $100 million in a Series D round; 200 new Edmonton-based jobs projected.
Attabotics	Secures $95 million in Series C-1 round; scales robot-run fulfillment centres.
Summit Nanotech	completes a $76 million fundraising round; expands core business activities to include lithium extraction from brine.
Teknol	Software firm moves its engineering hub from Silicon Valley to Calgary; $12.5 million investment and 125 jobs projected
Vantage Circle	Global HR SaaS firm selects Calgary as its North American headquarters; 250 jobs projected.
Eventcombo	SaaS firm to open North American headquarters in Calgary; $10 million investment and 250 jobs projected.

Considering recent foreign and homegrown business activity, the hot Alberta economy is expected to perform strongly from 2023 onward. According to TD Economics, Alberta’s GDP growth is forecasted to outstrip the national average, tying with Saskatchewan in 2023.[38]

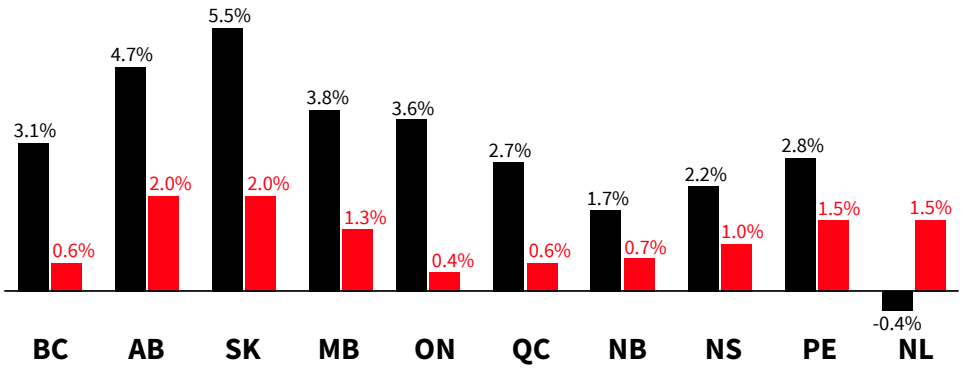
35 Alexandra Cutean, Mairead Matthews, « A Resilient Recovery: Alberta’s Digital-Led Post-COVID Future,” Information and Communications Technology Council, June 30, 2022, https://www.digitalthinktankictc.com/reports/a-resilient-recovery

36 Statistics Canada. Table 34-10-0035-01 Capital and repair expenditures, non-residential tangible assets, by industry and geography (x 1,000,000)

37 Ibid.

38 Beata Caranci, Derek Burleton, Rishi Sondhi, Jenny Duan, ”Provincial Economic Forecast : Regional Growth Resiliency On a Time Limit as Rate Hikes Bear Down,” TD Economics, March 16, 2023, https://economics.td.com/provincial-economic-forecast

FIGURE 4 **Real GDP Change - 2022 vs 2023**



Real GDP Change (%) 2022; forecast for 2023. Source: TD Economics, 2023.

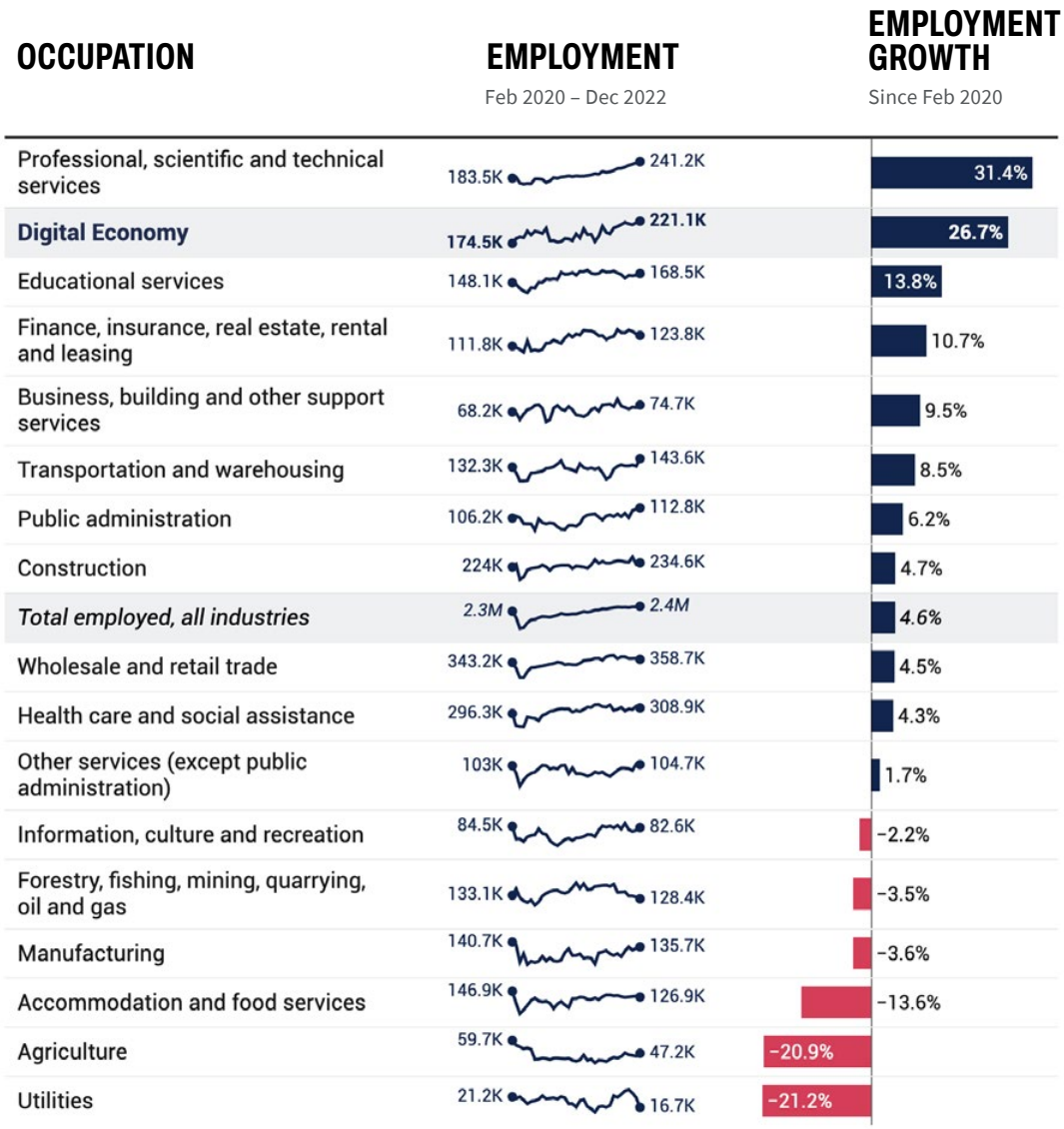
LABOUR MARKET IMPACTS: RECENT TRENDS

Like many provinces, Alberta has experienced economic and labour market fluctuations since the pandemic. Deep dips were seen across the economy in late 2020 and early 2021 following pandemic-induced lockdowns and shutdowns. During this period, all sectors experienced a downturn, including the digital economy. Although most digital workers were able to work from home, the unstable and uncertain conditions of the early pandemic slightly blunted hiring. It is generally understood that in a strong economy, employers tend to hire more, and during poor or uncertain conditions, they hire less to manage risk. However, research from the Harvard Business Review suggests other hiring scenarios during uncertainty. For example, job postings requiring a bachelor's degree or higher rose by more than 10% during the 2008 recession (for jobs that didn't previously require this level of education) and immediately fell as labour markets recovered.[39]

As pandemic restrictions began to lift and general economic activity picked up, employment in the digital economy spiked. At the end of 2022, however, several sectors, such as utilities, agriculture, and accommodation and food services, still remained negatively impacted, with employment down by more than 21%, 20%, and 13%, respectively, since before the pandemic. By contrast, in December 2022, employment in Alberta's digital economy was nearly 27% higher than before the pandemic, adding more than 46,500 jobs. The three digital occupations that saw the highest employment growth during this period were computer and information systems managers (roles including cybersecurity professionals mapped to this NOC), database analysts and data administrators (roles including data analysts are mapped to this NOC), business development officers and marketing research consultants (roles including sales professionals are mapped this NOC).

39 Alicia Sasser Modestino, Daniel Shoag, « Research : When the Economy is Good, Employers Demand Fewer Credentials," Harvard Business Review, August 21, 2018, https://hbr.org/2018/08/research-when-the-economy-is-good-employers-demand-fewer-credentials

FIGURE 5 **Employment by Sector in Alberta**



Employment by sector in Alberta: February 2020 to December 2022. Employment data adjusted for seasonality.
Source: ICTC, Stats Canada, 2023.

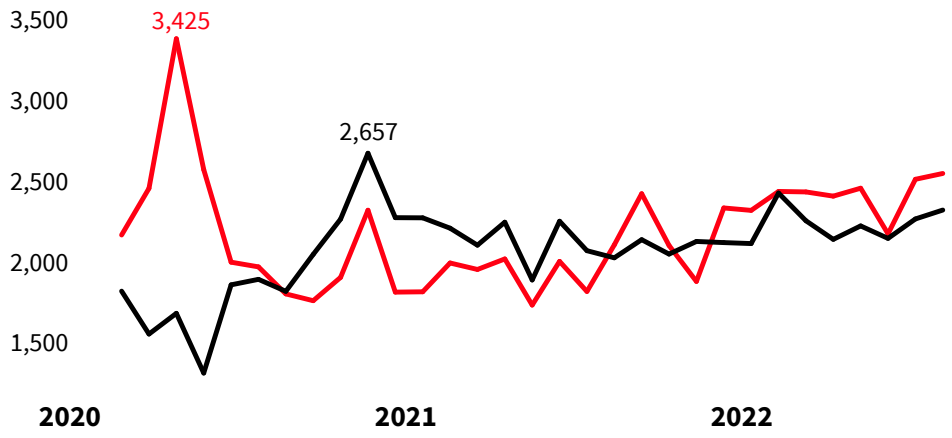
FIGURE 6 **Employment Change in Digital Occupations**

Employment change in digital occupations: February 2020 to December 2022. Three-month moving average. Employment data adjusted for seasonality. Source: ICTC, Stats Canada, 2023.

BUSINESS IMPACTS

Alberta employers, especially small and medium sized employers, faced numerous challenges during the pandemic. In 2020, business leaders navigated the uncertainty of COVID-19, the spread of which led to lockdowns, shutdowns, and capacity reductions. As such, 2020 was a record year for business exits (closures of more than six months). Although data for business exits is only available until August 2022, from February 2020 to August 2022, more than 67,200 companies in business-sector industries[40] permanently exited the Alberta economy, compared to just over 64,100 that entered—a net loss of more than 3,000 businesses. Compared to neighbouring British Columbia, from February 2020 to August 2022, just over 80,000 B.C. businesses exited, but more than 84,000 entered—a net gain of more than 4,000 businesses.

FIGURE 7 **Alberta Entrants and Exits**



Entrants and exits, Alberta business-sector industries, Feb 2020-August 2022. Source: Statistics Canada, 2023.[41]

Although data on entrants and exists by sector is not available, shifting consumer trends like online education, shopping, and content consumption supported the resiliency of the tech sector during the pandemic. For example, from February 2020 to July 2022, e-commerce sales increased by nearly 68%.[42] The total share of e-commerce sales (as a portion of all sales) also rose from 3.9% in 2019 to 6.5% in December 2022.[43] The relative persistence of e-commerce as a preferred transaction method suggests a potential long-term change in consumer spending habits, which in turn prompts the need for other businesses to leverage technology to adapt business models and operations.

40 T004.

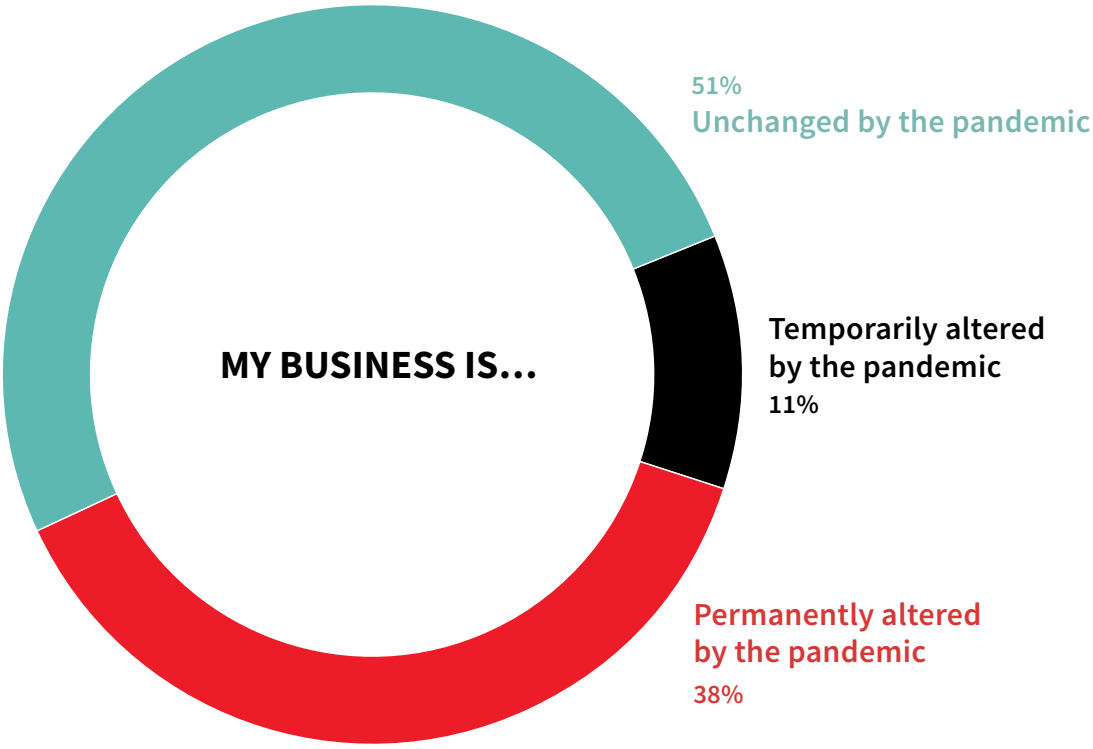
41 Statistics Canada. Table 33-10-0270-01 Experimental estimates for business openings and closures for Canada, provinces and territories, census metropolitan areas, seasonally adjusted

42 Salim Zanzana, Jessica Martin, "Retail e-commerce and COVID-19: How online sales evolved as in-person shopping resumed," Statistics Canada, February 21, 2023, https://www150.statcan.gc.ca/n1/pub/11-621-m/11-621-m2023002-eng.htm

43 "Retail Trade, December 2023," Statistics Canada, February 21, 2023, https://www150.statcan.gc.ca/n1/daily-quotidien/230221/dq230221b-eng.htm

A 2022 ICTC survey of Alberta businesses[44] highlights the resiliency of companies whose operations were rooted in technology. Over half of the respondents representing such companies reported minimal or no impacts to their business due to the pandemic; many were able to continue business operations with little disruption to their employee base, processes, business models, or ability to attract investment and grow revenue. Among the half that did report disruption, three-quarters believed they were permanently changed by the pandemic, while a quarter regarded the pandemic as a temporary shift. In both groups, the nature of the change was mostly related to remote work. Few employers had experience with remote work before the pandemic; the shift to fully or partially working from home presented both opportunities and challenges for many business owners and employees alike.

FIGURE 8 **Perceptions of Pandemic Impact in the Digital Economy**



Perceptions of pandemic impact, Alberta digital economy companies, Source: ICTC 2022.

44 Alexandra Cutean, Mairead Matthews, « A Resilient Recovery: Alberta's Digital-Led Post-COVID Future," Information and Communications Technology Council, June 30, 2022, https://www.digitalthinktankictc.com/reports/a-resilient-recovery

AFTER THE PANDEMIC: BUSINESS SHIFTS AND LABOUR MARKET 2023 ONWARD

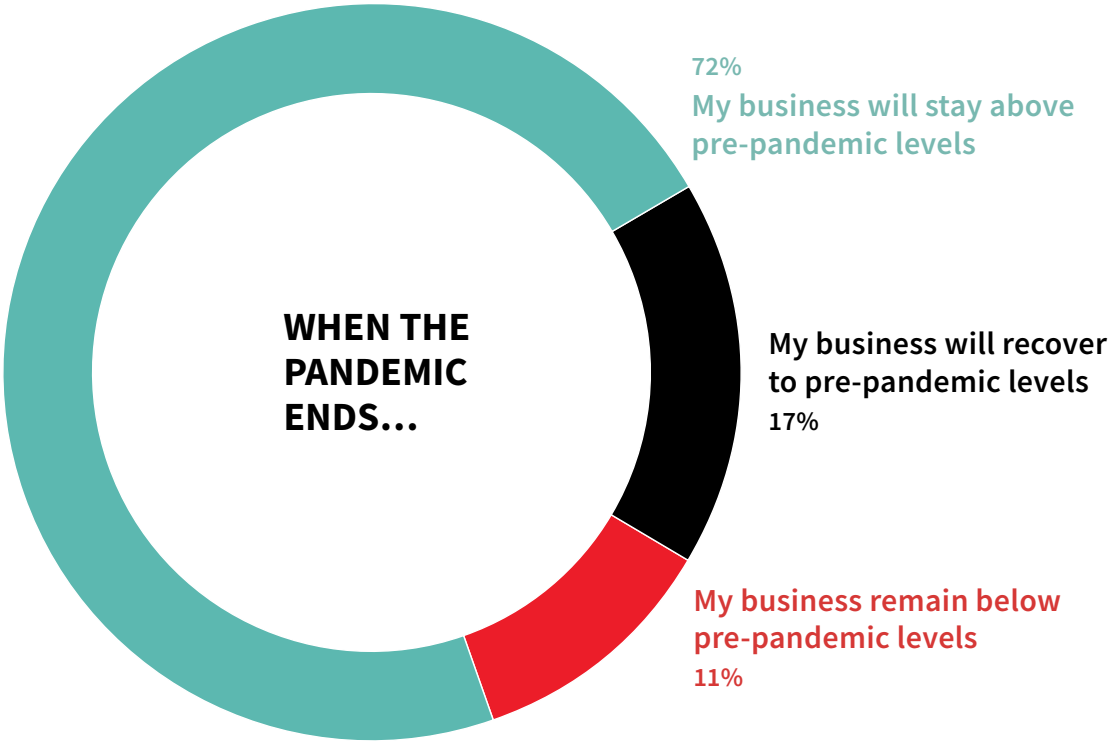
Looking beyond the pandemic, Alberta's digital economy employers largely believe that COVID-19 supercharged the demand for their products and services. With more "traditional" sectors adopting technology as a means of continuing business operations, digital products and solutions were needed to support this shift. Respondents from the 2022 ICTC survey shared a broad sense of optimism about the future of their businesses post-COVID. Three-quarters believed that the pandemic was a key turning point and that their recent growth would continue.

Only 11% believed that they would not recover to pre-pandemic levels. This group frequently noted the challenges of adapting their business models to suit evolving needs. Notably, remote and hybrid work came up again as a core challenge. Most businesses in this group felt that their "innovation factor" would remain subdued the longer that remote or hybrid work persisted. As one respondent put it, "*New product development was hit hard, especially high collaboration tasks requiring multiple disciplines to work together.*" These sentiments appear to resonate to a degree, especially as some employers bring workers back to the office. Although recent research attempting to assess the impact of remote work on productivity produces mixed results, several studies have pointed to a potential innovation deficit associated with remote or hybrid work. For example, a 2022 study by MIT analyzed email traffic from its own researchers and faculty from December 2019 to June 2021: the results displayed a notable drop off in communication between different research units and, as a result, a growth in what they refer to as "weak ties," preventing the free exchange of ideas and ultimately, innovation.[45] Similarly, Northeastern University recently surveyed more than 1,000 US-based C-suite executives and found that, despite a general understanding that remote work can be a key recruitment tool, it also poses an innovation challenge. Here, over half of the executives expressed concerns about workers' abilities to exercise creativity and innovation in a work environment that is primarily remote.[46] Interestingly, job posting data collected by ICTC shows a slight decline in roles marked as "remote" or "hybrid" in key cities in Alberta during Q1 2023, compared to Q1 2021 and 2022.

45 Daniel Carmody, et al., "The effect of co-location on human communication networks," Nature Computational Science, August 2022, https://www.nature.com/articles/s43588-022-00296-z

46 Sean R. Gallagher, Michael Ferrari, "Employers' Post-COVID Business Strategy and the Race for Talent: A View From the C-Suite," Northeastern University, December 2021, https://cps.northeastern.edu/wp-content/uploads/2022/01/NUReport_CFHETS_EmployersPostCovid_12-22-2021.pdf

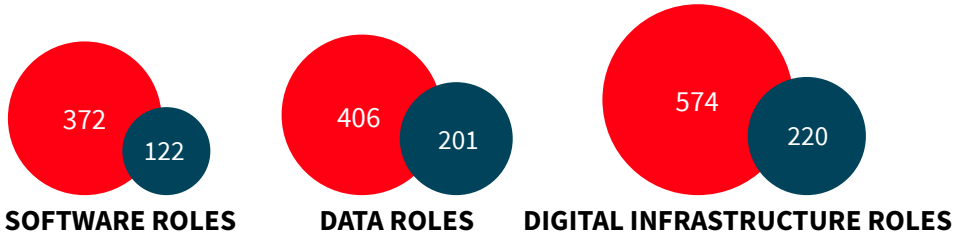
FIGURE 9 Perceptions of Post-Pandemic Business Success in the Digital Economy



Perceptions of post-pandemic business success, Alberta digital economy companies. Source; ICTC 2022.

Whether fully remote, hybrid, or fully in-office, digital workers remain in high demand in Alberta. Core occupational groupings like software roles, data roles, and digital infrastructure roles still see strong demand in 2023 across Alberta's largest tech ecosystems. In Calgary and Edmonton, Q1 2023 saw nearly 500 jobs postings for full-stack, UX/UI (front-end), back-end, and mobile developers (core software roles); over 600 job postings for data engineers, data scientists, data analysts, and machine learning engineers (core data roles), and nearly 800 job postings for cybersecurity professionals, DevOps professionals, network administrators, and cloud engineers (digital infrastructure professionals).

FIGURE 10 Digital Economy Job Postings in Calgary and Edmonton



Software roles, data roles, digital infrastructure roles: Job postings from Calgary and Edmonton Q1 2023. Source: eTalent Canada, accessed June 12, 2023.

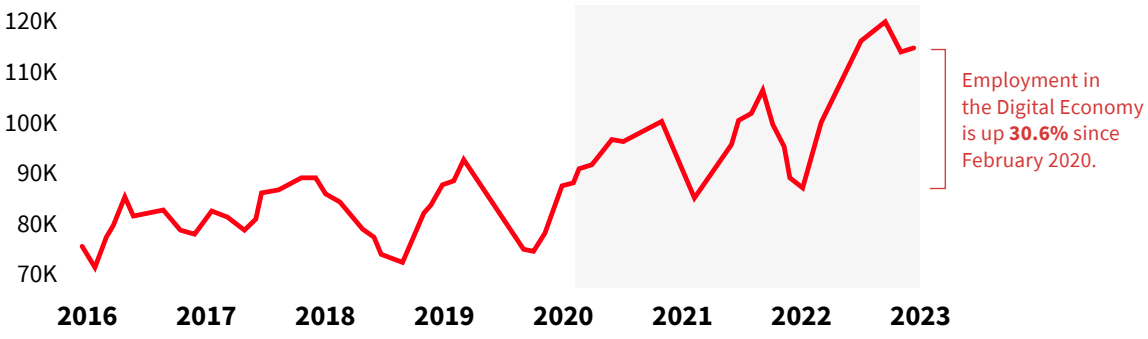
PART III

CALGARY'S DIGITAL FOOTPRINT

LABOUR MARKET IMPACTS: RECENT TRENDS

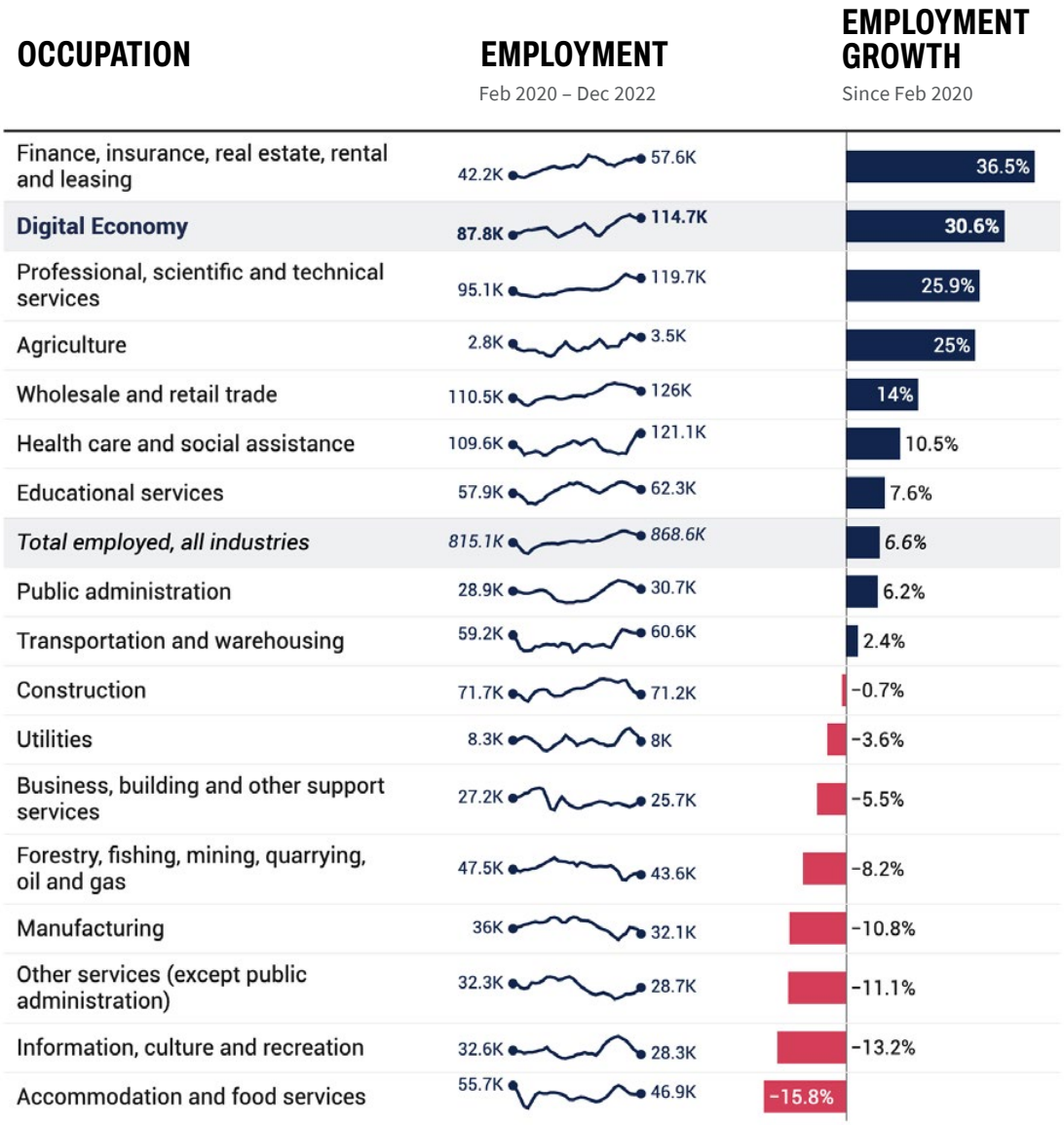
September 2022 marked the height of Calgary's digital economy over the last two years. This month, the city's digital economy employed nearly 120,000 workers, a jump of over 30,000 jobs compared to pre-pandemic levels. Although a cooling economy ushered in a stabilization of the digital labour force by the end of 2022, Calgary's digital economy weathered the storm of the pandemic and outperformed pre-pandemic hiring trends considerably. By December 2022, the city's digital economy employment had grown by more than 30% since February 2022, outpacing growth in all sectors but finance. By contrast, the city's overall economy saw employment growth of just 6.6% during this period. Three core digital roles that saw strong growth during this period are database analysts and data administrators (roles including database administrators and data analysts are mapped to this NOC), software engineers and designers (roles including full-stack, back-end, and front-end developers are mapped to this NOC), and graphic designers and illustrators (roles including technical artists are mapped to this NOC).

FIGURE 11 **Calgary's Digital Economy Job Growth**



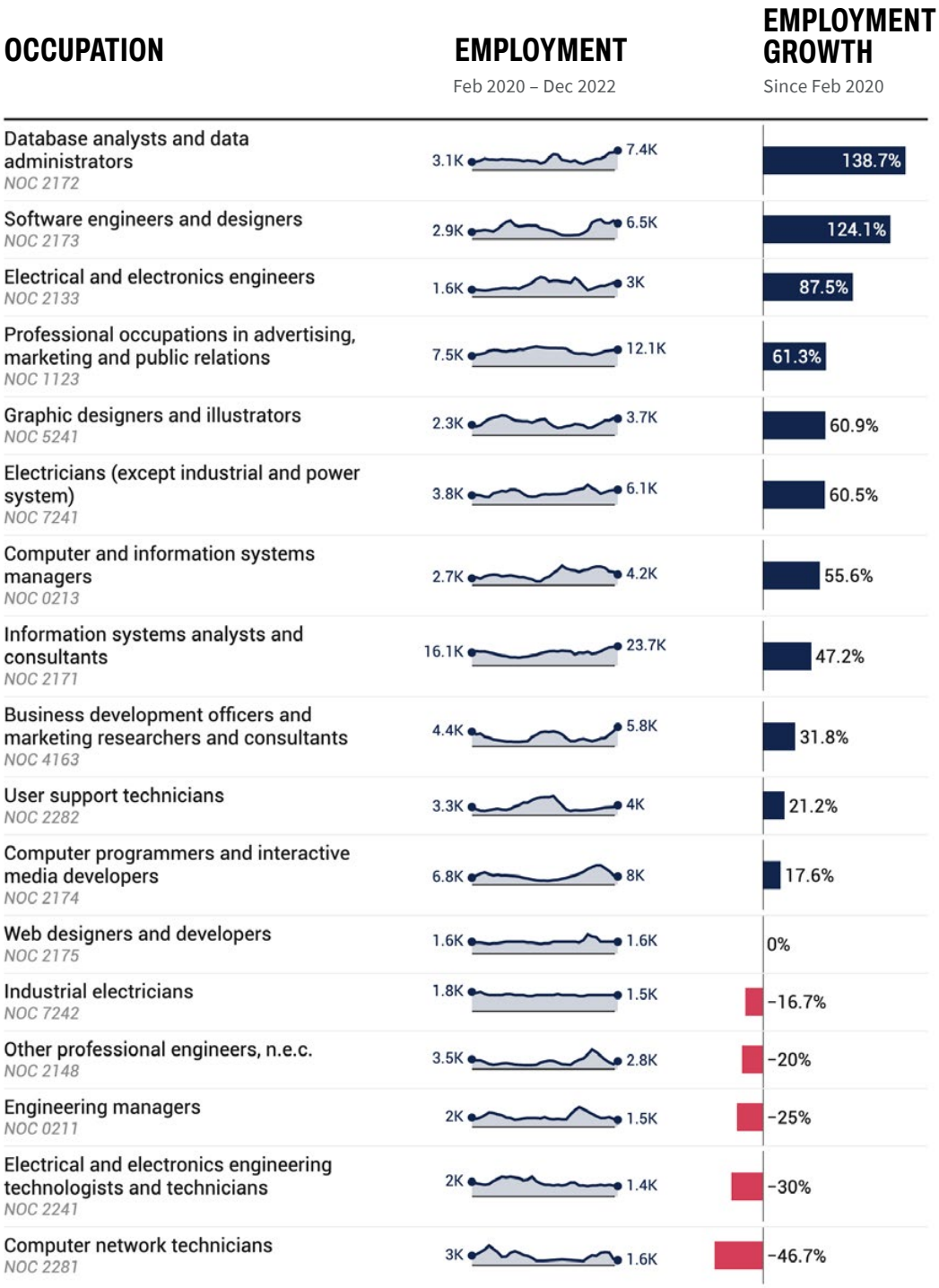
Employment growth, Calgary digital economy February 2020 to December 2022, three-month moving average; data adjusted for seasonality. Source: ICTC, Statistics Canada, 2023.

FIGURE 12 Comparison of Employment Sectors in Calgary



Employment: Sector comparison, Calgary. February 2020 to December 2022, three-month moving average; data adjusted for seasonality. Source: ICTC, Statistics Canada, 2023.

FIGURE 13 Digital Occupations in Calgary



Employment: digital occupations, Calgary. February 2020 to December 2022, three-month moving average; data adjusted for seasonality. Source: ICTC, Statistics Canada, 2023.

CALGARY: LIVE ACTION HUB SEES GROWING DEMAND FOR DIGITAL TALENT

The 2023 Alberta budget included a further $100 million investment in the Film and TV tax credit (FTTC). The FTTC plays a critical role in attracting investment and establishing Alberta as a key destination for film and TV production. A core element is the up to 30% tax credit on eligible production spend and labour costs associated with a film, TV series, or other screen-based production.

In 2021, it was estimated that revenues from just 50 productions using the FTTC injected $522 million into the Alberta economy and added 4,985 jobs.[47] Calgary is a well-known destination for movie makers from around the world. In 2023, it placed eighth on MovieMaker's list of "Best Cities to Live and Work as a Moviemaker." Attractive features of the city include the FTTC, its diverse landscape, relatively uncomplicated permitting processes, and availability and affordability of equipment and host houses.[48] On top of playing host to blockbusters like *The Last of Us, Prey* and *Fargo*, Calgary hosted 28 different productions in 2023, including the 17th season of *Heartland*, *Billy the Kid*, and *The Order*.

The expected ever-growing presence of live-action production in and around Calgary will bring with it the need for adjacent roles that are rooted in digital foundations. Jobs like production supervisors, visual effects (VFX) artists, pipeline technical directors, lighting engineers, and others will see increasing demand as movie makers from around the world continue to choose Calgary.

Alongside three other sectors (energy and environment, transportation and logistics, and financial services), the creative industries are expected to invest notably in digital transformation in Calgary by 2024, totalling $1.3 billion.[49]

47 Elise von Scheel, "Recent film, TV projects bringing $482M to Alberta's economy," CBC, July 31, 2021, https://www.cbc.ca/news/canada/calgary/alberta-film-spending-1.6124746

48 Tim Molloy, "Best Places to Live and Work as a MovieMaker, 2023," Movie Maker, January 18, 2023, https://www.moviemaker.com/best-places-to-live-and-work-as-a-moviemaker-2023/4/

49 Hubba Khatoon, "Digital Transformation (DX) spending statements," Calgary Economic Development, April 2021.

CALGARY: A GROWING CLEANTECH ECOSYSTEM

Home to Canada's most productive energy sector and the highest rate of STEM-educated professionals per capita, it is no surprise that Calgary is building a thriving cleantech ecosystem. In 2021, 945 cleantech companies were headquartered in Alberta, with over 65% specifically targeting customers in the oil and gas sector, a means of generating business opportunities while supporting the province's transition to net zero goals.

Foresight Canada identifies over 100 support mechanisms that underpin the cleantech industry in the province. Resources include venture capital funds, grant funding mechanisms and tax credits, labour subsidies, and accelerators.[50] According to data from Calgary Economic Development, the energy sector is set to invest the most in digital transformation by 2024, totalling $2.3 billion. Key areas of focus for the city's thriving cleantech industry include:

- Hydrogen
- Agri-tech and agriculture
- Carbon capture, utilization, and storage
- Digitization
- Electrification
- Energy efficiency

Although various digital roles—including software developers, data scientists, data engineers, and cloud architects—are key to supporting the growth of the ecosystem, data from Statistics Canada shows a strong demand for traditional engineering occupations in the city as well, many that are germane to the energy sector. Electrical engineers, for example, saw employment growth of over 87% between February 2020 to December 2022.

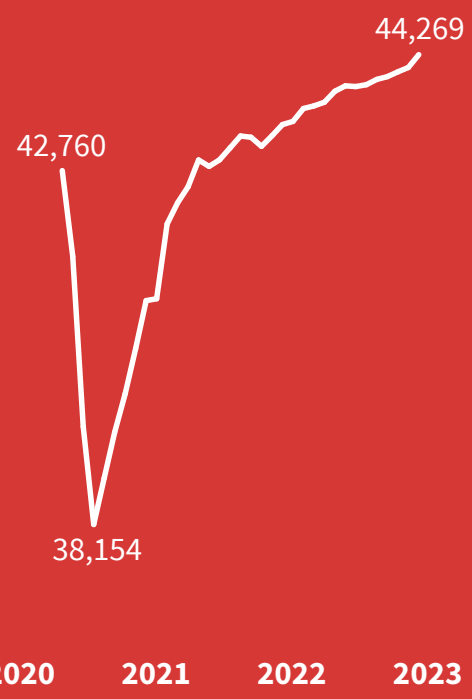
50 "Alberta Cleantech Ecosystem Map 2023," Foresight Canada, https://a.iscdn.net/foresight/2023/04/654_AB-Cleantech-Ecosystem-Map-Feb-2023-2.pdf

BUSINESS IMPACTS

Calgary businesses, like Alberta overall, suffered closures, disruptions and delays due to the pandemic. While data on business entrants and exits is not available for the city, estimates point to a growth in active businesses across business sector industries, despite the toll of the pandemic. By the end of 2022, Calgary had 3.5% more active businesses[51] than it did in February 2020.

According to ICTC's 2022 survey of Alberta digital businesses, few Calgary-based digital economy companies reported major disruptions due to the pandemic—on the contrary, many believed that the pandemic was their opportunity to "be bold" and take risks." Over 80% of respondents suggested using the pandemic as an opportunity to expand their business, compared to slightly less than 70% across Alberta. Similarly, while approximately 70% of Alberta's digital economy businesses believed that revenues and growth would remain above pre-pandemic levels in future, in Calgary, 80% of businesses felt this was the case.

FIGURE 14 Active Businesses in Calgary



Active businesses, business sector industries, Calgary, February 2020 – December 2022. Source: Statistics Canada, 2023.[52]

Investment in digitization grew substantially during the pandemic before levelling off in Q1 2023. For example, data from the Bank of Canada's Q2 2022 Business Outlook Survey identified that companies across sectors expected to increase investment spending, with a key priority being expanding capacity and improving productivity through digitization and automation.[53] Similar sentiments were echoed in Calgary. According to data from Calgary Economic Development, Calgary businesses across all sectors expect to spend a combined $7.5 billion on digital transformation by 2024.[54] The Q1 2023 Business Outlook Survey found that although technology investments are expected to continue into 2024, positive investment intentions have steadily decreased since Q2 2022 as companies increasingly prepare for a recession.[55] On average, business leaders believe that inflation will remain "sticky," staying above 2% until at least 2025.[56]

51 Businesses reporting as having one or more employee in a given month.

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

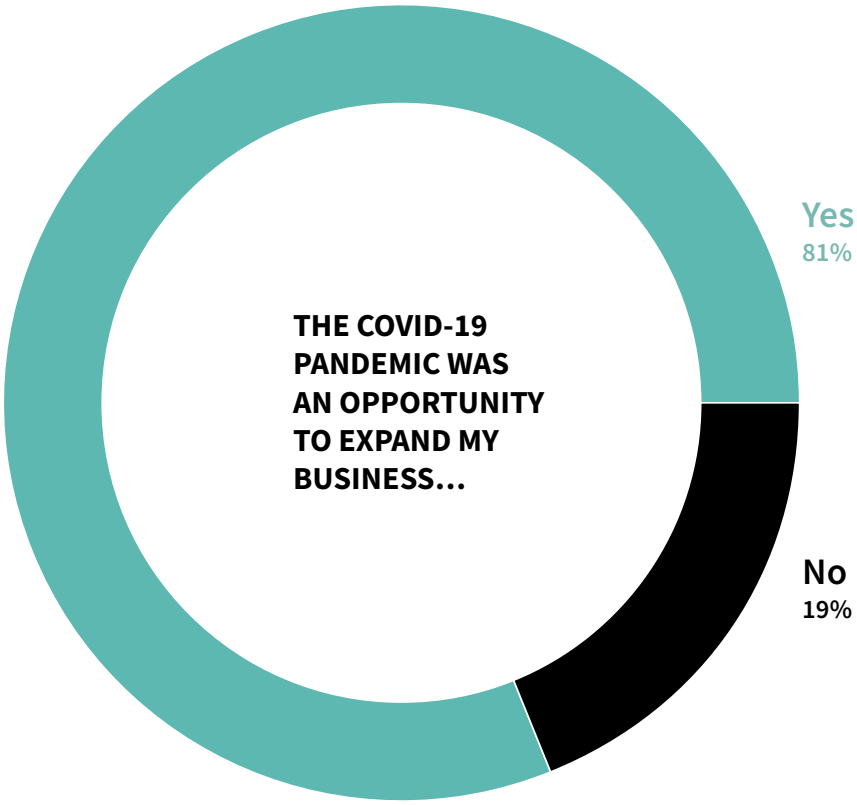
53 "Business Outlook Survey – Second Quarter of 2022," Bank of Canada, July 4, 2022, https://www.bankofcanada.ca/2022/07/business-outlook-survey-second-quarter-of-2022/

54 Hubba Khatoon, "Digital Transformation (DX) spending statements," Calgary Economic Development, April 2021.

55 "Business Outlook Survey – First Quarter of 2023," Bank of Canada, April 3, 2023, https://www.bankofcanada.ca/2023/04/business-outlook-survey-first-quarter-of-2023/

56 Ibid.

FIGURE 15 **Perceptions of the Pandemic as a Catalyst for Change**



Calgary digital economy companies. Source: ICTC 2022.

Our line of IoT solutions expanded. – Calgary digital economy business owner

The Q1 2023 Business Outlook Survey also found that businesses still characterize the labour market as tight but note a slight softening in demand and decreasing wage pressures. Despite the cooling effect, more than half of businesses still expect to expand their workforce over the next year.[57]

About 60% of Calgary digital economy employers surveyed by ICTC in 2022 reported hiring staff throughout the pandemic, oftentimes at volumes that exceeded pre-pandemic expectations. A recent study by KPMG reinforces this notion of pandemic-fuelled or pandemic-resistant digital hiring. Partly to meet growing consumer demand and partly to support changing business models, the study notes that more SMEs sought employees with key digital skills—including cybersecurity and data analytics skills—during the pandemic than ever before.[58]

57 Ibid.

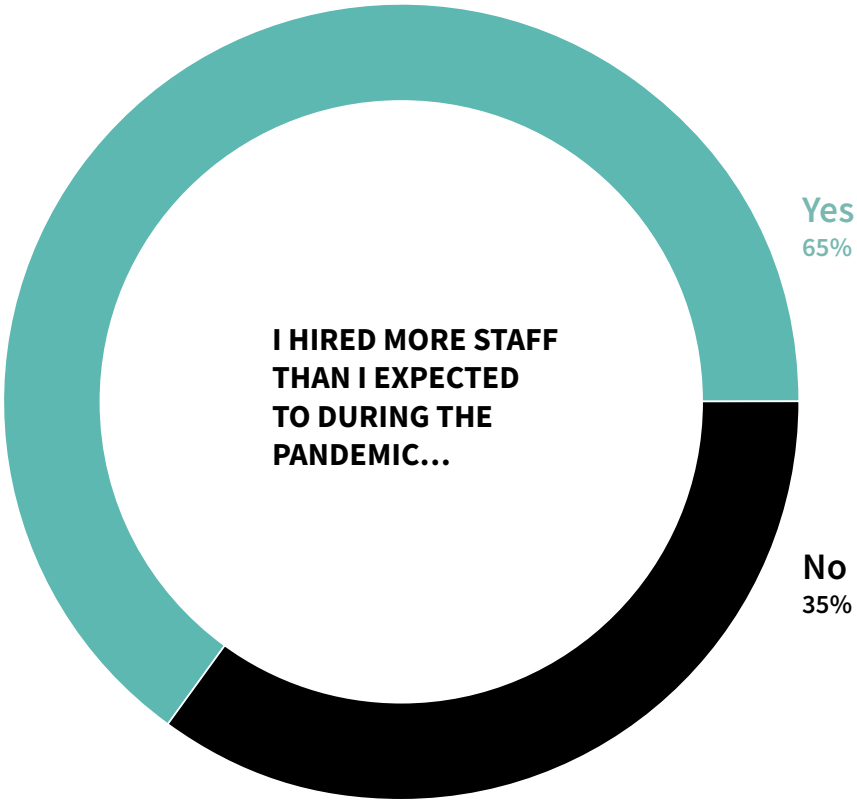
58 "Canadian SMBs: Optimistic, hiring, and looking to make a difference," KPMG, October 4, 2021, https://home.kpmg/ca/en/home/insights/2021/10/canadian-smbs-optimistic-hiring-and-looking-to-make-a-difference.html

In Calgary, companies mentioned onboarding talent in areas including software development, business intelligence, technical sales, engineering, and design. Few respondents reported laying off staff, even after the height of the pandemic. Among the small portion that did (15%), displaced roles tended to be in support functions like administration, human resources, and operations. This echoes the type of displacement seen in late 2022 and early 2023 at technology companies themselves: recruitment and human resources were the significantly impacted areas, followed by other customer-facing roles like sales.[59]

We had to lay off…a great office admin and HR person.

– Calgary digital economy company

FIGURE 16 **Hiring During the Pandemic**



Calgary digital economy companies. Source: ICTC, 2022.

59 "The Crunchbase Tech Layoffs Tracker," Crunchbase, last updated: June 9, 2023, https://news.crunchbase.com/startups/tech-layoffs/

PART IV

THE DEMAND FOR TALENT IN CALGARY'S DIGITAL ECONOMY

RECENT HIRING AND SHIFTING LABOUR MARKET DYNAMICS

Across Canada, small and medium sized enterprises (SMEs)[60] make up most of economic activity. As of June 2022 (the latest data available), 98% of Canadian and Alberta companies were SMEs.[61] In the digital economy, this figure increases to over 99%.[62] Likewise, ICTC's survey of Calgary digital economy businesses found that most are small; however, over half (58%) classify themselves as actively "scaling up" and seeking skilled workers to fill key roles. Irrespective of company size, most (97%) expressed an optimistic outlook about the future; many felt confident that they would be able to rebound from the pandemic and continue to create high-quality job opportunities for Calgarians.

Starting in summer 2022, global technology stocks entered a downturn, and many large technology companies, including the "FAANG" (Facebook, Amazon, Apple, Netflix, Google) as well as Canadian-grown Shopify, announced layoffs of tech workers. According to aggregator Layoff.fyi, over 206,000 workers lost their jobs since the pandemic across 768 companies. While much displacement has been in non-technical roles, ultimately, digital workers were not completely spared. However, employers consulted in this study tended to believe that laid-off technical and digital workers are easily re-absorbed into the labour market.

60 Classified as businesses employing 1-99 people.

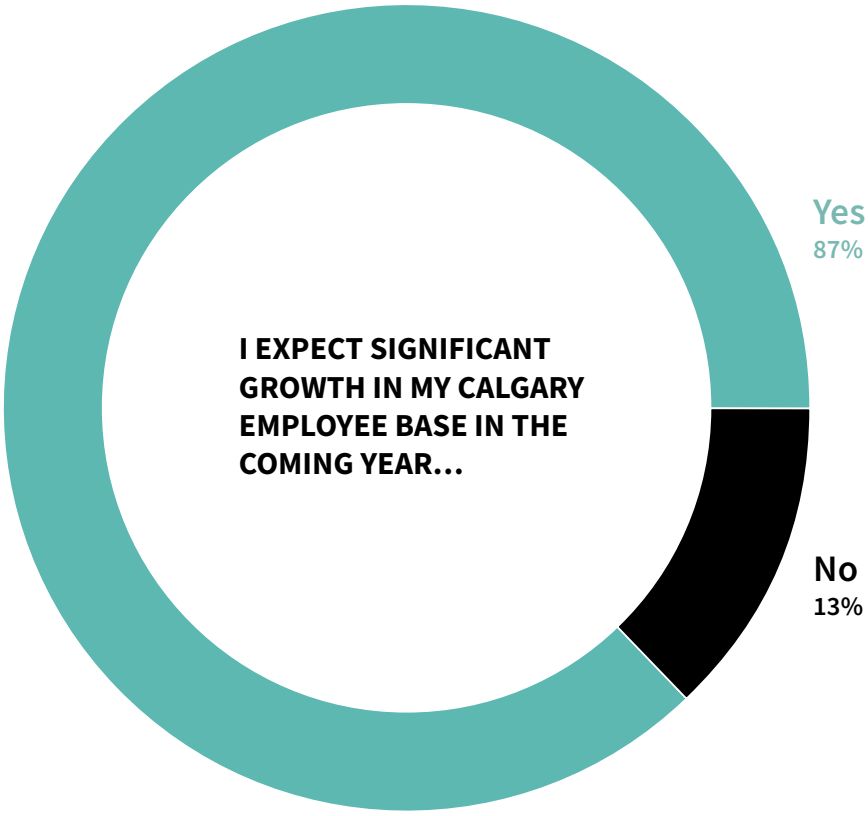
61 Statistics Canada, Table 33–10–0304–01 Canadian Business Counts, with employees, June 2022, Table 17–10–0005–01 — Population estimates on July 1, by age and sex; and ISED calculations

62 Statistics Canada, Table 33–10–0304–01 Canadian Business Counts, with employees, June 2022, ICTC.

Some suggested that these workers can find a new opportunity in just "a matter of days."[63] As of June 2023, Layoff.fyi reports layoffs at four companies with Calgary operations (Symend, Benevity, Reach, and Goodfood)—in most cases, layoffs represented 25% of the employee base or less.

Across growth stages, most Calgary digital economy companies (87%) expected hiring to be "significant" going forward. While startups or early-stage scaleups expected to hire smaller numbers of workers (anywhere from five to 25), established companies with broader market share expressed the need to hire between 50 to 200. When it came to the type of talent companies sought to onboard, the majority (80%) relayed a strong need for those with software development skills, followed by talent with data analytics skills (70%) and cloud computing knowledge (62%).

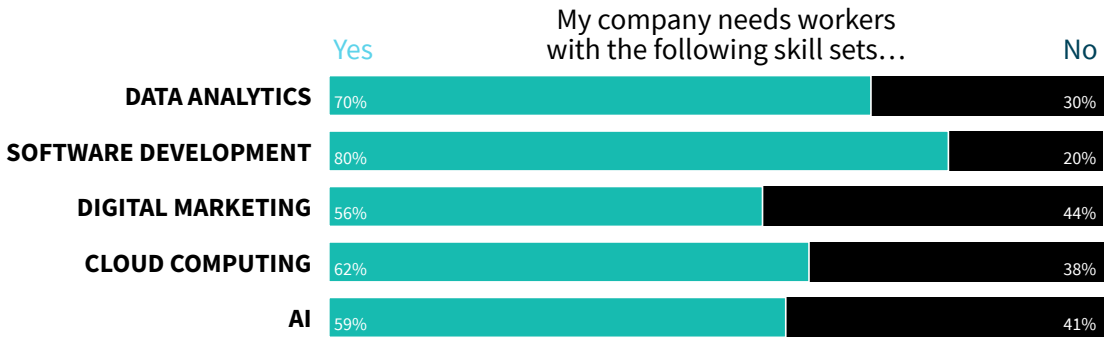
FIGURE 17 **Expectations of Future Hiring**



Calgary digital economy companies. Source: ICTC, 2022.

63 Tara Deschamps, « Canadian tech talent still in demand, despite layoffs and recession predictions",," CTV News, July 10, 2022, https://www.ctvnews.ca/sci-tech/canadian-tech-talent-still-in-demand-despite-layoffs-and-recession-predictions-1.5981652

FIGURE 18 **Types of Talent / Skill Sets Needed**



Calgary digital economy companies. Source: ICTC 2022.

GENERATIVE AI AND THE DEMAND FOR WORKERS WITH AI AND MACHINE LEARNING SKILLS

At the time of this survey, nearly 60% of Calgary employers noted a need for workers with strong AI skills. While this survey concluded in Q2 2022, it is likely that the demand for workers with this set of knowledge and skills has grown in lockstep with the growth of generative AI.

On November 30, 2022, OpenAI launched ChatGPT. A large language model (LLM), ChatGPT is just one—although arguably both the most advanced and well-known—example of generative AI applications that exist today; others include DALL-E-2, GPT-4 (both owned by OpenAI), AlphaCode (DeepMind), and Bard (Google). Generative AI applications leverage algorithms that, with prompting, can create unique content.

Unfettered advancement in generative AI undoubtedly poses risks, but many businesses also see it as a tool to generate efficiencies, boost productivity, and even spearhead new lines of business.[64] To this end, the "prompt engineer"—a job that barely existed until recently—has been dubbed one of the "hottest jobs" in generative AI.[65] Workers in this role help generative AI applications work better by developing and testing prompts. Some believe that this job is "here to stay,"[66] while others surmise that the role's presence is likely to be short-lived, eventually turning into an in-demand skill that is integrated into other AI or machine learning roles. Regardless of what the future holds for this role specifically, generative AI is likely to play a larger and more disruptive role in the future. In turn, workers with AI and machine learning skills, as well as knowledge of generative AI risks and industry context, are key.

64 Michael Chui, Roger Roberts, Lareina Yee, "Generative AI is here: How tools like ChatGPT could change your business," McKinsey & Co., December 20, 2022, https://www.mckinsey.com/capabilities/quantumblack/our-insights/generative-ai-is-here-how-tools-like-chatgpt-could-change-your-business

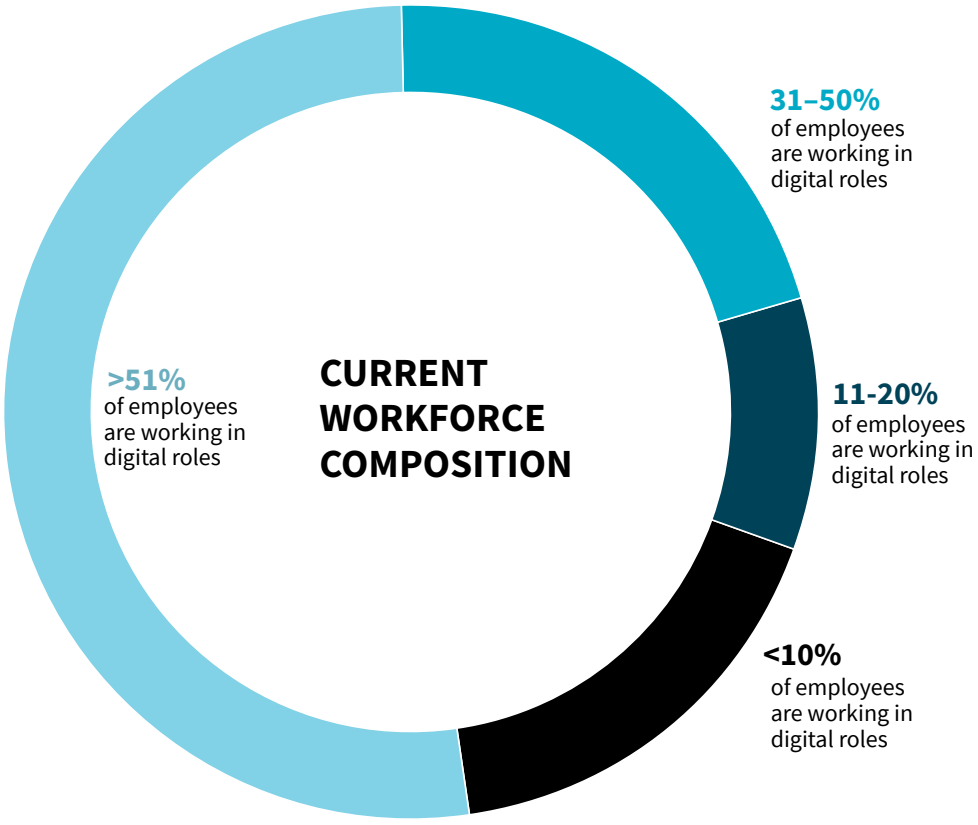
65 Amy Daali, "The Rise of Prompt Engineering: Exploring the Hottest Job in Generative AI," LinkedIn, April 5, 2023, https://www.linkedin.com/pulse/rise-prompt-engineering-exploring-hottest-job-ai-amy-daali-phd/

66 Ibid.

IN-DEMAND JOBS IN CALGARY:
A LOOK BACK AT 2021 AND 2022

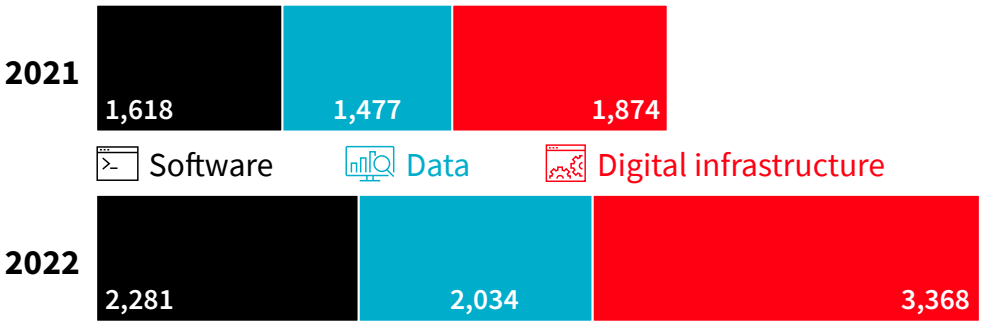
Much of the demand for future hiring is centralized in digital or technical roles, oftentimes mirroring existing workforce composition. This study's survey respondents said that nearly three-quarters of their current talent base is at least one-third digital. Although a broad array of occupations can make up the digital talent base, ICTC data gathered during 2021 and 2022 in Calgary finds nearly 4,000 job postings for core software roles (full-stack, back-end, UX/UI, mobile developers), over 3,500 job postings for core data roles (data engineer, data analyst, data scientist, machine learning engineer), and more than 5,000 job postings for core digital infrastructure roles (cybersecurity professional, DevOps professional, network administrator, cloud engineer).

FIGURE 19 **Digital Talent Representation**



Calgary digital economy companies. Source: ICTC, 2022.

FIGURE 20 **Digital Job Postings in Calgary**



Job postings for software, data, and digital infrastructure roles in Calgary: 2021 and 2022.
Source: ICTC eTalent, accessed June 13, 2023.

More than 80% of job postings within the digital infrastructure category are for cybersecurity professionals. Although a significant portion of these roles is associated with consulting firms (which tend to have robust cybersecurity practices that can provide a gamut of services to employers who may otherwise lack the resources to develop their own in-house teams), the strong demand suggests that businesses are increasingly prioritizing cybersecurity. This is a particularly important (and promising) development considering the acceleration of digital adoption that occurred during the pandemic. While data from Statistics Canada notes that in 2019, just over 20% of Canadian businesses reported being impacted by cybersecurity incidents,[67] a 2021 report from CyberEdge Group identified that 85% of Canadian companies experienced at least one cyberattack that year.[68] Another 61% were impacted by ransomware.[69]

67 "Cybersecurity risks impact Canadian businesses," Statistics Canada, March 10, 2022, https://www.statcan.gc.ca/o1/en/plus/514-cybersecurity-risks-impact-canadian-businesses

68 "2020 Cyberthreat Defense Report," CyberEdge Group, https://www.imperva.com/resources/resource-library/reports/2020-cyberthreat-defense-report/

69 Ibid.

KEY DIGITAL SKILLS:
SOFTWARE, DATA, OPERATIONS

Many digital roles saw substantial demand in Calgary over the last few years. Employers are confident that these roles will continue to see growth, and many seek to onboard talent in several different areas and with different levels of experience.

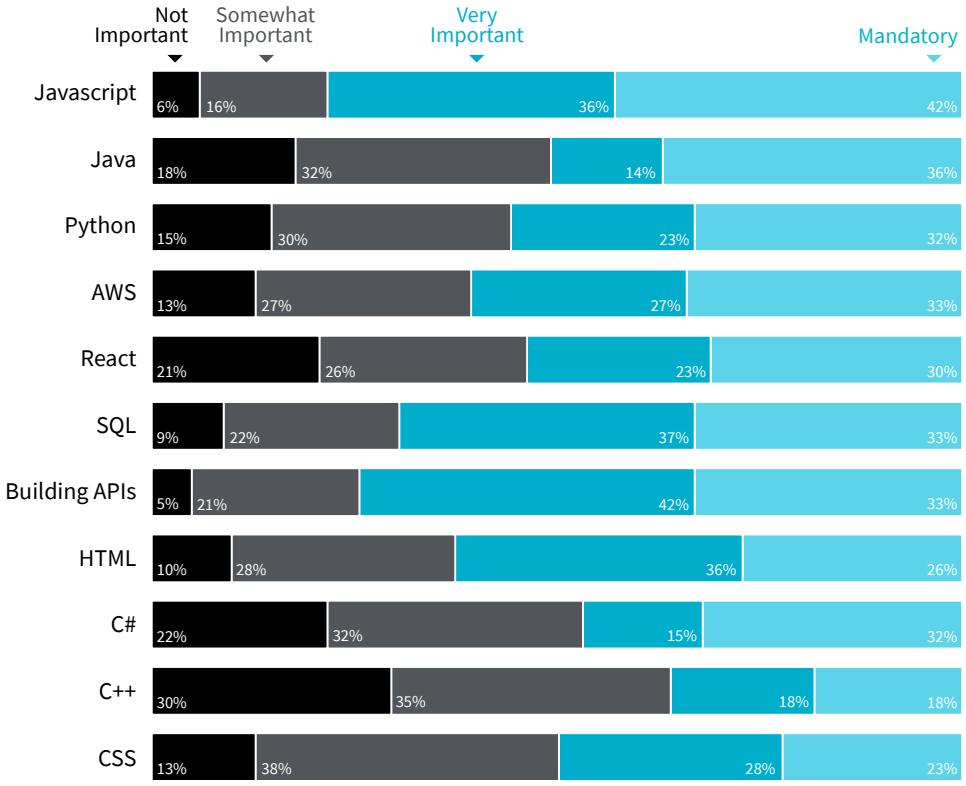
Top digital roles in Calgary can be classified under three different groups: software-related, data-related, and digital infrastructure. The software grouping includes jobs like full-stack developers, front-end developers, back-end developers, mobile developers, blockchain developers, and gameplay programmers, among others. Data-related roles include data scientists, data analysts, data engineers, machine learning engineers, AI architects, and business analysts. Digital infrastructure roles can include a blend of roles that work on software applications, as well as those that work with or interact with hardware. Examples of key roles in this space include site reliability engineers, DevOps professionals, database administrators, network administrators, cybersecurity specialists, cloud administrators, IT support personnel, and QA testers.

Although skill needs for software roles can vary depending on the nature of each business, the tech stack used, and even company size, the following digital skill sets were identified by Calgary employers as relevant. In order of importance, they are:

Proficiency with JavaScript	78%
Ability to build and maintain APIs	75%
Proficiency with SQL	70%
Proficiency with HTML	62%
Proficiency with Python	55%
Proficiency with AWS (Amazon Web Services)	53%
Proficiency with React	53%
Proficiency with CSS	51%
Proficiency with Java	50%
Proficiency with C#	47%
Proficiency with C++	36%

◀ % of employers who rate as mandatory and very important

FIGURE 21 **Skill Importance Levels of Software Roles**



Calgary, 2021. Source: ICTC, 2021.

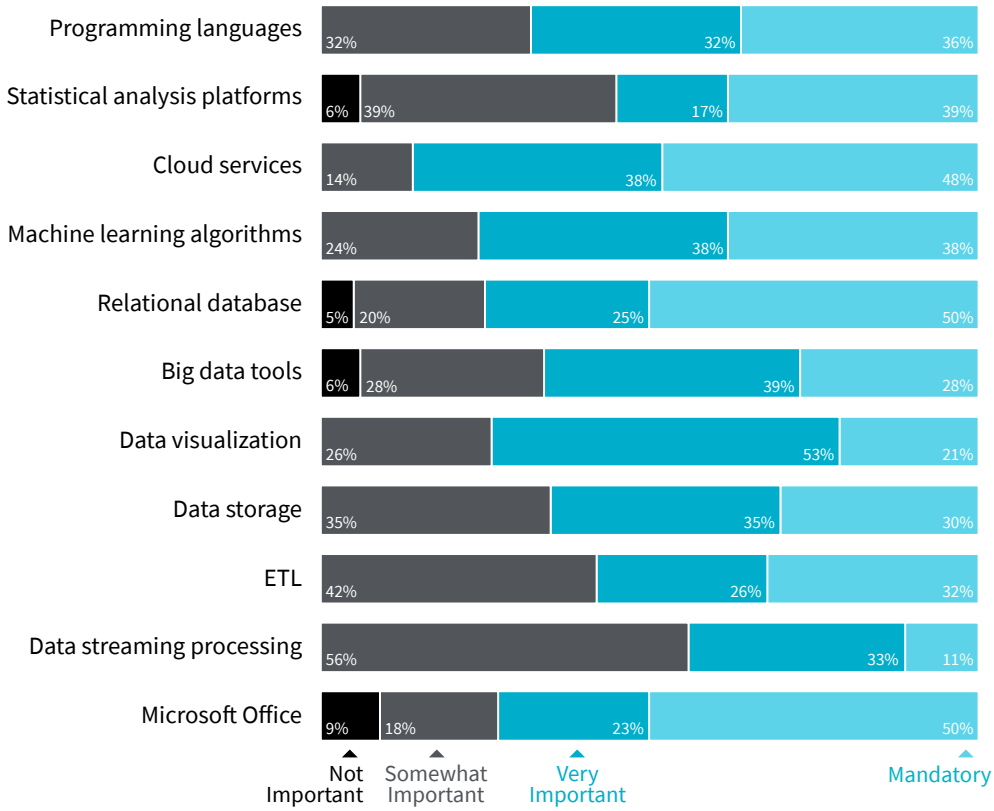
Unlike software roles, skill requirements for data roles tend to be more uniform. That is, the core skills for a data analyst working at a small versus large company or a software company versus a retail company are unlikely to change dramatically. Likewise, roles like machine learning engineers may be tasked with different day-to-day activities at a marketing company versus at a research organization, but core skill sets and competencies will resonate. The following top digital skill sets were identified as key for data roles in Calgary. In order of importance, they are:

Proficiency with cloud services	86%
Knowledge of machine learning algorithms	76%
Proficiency with relational databases	75%
Proficiency with data visualization	74%
Proficiency with Microsoft Office	73%
Proficiency with programming languages	68%
Proficiency with big data tools	67%
Proficiency with data storage	65%
ETL capabilities	58%
Proficiency with statistical analysis platforms	56%
Knowledge of data streaming processing	44%

◀ % of employers who rate as mandatory and very important

◀ Note: Proficiency with Microsoft Office, while not specific to data-related roles or in high demand, is considered very important because it is often mandatory for all data jobs as a baseline.

FIGURE 22 **Skill Importance Levels of Data Roles**



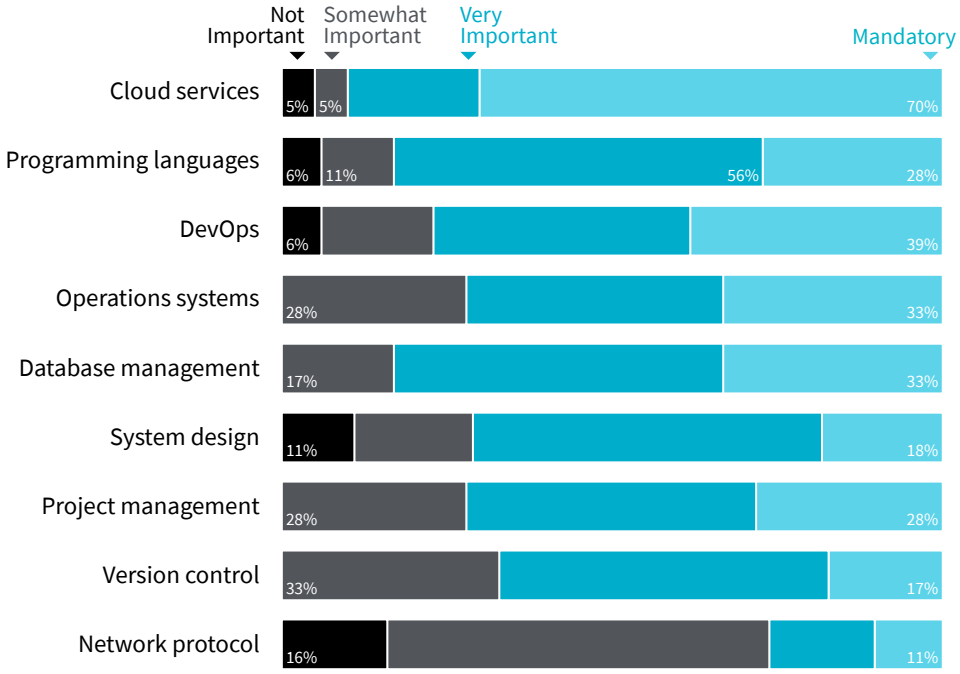
Calgary, 2021. Source: ICTC, 2021.

Lastly, digital infrastructure roles vary greatly both in terms of responsibility and skill sets. The category of digital operations includes the cybersecurity specialist, QA tester, and IT support representative. Although this grouping of occupations has the most variance, several in-demand skill sets can still be identified across the board. The following top digital skill sets were identified as key for digital infrastructure roles in Calgary. In order of importance, they are:

Proficiency with cloud services	90%
Proficiency with programming languages	84%
Database management capabilities	83%
Proficiency with DevOps	78%
Project management capabilities	72%
Proficiency with operating systems	72%
Knowledge of system design	71%
Proficiency with version control	67%
Knowledge of network protocol	27%

◀ % of employers who rate as mandatory and very important

FIGURE 23 **Skill Importance Levels of Digital Infrastructure Roles**



Calgary, 2021. Source: ICTC, 2021.

DEMAND FOR "SOFT" SKILLS

"Soft" skills, also referred to as "human skills," "transferrable skills," "durable skills," or "enabling competencies," are increasingly in-demand across all jobs. In fact, an analysis of data from more than 82 million job postings in the US, completed by the non-profit organization America Succeeds, underlines the criticality of these skills. The top 10 "durable skills" are leadership, character, collaboration, communication, creativity, critical thinking, metacognition, mindfulness, growth mindset, and fortitude.[70]

While job-specific skills can include a variety of digital skills (e.g., proficiency with programming languages, proficiency with machine learning), technical expertise or certifications (e.g., CISSP), or even domain knowledge of a particular industry, "soft" skills are mostly consistent across roles. Soft skills often act as a foundation for workers to continually build upon and/or adapt to new situations and jobs.

Numerous other studies have identified the importance of soft skills in the workplace, namely as work becomes increasingly digital. According to Harvard Business School, five core soft skills ("human skills," as they are coined in this work) are critical to thriving in the digital future: empathy, communication, adaptability, coaching, and trust building.[71]

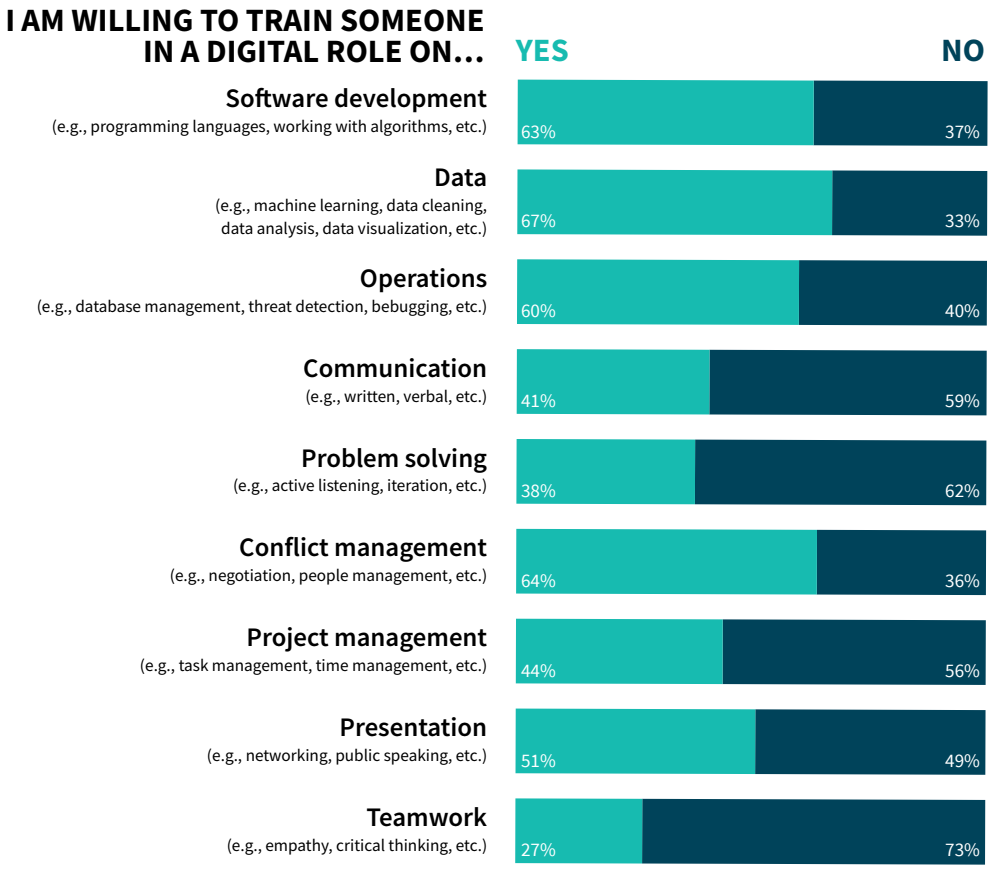
70 "The High Demand for Durable Skills," America Succeeds, April 2021, https://americasucceeds.org/wp-content/uploads/2021/04/AmericaSucceeds-DurableSkills-NationalFactSheet-2021.pdf

71 Abbey Lewis, "5 Key Human Skills to Thrive in the Future Digital Workplace," Harvard Business Publishing, July 14, 2021, https://www.harvardbusiness.org/5-key-human-skills-to-thrive-in-the-future-digital-workplace/

A 2020 study by researchers at the University of Calgary, Mount Royal University, Alberta University for the Arts, and the University of Guelph identified six core categories making up a Competencies for Life framework: problem solving (e.g., analytical thinking, creativity, curiosity), self-reliance (i.e., adaptability, determination, initiative), collaboration (e.g., conflict management, trust, emotional intelligence), communications (i.e., active listening, effective verbal communication, effective writing), core literacies (e.g., civic literacies, financial literacy, technology literacy), and core workplace skills (e.g., continuous learning, time management, professional identity). Job seekers can leverage frameworks like C4L to restructure professional profiles that better showcase these competencies, speaking to the needs of employers that are increasingly hiring for these very skills.

Although digital and technical skills can vary according to the role, the importance of soft skills emerged strongly in ICTC's employer survey and in interviews with staffing agencies in Calgary. For example, although the majority (90%) of survey respondents ranked several enabling competencies as in-demand (mandatory or very important), they were less willing to spend time training new staff on these versus job-specific digital skills. In other words, employers expect employees to come equipped with strong soft skills.

FIGURE 24 **Skills That Employers are Willing to Train New Hires On**



Calgary. Source: ICTC, 2021.

Both employers and staffing agency representatives believed that workforce transitioners tend to possess several in-demand transferable soft skills, including communications skills (verbal and written), the ability to work well on a team (and often across different time zones), strong work ethic, adaptability, and strong business acumen. Other assumed soft skills included knowledge or previous experience with project and task management, time management, results measurement, and conflict resolution. Representatives from staffing agencies felt that these skill sets could make workforce transitioners inherently good candidates for roles like project coordinators, project managers, and sales positions; and with some technical training, additional opportunities in data analysis and business intelligence, software development, and digital infrastructure operations were possible. Regardless of role, though, staffing agency representatives often advised their workforce transitioner clients to hone, harness, and "sell" these so-called soft skill sets.

It's really tough to find people that have a blend of the technical and soft skills [in the marketplace]… It's easier to find people with strong technical skills, but they may be lacking on the soft skills side.

– Calgary staffing agency representative

Although skill crosswalks are often digital or technical in nature, many employers relayed strong appreciation for workforce transitioners because of their level of self-awareness, determination, and dedication to lifelong learning. In addition to continuous learning and development, top enabling competencies—which were often required at advanced or expert levels—include analytical thinking, curiosity, adaptability, emotional intelligence, active listening, and time management.

Excellent individual. The factor of being a workforce transitioner was further reflected in their emotional and professional maturity and approach. That put them over and above equally technically qualified candidates.

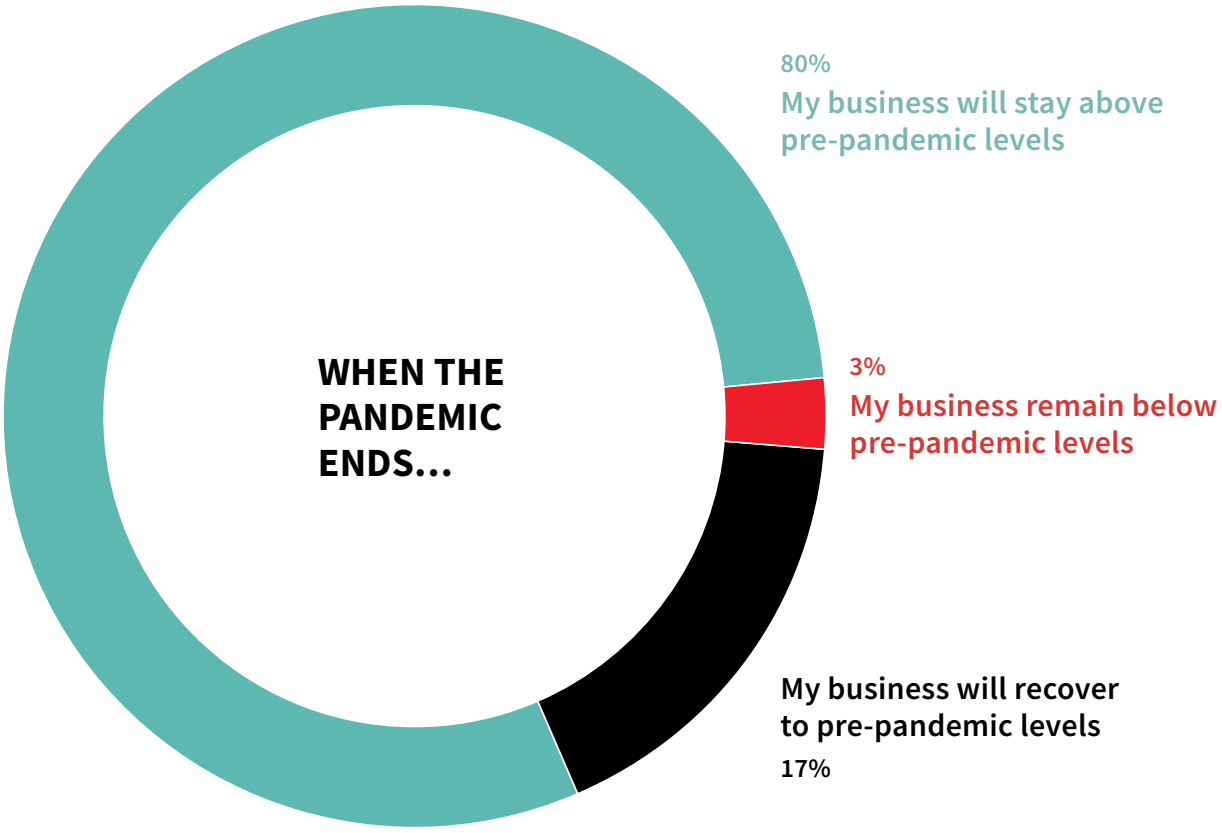
– Calgary workforce transitioner employer

AFTER THE PANDEMIC: BUSINESS SHIFTS AND LABOUR MARKET 2023 ONWARD

Like employers across Alberta, Calgary-based digital economy employers were generally optimistic about growth prospects post-pandemic. While three-quarters of Alberta employers believed growth would stay above pre-pandemic levels from 2023 onward, 80% of employers based in Calgary shared this sentiment (and only 3% believed their business prospects would be below pre-pandemic levels, compared to 11% across the province).

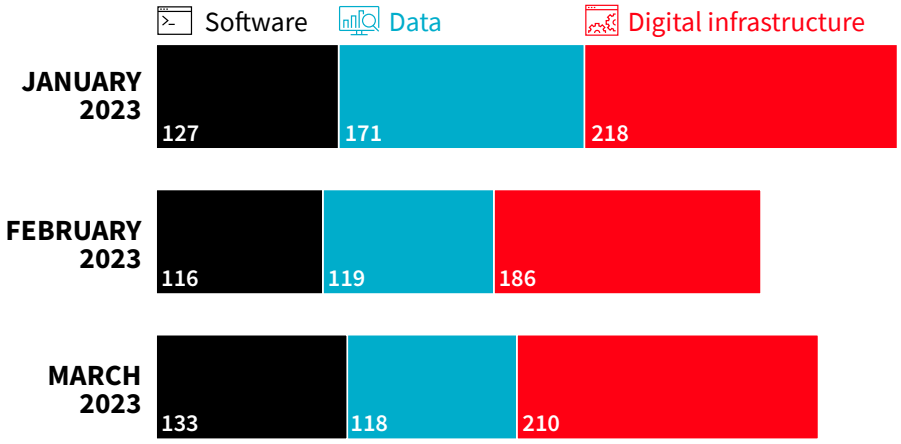
A look at recent labour market trends adds further context. Core occupational groupings like software roles, data roles, and digital infrastructure roles continue to see strong hiring momentum in Q1 2023, despite macroeconomic shifts, including rising interest rates, that threaten to soften labour market demand across the economy. From January to March 2023, Calgary saw 376 job postings for software roles, 408 job postings for data roles, and 614 postings for digital infrastructure roles. Although demand is cooler in Q1 2023 compared to the heights of Q1 2022, it remains elevated compared to Q1 2021 levels. Using job posting volume as a proxy for a labour demand in Calgary, demand for software roles was 22% higher in Q1 2023 than in Q1 2021; demand for data roles was 68% higher in Q1 2023 than in Q1 2021; and demand for digital infrastructure roles was 75% higher in Q1 2023 than in Q1 2021.

FIGURE 25 **Perceptions of Post-Pandemic Business Success**



Calgary digital economy companies. Source: ICTC, 2022.

FIGURE 26 **Digital Job Postings in Calgary: Q1 2023**



Job postings for software, data, and digital infrastructure roles in Calgary: Q1 2023.
Source: ICTC eTalent, accessed June 13, 2013.

NEW IN-DEMAND ROLES: EDGE UP 2.0: A SCALING OPPORTUNITY

Many in-demand occupations exist in Calgary's digital ecosystem, providing ample transition opportunities for displaced workers. The first phase of EDGE UP identified seven in-demand jobs and five displaced roles from the energy sector. Short-duration training allowed displaced workers to transition to in-demand roles and support Calgary businesses. Since its launch in 2019, ICTC has regularly added new in-demand jobs to the Calgary Upskill website.[72] Calgary Upskill enables the city's energy sector jobseekers to understand their "fit" for in-demand roles, including skill matches and gaps.

Research for this second phase of EDGE UP identified four new occupations with both employment demand and skill overlaps for displaced workers: back-end developers, site reliability engineers, marketing specialists, and product managers. Combined, there are now 21 in-demand occupations in Calgary's digital economy with corresponding employment pathways.

72 Calgary Upskill, www.CalgaryUpskill.ca

TABLE 1 **Upskill Jobs in Calgary**

EDGE UP 1.0 2018	ADDITIONAL ROLES 2019–2021	EDGE UP 2.0 2022
Data scientist	Full stack developer	Back-end developer
Data analyst	DevOps	Site reliability engineer
UX/UI designer	Cloud administrator	Marketing specialist
QA tester	Network administrator	Product manager
Software developer	Business analyst	
Project Manager	IT support	
Business development manager	Cybersecurity professional	
	AI architect	
	Data engineer	
	Cloud architect	

Calgary Upskill jobs. ICTC 2022.

While 21 in-demand jobs have been identified as mappable to the skills of displaced energy sector workers, the EDGE UP program provided training for roles that have both the best "fit" (or skill overlap) as well as the strongest labour market demand. As such, the two phases of the EDGE UP program offered training to individuals in the following programs:

TABLE 2 **Upskill Jobs in Calgary**

EDGE UP 1.0	EDGE UP 2.0
Full Stack Development	Product Management with specialization in Digital Product Marketing
Data Analytics	Data Analytics
IT Project Management	Cyber Security for Today's World
	Data Analytics with Clean Technology Foundations
	IT Network Management
	Full Stack Development
	AWS Cloud Training
	IT Project Management

Calgary Upskill jobs. ICTC 2022.

BACK-END DEVELOPER

A back-end developer is a software developer that is responsible for maintaining the "behind the scenes" functionalities of a website. These functionalities enable the "front end" of a website or the part that users interact with. Back-end developers manage servers, databases, and other applications that power and support websites and applications. Their responsibilities include core application coding, API development, and database connectivity.

Key technical skill sets for a back-end developer include:

- Proficiency with container technologies (Docker, Kubernetes, etc.)
- Knowledge of various programming languages used in the back end (Python, Java, PHP, etc.)
- Proficiency with SQL
- Ability to build and manage APIs
- Proficiency with cloud services (AWS, Azure, etc.)
- Proficiency with GitHub
- Proficiency with Software as a Service (SaaS) tools
- Knowledge of Front-End programming languages (JavaScript, HTML, etc.)
- Knowledge of continuous integration and continuous deployment

SITE RELIABILITY ENGINEER

Site Reliability Engineers are responsible for developing effective and efficient automated processes to support operational aspects of an organization like capacity planning, change management, and disaster recovery and response. Working increasingly within a cloud context, this role has some overlap with DevOps, especially as it relates to the automation of digital infrastructure.

Key technical skill sets for site reliability engineers include:

- Proficiency with container technologies (Docker, Kubernetes, etc.)
- Knowledge of key programming languages, especially those used in the back end (Python, Java, PHP, etc.)
- Proficiency with cloud services (AWS, Azure, etc.)
- Proficiency with cloud platforms (Heroku, etc.)
- Proficiency with open source infrastructure (Terraform, etc.)
- Knowledge of continuous integration and continuous deployment
- Proficiency with open-source operating systems (Linux, kernel, etc.)
- Proficiency with GitHub
- Proficiency with Software as a Service tools

MARKETING SPECIALIST (DIGITAL)

Marketing specialists (often the title used for digital marketers in Calgary job postings) are responsible for developing, executing, and maintaining the digital aspects of an organization's (or product's/service's) marketing and engagement strategy. Marketing specialists may design and implement social media campaigns and use digital tools to promote brand awareness, reach customers, and perform split testing.

Key technical skill sets for marketing specialists include:

- Proficiency with social media marketing
- Knowledge of digital marketing strategy and tools
- Proficiency with creative content tools (Adobe, Sketch, etc.)
- Knowledge of Search Engine Optimization (SEO)
- Proficiency with advertising on social media platforms (e.g., Facebook, Instagram, Twitter, etc.)
- Knowledge of marketing strategy and execution protocols
- Proficiency with split testing and other forms of user experience research
- Proficiency with Excel
- Proficiency with Customer Relationship Management (CRM) tools (Salesforce, etc.)
- Knowledge of Search Engine Marketing (SEM)
- Proficiency with Content Management Systems (CMS) (Drupal, WordPress, etc.)

PRODUCT MANAGER

Product managers guide the development and evolution of products, leveraging the product lifecycle to achieve results. They gather and prioritize product and customer requirements, develop the product vision, and work cross-functionally (with engineering, operations, marketing, etc.) to deliver the product, track product uptake and user experience, and adjust as needed.

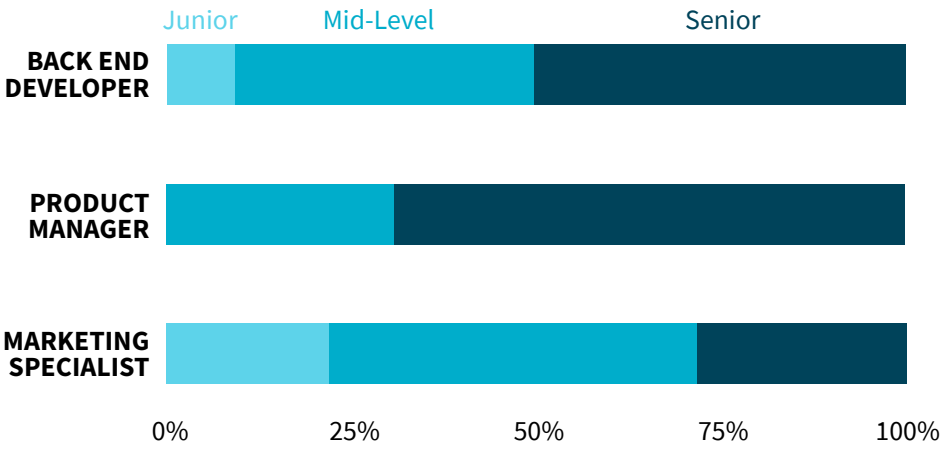
Key technical skill sets for product managers include:

- Proficiency with the Product Lifecycle
- Knowledge of product roadmap design
- Proficiency with SQL
- Proficiency with SaaS tools
- Knowledge of basic computer science principles

- Knowledge of basic marketing principles
- Knowledge of User Experience (UX) concepts
- Proficiency with cloud services (AWS, Azure, etc.)
- Proficiency with Agile Product Methodology
- Knowledge of Front-End programming languages (JavaScript, HTML, etc.)
- Proficiency with Excel
- Proficiency with results measurement frameworks (KPIs, OKRs, etc.)

Although data is not available to assess the seniority levels most often sought for site reliability engineers, mid and senior-level talent was in high demand for the remaining three roles. Employers that hired product managers—the role's very nature being management/mid-level—often sought them at senior levels; 69% of employers looked for product managers that had seven or more years of experience in the role or experience in related positions such as project management or marketing. Back-end developers were more evenly distributed between mid and senior levels, with over 90% of employers looking for developers with at least three years of experience in the field, in a related role, or with key digital and technical capabilities. Marketing specialists had the highest proportion of talent hired at a junior level—one-quarter of employers hired workers in this role with no previous related experience.

FIGURE 27 **Levels Most Often Hired for in Top Three New EDGE UP Jobs**



Calgary Upskill jobs. ICTC 2022.

PART V

FROM DISPLACED TO IN-DEMAND

The EDGE UP program was born out of a desire to engage and retain highly skilled workers displaced from Calgary's energy sector. At the height of the 2015 oil crash, it was estimated that Alberta lost over 25,000 jobs.[73] This represented the most significant labour market displacement since the recession of 1985, which shed over 45,000 jobs. Although Alberta's energy sector is not solely concentrated in Calgary, the city represents more than 30% of all provincial employment. As a result, the recession and talent loss left a deep imprint on the city's labour force. Many of the sector's displaced energy workers came from engineering and scientific backgrounds that, only years prior, were in high demand. Professionals in these occupations have deep foundational skills in science, technology, engineering, and math (STEM) and are equipped with other skill sets and competencies relevant to the city's technology sector.

73 Statistics Canada. Table 14-10-0287-03 Labour force characteristics by province, monthly, seasonally adjusted

Research completed to support the first phase of the EDGE UP in 2018 identified five core displaced occupations with mappable skills to in-demand tech jobs: petroleum engineers, geoscientists, engineering managers, electrical engineers, and chemical engineers. Skill mapping offered these workers clear guidelines on skill overlaps and mismatches and, in many ways, provided them with the tools and confidence to undertake their career transitions. The EDGE UP pilot ran from 2019 to 2021 and trained 98 displaced workers for in-demand roles in the city's digital economy.

In 2020, it became evident that the need for this program did not just persist; it accelerated. Data from Statistics Canada identified a loss of more than 38,000 jobs in Calgary's economy from March to April 2020 alone.[74] Although many impacted workers were from high-touch sectors like retail, hospitality, and tourism, the combination of lockdowns and dwindling global demand for energy products at that time had a big impact on the city's energy sector again. Approximately 15% (6,000) of all 2020 job losses were found in the fishing, forestry, mining, quarrying and oil and gas sectors.[75]

As the pandemic continued in early 2020, so did job losses, and it became clear that scaling the EDGE UP initiative and others like it was key to avoiding long-term negative impacts, including labour force scarring.[76] As a result, the EDGE UP program was provided with an opportunity to scale and facilitate employment transitions for more displaced workers. Although workers from the existing five occupations were still eligible to participate in the program, additional displaced roles were added, and the labour pool was expanded.

Collecting and analyzing data from Statistics Canada's Labour Force Survey, job boards, and other labour force databases, the following five occupations were identified as experiencing shrinking or no employment growth in the energy sector and possessing mappable skills to in-demand roles.

Accounting occupations

Finance occupations

Human resources occupations

Marketing occupations

Logistics occupations

74 Statistics Canada Labour Force Survey, April 2020.

75 Ibid.

76 Damage done to economies and the labour force that manifests in long-term unemployment has on future labour markets; examples include permanent (or long-term) displacement of certain roles—for example, the longer one remains unemployed, the more difficult it becomes to re-enter the labour market.

APPETITE FOR WORKFORCE TRANSITIONERS GROWS: LIFELONG LEARNING INCREASINGLY EXPECTED

Calgary digital economy employers show a general openness to hiring from diverse talent pools, including workforce transitioners. Over 85% of survey respondents were interested in hiring a workforce transitioner, with many believing that these individuals possess relevant skills and knowledge that can be applied to their in-demand roles. Additionally, more than 60% of employers had previously hired a workforce transitioner, half (52%) originally from the energy sector. Of the employers that hired workforce transitioners, nearly all noted positive experiences; 95% stated that they would likely hire a workforce transitioner again.

FIGURE 27 **Openness to Hiring Workforce Transitioners**

Calgary employers. Source: ICTC, 2021.

Employers increasingly believe that a clear commitment to lifelong learning is no longer just a "nice to have"—in fact, two-thirds of employers surveyed in this study expect it. This sentiment is corroborated by the OECD's recent Skills Outlook 2021 report. This study finds that with accelerated digitization and automation, workers will need to better adapt and "proactively engage in lifelong learning," including continuously building new competencies, abilities, and knowledge.[77]

FIGURE 28 Perceptions of Continuous Skill Development

Calgary employers.
Source: ICTC, 2021.

In a very short time, they had acquired a lot of skills for their new career path, and this showed that they are a very good learner.

– Calgary workforce transitioner employer

[The workforce transitioner] showed exceptional initiative and had related experience from [their past industry…willing to join at a salary level that took into account [their] lack of experience in our industry. [They] were a very hard worker, highly motivated to provide value to the business.

– Calgary workforce transitioner employer

77 "OECD Skills Outlook 2021: Learning for Life," OECD, https://www.oecd-ilibrary.org/sites/f37893af-en/index.html?itemId=/content/component/f37893af-en#section-d1e883

THE SKILL CROSSWALK: NEW DISPLACED OCCUPATIONS IN THE ENERGY SECTOR TO IN-DEMAND JOBS IN CALGARY'S DIGITAL ECONOMY

Professionals in five key occupational categories (accounting, finance, marketing, human resources, logistics) were found to have educational backgrounds, skills, and experiences that fit well with top occupations in Calgary's digital economy. These occupations were displaced or shrinking in the energy sector, and with short-duration training, participants could gain key skills and competencies needed for in-demand roles.

TABLE 3 Top Job Titles of Displaced Workers in Selected Occupational Groupings

ACCOUNTING	FINANCE	MARKETING	HUMAN RESOURCES	LOGISTICS
Production Accountant	Financial Accountant	Marketing Manager	HR Analyst	Project Procurement Manager
Controller	Financial Reporting Manager	Marketing Coordinator	HR Advisor	Procurement Specialist
Operations Accountant	Treasury Analyst	Marketing Analyst	HR Specialist	Logistics Manager
Accounting Manager	Financial Reporting Manager	Marketing Assistant	HR Director	Logistics Supervisor
Revenue Accountant	Financial Reporting Analyst	Communications Assistant	HR Information Systems Analyst	Supply Chain Analyst

Top job titles of displaced workers in each of the five occupational groupings, Calgary. ICTC, 2022.

Data associated with the above job categories, including from Canada's National Occupation Classification (NOC) framework, the O*NET framework, job postings, key informant interviews, and focus groups with displaced workers, was used to identify and map employment pathways. The following offers a detailed overview of the total "fit" to in-demand jobs and specific skill matches and gaps.

ACCOUNTING PROFESSIONALS

Total Match: Accounting Professionals to In-Demand Jobs in Calgary's Digital Economy

TABLE 4

IN-DEMAND JOB	ACCOUNTING
Project Manager	55%
Business Analyst	52%
Business Development Manager	50%
Data Analyst	48%
Data Scientist	46%
Product Manager	45%
QA Tester	43%
Cloud Administrator	43%
Cloud Architect	37%
Network Administrator	37%
IT Support	37%

DevOps	37%
Cybersecurity professional	36%
Full Stack Developer	35%
Data Engineer	35%
AI Architect	35%
Marketing Specialist	35%
Back-End Developer	33%
Software Developer	32%
Site Reliability Engineer	30%
UX/UI Designer	28%

Skill crosswalk: accounting professionals to in-demand jobs. ICTC 2022.

Skill Matches and Gaps: Accounting Professionals to In-Demand Jobs in Calgary's Digital Economy

✓ SKILL MATCHES	✕ SKILL GAPS
Some understanding of logic-based decision making	Understanding of Agile methodology
Strong customer relations, communication, and stakeholder management skills	Project management practices, principles, and tools, including Microsoft Project, Access
Strong people management skills, with the ability to coach and mentor staff	Strong research skills, including experience conducting complicated technical research
Proficiency with Microsoft Office, including experience creating complex Excel macros	Proficiency with modern programming languages like Python, Ruby, JavaScript, and/or SQL
Strong understanding of math and statistics	Strong database management skills via tools like MySQL, Oracle, MongoDB
Business analysis skills, related to technology needs	Familiarity with test automation and bug tracking tools like Jira, Wrike, Asana, Selenium
Experience working with Enterprise Resource Planning (ERP) and Financial systems (SAP, Peoplesoft, Hyperion)	Knowledge of process design and modelling
Domain knowledge about finance and accounting	Holistic understanding of quality assurance skills, processes and practices
Strong system audit skills	Basic domain knowledge of the digital/technology sector
Strong teamwork skills, with the ability to work across departments in an organization	Proficiency with cloud computing platforms such as AWS, Microsoft Azure, Google Cloud, IBM Bluemix
Knowledge of basic principles of data analytics, with some experience analyzing large data sets	Proficiency with data visualization tools like Tableau, Microsoft PowerBI, DJ3.js, Node.js
Basic data sorting, storage, and management skills	Strong project management skills, including the ability to manage various moving pieces of a project
Understanding of business intelligence and analytics metrics.	
Understanding of procurement and contracting processes	

FINANCE PROFESSIONALS

Total Match: Finance Professionals to In-Demand Jobs in Calgary's Digital Economy

TABLE 5	IN-DEMAND JOB	FINANCE
	Project Manager	57%
	Business Analyst	55%
	Business Development Manager	52%
	Data Analyst	50%
	Data Scientist	50%
	QA Tester	48%
	Cloud Administrator	46%
	Product Manager	45%
	DevOps	41%
	Full Stack Developer	41%
	Data Engineer	41%
	Back-End Developer	40%
	Cybersecurity Professional	40%
	IT Support	39%
	Cloud Architect	39%
	Network Administrator	39%
	AI Architect	38%
	Software Developer	38%
	Marketing Specialist	35%
	Site Reliability Engineer	34%
	UX/UI Designer	31%

Skill crosswalk: finance professionals to in-demand jobs. ICTC 2022.

Skill Matches and Gaps: Finance Professionals to In-Demand Jobs in Calgary's Digital Economy

✔ SKILL MATCHES	✕ SKILL GAPS
Basic data sorting, storage, and management skills	Strong understanding of project management practices, principles, and experience with tools including Microsoft Project, Access
Business analysis skills, related to technology needs	Understanding of Agile methodology
Experience working with ERP and Financial systems (SAP, Peoplesoft, Hyperion)	Familiarity with test automation and bug tracking tools like Jira, Wrike, Asana, Selenium
Knowledge of basic principles of data analytics, with some experience analyzing large data sets	Holistic understanding of quality assurance processes and practices
Knowledge of process design and modelling	Basic domain knowledge of the digital/technology sector
Basic understanding of data science and holistic understanding of data analysis	

Domain knowledge of finance and accounting

Proficiency with Microsoft Office, including experience creating complex Excel macros

Proficiency with R

Understanding of logic-based decision making

Strong customer relations, communication, and stakeholder management skills

Strong people management skills, with the ability to coach and mentor staff

Strong research skills, including experience conducting complicated technical research

Strong system audit skills

Strong understanding of math and statistics

Understanding of business intelligence and analytics metrics

Proficiency with cloud computing platforms such as AWS, Microsoft Azure, Google Cloud, IBM Bluemix

Proficiency with modern programming languages like Python, Ruby, Javascript, and/or SQL

Strong database management skills via tools like MySQL, Oracle, MongoDB

Strong project and task management skills, including the ability to manage various moving pieces of a project

Strong problem-solving skills and basic knowledge of troubleshooting

Superior presentation skills, with the ability to showcase value propositions to clients

MARKETING PROFESSIONALS

Total Match: Marketing Professionals to In-Demand Jobs in Calgary's Digital Economy

TABLE 6

IN-DEMAND JOB	MARKETING
Marketing Specialist	66%
Business Development Manager	65%
Project Manager	52%
QA Tester	49%
Business Analyst	44%
Cloud Administrator	43%
Product Manager	43%
Cloud Architect	38%
UX/UI Designer	37%
Full Stack Developer	36%
Cybersecurity Professional	35%
IT Support	35%
Network Administrator	35%
Data Scientist	31%
Data Analyst	30%
DevOps	29%
AI Architect	29%
Back-End Developer	27%
Software Developer	26%
Data Engineer	26%
Site Reliability Engineer	23%

Skill crosswalk: marketing professionals to in-demand jobs. ICTC 2022.

Skill Matches and Gaps: Marketing Professionals to In-Demand Jobs in Calgary's Digital Economy

✓ SKILL MATCHES	✕ SKILL GAPS
Proficiency with web design and web marketing basics, including market-focused strategies, consumer experience marketing	Understanding of Agile methodology
Understanding of design thinking	Possess basic domain knowledge of the digital/technology sector
Strong project management practices, principles, and tools, including Microsoft Project, Access	Familiarity with test automation and bug tracking tools like Jira, Wrike, Asana, Selenium
Strong customer relations, communication, and stakeholder management skills	Knowledge of process design and modelling
Strong research skills, including experience conducting complicated technical research	Holistic understanding of quality assurance skills, processes and practices
Strong people management skills, with the ability to coach and mentor staff	Understanding of user experience and user interface principles and practices
Proficiency with Microsoft Office, including experience creating complex Excel macros	Experience using CMS (WordPress, Drupal…)
Strong project and task management skills, including the ability to manage various moving pieces of a project	Experience with graphic tools (Adobe Creative Cloud, Canva, Affinity Designer…)
Business analysis skills, including those related to technology needs	Product management skills
Superior presentation skills, with the ability to showcase value propositions to clients	Experience with product models (physical, digital, SaaS)
Strong teamwork skills, with the ability to work across departments in an organization	Proficiency with data visualization tools like Tableau, Microsoft PowerBI, DJ3.js, Node.js
Basic data sorting, storage and management skills	Proficiency with modern design platforms like Dreamweaver and wireframes and prototype development
Understanding of business intelligence and analytics metrics	
Experience working with customers, vendors and clients	
Proficiency with CRM (Salesforce…)	
Some knowledge of business development practices and experience with sales (including industry-specific)	
Experience managing social media accounts and campaigns (Meta, Instagram, Twitter…)	
Experience using digital marketing tools (SEO, PPC, Google Analytics...)	
Proficiency with modern marketing techniques	
Understanding of procurement and contracting processes	
Experience working with ERP and Financial systems (SAP, Peoplesoft, Hyperion)	

HUMAN RESOURCES PROFESSIONALS

Total Match: HR Professionals to In-Demand Jobs in Calgary's Digital Economy

TABLE 7	IN-DEMAND JOB	HUMAN RESOURCES
	Business Development Manager	59%
	Project Manager	53%
	QA Tester	44%
	Marketing Specialist	41%
	Product Manager	40%
	Business Analyst	40%
	Cloud Administrator	38%
	Cloud Architect	33%
	Full Stack Developer	32%
	IT Support	32%
	Network Administrator	32%
	UX/UI Designer	31%
	Cybersecurity professional	30%
	Data Scientist	27%
	Data Analyst	25%
	DevOps	25%
	AI Architect	24%
	Software Developer	22%
	Data Engineer	22%
	Back-End Developer	21%
	Site Reliability Engineer	20%

Skill crosswalk: Human resources professionals to in-demand jobs. ICTC 2022.

Skill Matches and Gaps: HR Professionals to In-Demand Jobs in Calgary's Digital Economy

✓ SKILL MATCHES	✕ SKILL GAPS
Basic data sorting, storage and management skills	Understanding of Agile methodology
Business analysis skills, including those related to technology needs	Knowledge of process design and modelling
Experience working with customers, vendors and clients	Familiarity with test automation and bug tracking tools like Jira, Wrike, Asana, Selenium
Experience working with ERP and Financial systems (SAP, Peoplesoft, Hyperion)	Experience managing social media accounts and campaigns (Meta, Instagram, Twitter…)
Possess basic domain knowledge of the digital/technology sector	Experience using CMS (WordPress, Drupal…)
Proficiency with Microsoft Office, including experience creating complex Excel macros	

Knowledge of project management practices, principles, and tools, including Microsoft Project, Access

Strong customer relations, communication, and stakeholder management skills

Strong teamwork skills, with the ability to work across departments in an organization

Strong project management skills, including the ability to manage various moving pieces of a project

Strong people management skills, with the ability to coach and mentor staff

Strong research skills, including experience conducting complicated technical research

Superior presentation skills, with the ability to showcase value propositions to clients

Understanding of business intelligence and analytics metrics

Understanding of negotiation principles and practices

Experience using digital marketing tools (SEO, PPC, Google Analytics...)

PMP certificate

Domain knowledge about finance and accounting

Product management skills

Proficiency with CRM (Salesforce, CAS, …)

LOGISTICS PROFESSIONALS

Total Match: Logistics Professionals to In-Demand Jobs in Calgary's Digital Economy

TABLE 8

IN-DEMAND JOB	LOGISTICS
Project Manager	37%
Business Development Manager	36%
Business Analyst	31%
QA Tester	30%
Product Manager	29%
Cloud Administrator	28%
DevOps	27%
IT Support	26%
Cloud Architect	25%
Network Administrator	25%
Cybersecurity Professional	24%
Data Scientist	23%
Marketing Specialist	22%
Site Reliability Engineer	22%
Full Stack Developer	22%
Data Analyst	22%
Data Engineer	20%
UX/UI Designer	20%
AI Architect	19%
Back-End Developer	17%
Software Developer	17%

Skill crosswalk: logistics professionals to in-demand jobs. ICTC 2022.

Skill Matches and Gaps: Logistics Professionals to In-Demand Jobs in Calgary's Digital Economy

✓ SKILL MATCHES	✕ SKILL GAPS
Basic data sorting, storage and management skills	Understanding of Agile methodology
Business analysis skills, including those related to technology needs	Proficiency with cloud computing platforms such as AWS, Microsoft Azure, Google Cloud, IBM Bluemix
Experience working with customers, vendors and clients	Proficiency with modern programming languages like Python, Ruby, JavaScript, and/or SQL
Experience working with ERP and Financial systems (SAP, Peoplesoft, Hyperion)	Strong research skills, including experience conducting complicated technical research
Knowledge of basic principles of data analytics, with some experience analyzing large data sets	Superior presentation skills, with the ability to showcase value propositions to clients
Knowledge of process design and modelling	Familiarity with test automation and bug tracking tools like Jira, Wrike, Asana, Selenium
Holistic understanding of quality assurance skills, processes, and practices	PMP certificate
Basic domain knowledge of the digital/technology sector	Product management skills
Domain knowledge about finance and accounting	Proficiency with data visualization tools like Tableau, Microsoft PowerBI, DJ3.js, Node.js
Proficiency with Microsoft Office, including experience creating complex Excel macros	Sales experience
Strong customer relations, communication, and stakeholder management skills	Strong database management skills via tools like MySQL, Oracle, MongoDB
Knowledge of project management practices, principles, and tools, including Microsoft Project, Access	Understanding of design thinking
Strong teamwork skills, with the ability to work across departments in an organization	
Strong project management skills, including the ability to manage various moving pieces of a project	
Understanding of math and statistics	
Understand procurement and contracting processes	

CONCLUSION

Rapid and accelerated growth has defined the Canadian digital economy over the last decade. Despite a generally cooling overall economy in 2023, digital workers remain largely in demand across sectors. The same is true for Alberta and Calgary, which have each experienced high employment growth despite the pandemic that shook the world. In December 2022, employment in Alberta's digital economy was more than 26% above pre-pandemic levels, and key digital, technical, and business roles continued to see high demand with no signs of a slowdown. This upward trajectory is echoed in Calgary's digital economy: from February 2020 to December 2022, digital economy employment grew by more than 30%. This sentiment of growth is also found among Calgary's digital economy employers, many of whom hold a positive outlook on business and revenue opportunities and talent needs going forward. Some 90% of employers surveyed expect to continue to build their talent base, and many are competing for talent in areas like software development, data, and digital infrastructure.

The first phase of research to support the EDGE UP program identified seven in-demand jobs across the digital economy and five displaced energy sector occupations that, with short-duration training, could lend themselves to transition. Over the years, more in-demand jobs were added, and phase one of EDGE UP trained 98 displaced workers. The second phase of EDGE UP expanded the pool of displaced workers and in-demand roles and helped more than 300 Calgarians transition to in-demand jobs in tech.

Although displaced or shrinking in the energy sector, newly identified displaced roles already share key technical, business, and "soft" skill requirements needed for in-demand jobs in the city's digital economy. A human resources professional, for example, is already a 59% match for a business development role and a 44% match for a QA testing role; a marketing specialist, on the other hand, is already a 52% match for a project management role and a 43% match for a cloud administrator role. Employment pathways for 10 displaced occupations in Calgary's energy sector to 21 in-demand jobs are available on www.CalgaryUpskill.ca.

APPENDIX

RESEARCH METHODOLOGY

The data and analysis supporting this study is rooted in a combination of primary and secondary research.

PRIMARY RESEARCH

The primary research portion of this study comprised six key components: an employer survey of Calgary digital economy companies, key informant interviews with staffing firms and recruiters, a displaced worker focus group, consultations with business development professionals, web scraping, and input from the EDGE UP project advisory committee.

Employer Survey

ICTC developed and deployed an employer survey to better understand employer labour force needs. Among other questions, employers were asked to identify in-demand occupations in Calgary's digital economy over the last few years, employment impacts associated with the pandemic, jobs in demand based on volume versus jobs in demand based on specialization, key hard and soft skills required for in-demand roles, levels of experience most often sought, perceptions and experiences with career transitioners, willingness to train for key skills, and willingness to hire career transitioners in the future. A total of 105 usable responses were received to the survey; incentives were offered to boost participation.

Key Informant Interviews

Seven key informant interviews were completed with staffing firms in Calgary that specialize in placements for the technology sector and/or technology-related roles. Among other things, representatives from these firms were asked to discuss changes to the recruitment pipeline during the pandemic, top jobs they hire for, roles seeing a decline in placements, previous experience with workforce transitioners, and opportunities and challenges to placing workforce transitioners.

Displaced Worker Focus Groups

After identifying the five new occupational groupings with mappable skills to in-demand roles, ICTC held a focus group with displaced energy workers from those occupational groupings in early 2022. Although initial interest in the focus groups was significant, and ICTC offered incentives for participants to attend, only eight participants attended in the end. These participants offered insight into areas like key digital and soft skills they possess, proficiency levels for key skills (e.g., skills they have at an advanced vs. beginner level), educational backgrounds, experiences gained on the job at previous roles, other training taken during their previous occupations (online, in-class, or informal).

Consultations With Business Development Representatives

While the employer survey was still in the field, ICTC attended employer roundtables hosted by Calgary Economic Development to better understand hiring needs and challenges, and held separate consultations with business development professionals that support Calgary Economic Development's activities. Five professionals attended a one-hour meeting. They provided insights into recent investments in the city, discussed talent needs as relayed by investors, and provided feedback on anticipated near and long-term investments. This knowledge allowed ICTC to consider future talent pipelines that may be in demand once those investments materialize or ramp up.

Web Scraping

ICTC built scrapers to collect data on key jobs across Calgary's digital economy. Data was collected monthly for the previously identified jobs in Calgary's digital economy, as well as the new jobs identified via the employer survey and/or key informant interviews. Monthly data collected includes job ID, job counts, location, job description and skills. Insights were also gained from the employer survey, other research on skill importance, O*NET and more. The combination was used to complete employment crosswalks from displaced to in-demand occupations.

Engagement With the EDGE UP Project Advisory Committee

Throughout the course of this study, ICTC representatives participated in the EDGE UP project advisory committee meetings. During these meetings, ICTC provided updates on the status of the research, discussed key training pathways and educational programming options, and obtained feedback from the advisory committee on important research tools like the employer survey.

SECONDARY RESEARCH

The secondary research completed during this study includes an analysis of existing secondary data, a literature review, and two environmental scans. Sources include Statistics Canada, O*NET, Calgary Economic Development literature and data dashboards, Government of Alberta statistics, OECD, IMF, Harvard Business Review, WIRED, and more.

LIMITATIONS OF RESEARCH

SURVEY RESPONSES

Although the survey received over 150 responses, some were incomplete. That is, not all employers answered all questions, making full comparisons challenging. Moreover, some responses showed evidence of being automated (sometimes prevalent in surveys that offer incentives), including the presence of blank submissions or other errors (e.g., the same response for every question)—as such, several responses were removed, leaving a usable sample of 105. Survey responses were also not detailed enough in terms of industry selection to be able to glean meaningful results from technology sub-sectors (e.g., technology companies specializing in fintech vs. digital health).

DISPLACED WORKER FOCUS GROUPS

Although the displaced worker focus groups provided important insights into the skills and experiences possessed by displaced energy workers in the five new occupations identified, the sample size of attendees is too small to draw tangible conclusions. Instead, this data was leveraged as a validator of information gathered from other sources, including key informant interviews, the employer survey, O*NET, and web scraping.