Canada's Got Tech Talent

Canada's tech workers and their compensation

Angus Lockhart and Viet Vu | June 2024
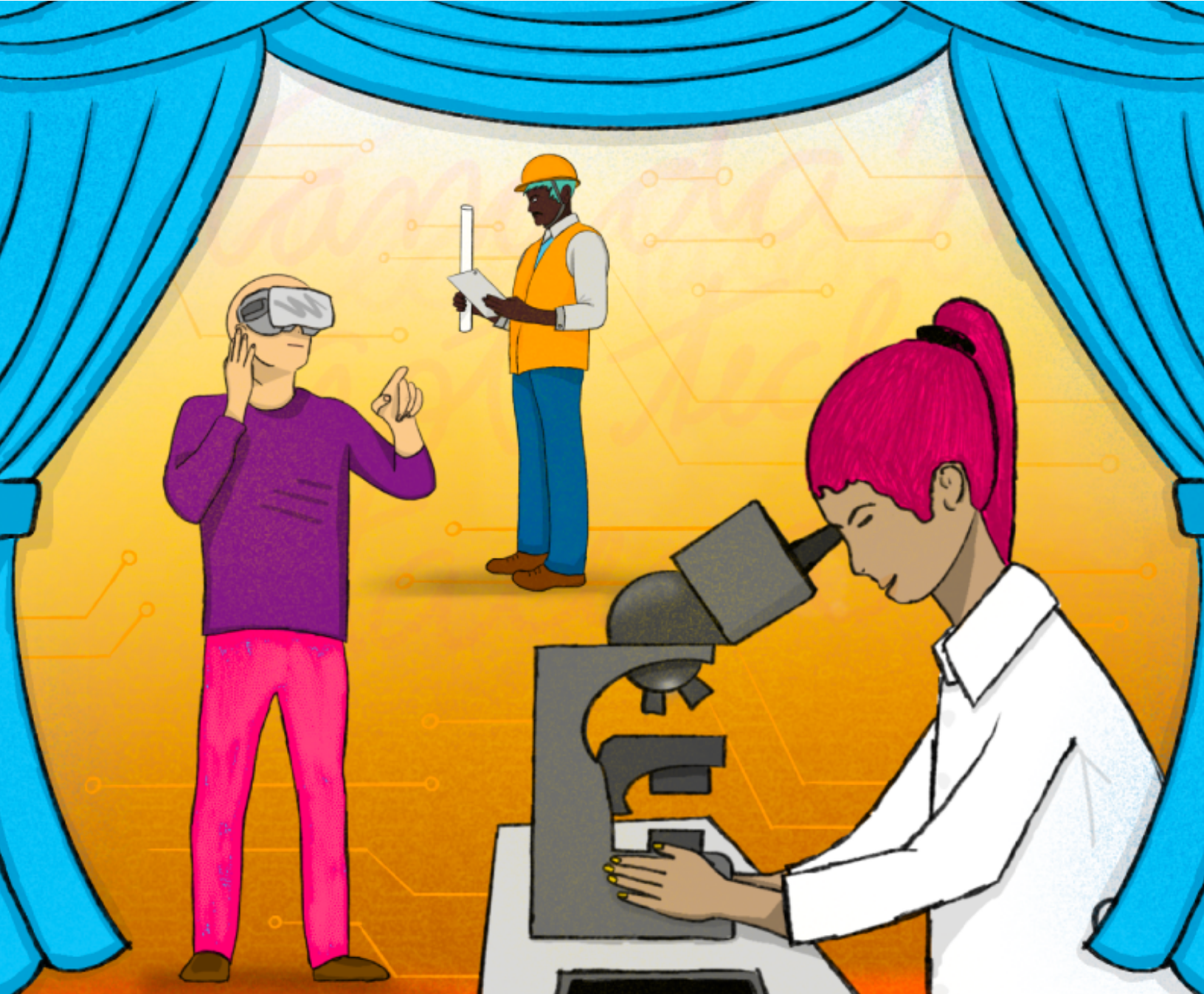
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1 Introduction and Key Findings

The development of ChatGPT, alongside the boom and bust experienced by other prominent technologies (such as blockchain and the metaverse) have captured the attention of many people. Such fascination, particularly in Canada, is well founded, as technology has an important role to play in bolstering Canada's sluggish productivity. However, technology can only solve the productivity crisis if it is value-adding, as opposed to value-exploiting. To ensure that technology benefits all those in Canada, we need to study the workforce that creates it and the specifics of their jobs and compensation.

Leveraging a skills-based definition of tech workers that we developed, we use data from the 2021 Canada long-form census to explore the landscape of tech workers in Canada. In this first chapter of a multi-part series, called *Canada's Got Tech Talent*, we focus on the overall volume of tech workers, as well as issues related to their pay. We then compare this to the snapshot that was taken in the 2016 census, particularly in understanding how the tech workforce has evolved and changed.

We find that:

- Canada has nearly **one million tech workers across the country**. The most common tech job category in Canada is currently "information systems specialists", where workers with this title hold nearly 150,000 jobs.

- Ontario is the most tech-intensive province in the country — 5.8 percent of workers in Ontario are engaged in tech work, and Ontarian tech workers make up almost half of all tech workers in Canada. Comparatively, in most Atlantic Canadian provinces, less than three percent of workers are engaged in tech work.

- **The share of Canada's workforce engaged in tech work has declined** since 2016. Now, 4.7 percent of workers in Canada are engaged in tech work, whereas in 2016 the total was 5.1 percent. From 2016 to 2021, the size of the non-tech workforce grew significantly faster than the size of the tech workforce.

- Tech work in Canada remains very well paid compared to other occupations domestically, though the gap with non-tech work has narrowed since 2016. On average, Canadian **tech workers earn $40,000 more per year than workers employed in other fields**; however, Canada's tech workers are still underpaid compared to the same occupations in the United States.

- Tech pay varies significantly across metropolitan areas within Canada — in Vancouver, tech workers make $102,479, a premium of 91 percent over the average non-tech worker, compared to Québec City where tech workers only earn 50 percent more than non-tech workers with an average salary of just over $75,000.

- Just 0.2 percent of tech workers (1,960 individuals) declared more than $250,000 in capital gains on their personal taxes in 2021, compared to 0.15 percent of non-tech workers.

This first chapter serves as a beginning of our comprehensive analysis of the talent that makes up the technology workforce in Canada. When our analysis is complete, this analysis will allow readers to gain a comprehensive picture into the state of tech workers in Canada, and equip them with the right insights to improve an important component of the Canadian economy.

2 Data Sourcing

To engage in this analysis, we rely mainly on the 2021 Canadian long-form Census of Population microdata - individual level records with every Canadian's demographic information - accessed through Statistics Canada's Research Data Centre. The long-form census is conducted every five years as part of the Census of Population in Canada. During each census period, a quarter of all respondents are asked to complete a significantly more extensive questionnaire covering a range of topics including labour market activities, income, education, and more. The exception to this was in 2011 when the long-form census was made optional, resulting in data that is less directly comparable with other iterations.

Additionally, Statistics Canada is able to match long-form census responses with existing data from other administrative sources, including income tax data and immigration data, to create a rich dataset with information on the lives of Canadians that can be accessed through the Canadian Research Data Centre Network.

Important to this research, the long-form Census includes detailed information on Canadians' occupation and industry, along with socio-demographic information on other characteristics including gender, visible minority identities, and more.

The most recent iteration of the Census took place in May 2021. This is important to acknowledge as that was in the midst of the COVID-19 pandemic when many parts of daily life were significantly impacted by disruptions to the labour market. However, past research has shown that tech work was more resilient to the impacts of the global pandemic than other occupations.[1]

3   How We Define Tech Workers

There are no standard approaches to defining tech workers. However, tech workers have frequently been defined using one or more of the following three broad approaches: by identifying sectors of the economy in which someone is employed,[2] by manually categorizing specific occupations into tech or non-tech categories,[3] or by employing a common standard to assess each occupation by their digital skills needs, to establish a set of occupations that require high levels of technical competencies.[4]

The approach we use for this study is based on a skills-based definition as established in previous work.[5] We believe this is the preferred approach as it allows for direct temporal comparison of tech worker trends. In addition, given the definition employed (which we detail below), we can also ensure that the set of occupations that we define as "tech" captures the most technically-intensive occupations at any one point, to directly consider the changing nature of tech work itself. Such changes to the definition for the period covering 2006 and 2021[6] in Canada were explored previously in Race Alongside the Machines (2022), further solidifying our basis for using this definition for this report.

Specifically, we rely on the US Department of Labour's O*NET database — cross-walked to Canadian occupations[7] —which tracks skills, knowledge, and work activities for occupations and assigns them scores based on the level of the skill and how important the skill is to the occupation. Level of skill in this case refers to the measure of complexity at which one is required to know the skill, and is measured on a scale from one to seven, with

unique anchor points for each skill. Importance of a skill to an occupation is measured uniformly on the same five-point scale with one representing "Not at all important" and five representing "Very important".

We focus on six skills, knowledge, and work activities that constitutes tech attributes of work:

- **Interacting with Computers:** Using computers and computer systems (including hardware and software) to program, write software, setup functions, enter data, or process information.

- **Computers and Electronics:** Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

- **Programming:** Writing computer programs for various purposes.

- **Technology Design:** Generating or adapting equipment and technology to serve user needs.

- **Engineering and Technology:** Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

- **Telecommunications:** Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.

Because these scales are ordinal (that is, while going from a 1 to a 2 or a 2 to a 3 on a scale both mean increasing that score, they do not necessarily mean the same degree of increase, nor is a 4 necessarily twice as important or complex as a 2, and the level scales are not directly comparable across different skills, we do not rely on averages of the actual attributed values. Instead, we take the product of level and importance for a skill, and rank all represented occupations on that combined metric for each of these six attributes. Combining these metrics this way is in line with recommendations from O*NET to incorporate the information from both scales.

We then combine all six skills, work activities, and knowledges by taking the harmonic mean of their scores. Using harmonic means rather than geometric means results in occupations that score highly on any given metric qualifying as tech work, rather than penalizing them for having any specific activity with a low score. We detail this approach in our separate detailed methodology report.

This leaves a single numeric score attached to every occupation. Consistent with the approach taken in our report Who Are Canada's Tech Workers? (2019), we classify the top five percent of jobs on this metric as tech work.

Figure 1: Defining Tech Occupations
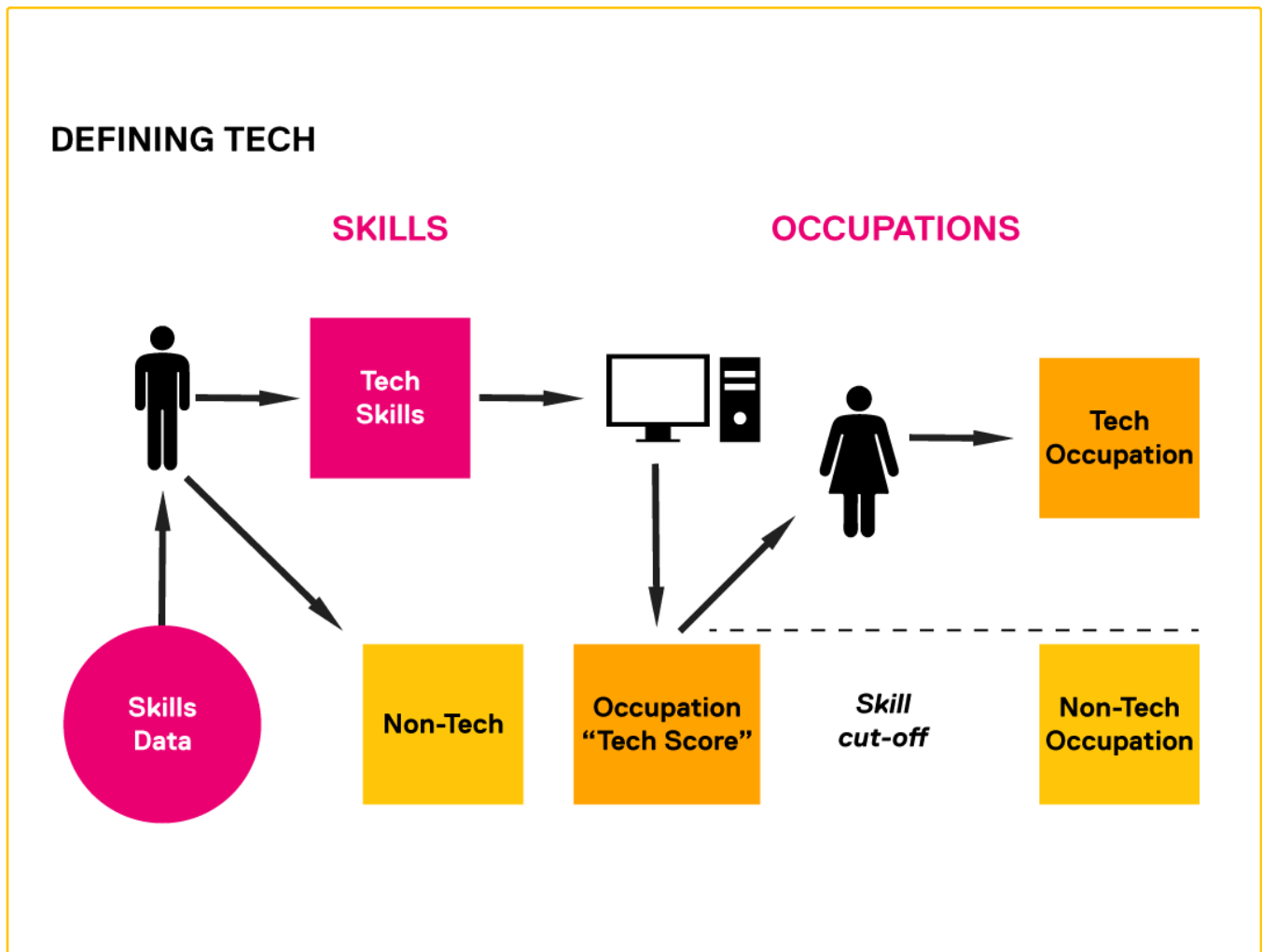
4 Canada's Tech Workers
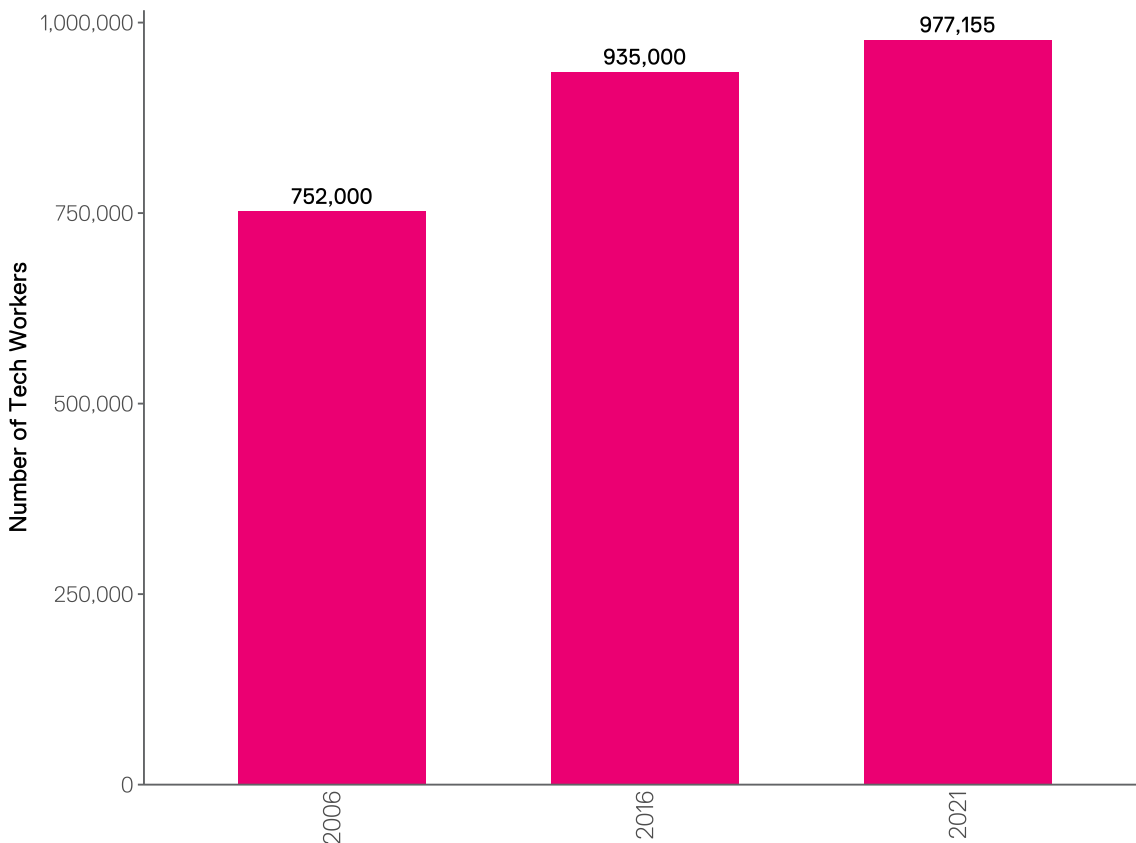
Using the above definition of tech work, we find that just under five percent of workers in Canada are tech workers.

Table 1: Size of the tech workforce in Canada

Occupation	Number of Workers	Share of workforce
Tech	977,155	4.7%
Non-tech	19,653,360	95.3%

**Figure 2:** Number of tech workers in Canada over time

Source: 2021 Long Form Census

In 2016, there were 935,000 tech workers in Canada—which means that the size of the tech workforce in Canada has nominally increased.

However, the share of this workforce as a share of the overall labour force in Canada has shrunk between 2016 and 2021. Canada experienced rapid population and labour force growth between 2016 and 2021, and that growth has been disproportionately concentrated in non-tech occupations, which have risen from 18.3 million to over 19.6 million by 2021. This means the share of workers in tech has declined from 5.1 percent in 2016 to only 4.7 percent in 2021.

It is important to reiterate here that our definition of tech workers captures the group of workers who are most technically intensive in a given year. This simple comparison does not capture any broad-based shifts that might mean that every worker in Canada employs more digital technology in their work in 2021 compared to 2016.
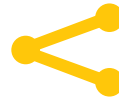
The share of workers in tech has declined from 5.1 percent in 2016 to only 4.7 percent in 2021.

Figure 3: Top 10 tech occupations in Canada
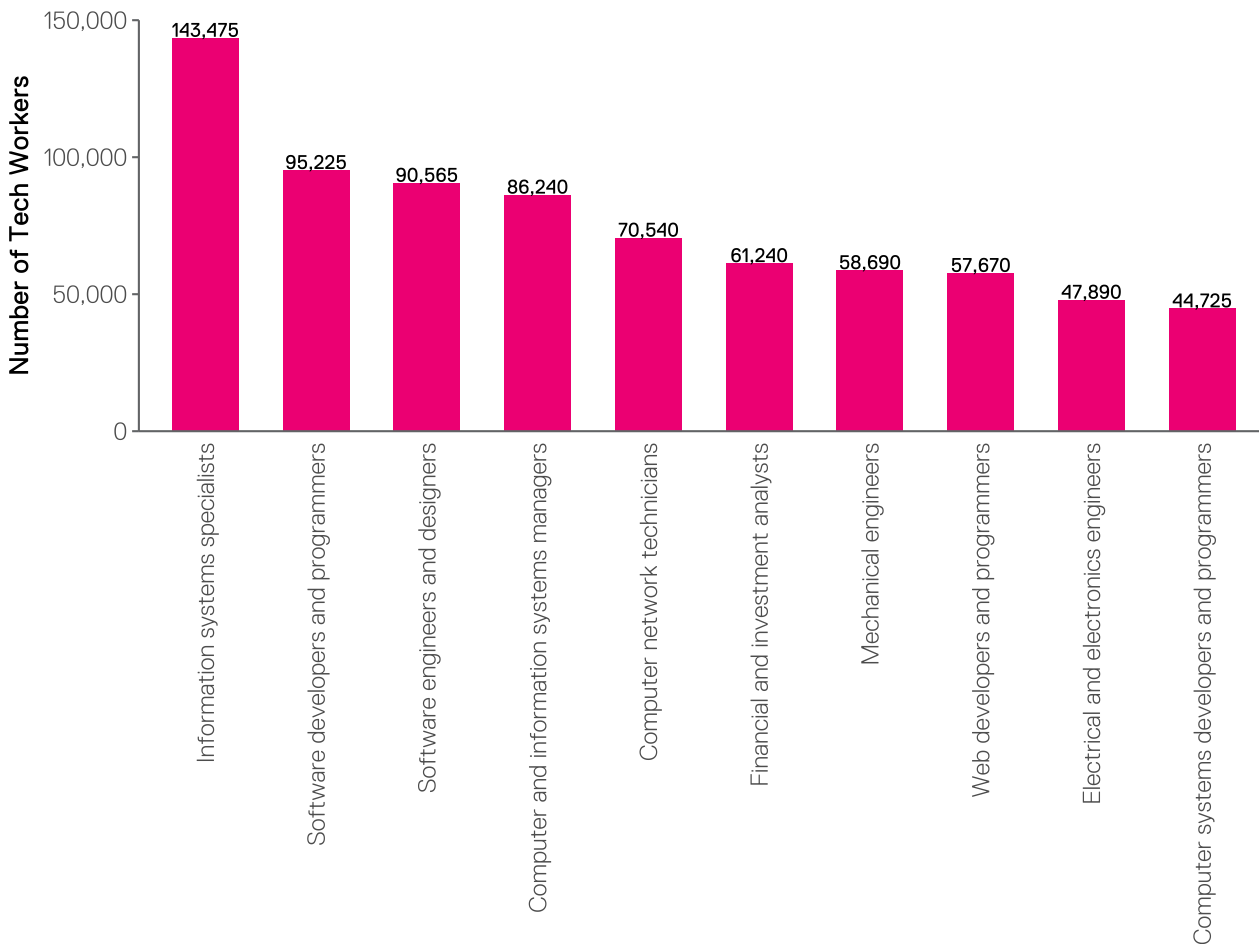
Source: 2021 Long Form Census

Figure 3 shows the top tech occupations in Canada. With nearly 150,000 workers, "information systems specialists" form the plurality of tech workers in Canada. This was also the most common tech occupation in 2016, with "information systems analysts and consultants" at 159,000 workers (the slight change in the occupation title is due to an update in Canada's occupational classification system, but the two occupational groups largely capture the same workers).

It's important to note that the most recent update to Canada's National Occupational Classification (NOC) added a number of new tech occupations of interest: namely data scientists and cybersecurity specialists. While neither occupation is large enough to enter the rankings of the most common tech positions, there are more than 15,000 people employed in each position (15,415 data scientists and 15,055 cybersecurity specialists).

Tech workers across Canada

Table 2 shows that across Canada, tech work is most heavily concentrated in Ontario and Québec—both in absolute numbers and as a share of their workforce. Because of its size, Ontario alone accounts for 48 percent of all of Canada's tech workers.

Conversely, other parts of Canada have significantly smaller tech workforces. In most provinces in Atlantic Canada, below three percent of their workforce work in tech occupations, with the exception of Nova Scotia at 3.2 percent, which is still below the national average by 1.5 percentage points. The Prairies are similarly light on tech work, and workers in the territories are even less likely to be engaged in tech work.
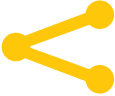
Ontario alone accounts for 48 percent of all of Canada's tech workers.

Table 2: Provincial employment in tech occupations

Province	Non-Tech	Tech	% Tech
Newfoundland and Labrador	237,910	5,570	2.3%
Prince Edward Island	78,525	1,950	2.4%
Nova Scotia	470,015	15,360	3.2%
New Brunswick	374,225	10,930	2.8%
Québec	4,228,930	209,430	4.7%
Ontario	7,002,940	429,545	5.8%
Manitoba	660,285	17,985	2.7%
Saskatchewan	560,125	12,510	2.2%
Alberta	2,214,240	82,810	3.6%
British Columbia	2,586,580	115,650	4.3%
Territories (combined)	46,710	685	1.4%

Figure 4: Participation rate in tech occupations by province
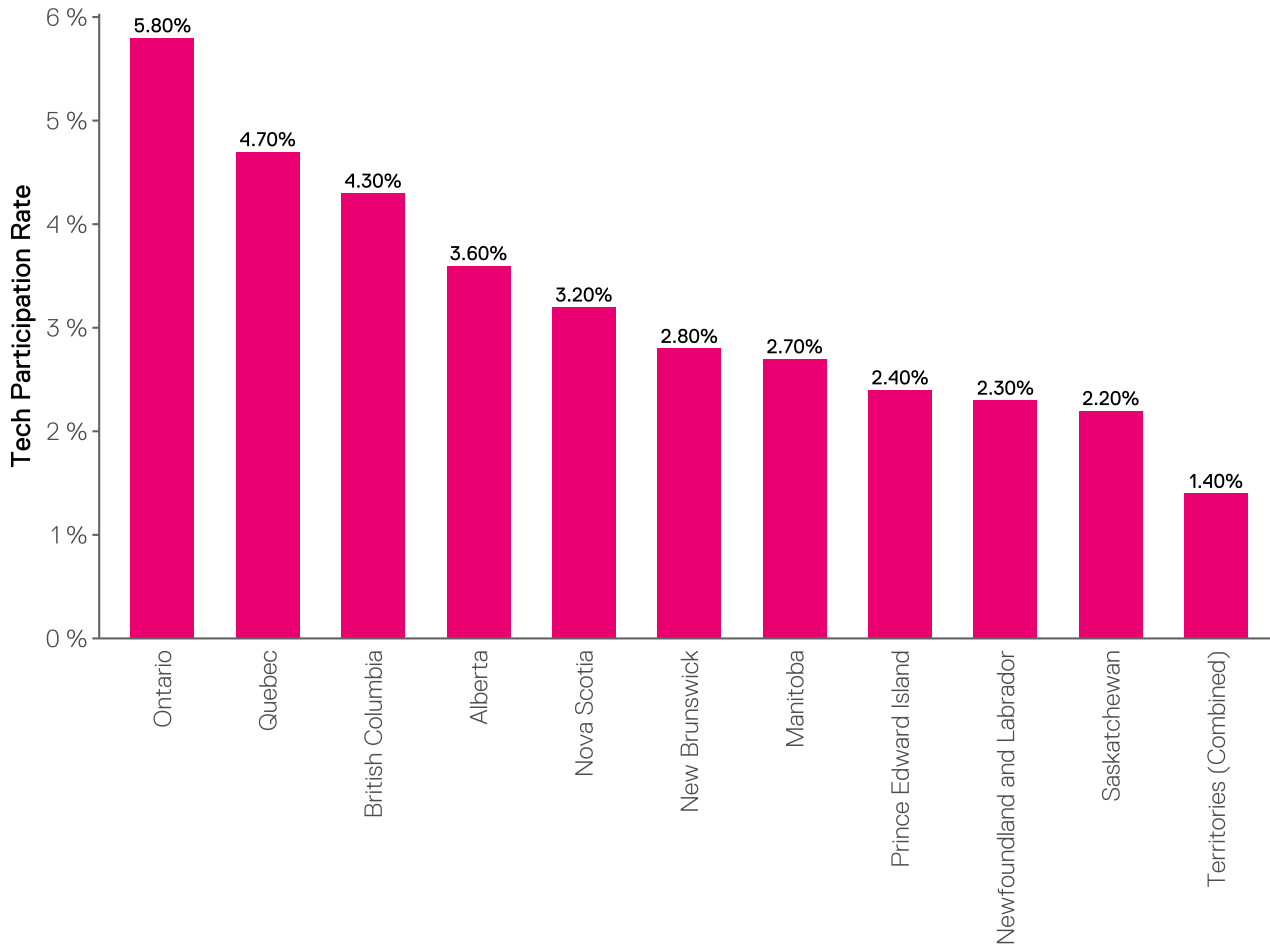
Source: 2021 Long Form Census

These disparities are driven by the locations of the major tech hubs in Canada: the four Census Metropolitan Areas (CMA) in Canada with the most tech workers are Toronto, Montreal, Vancouver, and Ottawa — all cities in Ontario, Québec, and British Columbia. However, Calgary and Edmonton, as well as Winnipeg, were all among the top 10 areas in Canada for tech workers.

Compared to 2016, these results represent growth in the tech workforce in Toronto, Montreal, Vancouver, and Ottawa. However, in Edmonton and Calgary, the number of tech workers in 2021 is actually lower than the absolute number of tech workers in 2016. Given the population increase in both cities over that period, the share of workers engaged in tech work has fallen even further. This has resulted in Ottawa-Gatineau surpassing Calgary to become the fourth largest tech workforce in the country.
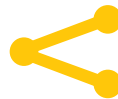
The four Census Metropolitan Areas (CMA) in Canada with the most tech workers are Toronto, Montreal, Vancouver, and Ottawa — all cities in Ontario, Quebec, and British Columbia.

Figure 5: Participation rate in tech occupations by Census Metropolitan Area (CMA)
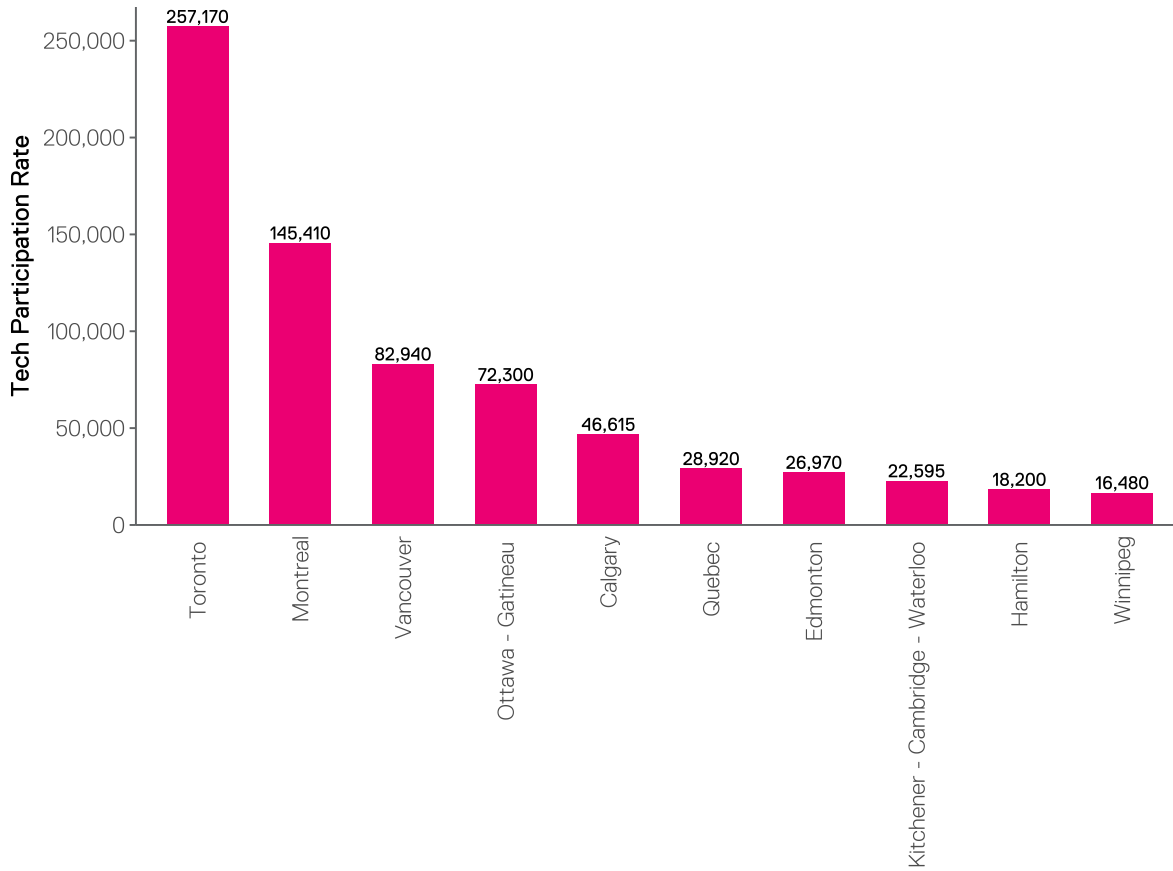
Source: 2021 Long Form Census

Table 4: Tech workers in CMAs

CMA	2021	2016	2006
Toronto	257,170	237,885	185,360
Montreal	145,410	140,240	107,645
Vancouver	82,940	81,535	61,685
Calgary	46,615	62,975	49,300
Ottawa-Gatineau	72,300	69,435	61,655
Edmonton	26,970	34,360	27,300
Québec	28,920	29,210	22,735
Kitchener-Cambridge-Waterloo	22,595	19,875	13,785
Hamilton	18,200	18,205	14,500
Winnipeg	16,480	18,080	15,575

5 Largest Tech-Intensive Industries in Canada

Tech work is not distributed evenly across all sectors of the economy. While tech workers are employed in firms of any size and in any sector, some sectors of the economy rely disproportionately on tech workers. Appendix B contains the complete list of the most digitally-intensive industries in Canada.

Overall, tech-intensive industries in Canada employ 1,421,190 workers in Canada as of 2021. Table 5 shows the largest tech-intensive industries in the 2021 census, as well as the number of tech workers employed in each industry. Nearly one-third of jobs in the tech sector come from computer systems design and related services (446,415 employed workers), and that sector also represents more than one-quarter of all workers in Canada engaged specifically in tech work.

Table 5: Largest tech-intensive industries in Canada

Industry	Total employment	Tech-specific employment	Percent tech work
Computer systems design and related services	446,415	274,095	61%
Architectural, engineering, and related services	295,440	57,260	19%
Wired and wireless telecommunications carriers (except satellite)	118,405	41,430	35%
Other financial investment activities	93,645	17,360	19%
Scientific research and development services	64,815	12,535	19%
Aerospace product and parts manufacturing	50,925	8,730	17%
Software publishers	47,245	24,285	51%
Management of companies and enterprises	46,980	8,965	19%
Securities and commodity contracts intermediation and brokerage	45,160	6,725	15%
Computer and communications equipment and supplies merchant wholesalers	38775	12700	33%

6 Tech Workers' Pay

Tech workers are paid significantly more than many other workers in Canada — on average, tech workers earn $40,000 more than non-tech workers. This is consistent with findings from previous findings from our report on the 2016 census. However, we observe an increase in both tech and non-tech workers' nominal wage between 2016 and 2021, and the gap has narrowed since 2016.

Table 6: Pay comparison between tech and non-tech occupations

Occupation	Average employment incomes in 2021	Average employment incomes in 2016	% increase
Tech	$91,333	$83,480	9.4%
Non-Tech	$51,305	$45,400	13%

On average, tech workers earn $40,000 more than non-tech workers.

Tech Pay Across Canadian Metropolitan Areas

While engaging in tech work means a worker earns a higher pay across Canada, there is a wide variation in the magnitude of such "tech premium" depending on where the work takes place. Figure 6 shows that while in Québec City tech workers are only paid a premium of 50 percent over non-tech workers, in Vancouver they make nearly double (91 percent more). Calgary—where non-tech workers receive one of the highest average salaries in Canada—still sees a significant premium for tech work, with tech workers there earning more than $100,000 a year (65 percent higher than non-tech workers) on average.

Figure 6: Salary comparison between tech and non-tech occupations in Canada's top tech hubs
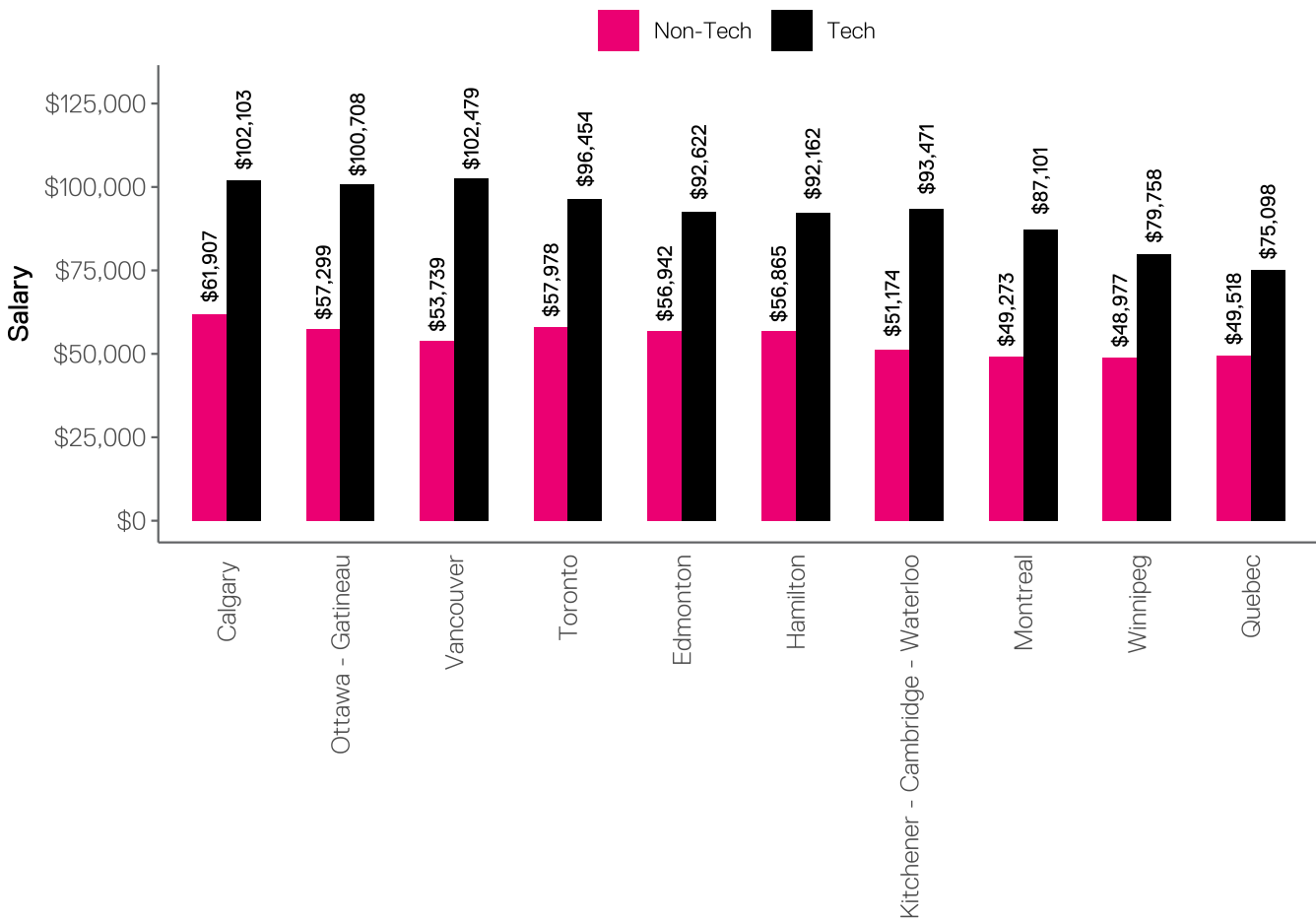
Source: 2021 Long Form Census

Past research has shown that Canadian tech workers earn significantly less than their American counterparts — on average, tech workers in the United States are paid 46 percent more than Canadian tech workers.[8] Using data from the Current Population Survey's Annual Social and Economic Supplement (CPS-ASEC) in the US, and adjusting for purchasing power parity, we can compare the pay for tech work in individual metropolitan areas. Figure 7 shows that across nearly every metropolitan area, tech workers in the United States out-earn tech workers in Canada. Only a few metro areas in Canada are competitive with the United States, and even then, the most competitive jurisdiction - the regional municipality of Wood Buffalo, which includes Fort McMurray - in Canada is middling at best when placed in the US perspective. However, Fort McMurray has high wages for many occupations due to the oil and gas industry which makes it unrepresentative for the broader Canadian tech ecosystem. The most competitive Canadian metropolitan area is Calgary, where the average income for tech workers would be ranked lower than 350th in the United States.

Figure 7: Comparison of Tech Occupation Pay - Metropolitan Areas

Source: 2021 Long Form Census, OEWS
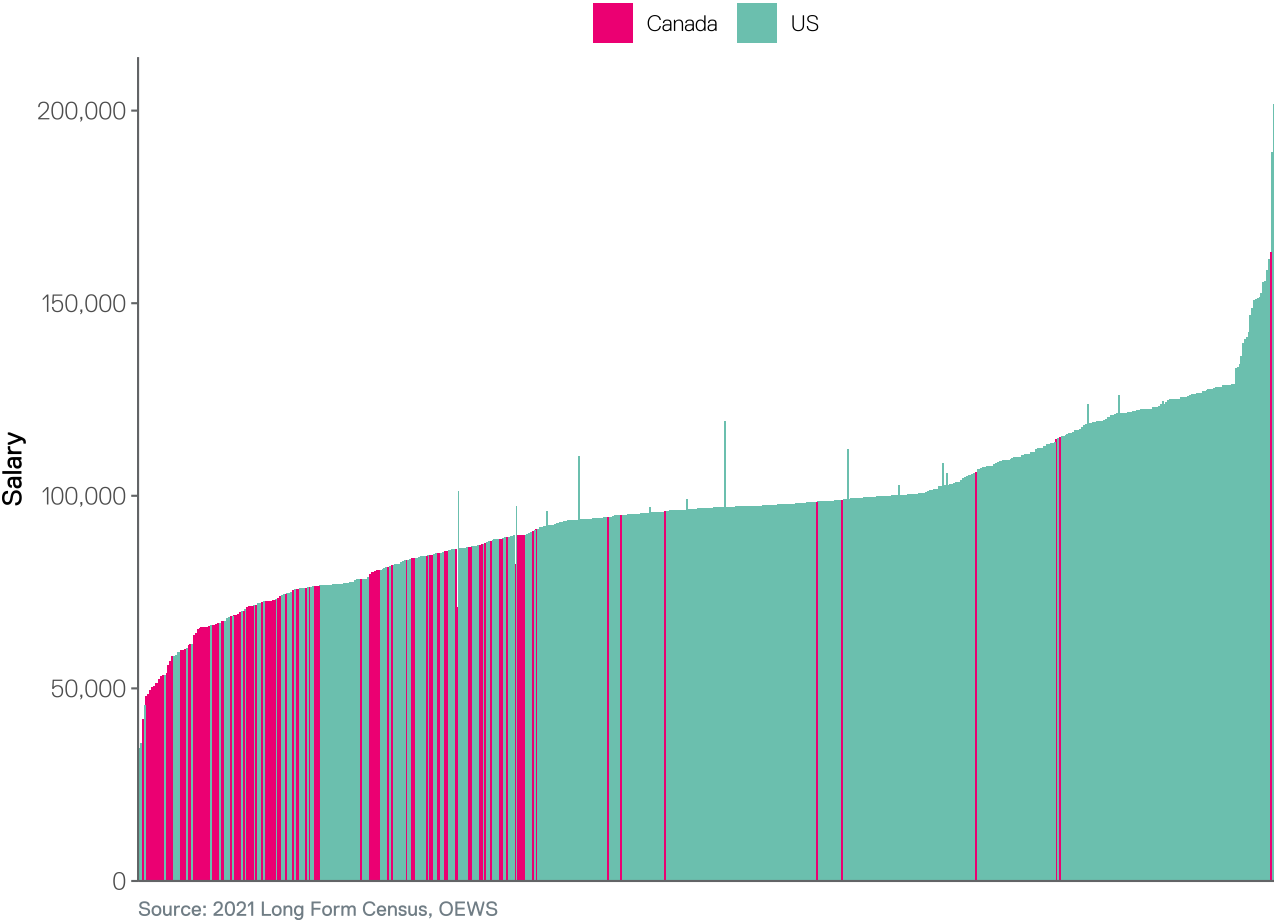
Capital Gains

The federal government's 2024 budget includes a proposed increase to the inclusion rate for capital gains from 50% to 66% for individuals who realize $250,000 or more in capital gains in a year. Many commentators have speculated that the increase could constrain the ability of companies to attract top talent and investment, and thereby damage the innovation economy in Canada. Our past research suggests that the median Canadian tech worker has $84,000 in equity gross value that has not yet been sold.[9] More generally, a non-trivial share of a tech worker's compensation consists of non-wage factors, such as stock options.

Tech workers are more likely to be impacted by an increase in the capital gains inclusion rate than other workers in Canada. More tech workers declare capital gains in excess of the $250,000 cutoff on their personal taxes where the new inclusion rate would have an impact. Our analysis of long-form Census data shows that 1,960 tech workers declared more than $250,000 in capital gains in 2021.

This represents 0.20% of tech workers affected by the change, compared to 0.15% of non-tech workers. It is worth noting that for owners of qualified small business corporations, the first $1.25 million of cumulative lifetime capital gains are also exempt. A large majority of tech workers in Canada are not, and will never be, personally affected by this policy change. However, the effects on investment in the innovation economy, and on corporations that are affected by the tax change, remain to be seen.

This represents 0.20% of tech workers affected by the change, compared to 0.15% of non-tech workers.

7 Conclusion

In this first chapter of our analysis on Canada's Tech Talent, we focused on establishing a profile of the share of tech workers in Canada's labour force, plus the growth and average pay within the last five years, across the country and across regions. In these findings, we see a picture that continues to reveal tech workers' value to the economy, demonstrated through the income premium many tech workers receive for their work.

However, there are also some discouraging signs. Most importantly, the number of tech workers in Canada has barely changed since 2016, and the share of tech workers as a proportion of the population has declined. While this chapter does not detail our understanding of why such stagnation has occurred, in forthcoming chapters, we will keep this key fact in mind.

One fairly clear potential reason for this decline, however, is the lack of competitiveness of the Canadian tech ecosystem as compared to the United States. When a Canadian tech worker can increase their pay by almost half by moving to the US, a very large non-monetary incentive is required for a top Canadian tech worker to remain in Canada. And the problem is systemic, unlikely to be resolved by marginal changes in the tax regime, and can only solvable by stimulating competition and growth, to ensure Canadian tech companies can competitively hire for top talents in Canada and keep growing the industry.

In the upcoming chapters, we will focus our lens on uncovering the kaleidoscope of tech workers in Canada, from their identities, their contribution to Canada's productivity growth, and many other distinguishing factors.

Appendix

List of Tech Occupations

Occupation code	Occupation title	Tech intensity (percentile)
21311	Computer Engineers (Except Software Engineers and Designers)	0.9
21232	Software Developers and Programmers	1.0
21301	Mechanical Engineers	1.2
21320	Chemical Engineers	1.4
22220	Computer Network and Web Technicians	1.5
21234	Web Developers and Programmers	1.6
21390	Aerospace Engineers	1.7
10030	Telecommunication Carriers Managers	1.8
21230	Computer Systems Developers and Programmers	2.2
21310	Electrical and Electronics Engineers	2.4
22211	Industrial Designers	2.6
21222	Information Systems Specialists	2.8
22222	Information Systems Testing Technicians	2.8
20012	Computer and Information Systems Managers	2.8
72205	Telecommunications Equipment Installation and Cable Television Service Technicians	2.9
21220	Cybersecurity Specialists	3.2
21223	Database Analysts and Administrators	3.2
52112	Broadcast Technicians	3.3
21233	Web Designers	3.5
21211	Data Scientists	3.9
72204	Telecommunications Line and Cable Installers and Repairers	4.1
21330	Mining Engineers	4.5
21331	Geological Engineers	4.5
21109	Other Professional Occupations in Physical Sciences	4.6
21100	Physicists and Astronomers	4.8
21399	Other Professional Engineers	4.9
22302	Industrial Engineering and Manufacturing Technologists and Technicians	5.1
21322	Metallurgical and Materials Engineers	5.2

List of Tech Industries

NAICS code	Industry name
3342	Communications Equipment Manufacturing
4173	Computer and Communications Equipment and Supplies Merchant Wholesalers
5173	Wired and Wireless Telecommunications Carriers (Except Satellite)
5174	Satellite Telecommunications
5179	Other telecommunications
5415	Computer Systems Design and Related Services
5417	Scientific Research And Development Services
5511	Management of Companies and Enterprises
3333	Commercial and Service Industry Machinery Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, measuring, medical and control instruments manufacturing
3364	Aerospace Product and Parts Manufacturing
3369	Other Transportation Equipment Manufacturing
4862	Pipeline Transportation of natural Gas
5112	Software Publishers
5182	Data Processing, Hosting, and Related Services
5211	Monetary Authorities - Central Bank
5231	Securities and Commodity Contracts Intermediation and Brokerage
5413	Architectural, Engineering and Related Services
5232	Securities and Commodities Exchange
5239	Other Financial Investment Activities
5261	Pension Funds
5269	Other funds and financial vehicles
3341	Computer and Peripheral Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
3345	Navigational, measuring, medical and control instruments manufacturing
5182	Data processing, hosting, and related services
5413	Architectural, engineering and related services

Endnotes

[1] Viet Vu and Sihwa Kim, *Are Tech Jobs More Pandemic-Proof?*, Brookfield Institute for Innovation + Entrepreneurship, 2020, https://brookfieldinstitute.ca/are-tech-jobs-more-pandemic-proof/.

[2] Kevin Barefoot, Dave Curtis, Willaim Jolliff, Jessica Nicholson, and Robert Omohundro, "Defining and Measuring Digital Economy", 2018, US Bureau of Economic Analysis, https://www.bea.gov/sites/default/files/papers/defining-and-measuring-the-digital-economy.pdf.

[3] Creig Lamb and Matthew Seddon, *The State of Canada's Tech Sector*, 2016, , Brookfield Institute for Innovation + Entrepreneurship, 2016, https://brookfieldinstitute.ca/the-state-of-canadas-tech-sector-2016/.

[4] Giovanni Gallipoli and Christos A. Makridis, "Structural Transformation and the Rise of Information Technology," *Journal of Monetary Economics*, 97, (2018) 91–110.

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[6] Ibrahim Abuallail and Viet Vu, *Race Alongside the Machines: Occupational Digitalization Trends in Canada, 2006-2021*, Brookfield Institute for Innovation + Entrepreneurship, 2022, https://brookfieldinstitute.ca/race-alongside-the-machines/.

[7] Viet Vu, The O*NET/NOC Crosswalk, an update (blog post), Brookfield Institute for Innovation + Entrepreneurship, 2022, https://brookfieldinstitute.ca/crosswalk-blog-post/.

[8] Vivian Li, Mahmehr Hamza, and Anusha Arif, *Mind the Gap: Compensation Disparity Between Canadian and American Technology Workers*, The Dais, 2023, https://dais.ca/reports/mind-the-gap-compensation-disparity-between-canadian-and-american-technology-workers.

[9] Ibid.