The Metro Vancouver Region's High-tech Engine

Boosting the Economic Landscape

INVEST VANCOUVER

A service of **metro**vancouver

Indigenous Territorial Recognition

Metro Vancouver acknowledges that the region's residents live, work, and learn on the shared territories of many Indigenous peoples, including 10 local First Nations: q̓i̓c̓əy̓ (Katzie), q̓ʷɑ:ƛ̓əƛ̓əm (Kwantlen), kʷikʷəƛ̓əm (Kwikwetlem), máthxwi (Matsqui), xʷməθkʷəy̓əm (Musqueam), qiqéyt (Qayqayt), se'mya'me (Semiahmoo), Sḵwx̱wú7mesh Úxwumixw (Squamish), scəw̓aθən məsteyəxʷ (Tsawwassen) and səlilwətaɬ (Tsleil-Waututh).

Metro Vancouver respects the diverse and distinct histories, languages, and cultures of First Nations, Métis, and Inuit, which collectively enrich our lives and the region.

About Metro Vancouver

Metro Vancouver is a diverse organization that plans for and delivers regional utility services, including water, sewers and wastewater treatment, and solid waste management. It also regulates air quality, plans for urban growth, manages a regional parks system, delivers affordable housing, provides an economic development service through Invest Vancouver, and serves as a regional federation. The organization is a federation of 21 municipalities, one electoral area, and one treaty First Nation located in the region of the same name. The organization is governed by a Board of Directors of elected officials from each member jurisdiction.

About Invest Vancouver

Invest Vancouver is Metro Vancouver's regional economic development service. By attracting strategic investment in key export-oriented industries, conducting research and policy analysis, and fostering collaboration on a local, national, and global scale, Invest Vancouver is facilitating the creation of high-quality jobs to achieve a resilient regional economy that delivers prosperity for all residents of the Metro Vancouver region. Working closely with leaders across all levels of government in the region and beyond, Invest Vancouver is addressing regional concerns to increase economic resilience, strengthening strategic export-oriented industries, attracting word-class companies, and laying the foundation for a region where every resident can thrive in today's rapidly evolving global economy. Our data-driven, objective research aims to provide actionable intelligence to position the region for success in a rapidly evolving global economy.

For any questions about the report contact: info@investvancouver.ca

Acknowledgements

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Executive Summary

The technology sector in the Metro Vancouver region encompasses a wide array of activities that Invest Vancouver groups into four industries: Digital Media & Entertainment, the Life Sciences, High-tech Goods, and High-tech Services. This expansive definition of the technology sector, developed by BC Stats, aligns with Invest Vancouver's economic development and investment attraction mandate. This report covers the regional technology sector in three sections.

Section I – The region's emerging technology hub

The Metro Vancouver region is home to an emerging technology hub. Employment in the sector is large and growing rapidly and investment activity highlights the panoply of specializations thriving in the region. BC's technology sector is concentrated in the Metro Vancouver region, which accounted for 77% of provincial employment in the sector in 2021. From 2009 to 2021, Digital Media & Entertainment (+104%), Life Sciences (+95%), and High-tech Services (+74%) all added employment much faster than the broader regional economy (+33%), underscoring the sector's importance.

A diverse mix of high technology sector firms headquartered in the Metro Vancouver region was involved in deals worth more than $31 billion USD from 2018 to 2023, according to data from PitchBook. Based on the target users of their products and services, firms specializing in information technology applications attracted the most investment, totaling $18 billion. Significant investment was also channeled into firms developing applications in healthcare, energy, and materials and resources, reflecting the intersection between traditional (non-technology) industries and the technology sector.

Although many of the factors that contributed to the technology sector's success are still in place, continued growth is not a given. In particular, the region needs to ensure there is a sufficient number of workers with the appropriate skills to match industry needs. Additionally, the pace of growth may be hindered by the rising cost of living, particularly for housing; lackluster export growth; insufficient scaling of regional firms; weak productivity growth; industrial land availability and cost; greater competition for investments; and artificial intelligence-driven economic disruptions.

Section II – Location decisions and the regional technology sector

An evidence-based strategy for investment attraction requires understanding how firms evaluate potential locations. Yet, many of the largest multinational enterprises work with global consultancies to select locations, and rarely explain their decision-making process. To gain insights into the criteria that influence these location decisions, Invest Vancouver worked with one such provider of site selection services.

The region's talent pool is, at present, one of its key assets, and access to high-quality talent is the primary reason multinational firms chose to invest in the region and, in some cases, further expand. Maintaining this advantage will require ensuring continued stream of graduates through the region's institutions of higher learning and workforce development initiatives. The favourable Canadian immigration process also helps firms fill labour market gaps.

The presence of a cluster, especially one that includes major multinational firms, implies the availability of necessary business inputs and resources. In the Metro Vancouver region, concentrations of firms are evident in multiple technology industries, including motion picture production, animation, gaming, software, aerospace, networking, telecommunications, and semiconductors. Additionally, firms in the region's high technology sector benefit from a robust innovation ecosystem.

Cost considerations are fundamental in any discussion of location decisions. The reasonable cost of inputs in the region, especially wages, along with government incentives, work in favor of attracting multinational enterprises, particularly for companies from high-cost locations. However, the region compares less favourably for firms requiring industrial space, due to the high market prices and low vacancy rates.

The ease of doing business matters to firms making location decisions. They favour regions that streamline regulatory processes and expedite business set up to facilitate early revenue generation. The Province of BC and other governments in BC are making progress in implementing business-friendly policies, but still lag behind metro regions such as Montreal, QC and Calgary, AB. Further efforts in this area could improve the region's chances of attracting investment in the technology sector.

Yet, despite clear benefits as a potential location, many international technology firms do not place the Metro Vancouver region at the forefront of their expansion plans. The large and growing technology sector notwithstanding, the region is still better known internationally as a tourist destination. To the extent that site selection is like a job search, many firms never even review the Metro Vancouver region's resume.

Firms that overlook the region may have an incomplete understanding of its capabilities. Building a reputation takes time, and the region's technology industries have only recently risen to prominence. Nonetheless, many multinational enterprises have recognized the region's value proposition. This is particularly true

among firms working in areas in which the region's specialized expertise puts it among the global leaders, such as hydrogen fuel cells and animation.

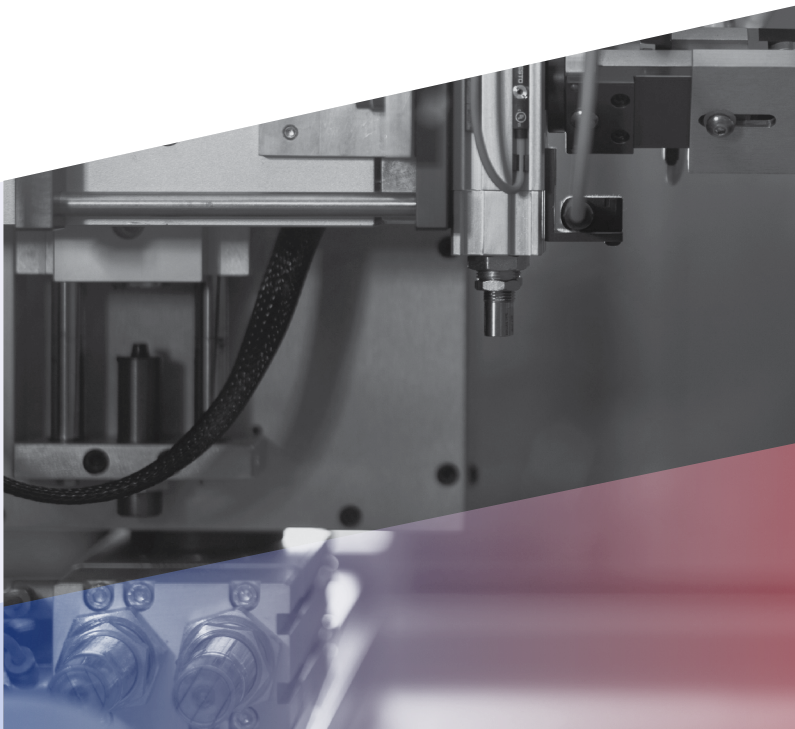
For successful investment attraction, more international technology firms need to include the Metro Vancouver region on their respective short lists of possible expansion locations. Raising the profile of more specializations in the technology sector might lead firms to consider the region's comparative advantages and not just its scenic landscapes.

Section III – Artificial intelligence's transformative potential

Artificial intelligence (AI) stands at the forefront of technological innovation, with the potential to significantly reshape not only the technology sector but myriad aspects of business and everyday life. The rapid adoption of AI brings both risks and opportunities. One clear risk is that of missing out, i.e. the risk of not benefiting from the potential productivity gains of AI integration.

Uneven adoption of AI could create a new version of the digital divide, based on the capacity and willingness of individuals, firms, and countries to integrate AI into their systems and processes. People and firms that move swiftly to embrace AI stand to gain a competitive edge. The urgency for AI adoption is acute in both BC and Canada, where the prevalence of small firms and a more risk-averse business culture may hinder readiness to embrace AI. Multiplied across individuals and firms, reluctance to adopt AI could see Canada forego a much-needed productivity windfall.

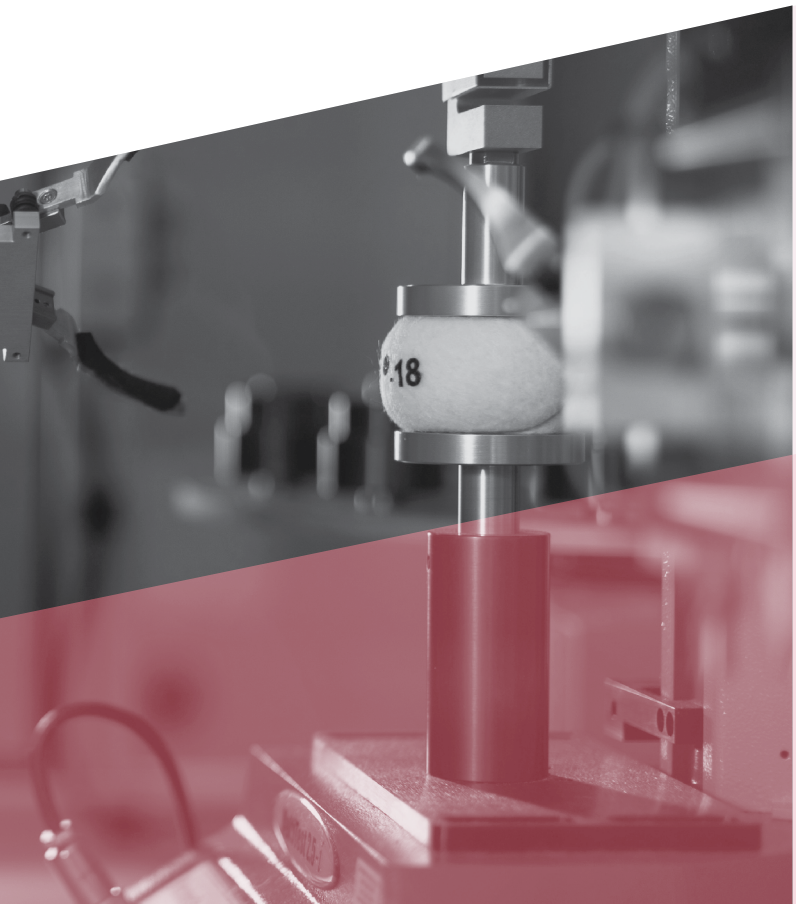
At the same time, the Metro Vancouver region has a growing cluster of applied AI firms. Embracing AI and fostering its application in areas of significant regional expertise could create economic development opportunities. AI is an enabling technology that businesses can leverage to enhance decision-making, automate processes, and unlock insights from vast amounts of data. People and firms that can pair AI with a deep understanding of a data-intensive domain will benefit most from its adoption. The Metro Vancouver region and BC have such expertise in resource extraction, construction, and health care.



Resource extraction is an excellent candidate for AI-based improvements. In particular, mining urgently needs enhanced sustainability and efficiency. The escalating global demand driven by the need for critical minerals to support the clean energy transition ensures firms specializing in mining technology have global reach almost from inception. In the region, firms like Hyperspectral Intelligence, Ideon Technologies, MineSense, and Novamera are already working on AI-driven mining solutions.

The Metro Vancouver region could be at the forefront of AI-based building techniques. UBC researchers have already designed AI-controlled drones for inspection work and real-time onsite mapping. Using a digital twin based on the mapping, a separate AI system can safely control equipment, such as a crane, to autonomously unload and place large cement blocks. The same lab is working on autonomously controlled excavators with ambitious plans for additional equipment. This leading-edge work will transform the construction industry, making it possible to quickly build more housing with fewer people.

Integrating AI with health services and harnessing health data could improve patient outcomes and bolster the Life Sciences industry. Fraser Health is prototyping and testing AI and other technology to improve the health system. Providence Health Care Ventures's Integrated Health Informatics Datalab enhances access to diverse datasets while upholding stringent privacy and ethical standards. This innovation-friendly effort is attractive to local and international firms. With support, it could foster industry clustering and the emergence of anchor companies.



Conclusion

The Metro Vancouver region is developing into a technology hub, driven by a robust innovation ecosystem and specialized tech talent. The potential integration of AI holds opportunity for sparking further innovation and economic growth. Nevertheless, challenges like talent shortages, escalating living costs, and fierce competition for investment could impede this growth. To realize its full potential as a tech leader, the region must strengthen its brand, address pressing issues, and capitalize on opportunities such as applied AI. Strategic initiatives to promote a business-friendly environment and foster innovation are essential for Metro Vancouver to maintain its trajectory toward becoming a global tech powerhouse.

Report Overview

The technology (tech) sector in the Metro Vancouver region is a blend of locally headquartered firms and branch operations of multinational enterprises. Many are developing solutions for mining, forestry, fisheries, agriculture, construction, and food processing. One such firm is Ideon Technologies, a world leader in the use of cosmic radiation (muons) to create subsurface imagery for mining (see box). Firms in the sector are often export-oriented. There is a worldwide market for critical delivery systems for molecular therapeutics, films with stunning visual effects, and environmental engineering services. This allows the sector to make an outsized contribution to the regional economy.

This report explores the technology sector in the Metro Vancouver region, as defined by BC Stats.[1] This expansive view of the technology sector is a better fit with Invest Vancouver's economic development and investment attraction mandate than a narrower focus on just "deep tech", i.e. those firms focused on solving problems through innovative engineering or scientific advancement. Adopting the BC Stats definition enhances the compatibility of the report with other research conducted in the province, which is important given the many approaches to defining the high technology sector.

Ideon Technologies, a product of the region's innovation ecosystem, is a spinoff from the TRIUMF subatomic physics research lab at the University of British Columbia (UBC). The Richmond-based firm has raised $10 million in non-dilutive funding from government and industry initiatives.

With a product that combines proprietary sensors, imaging systems, and artificial intelligence, Ideon draws its workforce from a regional labour pool that includes concentrations in multiple fields related to computers, software, and engineering. The firm's 3D maps locate mineral deposits more precisely and less invasively, thereby minimizing mining's cost, waste, and greenhouse gas emissions.

1 "Profile of the British Columbia Technology Sector: 2020 Edition", BC Stats, March 2021.

The report consists of three sections.

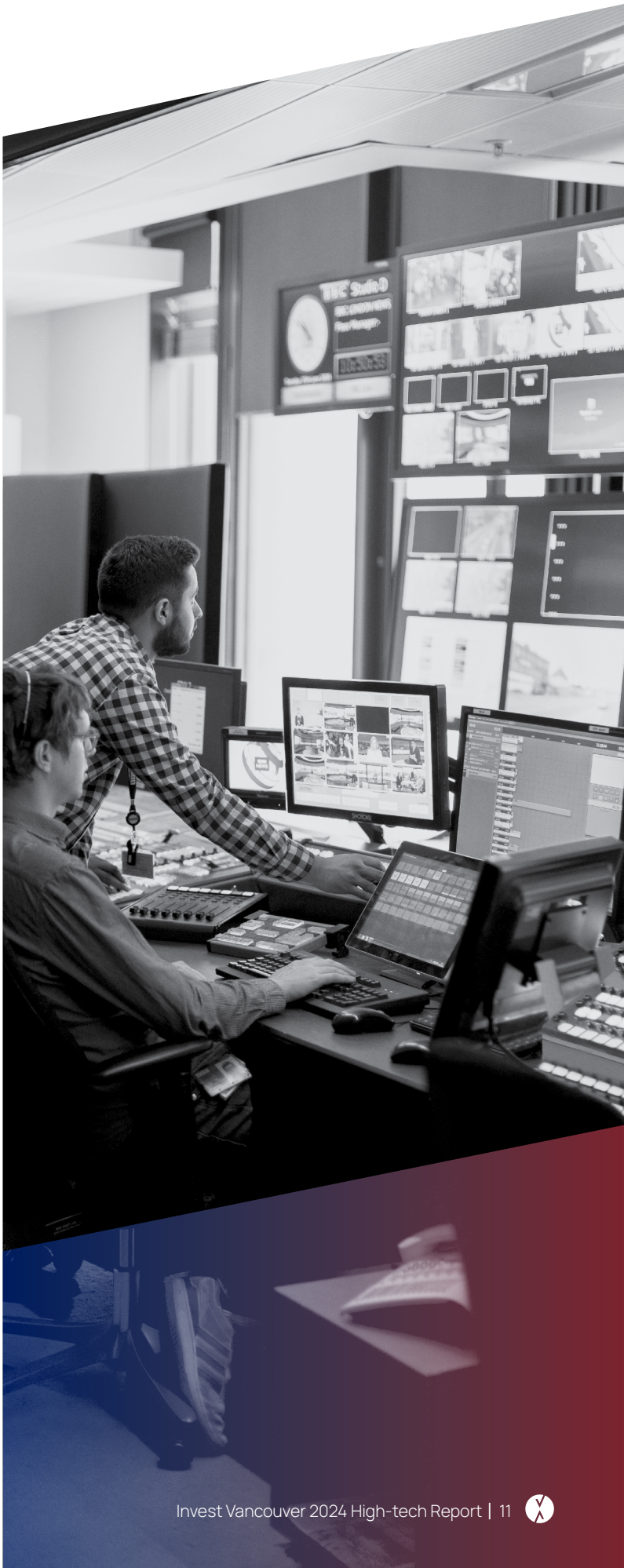
Section I – "The region's emerging technology hub" utilizes three different data-driven perspectives to describe the emerging technology hub in the region. From an industry-based perspective, the BC technology sector is large, growing rapidly, and concentrated in the Metro Vancouver region. From an investment perspective, the billions of dollars flowing into firms headquartered in the region reveal the presence of multiple specializations in a diversified technology sector that is about much more than just "pure tech". Similarly, from a labour-based perspective, occupations data confirm the presence of concentrations of skilled workers (and therefore regional specialization in the industries that rely on them) and provide compelling evidence of regional competitive advantages. The section concludes by identifying persistent and emerging issues that could jeopardize continued outperformance in the sector.

Section II – "Location decisions and the regional technology sector" investigates the region's technology sector through the lens of multinational enterprises navigating decisions to either expand or establish operations in new locales. According to seasoned location experts who work directly with such firms, the most important considerations guiding these decisions are talent; an established cluster and supporting ecosystem; return on investment; and ease of doing business. Invest Vancouver evaluates the region's technology sector on these factors, adding comparisons to relevant Canadian and US West Coast jurisdictions. The section concludes by explaining why the region is not an obvious choice for many international technology firms – despite rating well on many location factors – and considers ways to raise the region's profile and increase investment attraction.

Section III – "AI as an economic development opportunity" discusses artificial intelligence. While AI has been in development for years, the release of OpenAI's ChatGPT has put the technology in the spotlight. The rapid adoption of AI will bring numerous risks and opportunities. One clear risk is that of missing out, i.e. the risk of not benefiting from the potential productivity gains of AI integration. This section contemplates the implications of a gradual approach to integrating AI, cautioning that such hesitancy could land individuals and firms on the wrong side of a new digital divide. It then pivots to areas of opportunity, highlighting the possibilities of embracing AI and nurturing its deployment in domains where the region holds considerable expertise. By leveraging AI in resource extraction, construction, and healthcare, the region could drive advancement in these critical areas and create economic development opportunities.

Methods and Sources: Preparation of the report involved considerable primary and secondary research. The primary research was both quantitative and qualitative. The quantitative portion relied on data from the Invest Vancouver Strategic Industries Analytics (SIA) project, additional tables from Statistics Canada and BC Stats, plus data from the commercial services including PitchBook, Lightcast, Capital Compass, and fDi Benchmark.[2]

The qualitative research consisted of structured interviews conducted with founders and executives from firms with operations in region, as well as leaders, professors, and knowledgeable representatives from industry groups, accelerators, academic institutions, and investment funds. To improve coverage of such a large sector, Invest Vancouver engaged KPMG to conduct additional interviews for this project and drew upon original research by the Deetken Group conducted for Invest Vancouver's Tech Talent Guide.[3] Additionally, Invest Vancouver worked with KPMG to gain access to location experts and industry experts who provide guidance to international firms deciding where to establish or expand operations. Interviewees were offered anonymity to ensure candid assessments. The primary research was supplemented with secondary research that draws from academic, industry and government studies and reports, media coverage, presentations, and other public sources.



2 The SIA project used statistical techniques and information from multiple Statistics Canada tables to generate comprehensive, region-specific data sets for NAICS national industries. The dataset ends in 2021. Invest Vancouver, "Strategic Industries Analytics Project," (November 2023).

3 Invest Vancouver gratefully acknowledges CanExport funding that supported this research.

Section I

The region's emerging technology hub

A remarkable expansion within the technology sector is driving economic development in the Metro Vancouver region. In this section, three data-driven perspectives highlight the growth.

1. Growth in multiple technology industries is outpacing the broader economy, as shown by employment data from the Invest Vancouver SIA project.
2. The region's technology firms are attracting investment for innovations applicable to a wide variety of the economy, based on activity tracked by PitchBook.
3. Concentrations of workers with specialized skillsets and unique competitive advantages underpin the sector's growth, as demonstrated by trends in high-tech-related occupations.

The section concludes with some of the risks that could disrupt future growth.

Employment growth in the high technology sector is outpacing the broader economy

The Metro Vancouver regional economy grew faster than the provincial economy excluding the Metro Vancouver region and the Canadian economy as a whole after the 2008 global financial crisis.[4] Within the regional economy, some of the fastest employment growth has been in industry components of the high technology sector.

This report uses the BC Stats definition of the **high technology sector**.[5] The sector is composed of a set of North American Industry Classification System's (NAICS) national industries, which Invest Vancouver describes individually as 'industry components'.

Invest Vancouver grouped the set of industry components into four industries: Digital Media & Entertainment, High-tech Services, High-tech Goods and Life Sciences, as shown in Figure 1.

4 For the divergence between Metro Vancouver regional economy and rest of the province and the Canadian economy over the last business cycle, see Figure 2.1 in the Invest Vancouver Strategic Industries Analytics report.

5 The BC Stats definition is based on national industries, the most specific category of the North American Industry Classification System (NAICS) used to organize firm level data. For industry-based data, Invest Vancouver used the same set of national industries as BC Stats. (There are two small exceptions: Invest Vancouver's data did not include testing labs or R&D in the social sciences and humanities.) For everything else, such as data covering investment activity, only the relevant categories that most closely aligned with the BC Stats definition were included.

Figure 1: BC's High Technology Sector

Digital Media & Entertainment Industry Industry Components: Motion picture production, post-production (including special effects, graphics, and animation), video game design and development, etc.	**High-tech Services Industry** Industry Components: Engineering services, computer systems design, data processing and hosting, etc.
High-tech Goods Industry Industry Components: All other electrical equipment and component manufacturing, areospace manufacturing, etc.	**Life Sciences Industry** Industry Components: Pharmaceuticals and medicine manufacturing, research and development in the physical, engineering and life sciences, etc.

The large, rapidly growing high technology sector is concentrated in the region

Figure 2 presents employment in the technology sector by industry and growth since 2009 in the Metro Vancouver region and the rest of BC.

Figure 2: Technology sector employment in the Metro Vancouver region and BC excluding MV (ranked by percentage change by industry in MV since 2009)

Industry	Metro Vancouver Region		BC (excluding Metro Vancouver)	
	2021 Q4	% Change 2009-2021	2021 Q4	% Change 2009-2021
Digital Media & Entertainment	20,509	104%	4,232	77%
Life Sciences[6]	15,519	95%	4,412	62%
High-tech Services	79,908	74%	26,513	72%
High-tech Goods	8,685	17%	2,408	10%
Total - Technology Sector	**124,621**	**75%**	**37,565**	**66%**
MV Region Economy – All Industries	**1,293,948**	**33%**	**1,402,852**	**15%**

SOURCE: INVEST VANCOUVER STRATEGIC INDUSTRIES ANALYTICS PROJECT. THE SIA DATASET ENDS IN 2021.

6 The regional number is a subset of the larger figure reported by Life Sciences BC, which covers the entire province and includes additional population-serving industry components. For more on the Life Sciences industry, see Invest Vancouver's report "Life Sciences in Metro Vancouver: Shaping a Globally Prominent R&D Hub" (April 2023) and the Life Sciences BC labour market intelligence study "Fostering a Globally Competitive Life Sciences Ecosystem in B.C." (February 2024).

The Metro Vancouver region's technology sector employed almost 125,000 people in 2021, an increase of 75% since 2009 and representing nearly one in every ten jobs in the region (9.6%). While the region accounted for 48% of provincial employment across all industries in 2021, it contributed 77% of BC's high technology workforce, meaning the provincial sector is highly concentrated in the Metro Vancouver region.[7]

Investors are backing firms in the region working on solutions for a wide variety of industries

Access to financial capital is vital for established firms looking to scale up and for smaller ones moving towards successful commercialization. The investment activity itself can also indicate areas of regional specialization and interest to investors. This part focuses on the deal flows and investment activity. PitchBook investment data from 2018 through 2023 shows more than $31 billion USD in deals involving firms from the high technology sector headquartered in the Metro Vancouver region.[8] This figure understates total investment activity in the region because it does not include the activity of multinational enterprises (see box).[9]

Activities of Multinational Enterprises

Investments by multinational enterprises are a poorly tracked but vital source of growth in the regional technology sector. **Fortinet**, a major cybersecurity company, Disney's **Industrial Light & Magic**, and **Intel**, for example, have been in the region for many years and have expanded their operations multiple times.

Microsoft expanded its cloud services operations in the region in 2020; added 500 technical positions in 2021; announced in 2022 plans for a new 20-storey office hub in downtown Vancouver; and has reportedly begun relocating artificial intelligence staff from China to Vancouver.

Electronic Arts (EA), one of the largest interactive entertainment companies in the world, added two new buildings at its Burnaby campus in 2021 to accommodate an additional 500 workers.

The data is presented in three ways:

1. **Annual investment totals** to show broad trends in activity across the sector as a whole.
2. PitchBook's "**industry verticals**" that group together firms that focus on a shared niche or specialized market spanning multiple industries. Verticals include areas such as "Cybersecurity", "FinTech", "Quantum Technology", and "Mobility Tech".
3. The **target industries** benefitting from the technology firms' solutions.

7 The tech sector is also concentrated in the region based on GDP. The region accounted for 57% of total provincial GDP in 2020; in BC's high technology sector, it contributed 77% of GDP.

8 PitchBook tracks investment activity in US dollars and does not organize its data by NAICS codes. Deals were included based on congruence with the high technology sector as defined by BC Stats.

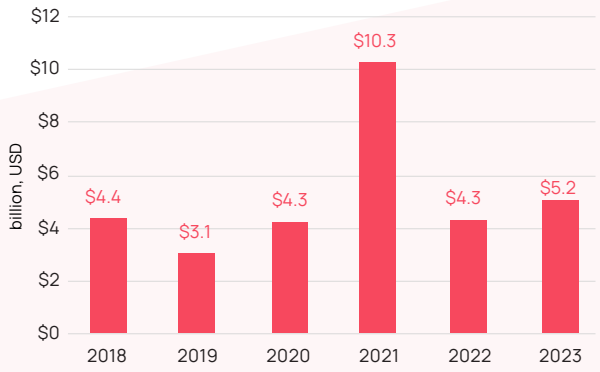
9 Except for purchases of existing firms headquartered in the region (which are tracked by PitchBook), no data source provides complete coverage of the many incremental investments by multinational firms expanding their operations in the region.

The distinction between the two more granular perspectives (industry verticals and target industry) is the difference between the views of an investor and investee. For example, a single transaction could be characterized as both "cleantech" (from an industry verticals standpoint) and "mining" (using the industry target approach). The former is the view of the investment manager who says, "My fund invests in cleantech firms." The latter is the perspective of the investment recipient firm, which says it "develops water treatment solutions for the mining industry." Thus, the transaction is an investment in a cleantech firm supplying solutions for the mining industry. Both perspectives provide insights into the diversity of technology specializations attracting investor interest in the region.

Robust investment activity despite the pandemic

Investment activity in the high technology sector is shown in Figure 3.

Figure 3: Investments in high-tech firms headquartered in the Metro Vancouver region (USD billions)



SOURCE: PITCHBOOK

Notable Investment Deals, 2018-2023

Galvanize, a SaaS company that develops governance, risk management and compliance software, was acquired by Diligient in April 2021, for $1 billion USD.

Dapper Labs, a developer of blockchain-enabled applications, has raised $643.4 million USD since 2018.

Svante, a firm developing technology for efficiently capturing and purifying CO2 from industrial emissions, raised $439 million USD in three rounds of venture funding, 2018-2023.

Xenon Pharmaceuticals, a clinical-stage biopharmaceutical company, raised $300 million in 2023.

In early 2020, the COVID-19 pandemic initially curtailed investment, but the pandemic effects are not visible in the annual investment total due to a strong rebound in the latter half of the year. The $10.3 billion invested in 2021 marks a multi-year peak. In 2022, the sharp drop to $4.3 billion mirrored declines in investment activity elsewhere in Canada and the US amid supply chain disruptions, rising inflation, higher interest rates, and investor uncertainty.[10] Even so, investment activity rebounded to $5.2 billion in 2023, exceeding the annual totals in the two years immediately preceding the pandemic.

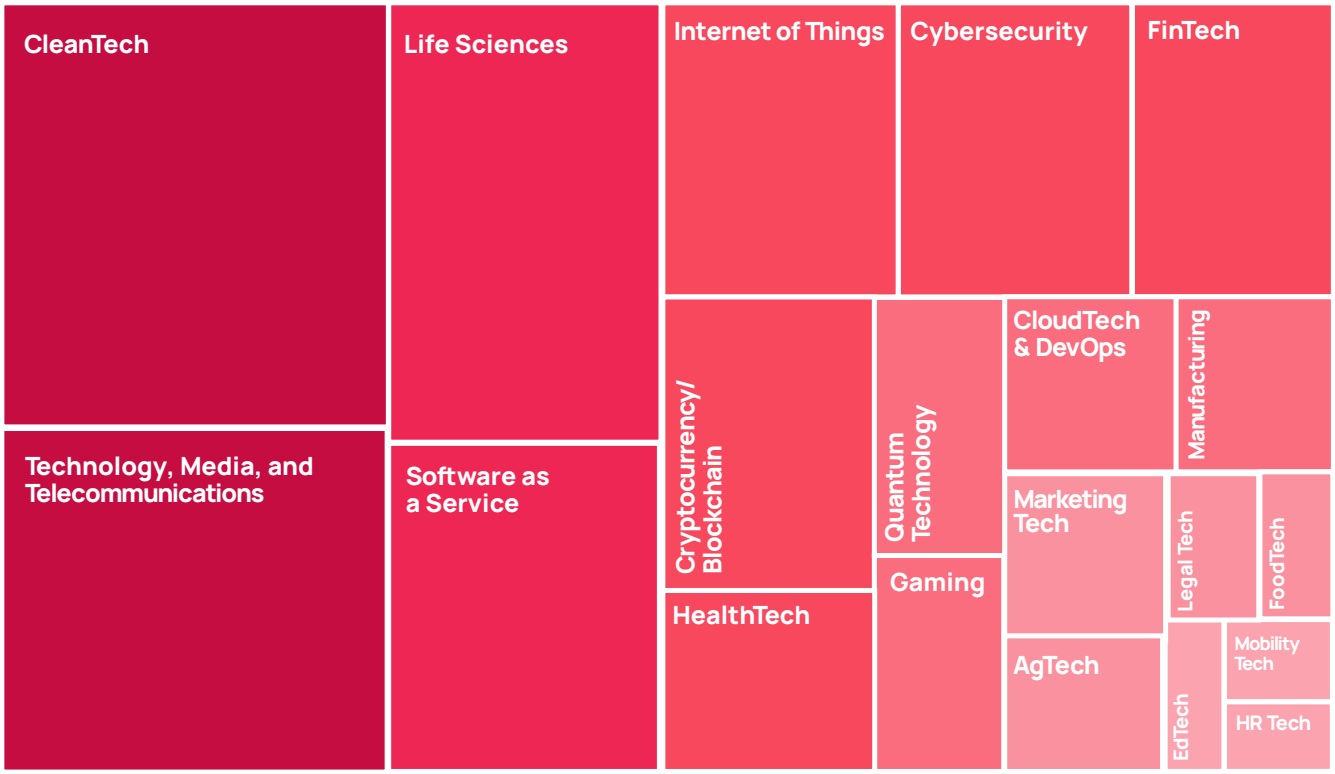
10 Aleksandra Sagan, "IPO Outlook 2023: Will More Canadian Tech Companies Brave the Markets in the Year Ahead?" The Logic, February 6, 2023.

Investors are pursing deals in multiple regional specializations in high technology

Invest Vancouver reviewed all of the high technology transactions from 2018 to 2023 involving firms headquartered in the region. To avoid double counting, each firm was assigned to a single industry vertical that most closely matched their primary activity.

Figure 4 shows the 20 largest technology-related verticals by investment size in the Metro Vancouver region. The box size corresponds to the value of the deals in the vertical (larger boxes indicate more investment); however, the size is an approximation due to limitations with the PitchBook data.[11] Cleantech, TMT (technology, media and telecoms, which includes many Digital Media & Entertainment firms), Life Sciences, Software as a Service (SaaS), Cybersecurity, Internet of Things, FinTech (Financial technology), and Cryptocurrency/Blockchain are the high technology specializations that have attracted the most investment in firms headquartered in the region 2018 through 2023.[12]

Figure 4: Investment Activity by Vertical in Metro Vancouver (by value, total of 2018-2023)



SOURCE: INVEST VANCOUVER COMPILATION OF PITCHBOOK DATA.

11 PitchBook provides tags to help users quickly find companies working in areas they are interested in such as "cleantech" or "robotics and drones". The tags are not exclusive, however, as there is significant conceptual overlap between verticals, e.g. "cleantech" and "climate tech" and PitchBook assigns many firms to multiple verticals. In addition, the tags for verticals are assigned inconsistently and sometimes not at all.

12 Virtual reality/augmented reality (VR/AR), a growing specialization in the region, was the 21st largest vertical.

The investment verticals show how investors look at the technology sector, which is important when attracting new investment. To understand the linkages between the high technology sector and the rest of the economy, however, it is helpful to consider investment activity based on the industry of the end users.

Target industries indicate the diversity of the region's technology sector

In Figure 5, investment activity is organized in firms headquartered in the Metro Vancouver region, 2018 to 2023, based on the target industry of the technology firms. For example, the retail category shows the value of investments in firms providing software or other technology solutions to businesses in those areas. Firms focused on information technology drew the most investment activity, at $18.0 billion. However, there were also significant investments in firms providing solutions in healthcare, energy, and materials and resources, reflecting the intersection between traditional (non-technology) industries and the technology sector. This investment variety demonstrates how technology firms are increasingly crucial to the innovation and advancement within traditional sectors.

Figure 5: Investments in the High-tech Firms Headquartered in Metro Vancouver by target industry (2018-2023, USD millions)

Information Technology	**$18,016.7**	**Energy**	**$1,335.0**
Software	10,044.8	Energy Equipment	686.6
Communications and Networking	3,533.1	Exploration, Production and Refining	417.5
Computer Hardware	2,183.6	Energy Services	230.5
IT Services	1,941.7	Other Energy	0.4
Semiconductors	313.5		
Healthcare	**$5,023.1**	**Consumer Products and Services (B2C)**	**$1,165.3**
Pharmaceuticals and Biotechnology	3,669.7	Transportation	361.8
Healthcare Devices and Supplies	616.5	Consumer Non-Durables	234.8
Healthcare Services	499.7	Retail	130.0
Healthcare Technology Systems	237.2	Restaurants, Hotels and Leisure	126.7
Business Products and Services (B2B)	**$3,272.3**	**Services (Non-Financial)**	**$103.9**
Commercial Services	2,029.7	Media	99.5
Commercial Products	1,209.3	Consumer Durables	63.8
Other Business Products and Services	32.3	Apparel and Accessories	44.9
Commercial Transportation	1.0		
Materials and Resources	**$1,607.4**	**Financial Services**	**$1,063.8**
Metals, Minerals and Mining	1,178.4	Other Financial Services	758.7
Chemicals and Gases	188.0	Capital Markets/Institutions	254.4
Agriculture	115.8	Commercial Banks	29.2
Other Materials	75.1	Insurance	21.5
Containers and Packaging	50.2		
Grand Total: $31,483.5			

SOURCE: PITCHBOOK

Highly skilled talent is driving growth in the regional technology sector

Firms looking for talent in high-technology fields will find it in the Metro Vancouver region, which has significant concentrations of talent in multiple occupations related to technology. Concentrations of talent indicate regional specializations in the industries that rely on those occupations, and occupational growth patterns provide compelling evidence of regional competitive advantages. Both factors – industrial specialization and a business environment that fosters competitive advantages – are important considerations for firms making location decisions.

The analysis in this section covers 51 occupations related to the technology sector.[13] Employment increased in 46 of the 51 technology-related occupations, 2009 to 2023, and in most of the occupations, it grew much faster than the overall regional employment.

Talent is concentrated in the region in multiple high-technology fields

The "employment concentration ratio" is an effective economic tool for analyzing how focused an economy is on specific industries by comparing the share of the workforce in an occupation locally to the national share.[14] The default assumption is that the share is the same, in which case the employment concentration is 1.0. The employment concentration value rises when an occupation's share of regional employment is higher than the national share, and falls when it is less. For example, a concentration ratio of 2.0 indicates that the occupation's share of regional employment is two times greater than its share of national employment.

In 2023, the Metro Vancouver region had significant regional talent concentrations in high tech occupations related to High-tech Services and Digital Media & Entertainment. In High-tech Services, the region has concentrations of *software engineers and designers* (concentration ratio of 2.6), *information systems testing technicians* (2.1), and *computer systems developers and programmers* (1.6). It also has mining-related engineering talent, including *geological engineers* (2.1), *mining engineers* (1.6), and *geoscientists and oceanographers* (1.6). The presence of hundreds of mineral exploration companies headquartered in the Metro Vancouver region helps explain these concentrations.[15] As one of Canada's principal centres for motion picture production, the region also has a high concentration of employment in related occupations, including those in film production (e.g., *motion pictures… assistants and operators* (3.8) and *audio and recording technicians* (2.1)), as well as visual effects and animation (e.g., *graphic arts technicians* (1.9)).

Employment growth patterns reveal regional competitive advantages

Further evidence for competitive advantages in high technology fields in the Metro Vancouver region can be found using "shift-share analysis", an economic technique for spotting regional comparative advantages and specializations using changes in occupation data. The technique compares "expected

13 Statistics Canada organizes occupation data using the 2021 National Occupation Classification (NOC) codes, a hierarchy that gets increasingly specific as it moves through five levels from 10 broad occupational categories to 516 unit groups. Invest Vancouver reviewed all 516 unit groups, identified the 51 most relevant to the high technology sector, and then analyzed regional data for those 51 from Lightcast.

14 The employment concentration ratio is also known as a 'location quotient'.

15 There are approximately 800 mineral exploration companies headquartered in the region, including two of the largest mining companies in the world, Teck Resources Limited and Goldcorp Inc. Vancouver Economic Commission, "Other Sectors" (September 7, 2022).

employment" (i.e. how much regional employment in an occupation would change if it followed national trends) with actual employment changes observed over a given period. The difference between these figures, the expected and actual changes, is the "competitive effect." This effect is generally attributable to a unique combination of regional characteristics and trends. Identifying a competitive effect can indicate where to look for the regional strengths or weaknesses that produced it.

Invest Vancouver analyzed Metro Vancouver regional employment growth in 51 tech occupations from 2009 to 2023. The shift-share analysis revealed a competitive effect in many of the occupations, indicating an advantage for firms in the region in industries that rely on those workers. Of particular note, the analysis showed:

- A large competitive effect in many occupations related to High-tech Services, including *software engineers and designers; software developers and programmers; computer systems developers and programmers and information system specialists*.
- Evidence of strengths in the Life Sciences (*biologists and related scientists*) and connections between the regional technology sector and resource industries in the province (*geological engineers and mining engineers*).
- Other strengths, such as in *mechanical engineers and industrial* and *manufacturing engineers*. People in these occupations are often employed by consulting firms, which is a known strength in the region (*professional, scientific, and technical services* is the second largest industry by employment in the region).

Overall, the occupations-based analysis underscores the importance of the region's specialized tech workforce. The data show concentrations of talent in the region, indicating clustering in the industries that rely on those occupations, and strong competitive effects, confirming firms in those industries enjoy some form of competitive advantage.

Past performance is not necessarily indicative of future results

The empirical evidence reflects the notable advancements in the Metro Vancouver region's technology sector. Although many of the factors that contributed to the sector's success are still in place, continued growth is not a given. Below are some points that might interrupt or hinder the pace of growth:

- **Talent supply could limit growth.** Continued growth will depend critically on the sufficient supply of suitable talent, as determined by education and recruitment: the former to create new graduates and help existing workers improve their skills, the latter to attract skilled foreigners and expats who might be willing to return. Since many firms in the technology sector require the same or similar skillsets, there is competition for talent within the region, meaning growth in one industry might come at the expense of another. Similarly, there is global competition for talent, with regions vying to attract and keep talent.
- **The rising cost of living could weaken the region's appeal.** Persistent high costs in areas such as housing, if not offset by commensurately higher salaries, will leave residents with lower disposable incomes. If people feel priced out of the region, it could make it harder to attract and retain workers and therefore more difficult to attract foreign direct investment.

- **Exports and outperformance go together.** In the region, the technology sector has grown much faster than the overall economy. This could be due to exports spurred by global demand and/or the integration of new technologies and services into the other parts of the BC economy. While supplying other sectors with goods and services is an important contribution to GDP, exports offer the best prospects for continued growth. Unlike population-serving firms reliant on local demand, competitive exporting firms can grow faster than the local population and economy.[16]
- **Firms struggle to scale up in the region.** In the Metro Vancouver region in 2021, only 2.6% of tech firms employed 100 people or more, and just 20 firms employed 500 people or more. A higher proportion of larger firms is desirable due to their tendency to allocate greater resources to research & development (R&D), exhibit higher productivity levels, offer higher salaries to their employees, and export more per employee compared to smaller counterparts.[17]
- **Productivity growth has been weak.** Since the early 2000s Canada has experienced relatively low labour productivity growth, ranking in the bottom third in the OECD from 2000 to 2019.[18] If this trend continues, it could dampen the Metro Vancouver region's economic outlook and its competitiveness relative to jurisdictions with higher output per worker.
- **Industrial land is scarce and expensive.** The economics look very different for established firms with their own facilities and new entrants looking for space. In the high-tech sector, this is particularly true for manufacturers. Newer firms may be more likely to conduct research, design, and development work in the region, while physically producing goods at scale elsewhere.
- **FDI attraction competition is intensifying.** In Digital Media & Entertainment industry, each new production represents a location decision, making the industry highly mobile. BC's early move on tax credits was successful, but Quebec, Ontario, multiple US states, the UK, and Australia now offer competing incentives. Feature film activity is less frequent in the region as a result. Production activity and a skilled labour force complement one another, with concentrations of specialized talent attracting productions, and vice versa. If workers find there are long gaps between jobs, they tend to leave for areas with greater opportunities. Therefore, the industry's future is tightly bound to tax credit policy.
- **Artificial intelligence is a wildcard.** The adoption of AI could derail the pattern of growth in the region's high technology sector if its adoption eliminates (or reduces) the human requirement in certain types of work. Conversely, the practical application of AI by the region's technology sector (and even by firms in more traditional industries, such as mining) might boost growth and create entirely new activities.

16 BC has a large trade surplus in high technology services, i.e. the province exports more than it imports. The surplus widened, 2010-2019. BC has a trade deficit in high-tech goods, which widened from 2010 through 2019. BC Stats, "Profile of the British Columbia Technology Sector: 2020 Edition" (March 2021).

17 The prevalence of small firms in the technology sector reflects patterns in the broader BC economy, where 98% of all businesses employed 50 or fewer workers in 2022. Small businesses contribute 34% of BC's GDP, the highest proportion in Canada, and account for 51% of private sector employment, the second highest in the country. In the technology sector, many of the largest employers locally are branches of multinational enterprises, which further highlights the rarity of local firms scaling up. Province of British Columbia, "High Technology" (September 25, 2023); Ken Peacock and Jock Finlayson, "From Good to Great: The Benefits of Scaling up BC Business," Business Council of British Columbia, November 2017; BC Stats "Small Business Profile."

18 Canada ranked 25th of 36 OECD countries in terms of productivity growth from 2000 to 2019. David Williams, "Low Productivity Growth Is Holding Back Canadians' Pay Growth", Business Council of British Columbia, July 2021.

Section II

Location decisions and the regional technology sector

Developing an evidence-based strategy for investment attraction requires an understanding of how firms evaluate potential locations.[19] Many of the largest firms do not work with public investment attraction agencies (like Invest Vancouver), and if they do, the engagement happens after the shortlist of possible locations has been decided. Instead, these multinational enterprises work with one of the global consultancies that offer corporate site selection advice, and rarely explain their decisions or explain where the runners up fell short. Invest Vancouver created a project to investigate this process with the ultimate goal of increasing the success of investment attraction.

Invest Vancouver engaged KPMG to connect with their global network of location experts and technology industry specialists, i.e. the people with firsthand experience of how companies make such decisions. The objective was to discover which factors have the most influence on locations decisions, and where the Metro Vancouver region fits in the expansion plans of multinationals in the technology sector.

Invest Vancouver learned that the ranking of location factors varies widely among multinationals, even across the divisions of a single firm. The relative weighting of site location factors varies based on firm size, subsector, investment scale, operational models and the unique needs and priorities of individual firms. Nonetheless, despite these differences, there is consistency in the key elements sought by firms across the high technology sector.

In short, firms care most about access to suitable **talent**, followed by the presence of a **cluster** of firms engaged in similar activities, along with a supporting ecosystem, the potential **return on investment**, and the **ease of doing business**.[20] Surprisingly, the Metro Vancouver region is not at the forefront of international options for many expanding firms, despite scoring well on these considerations. The rest of this section elaborates on these site selection factors and to outsiders perspectives on the region.

19 The focus here is on multinational firms looking to expand research, development and production, rather than those expanding their sales, support and distribution activities. The latter type of expansion decision is primarily driven by cut market size and access. An expansion can come in many forms: an international firm might purchase a local one; establish an entirely new operation; or scale up their current activities. Whatever the form, these firms are making an additional investment in the regional economy that could have gone elsewhere.

20 Firms take factors such as government transparency (i.e. clear and accessible information on regulations; accountability in public services; and openness in government procurement processes) for granted outside the developing world. Similarly, modern infrastructure, including transportation links, reliable and sustainable energy, and high-speed internet are not typically competitive factors in location decisions, though affordable, clean power, for example, is an important consideration for many.

Talent is the top priority in investment decisions

Insight from location experts: Notwithstanding unique firm needs, the availability of skilled workers is generally the most important location factor. Specifically, firms seek specialised skills that match their immediate needs and confidence they will be able to meet future hiring needs. Firms often adopt a 'dual lens' when evaluating a location: it must meet their own needs for available talent while catering to the preferences of prospective employees seeking an attractive place to live.

Invest Vancouver findings: Interviews with senior executives of technology firms with operations in the region consistently confirm the attraction of the region's highly skilled workforce. International firms that have opened new branches in the region or purchased established local firms have repeatedly cited the acquisition of talent as their primary motivation.

The region's talent pool is a source of quality workers for the high technology sector.

Access to high-quality talent is the primary reason multinational firms choose to invest in the region. Many also expand for the same reason. CBRE, a global commercial real estate services and investment firm, provides further confirmation via its comparison of the technology labour pool in 50 North American jurisdictions. Based on market depth, vitality, and attractiveness to companies seeking tech talent and to tech workers seeking employment, the region ranks eighth overall (and second in Canada, after Toronto).[21] Maintaining this advantage will require ensuring a continued stream of graduates through the region's institutions of higher learning, and workforce development initiatives.

The region's post-secondary institutions provide the technology sector with a steady stream of graduates.[22] Post-secondary institutions can play a greater role in upskilling and providing micro credentials as they respond to rising demand from workers facing technology changes and evolving job requirements, particularly the need to integrate emerging technologies like AI.[23]

The Canadian immigration process, which has a streamlined visa process and policies favouring skilled workers, helps firms fill labour market gaps. Multiple federal programs apply to the technology sector, providing a path to permanent residency, targeting US H-1B visa holders, and permitting the temporary hiring of specialized talent.[24] At the provincial level, the Provincial Nominee Program (BC PNP) and its technology variant, the BC PNP Tech Pilot, offer pathways for foreign skilled workers and graduates to become permanent residents, with the latter providing a streamlined process for in-demand tech roles.

Generally, the Canadian process is easier to navigate and more permissive than the American system for technology firms seeking to hire skilled foreigners. Thus, a location in the region can allow a multinational firm access to talent they might not otherwise be able to hire if they were located in a different jurisdiction like the US. In interviews, Invest Vancouver heard that the region's high quality of life, ethnic and cultural diversity, and openness to immigrants also help attract foreign workers.

An established cluster and supporting ecosystem signal a favorable business environment

Insight from location experts: The presence of a cluster is an important factor in location decisions

21 CBRE, "Scoring Tech Talent 2023" (July 17, 2023).

22 The BC Tech Association is working on a report on this talent pipeline with the BC Ministry of Post-Secondary Education and Future Skills, and the post-secondary institutions.

23 The World Economic Forum predicted in a 2023 that the core skills of 44% of workers will be disrupted over the next five years, largely due to the adoption of frontier technologies. World Economic Forum, "Future of Jobs Report 2023" (May 2023).

24 These programs include the Federal Skilled Worker Program (FSWP), the Federal Skilled Trades Program (FSTP), and the Canadian Experience Class (CEC), H-1B Visa Holder Program, the International Mobility Program (IMP), and the Global Talent Stream (GTS). Please see Invest Vancouver's "Tech Talent Guide" for more information.

because it indicates the maturity and health of the broader ecosystem.

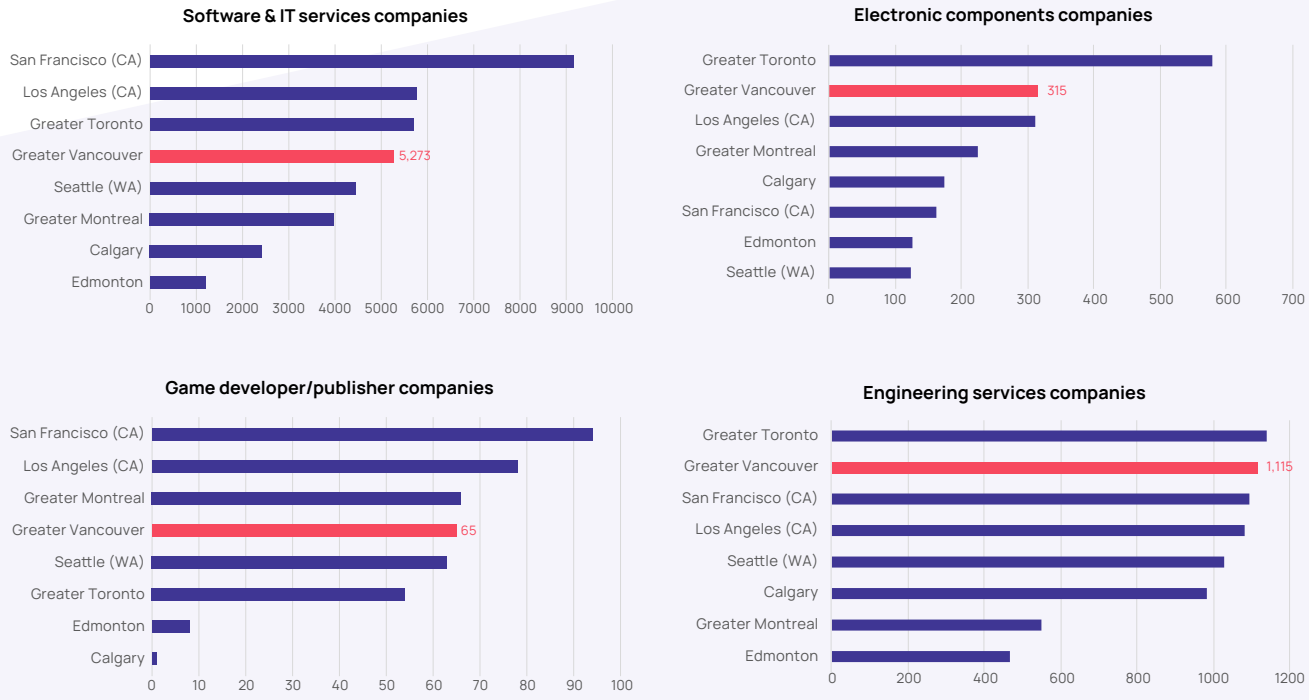
Invest Vancouver findings: A group of successful firms engaged in similar activities in close proximity implies that the necessary business inputs and resources are available and supported by a favourable regulatory environment. The presence of major multinational firms is a powerful indicator to other multinationals that the region could be fertile ground for their operations, too. The significance of clusters extends beyond current conditions. Over time, a cluster can catalyze a virtuous cycle wherein a growing workforce attracts more firms, which incentivizes a further increase in the pool of workers as more people stay or relocate in response to the greater demand for their skills.

The signs all point to emerging technology clusters in the region

The Invest Vancouver SIA project shows that many of the industry components that comprise the Life Sciences, Digital Media & Entertainment, and High-tech Services are growing much faster than the regional economy as a whole. Employment concentration data indicates that the Metro Vancouver region specializes in certain industries more than the national average. Shift-share analysis confirms the presence of the type of competitive advantages associated with clustering. Despite the region's size, it still stands out positively in total employment numbers compared to larger metropolitan areas.

Figure 6 compares the number of companies in several high technology industries in five Canadian census metropolitan areas (Vancouver, Toronto, Montreal, Calgary, and Edmonton) and three West Coast American jurisdictions (Seattle, San Francisco, and Los Angeles). These rankings, based on firm counts in 2021, represent the type of evidence of a cluster a firm might consider in the initial stages of a location search.

Figure 6: Number of firms in selected technology industries (2021)

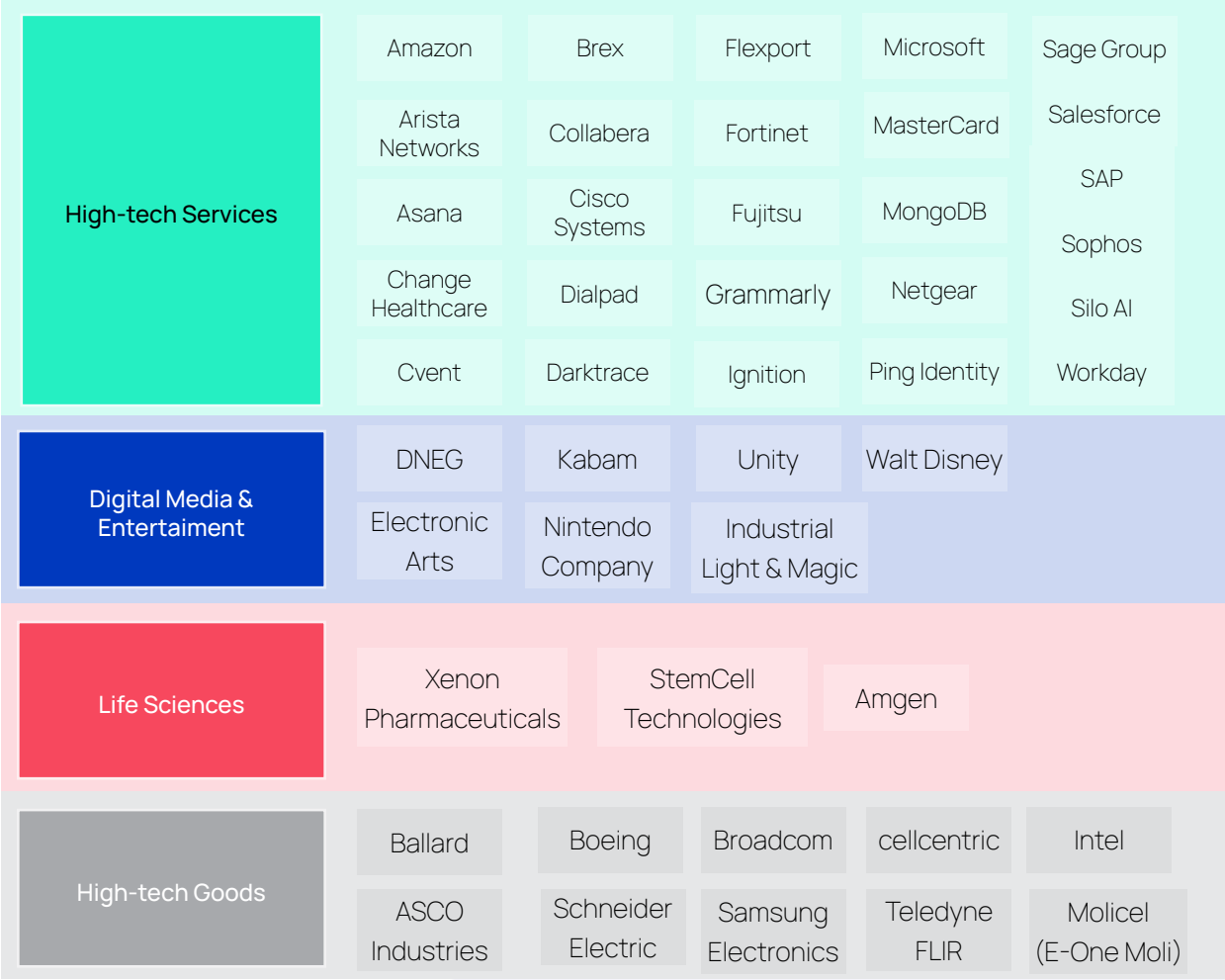


SOURCE: FDI BENCHMARK FROM THE FINANCIAL TIMES BASED ON DUN & BRADSTREET GLOBAL REFERENCE SOLUTION.

The data from fDi Benchmark is for 'Greater Vancouver', which includes Vancouver, Surrey, Burnaby, Richmond, Coquitlam, Langley, Delta, North Vancouver, Maple Ridge, New Westminster, and Port Coquitlam.

The signs of clustering are also evident in the corporate logos affixed to buildings across the Metro Vancouver region, which is home to branches of major multinationals engaged in motion picture production, animation, gaming, software, aerospace, networking, telecommunications, and semiconductors and more. Figure 7 shows a selection of the growing roster of multinationals operating in the region.

Figure 7: Selected multinational enterprises with operations in the Metro Vancouver region[25]



An established innovation ecosystem supports high technology firms in the region

Firms in the region's high technology sector benefit from a robust innovation ecosystem. The supporting environment, summarized in Figure 8, includes educational institutions, research institutes, accelerators, and industry associations. Contributions from the federal and provincial governments underpin the ecosystem.[26]

25 Some firms conduct business in multiple industries. The region's Life Sciences industry is predominately comprised of local firms who often work with MNEs based in other locations.

26 This is not an exhaustive list. For further information on the overall business ecosystem, see Invest Vancouver's Innovation Ecosystem Profile.

Figure 8: The Metro Vancouver region's high technology sector supporting ecosystem

Accelerators	• Creative Destruction Lab (CDL) • Empowered Startups • entrepreneur@UBC (e@UBC) • Launch Academy	• New Ventures BC (NVBC) • SFU Venture Labs • Spring Activator • Zen Launchpad
Industry Associations	• Artificial Intelligence Network of BC (AInBC) • BC Tech Association • DigiBC • First Nations Technology Council	• Frontier Collective • Motion Picture Production Industry Association of BC • Vancouver VR/AR Association
Post-Secondary Institutions and Specialty Schools	• British Columbia Institute of Technology (BCIT) • Capilano University • Centre for Digital Media • Douglas College • Emily Carr University of Art + Design • Kwantlen Polytechnic University	• Langara College • Northeastern University • Simon Fraser University (SFU) • University of British Columbia (UBC) • Vancouver Community College (VCC) • Vancouver Film School (VFS) • Vancouver Institute of Media Arts (VanArts)
Public Sector	• BC Ministry of Jobs, Economic Development and Innovation (JEDI) • Business Development Bank of Canada (BDC) • Canada Innovation Corporation • Creative BC • DIGITAL • Global Affairs Canada	• Innovate BC • Innovation, Science, and Economic Development Canada (ISED) • Mitacs • National Research Council (NRC) • Pacific Economic Development Canada (PacifiCan)
Research & Development	• Quantum Algorithms Institute • SFU Clean Hydrogen Hub • Stewart Blusson Quantum Matter Institute	• TRIUMF Particle Accelerator • UBC Smart Hydrogen Energy District

A strong **post-secondary education system** anchors the region's innovation ecosystem. The University of British Columbia (UBC) and Simon Fraser University (SFU) are internationally recognized for their focus on research and development.[27] The British Columbia Institute of Technology (BCIT) emphasizes technical skills, problem solving, and real-world experience. These organizations and the rest of the post-second system are a crucial source of skilled workers, entrepreneurs, and innovation.

27 In 2023, UBC was ranked in the top 5% of universities in the world by several prominent global university ranking agencies. UBC, "UBC's Instirutional Rankings." SFU was the most innovative university in Canada and 13th most innovative in the world in 2023. WURI, "Wuri Ranking 2023."

Complementing this educational foundation is a network of **accelerators** and **industry associations**. The accelerators help entrepreneurs and researchers transform innovative ideas into viable business ventures with financial support, mentorship, and strategic guidance. The industry associations serve as platforms for networking, knowledge sharing, and advocacy, and thus contribute to the sector's overall vitality.

The **public sector** plays a pivotal role advancing innovation, talent development, and investment. The public support extends to **research & development** organizations that focus on advancing technological innovation in frontier technologies such as quantum computing technologies and particle and nuclear science.

Maximizing potential return on investment is a priority for firms

Insight from location experts: Cost differences are implicit in any discussion of location decisions. Firms consider tax rates, labour costs, property costs, and the costs of regulatory compliance. While firms generally seek to minimize these costs, they may prioritize access to top-tier talent over lower costs in certain cases. Financial incentives (in the form of subsidies and tax breaks) can also be influential, though their significance varies among technology firms. Some firms consider such incentives crucial, while others regard them as supplementary rather than primary drivers of their decisions.

Invest Vancouver findings: Given the focus on maximizing return on investment, firms routinely scrutinize their cost structure. In interviews, firms providing services mentioned the region's relatively low labour costs as an advantage. Since labour is their largest input, the region's high office costs are not as much of an obstacle as they might be in other sectors. Land costs can be an obstacle for goods-producing technology firms, particularly for those that require a large footprint, because industrial land is scarce and expensive in the region. Both the provincial and federal governments have put in place incentives to help offset costs related to talent, R&D, and investment.

The cost of doing business in the region is attractive

The region is an attractive choice for companies in high-cost locations requiring a talented workforce and seeking strategic locations with relatively low labour costs.[28] Compared to US technology hubs like Silicon Valley and Seattle, the Metro Vancouver region offers access to high-quality talent at attractive rates. The region is also competitive with other Canadian metropolitan areas.

28 CBRE, "Scoring Tech Talent 2023" (July 17, 2023).

Figure 9 illustrates the average annual operating costs (labour + office space) in 2023 for a representative technology firm in the Metro Vancouver region compared to Montreal, Toronto, Calgary, and Edmonton and high-tech hubs along the US West Coast.

Figure 9: Average annual operating costs for a representative technology firm (USD millions, 2023)

Jurisdiction	Labour cost	Office cost	Total costs	Office cost as % of total costs
San Francisco Bay Area	$74.7	$4.2	$78.8	5%
Seattle	$59.3	$2.7	$62.0	4%
Los Angeles/Orange County	$53.3	$2.6	$55.9	5%
Calgary	$37.5	$1.3	$38.9	3%
Toronto	$36.0	$2.1	$38.1	6%
Vancouver	$35.1	$2.4	$37.5	7%
Edmonton	$32.6	$1.5	$34.1	4%
Montreal	$32.2	$1.6	$33.9	5%

SOURCE: SCORING TECH TALENT CBRE REPORT (2023).
Estimated one-year company costs based on an office space of 60K square feet, with 500 employees using metro area office costs.

The region's cost-competitiveness may be surprising to residents accustomed to thinking of the region as expensive. Yet, operating costs in the Metro Vancouver region are significantly lower than in major centres on the US West Coast and land right in the middle among large Canadian metro areas. The region's office space is the most expensive in Canada, at almost double the low-cost leader, Calgary. However, office space is such a small component of annual operating costs for a typical technology firm that its cost is negligible as a competitive factor. Conversely, labour costs, which make up the greatest share of annual operating costs, are lower in the region than in Toronto and Calgary and dramatically less than in US jurisdictions.[29]

Firms also consider additional costs beyond basic operating expenses in their location decisions. Such costs might include those associated with immigration (to address that skills gap, as discussed above) and healthcare. The Canadian immigration process is less expensive than the American equivalent, and interviewed firms mentioned these savings. Similarly, firms with US and Canadian locations noted that Canada's universal healthcare system saves them money on benefits packages for their employees.

29 Invest Vancouver replicated the CBRE cost comparison using fDi Intelligence from the Financial Times firms in various technology categories offered by fDi Intelligence, including software development, informatics R&D centre, video game design centre, engineering services, multi-media design centre, and film & TV and found the same result.

Industrial land requirements reduce the low-cost advantage

The region compares less favourably for firms requiring industrial space. Demand for industrial land in the region is high, the vacancy rate is very low, the supply is constrained, and market prices reflect the resulting scarcity.[30] The cost of industrial land in the Metro Vancouver region is the highest in Canada and the third highest amongst the jurisdictions in the previous example.

In contrast to service-producing firms, where the cost of physical space is a small share of total costs, land costs for typical industrial firms can be substantial. For example, in the same set of metro areas, fDi Benchmark estimates that industrial land costs for an electronic components manufacturer constitute 46% to 61% of a firm's total annual operating costs. Thus, finding suitable industrial land and absorbing the cost is likely to be an obstacle for new entrants to the region, making investment attraction more difficult.

Government and not-for-profits help firms in the region reduce their costs.

Support and incentives are important in attracting investment to the region. They are primarily provided through public sector and not-for-profit organizations and include various forms of assistance, such as funding, tax incentives, and programs for talent development. The supports loosely fall under talent; research & development; and business growth.

Firms in the tech sector have access to skilled labour, in part, due to programs aimed at upskilling and talent attraction and retention. They can benefit from financial support for R&D and programs that connect academia with industry as well as various incentives to increase capital investment, expand their operations, and adopt digital technologies. [31] Additionally, the Digital Media & Entertainment industry benefits from targeted tax incentives that have helped foster and grow media production, post-production, and video game design by reducing the of qualified labour expenditures.[32]

The ease of doing business matters to firms

Insight from location experts: Firms prefer not to waste time. Local municipalities and investment attraction agencies can enhance a region's attractiveness with custom services, such as organized site visits and one-on-one consultations. Sought after services include help accessing local resources, navigating administrative complexities, and swiftly resolving issues as they arise. Firms are more likely to favour regions that smooth out hurdles and provide a seamless and expedited path, thereby reducing their time to market and the start of revenue generation.

Invest Vancouver findings: Firms making location decisions behave like consumers. They try to minimize their expenses, which means avoiding situations where they have to pay interest and salaries while not earning revenue. Thus, they prefer jurisdictions with short, guaranteed permitting processes to those with lengthy, uncertain ones. In general, firms will prefer locations where the regulatory framework is simple to navigate, predictable, and stable. Creating business-friendly policies can be a cost-effective way to improve a region's attractiveness, particularly when competing with regions that offer substantial incentive packages. Also, enhanced coordination among the Metro Vancouver region's local ecosystem players would ensure a streamlined experience.

30 Claire Wilson, "Metro Vancouver's Industrial Land Shortage Threatens Future of B.C.'s Trade Economy," Business in Vancouver, September 21, 2023.

31 See Appendix for additional details.

32 For additional details, see Invest Vancouver's forthcoming Digital Media & Entertainment Sector Profile and BC Government, Film and television tax credit and Interactive digital media tax credit.

Progress among all orders of government in BC in the race to catch up with other regions

The Province of BC and other governments in BC are making progress in implementing business-friendly policies. However, they lag behind other metro regions such as Montreal, QC and Calgary, AB that have gone further in coordinating between local, regional, and provincial governments. This coordination presents a unified experience for prospective companies.

Signs of progress among all orders of government in BC include the Province of BC's Clean Energy and Major Projects Office (CEMPO), which it created to improve regulatory certainty, competitiveness, access to labour, and coordination with First Nations and local communities. At the municipal level, many communities have been systematically streamlining their development permit processes to make them simpler, faster, and more predictable. In particular, the City of Surrey has guaranteed timelines, an online permitting portal, pre-application meetings, and outreach to help applicants understand and correct application deficiencies. Business friendly efforts like these improve the region's chances of attracting investment in the technology sector.

The Metro Vancouver region is not always top of mind for many international technology firms

Insight from location experts: For many technology firms, the Metro Vancouver region is not at the forefront of international considerations when discussing possible investments and expansions. Toronto and Montreal overshadow the Metro Vancouver region and are themselves eclipsed by San Francisco and New York. To the extent that site selection is like a job search, firms have drawn up the interview list without ever having reviewed the Metro Vancouver region's resume.

Invest Vancouver findings: This may seem contradictory given the region scores well on the key factors identified as top determinations for investment location and the significant presence of prominent international tech firms. Yet, the region's international reputation rests on its appeal as a tourist destination, not as a technological powerhouse. Moreover, building a reputation takes time. The technology industries' rise to prominence in the region is relatively recent, particularly compared to its historical roles in international trade and resource extraction. Bridging this gap between the current reality and outdated perceptions is vital for raising international investors' awareness of the region as a potential location.

Firms that are aware of the region's value proposition have chosen to expand here

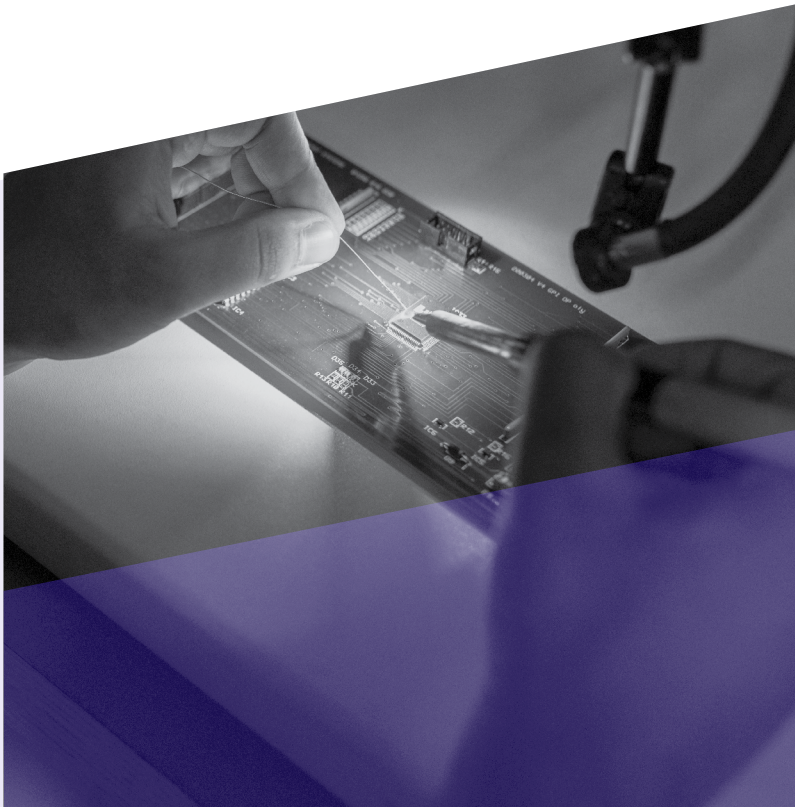
When the region's specialized expertise ranks among global leaders, firms are more likely to recognize its value proposition. In hydrogen, for example, the Metro Vancouver region has firms along the entire value chain and is a leader in fuel cells. Firms such as cellcentric Fuel Cell Canada (a joint venture between Daimler Truck AG and the Volvo Group Ab) have selected the region specifically to tap into the specialized talent in this field. Similarly, the region is a prominent location for filming and many elements of "creative tech," notably animation, visual effects, video game development, and increasingly, immersive media. The process is mutually reinforcing, since each multinational firm that adds a location in the Metro Vancouver region expands the cluster that attracted it and adds to its reputation.

Geographic proximity has also helped overcome reputational lag, with firms on the West Coast of the US more likely to be familiar the region's strengths, especially in Digital Media & Entertainment, software, the Life Sciences, and clean tech. For firms engaged in development work, proximity and a shared time zone combine to make the region a better fit. The more the work requires the engagement of high-level management, direct consultation, and creative collaboration among geographically dispersed teams, the more likely geographical proximity and a shared time zone matter. Executives facing frequent travel for in-person meetings prioritize shorter travel times and consistent time zones. The shared time zone also means that work hours overlap among remote teams based on the West Coast, allowing for immediate feedback and engagement via phone, email, and collaborative software tools.[33]

More work is needed to raise the profile of the region's technology hub

Promoting the Metro Vancouver region at key international technology events will help elevate the region's value proposition and strengthen connections to the global tech ecosystem. [34] Such outreach and connection cultivates an increasing awareness of the region and can highlight its advantages and strengths. The region could also raise its profile by hosting tech-oriented events. As an example, Lisbon's Web Summit has become one of the world's most prominent technology conferences and it has raised that region's prominence in the international tech community.

Proactive engagement with prospective firms is also important. This includes identifying and reaching out to firms considering expansion and providing business intelligence highlighting the region's strengths. The outreach may take the form of outbound delegations, which help raise awareness of what the region has to offer. Similarly, hosting inbound delegations provides an opportunity to sell prospective firms on the strengths of the regional technology sector, the supporting ecosystem, and the ease of doing business here. Finally, building relationships and networks is worthwhile because some of the best investment attraction opportunities grow out of such connections. Sharing information about an exciting project in the early stages of development or a compelling idea percolating in the local ecosystem, for example, may spark interest from a company that was not already considering the region.



33 These considerations are not unique to the West Coast. Toronto, for example, benefits from proximity to and a shared time zone with New York. Interestingly, the opposite can also be true. Firms in Asia are ending their day when it is early morning in BC, which means a location in the region can help cover 24-hour operations for client needs, crisis management, etc.

34 Invest Vancouver engages in this work, often in partnership with Global Affairs Canada, Invest in Canada, and Trade and Invest British Columbia.

Section III

AI's transformative potential

Artificial intelligence (AI) stands at the forefront of technological innovation, with the potential to significantly reshape not only the technology sector but myriad aspects of business and everyday life. Given the rapid evolution of AI and its profound implications, coupled with the Metro Vancouver region's noticeable advancements in applied AI, this report includes a focused segment on AI.

The launch of OpenAI's ChatGPT has propelled AI into the limelight, sparking widespread interest in the ongoing AI revolution. The adoption of AI may be similar to the internet in its capacity to fundamentally reshape the economy and transform society. AI will enable the creation of novel services and give rise to entirely new industries, the same way the internet made possible e-commerce, social media, streaming services, and digital apps.[35] It will transform roles in existing industries, and introduce ethical, legal, and societal concerns.[36] As AI evolves and expands the boundaries of what is possible, it will precipitate additional risks and opportunities, many of which are unclear or unknown at this time. Even in this period of rapid change, however, there is a clear risk arising from not integrating AI.

This section consists of two parts, both focused on the implications of AI adoption in the Metro Vancouver region and BC.

1. The risks from moving slowly to integrate AI and the possible creation of a new digital divide.
2. The economic development opportunities in three domains – resource extraction, construction, and healthcare – where the region holds considerable expertise and the integration of AI could yield novel solutions to pressing societal challenges.

Uneven AI adoption could create a new digital divide

Uneven adoption of AI could create a new version of the digital divide, based on the capacity and willingness of individuals, firms, and countries to integrate AI into their systems and processes. The job market will reward people who can use AI to complete tasks more efficiently. Firms that embrace AI, especially those that move swiftly, stand to gain a competitive edge over those that approach AI adoption with hesitation or avoidance. Countries where people, firms and governments that integrate AI will be better positioned to benefit from productivity gains.

35 Just as Netflix supplanted Blockbuster and then provoked a transformation in entertainment consumption, people will use AI to create business models that will disrupt incumbents and reshape markets. Also like the internet, AI will spur many smaller changes through applications that improve existing services and make workers more efficient.

36 Examples include law enforcement's use of biased facial recognition models trained on problematic data sets; legal risks surrounding the unauthorized use of all manner of intellectual property to train models; new cybersecurity risks; and the potential to undermine the democratic process with malicious AI-generated images and videos indistinguishable from the real thing.

For individuals, the rapid technological change induced by AI may provoke fear of job losses because AI allows for the automation of an even wider variety of routine tasks across many disciplines. The use of AI may eliminate some roles, but it will also ease labour shortages. For example, in shipbuilding a single welder able to oversee multiple AI-controlled welding robots can overcome a shortage of maritime welders. More broadly, AI will underpin a shift from 'doing' to 'supervising' in multiple settings, including call centre workers who transition to monitoring responses from chatbots interacting with many customers simultaneously. Such changes will make workers more productive and may improve their job satisfaction, but it might not be seamless. Many workers will need new skills to navigate the evolving job landscape.

Already, there is growing evidence that AI can make users more productive. Programmers who use AI-based tools, for example, can complete routine and repetitive tasks as much as 50% faster than those who do not.[37] Knowledge workers using AI are more productive, complete tasks more quickly, and produce higher quality results.[38] Workers who are more productive are likely to do better in the job market, suggesting competition from AI-proficient humans is a bigger employment risk than clever computers displacing humans.

A 2023 World Economic Forum study highlights that the adoption of frontier technologies, such as AI, is driving transformation and will necessitate comprehensive upskilling as automation and AI reshape job roles.[39] If AI adoption is similar to the introduction of computers and internet-based technologies in the workplace, older workers and people from backgrounds that limit their opportunities for appropriate training and access to the technology are the most likely to find themselves on the wrong side of the AI divide. In a cruel irony, they may also be the ones who would benefit most from using AI.[40]

For firms, the risk is waking up on the wrong side of the new digital divide, with their competitors far ahead in adopting AI. McKinsey, a global consultancy, found that firms building up their digital and AI capabilities outperformed laggards in total shareholder returns across every sector they analyzed, often substantially.[41] At a minimum, businesses should be collecting, sorting, and curating business-specific data for training AI models and creating digital twins. Comprehensive operations data can be incredibly valuable, both for improving the specific business that collected it and for deriving insights applicable to others like it. Especially for first movers, the secondary revenue stream from business-specific datasets may rival their primary business. Beyond figuring out a data strategy, firms need to embrace AI and invest in training for their employees, with people working in the field describing it as "irresponsible" for any business not to make AI adoption a top priority.[42]

37 See, for example, McKinsey Digital, "Unleashing developer productivity with generative AI" (June 2023).

38 Fabrizio Dell'Acqua et al., "Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity," *Harvard Business School Technology & Operations Management Unit Working Paper No. 24-013*, September 2023.

39 World Economic Forum, "Future of Jobs Report 2023" (May 2023).

40 Sida Peng et al. found that older and less experienced programmers benefitted the most from working with an AI programmer. See "The Impact of AI on Developer Productivity: Evidence from GitHub Copilot" arXiv.org, February 2023.

41 Bryce Hall et al., "Rewired and running ahead: Digital and AI leaders are leaving the rest behind," McKinsey & Company, January 12, 2024.

42 The panel at the Microsoft and Vancouver Tech Journal "Capturing the AI Opportunity in BC" event on February 13, 2024 emphasized the urgency of adopting an AI strategy and stressed the value of business data.

The urgency for AI adoption is acute for firms in both BC and Canada, where the prevalence of small firms and a more risk-averse business culture may hinder readiness to embrace AI. Overcoming these barriers is crucial to unlock the full potential of AI technologies. Notably, 98% of businesses in BC employed 50 or fewer workers in 2022. Smaller firms are slower to adopt new technologies (and AI in particular), and may lack the resources to pursue such investments.[43] Additionally, the Canadian business culture is more risk averse than in the US, affecting the pace of AI integration.

Large American firms seem to be moving more quickly to incorporate AI: 72% of US compared to just 35% of Canadian large firms reported using AI in their operations.[44] Invest Vancouver's interview with a Vancouver-based developer of a new AI-enabled service highlighted this discrepancy. One of their clients is a large firm with US and Canadian operations. The client's Canadian branch was still in preliminary discussions whereas the US branch had embraced and deployed the AI-based service.

Multiplied across individuals and firms, reluctance to adopt AI could see Canada forego a much-needed productivity windfall. In a public address in March 2024, the Bank of Canada noted that the country's business sector productivity was essentially the same as seven years earlier, and that our GDP per capita has weakened considerably compared to the US.[45] They called for coordinated efforts to fix this problem, including better use of technologies like generative AI.

Looking forward, boosting productivity is necessary to support higher Canadian wages and living standards. McKinsey estimates that AI-based automation could provide an annual boost to global productivity of 0.5% to 3.4% from 2023 to 2040, depending on adoption rate and worker redeployment.[46] To capitalize on this opportunity, our workforce needs to be adequately prepared to handle the major disruptions caused by this new technology.

While the risk of ending up on the wrong side of the AI divide should spur firms to action, there are plenty of reasons to be optimistic about AI and the implications for the regional economy.

AI as an economic development opportunity

The Metro Vancouver region and BC are poised to play a leading role in leveraging AI to tackle pressing societal challenges. Resource extraction, construction, and healthcare are just three applications where AI integration added to the region's existing industrial strengths, expertise, and skill sets could forge pathways to superior, more sustainable solutions. Innovations that enhance mining efficiency while mitigating its environmental footprint, accelerate building construction, and optimize healthcare delivery would be in high demand worldwide. Such advancements hold the promise of higher quality of life through enhanced housing affordability, improved healthcare accessibility, and reduced environmental degradation. For the region that hosts the companies supplying them, they would also foster job creation and economic resilience through exports.

43 Deloitte, Digital Equity: Empowering All Organizations to Succeed in the Digital Era (November 2023).

44 KPMG, "More than One Third of Canadian Businesses Experimenting with CHATGPT, KPMG Canada Survey Finds" (April 19, 2023).

45 In 1984, output per hour worked in Canada was 88% of US levels; by 2022, it had fallen to 71%. Over that same period, Canada's productivity lagged all G7 members except Italy. Senior Deputy Governor Carolyn Rogers, "Time to Break the Glass: Fixing Canada's Productivity Problem," Bank of Canada, March 26, 2024.

46 Michael Chui et al., "The Economic Potential of Generative AI: The Next Productivity Frontier," McKinsey & Company, June 14, 2023.

The region is already cultivating AI-powered solutions across myriad domains, despite the perception that AI innovation is concentrated elsewhere. The impression of the region as an outsider in AI stems from the region's peripheral role in the federal government's national AI development strategy, which primarily revolves around support for National Artificial Intelligence Institutes in Edmonton (Alberta Machine Intelligence Institute – AMII), Montreal (Mila), and Toronto (the Vector Institute). These institutes act as a magnet for researchers focussed on AI development, in contrast to our region, where Google poached leading AI academics from UBC in the early 2010s.

Yet, the region teems with vibrant AI initiatives. Vancouver-based **DIGITAL** uses federal funding to champion homegrown AI technologies as part of its overarching mission to catalyze R&D investment, foster technology adoption, and facilitate the re-skilling of Canadian talent. The UBC **Centre for Artificial Intelligence Decision-making and Action** (CAIDA) boasts over 100 professors and their research associates spanning 27 departments, schools, and institutes. At SFU's highly regarded **Big Data Hub**, industry, the public sector, and community groups collaborate with AI researchers pioneering solutions across multiple sectors.[47]

In the private sector, a diverse array of firms harness the power of AI, ranging from **Fujitsu's** AI research group to enterprises such as **Semios** and **Terramera** in agritech, **A&K Robotics** and **Sanctuary AI** in robotics, and **Variational AI** and **AbCellera** in life sciences. SaaS ventures like **Copilot AI** and **CharliAI**, digital content creators like **Lumen5**, and sustainability-focused enterprises like **intuitive** in waste management and **OnDeck** in fisheries management contribute to the rich tapestry of AI innovation. According to Capital Compass, a new investment-tracking tool from Innovate BC, the Metro Vancouver region hosts over 130 firms dedicated to developing cutting-edge products and services grounded in applied AI.

Matching the region's emerging excellence in applied AI with existing strengths and expertise could produce advancements in multiple areas.

Developing AI solutions for more efficient and sustainable mining

Separating the resource economy from the technology sector overlooks how technology not only boosts demand for resources but also fundamentally transforms the industry. In mining, technology is driving demand and altering the sector significantly. On the demand side, clean technology is poised to underpin a sustained boom in mining for critical minerals, even with significantly expanded recycling efforts. Within the industry, AI and machine learning are powering mining technology for enhanced recovery of metals. Mines are complex systems that generate vast data volumes and AI acts as an enabling technology that helps data-intensive industries glean insights from data to reach better outcomes.

Mining activity is abundant in BC, presenting an opportunity for technology companies in the region to work with the industry on tailored solutions. The BC mining sector offers fertile ground for the development of best-in-class mining technology, especially in mineral exploration and processing. The combination of industry experience and technological expertise should ensure an emphasis on practical solutions with tangible real-world applications. Mining technology is alluring on two fronts. First, the industry urgently needs enhanced sustainability and efficiency. Second, escalating global demand driven by the need for critical minerals to support the clean energy transition ensures firms specializing in mining technology have global reach almost from inception,

47 AIRankings.org rates the SFU Big Data Hub #1 in BC and #4 in Canada for AI capabilities.

with ample potential for export-driven growth.[48] Firms in the region are already working on AI-driven mining solutions (see box).

Hyperspectral Intelligence develops imaging technology for the mining and energy sectors, enabling precise rock analysis for safer and more efficient mining. Their cloud-based data processing offers real-time insights, enhancing sustainable resource extraction practices.

Ideon Technologies uses cosmic-ray muon tomography and artificial intelligence for subsurface imaging in mining. Their technology measures subatomic particles from supernovas to detect minerals and metals beneath the Earth's surface, offering a sustainable and more efficient alternative to conventional exploration methods.

MineSense leverages AI and machine learning in its technology to differentiate ore from waste in the mining process. Their system combines hardware and software, employing proprietary algorithms to analyze and report real-time data on ore grade and characteristics, thereby improving mining efficiency and decision-making.

Tackling housing affordability through AI-driven construction innovations

The Metro Vancouver region could be at the leading edge of new construction techniques made possible with applied AI. The region needs more housing, especially more affordable housing, to meet pent up demand from a growing population.[49] The housing issue is a complex one, and there are many challenges to overcome. No single solution will make housing plentiful and affordable. Yet, new building methods might reduce the time required for construction and mitigate the shortage of skilled workers in the building trades.[50] While these innovative construction techniques would address our local housing needs, the issues they target are not exclusive to our region. This presents an opportunity to export AI-driven construction solutions.

48 Canada Energy Regulator, "Market Snapshot: Critical Minerals are Key to the Global Energy Transition" (January 2023).

49 A recent RBC study found the cost of housing has reached all-time highs in Canada, including in Vancouver. To improve affordability, they call for a coordinated, multi-prong approach to increase housing supply, including the use of innovative technology such as artificial intelligence. RBC Economics, The Great Rebuild: Seven Ways to Fix Canada's Housing Shortage, (April 2024).

50 AI might also help streamline the approvals and permitting processes: Kelowna, BC is using AI to expedite building permits.

Next generation building techniques address affordability by making it possible to build more housing, more quickly, with fewer people. The Canada Mortgage and Housing Corporation (CMHC) forecasts that to make housing affordable by 2030, the country needs an additional 3.5 million homes beyond the number expected under business-as-usual scenario.[51] Housing affordability has also eroded globally, in large part due to a lack of supply.[52] The introduction of AI-powered building techniques will make it possible to build much more quickly. Faster is better because it helps bridge the gap between supply and demand that fuels rising prices, and longer construction periods escalate expenses, which developers pass on to buyers. Harnessing AI for routine and repetitive tasks will also make construction less labour intensive, which matters in this context because the shortage of skilled construction workers limits the pace of building. With the looming wave of retirements among the trades, expanded training programs will struggle to offset the losses. Building techniques that use less labour will make it possible to build more with greater efficiency at a lower cost, which should translate to a more affordable final product.

AI-based technology will be integrated throughout the future of building construction: in the initial design, in the permitting process, in the models used to schedule the onsite work, in the visualizations that allow designers and customers to tour a building before it is built; and, increasingly, in the construction itself.[53] These new buildings will be smart (with embedded monitoring technology), resilient (to earthquakes, floods, and fires), use sustainable materials (such as mass timber), and be designed to produce lower carbon emissions. Modular construction will see large components built offsite and then assembled onsite.

Moving part of the construction into a factory in modular construction will allow the use of AI-controlled robots in a matter already familiar from the automated production lines in the motor vehicle industry. The novel application is at the construction site. UBC researchers have already designed AI-controlled drones for inspection work and real-time onsite mapping. The drones can provide real time input to create a digital twin of the construction site. Using the digital twin, a separate AI system can safely control equipment, such as a crane, to autonomously unload and place large cement blocks. The same lab is working on autonomously controlled excavators and envisages moving on to equipment used throughout the building process. This work is at the leading edge of the coming transformation of the construction industry.

51 "For the purposes of this report, we define affordability in terms of the share of after-tax income that a household with average income would need to spend to buy the average house. The target is, by 2030, to return affordability to levels last seen around 2004, before the price growth that many Canadians have faced in the last decade and more." CMHC, Housing Shortages in Canada (September 2023).

52 World Economic Forum, What has Caused the Global Housing Crisis – and How Can We Fix It? (June 2022).

53 Rapid prototyping and testing of design options at the concept stage is a rapidly emerging use case. In permitting, the BC government and municipalities such as Kelowna are already exploring how the use of AI can reduce the time required to verify project compliance with municipal and provincial regulations, greatly increasing certainty and reducing processing time.

To address the housing issue, the most important development will be advancing new building techniques to the point where they reach economies of scale, i.e. they tip over from an expensive demonstration process to something routinely deployed across multiple building sites at lower costs. Accelerating the widespread deployment of these innovative solutions will bring the tipping point and the realization of efficiency gains closer.

The private and public sectors should explore ways to speed the adoption of these technologies within the region. Singapore, for example, is encouraging construction automation through financial incentives that reward off-site building.[54] In the public sector, novel approaches to procurement, demonstration projects, and routine deployment of these solutions can stimulate demand and assist in the achievement of economies of scale, thereby enhancing their market competitiveness. As part of the **CMHC Housing Supply Challenge**, for example, BC Housing, Metro Vancouver, Kope.ai, and other partners are developing a digital catalog of pre-qualified, off-site building components and a software tool to configure mid-rise buildings for prefabricated construction. The resulting standardization should spur growth in the industry, provide greater cost certainty, and make the delivery of housing more efficient.

The public interest in AI-integrated construction is threefold. First, it makes it possible to build more housing, more rapidly. Second, it makes it possible to build at lower cost once the techniques achieve scale, even if it is initially more expensive. Third, it allows the region to carve out a niche in which it excels, potentially becoming an engine for economic growth and innovation. The region is not alone in struggling to build housing, and there would be a substantial and growing export market for these technologies.

Harnessing AI to elevate patient care and strengthen the Life Sciences industry

Integrating AI with health services and harnessing health data could improve patient outcomes and bolster the life sciences industry. The strained provincial health system faces constant pressure to deliver care that is faster, better, more accessible, and more cost-effective. Strategic, small-scale experimentation with applied AI targeting patient outcomes could alleviate these pressures. Fraser Health is spearheading such testing in patient settings. Similarly, AI's efficacy in research and drug discovery hinges on access to comprehensive health data, an area where Providence Health Care is making progress.

54 Built Offsite, Singapore rewards offsite construction companies that embrace advanced offsite construction automation (September 2023).

BC might be in the optimal position for leveraging applied AI to enhance patient health, since the health sector in the province is small enough for effective coordination yet substantial enough to yield meaningful results. One interviewee cited the swift deployment of ultrasound machines across the province during the pandemic as the type of coordination BC handles better than larger jurisdictions. Consequently, the provincial health system could be an excellent environment for prototyping and commercializing applied AI.

Fraser Health, the largest of the five publicly funded regional health authorities in BC, serves more than two million people in 20 communities from Burnaby to Fraser Canyon. The health authority's Digital Patient and Provider Experience team is prototyping and testing AI and other technology implementations in the health system, including a pioneering enterprise digital twin and digital front door. This innovative use of predictive and prescriptive health analytics is driving improvements in health care access, delivery, and patient convenience.

Fraser Health is establishing partnerships to co-create AI solutions and recently won a 1.5-million-dollar prize from Scale AI to collaborate with Deloitte Canada. Through this collaboration, they are developing an AI-driven physician-scheduling tool to forecast patient demand accurately, which will improve the patient experience and reduce physician workloads.[55]

Adopting generative artificial intelligence, Fraser Health is using Google Cloud's Vertex AI and large language models (LLMs) that can learn policies and workflow processes, which are reducing clinicians' administrative workloads by simplifying the clinical documentation process within the MEDITECH Expanse EHR system.[56] In addition, in collaboration with Amazon Web Services, they have introduced a Virtual AI Assistant that is supporting staff and medical staff in quickly locating learning resources on MEDITECH Expanse functionality and workflows.[57]

Another notable example of Fraser Health's technological innovation is their deployment of the "GI Genius" system for colon cancer screening.[58] This initiative uses AI to assist medical teams by enhancing the accuracy of colonoscopy procedures through real-time, AI-assisted polyp detection. Such advancements underscore Fraser Health's commitment to employing cutting-edge technology to improve patient outcomes, with early detection playing a crucial role in increasing survival rates for colon cancer.

55 Hospital News, Scheduling for the future with artificial intelligence (December 2023).

56 Hospital Management, Fraser adopts generative AI for MEDITECH Expanse EHR (December 2023).

57 Fraser Health, New Virtual Assistant uses artificial intelligence to improve staff and medical staff learning experience with MEDITECH Expanse - Fraser Health Authority (February 2024).

58 Fraser Health, Improving colon cancer screening with artificial intelligence (December 2023).

Managing access to data presents a universal challenge: finding a balance between security and accessibility. Opting for inaction is convenient, but forfeits the potential health improvements and operational streamlining. In Canada, various models exist to address this challenge. Among them, **Providence Health Care**, a not-for-profit operator of hospitals and research centres in BC, stands out.[59] Providence Health Care Ventures, a subsidiary of Providence focused on technology partnerships and development, aims to further the integration of frontier technology such as AI with the healthcare system through a collaborative, secure, data-driven approach to improve patient outcomes. At the forefront of this innovation is their advanced Integrated Health Informatics Datalab (IHID), which our interviewees described as one of the most advanced health data programs in Canada.

IHID is designed to bridge the gap between the Life Science industry's need for health data access, while upholding the stringent privacy and ethical standards hospitals must adhere to. IHID's cloud-based system not only facilitates and streamlines data integration across multiple datasets, but also upholds patient privacy through de-identification and the implementation of strict controls, thereby ensuring a secure research environment. Companies are able to run models on IHID and can request restored access to the same dataset in the future to do additional testing. However, they are restricted from downloading the source health data from the cloud, so it remains within the secure environment. Only their researchers' derived research results leave the system at the conclusion of the project.

Providence's approach significantly enhances access to diverse datasets, providing firms with the certainty of cost and timing, which is crucial to effectively employ technologies like machine learning and AI to model potential outcomes and innovative products. Such an environment is highly conducive to innovation. Since it is attractive for both local and international firms, it could foster industry clustering and the emergence of anchor companies.

Concurrently, the use of AI allows Providence to enhance their own operational efficiencies. For example, they have begun using machine learning on their internal data to optimize the assignment of mobile blood draws based on physical layout and travel times within St. Paul's Hospital, which should result in significant internal efficiency gains and improved patient outcomes.

Thus, AI could improve healthcare in BC. From an economic development perspective, carefully managed and protected patient data could attract firms using AI to develop medical therapies. The diverse, multiethnic population of BC enhances the value of our patient data even further. Instead of conventional financial incentives such as tax credits or grants, the province could use access to this invaluable data as part of a compelling value proposition for attracting investment and pharmaceutical firms. Integrating data across health sector organizations in BC would make it more valuable, and would almost certainly repay the required investment and effort.

59 In addition to 18 health care sites, Providence Health Care includes the St. Paul's Foundation (fundraising), Providence Living (seniors' care), Providence Research (BC Centre of Excellence in HIV/AIDS, BC Centre on Substance Use, Centre for Heart Lung Innovation at UBC and St. Paul's Hospital, Advancing Health), Foundry (province-wide network of health and wellness services for young people), and Providence Health Care Ventures (commercialization of health care solutions).

Conclusion

The rise of the Metro Vancouver region as an emerging technology hub reflects a robust innovation ecosystem and the presence of pools of specialized tech talent. The sector has been an important driver of employment growth in the region, adding jobs far more rapidly than broader economy. It has also attracted tens of billions of dollars in investment in firms headquartered in the region and working in areas such as the Life Sciences, Cleantech, TMT (technology, media and telecoms, which includes many Digital Media & Entertainment firms), Software as a Service (SaaS), Cybersecurity, Internet of Things, FinTech (Financial technology), and Cryptocurrency/ Blockchain. Technology firms are increasingly offering solutions to traditional (non-technology) industries, a trend poised to accelerate with the integration of AI. Encouraging the deployment of AI in areas of significant regional expertise such as resource extraction, construction, and healthcare could spark further innovation and be a catalyst for economic development.

Continued rapid growth in the sector is not a given. Key risks such as the limited supply of needed talent, escalating living costs, and a fiercely competitive environment for investment attraction could disrupt the pace of growth. Effectively addressing these risks is essential for the high-tech sector and the wider regional economy.

Within the sector, more could be done to increase global awareness of the region's strengths. Many multinational enterprises have recognized the region's value proposition, but building a reputation takes time. With the relatively recent rise to prominence in many of the region's high technology industries, some firms remain more familiar with the region as a tourist destination, leading them to overlook it as a potential location. To drive greater investment attraction, the region's technology sector needs concerted efforts in brand building. Initiatives aimed at enhancing visibility, promoting a business-friendly environment, fostering innovation, and mitigating risks are essential if the region is to realize its full potential as a technology hub. By addressing challenges and embracing emerging opportunities, the Metro Vancouver region will secure its place as a leader in the global tech arena.

Appendix:

Metro Vancouver Regional Tech Sector Growth Supports

Talent

Upskilling and work-integrated learning. The *Stronger BC: Future Skills Grant* supports workers seeking short-term skills training at public post-secondary institutions for in-demand skillsets. *Mitacs*' internship program bolsters industry-academic collaboration, while the *BC Workplace Innovation Fund* invests in graduate scholarships and tech workforce development to address labor shortages.

Talent attraction and retention. The *Digital Skills for Youth* and the *Innovator Skills Initiative* focus on developing digital skills and promoting diversity in the tech sector. The *WorkBC Wage Subsidy Program* helps firms hire and retain talent, with a priority for youth and those with disabilities. *MOSAIC* connects newcomers to the region with employment opportunities. *NPower Canada*'s programs provide free training for underserved youth and adults for in-demand tech roles.

Research & Development

Conducting R&D. The *Scientific Research and Experimental Development* (SR&ED) program is a national tax incentive supporting R&D conducted by businesses regardless of size or sector.[60] The *Industrial Research Assistance Program* (IRAP) delivers financial assistance and advisory services to small and medium-sized enterprises (SMEs) developing and commercializing technologies, while *Innovations Solutions Canada* funds SMEs providing innovative solutions to pressing government needs.

Connecting academia and industry. The *Natural Sciences and Engineering Research Council of Canada* (NSERC) funds collaboration between academia and industry with grants. One such grant is Idea to Innovation, aimed at transforming academic research into commercially viable products or services.

Business Growth

Expanding operations. The *Accelerated Investment Incentive* encourages investment in assets like machinery and equipment with an enhanced capital cost allowance. The *Strategic Innovation Fund* (SIF) offers grants and loans for large-scale, transformative projects to support R&D, commercialization, firm expansion, and public-private collaborations. The *Venture Capital Tax Credit* offers a tax incentive for investments in BC small businesses, facilitating their access to early-stage capital for development and growth. *PacifiCan's Business Scale-Up and Productivity Program* offers interest-free loans to innovative and high-growth potential businesses.

60 To learn more about SR&ED, see: Government of Canada, Scientific Research and Experimental Development (SR&ED) Tax Incentives (December 1, 2023).

Adopting digital technologies. The *Canada Digital Adoption Program* assists SMEs in digital transformation through two streams: *Grow Your Business Online* grants for e-commerce integration, and Boost Your Business Technology grants for digital adoption planning and access to interest-free loans.

Digital Media & Entertainment

A variety of credits that reduce the cost of qualified labour expenditures have helped foster and grow media production, post-production, and video game design in the region.[61]

61 For additional details, see Invest Vancouver's forthcoming Digital Media & Entertainment Sector Profile and BC Government, Film and television tax credit and Interactive digital media tax credit.

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