

BC-led Canadian Digital Technology Supercluster Strengths and Capabilities

Introduction:

On March 22, 2017, the Government of Canada released its “Innovation Budget”, in which it proposed, “To invest up to \$950 million over five years, starting in 2017–18, to be provided on a competitive basis in support of a small number of business-led innovation ‘superclusters’ that have the greatest potential to accelerate economic growth.”¹

It is in this context that leaders of industry, industry associations, research, and post-secondary education from across British Columbia have come together to discuss BC’s global positioning, competitive strengths, and cluster capabilities.

The objective of this document is to describe the existing set of strengths and capabilities in BC that are foundational to the growth of a digital technology supercluster in the province.

This document is intended to serve as a key input to the national discussion on creating world-leading clusters and partnerships in Canada.

It is a precursor to any formal letter of intent or proposal to the national supercluster competition announced by Canada in the March 2017 budget.

This document contains general information from publicly available sources combined with interviews with industry leaders that Deloitte synthesized at the request of an assembly of industry, post-secondary, and public sector leaders in BC. Deloitte is not, by means of this document, rendering any professional advice, opinions, or services. This document is not a substitute for such professional advice, opinions, or services, nor should it be used as a basis for any decision or action that may affect your business. Deloitte shall not be responsible for any loss sustained by any person or entity who relies on the information contained in this document.

The data contained in this report, although believed to be accurate, is not warranted or represented by Deloitte to be so.

Executive Summary

British Columbia is positioned to lead Canada as a global digital technology supercluster

Executive Summary: British Columbia is positioned to lead Canada as a global digital technology supercluster



#1

Start-up ecosystem in Canada



3 of 5

Canadian unicorns



Fastest-growing

Tech sector in Canada



Largest

per capita tech startup cluster in Canada



2 of top 3

universities in software development in Canada



\$26 billion

in revenue



>150,000

tech jobs
(across all sectors)

Today, BC is home to a vibrant, diverse, and successful technology-enabled economy that has been building momentum since the 1960s. BC has:

- **The fastest-growing technology sector in Canada.** BC leads Canada in technology-sector GDP growth and job creation and boasts Canada's #1 startup ecosystem, 3 of 5 Canadian billion-dollar startups, and 2 of Canada's top 3 universities in software development.
- **A long history of pioneering technological innovation.** Companies in BC introduced the world's first cellular radio, developed the technology that powered the first broadband internet networks, and commercialized the world's first quantum computer.
- **Global companies increasingly attracted to BC.** A strong roster of the world's leading tech companies—including Microsoft, Amazon, Boeing, Cisco, Disney, Electronic Arts, GE, Sony, and SAP—as well as homegrown successes like Avigilon, Bardel, BuildDirect, Hootsuite, Slack, and Vision Critical all call BC home.

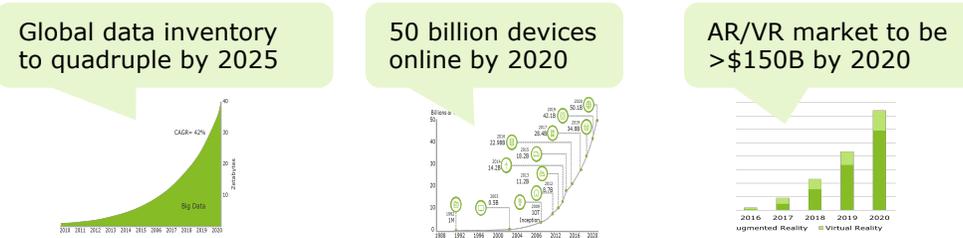
Its strong roots in innovation have created the foundational strengths that will propel BC as a global leader in digital technology. These strengths include:

- **A world-class creative and digital media talent.** Visual effects for the world's top-grossing films (such as Star Wars) are created in Vancouver, and the world's #1-selling video games (including FIFA soccer) are produced in BC.
- **A global centre of excellence in the Internet of Things (IoT).** Founded and headquartered in BC, Sierra Wireless is the global leader in connectivity hardware and devices for IoT. Also headquartered in BC is Wavefront, Canada's national centre of excellence for IoT, which is leading the efforts in the commercialization and adoption of IoT innovations.
- **World-leading data analysis capabilities and infrastructure.** Fortified by top researchers in data science and big data analytics, major companies like Boeing, Finning, Fortinet, Schneider Electric and SAP have set up global centres of excellence in the province. Research institutes such as Genome BC, TRIUMF, Ocean Networks Canada, the Quantum Matter Institute and the Herzberg Institute's Canadian Astronomy Data Centre are integral to this world-class data infrastructure.
- **Post-secondary institutions produce world-class talent and generate world-class research.** BC universities attract over \$800 million a year in research funding and account for more than 25 percent of all US patents derived from post-secondary research in Canada.
- **A geographic advantage as Canada's gateway to Asia.** BC leads Canada in trade with Asia and benefits from strong economic and cultural connections, which allows it to cultivate an unparalleled market access to the world's fastest-growing economies.
- **An integral role in the Cascadia Innovation Corridor.** BC's centrality in the Cascadia corridor offers significant leverage for the province's tech sector, particularly in the critical areas of cross-border talent access, capital access, and distribution/market access to the largest technology market in the world, the US.

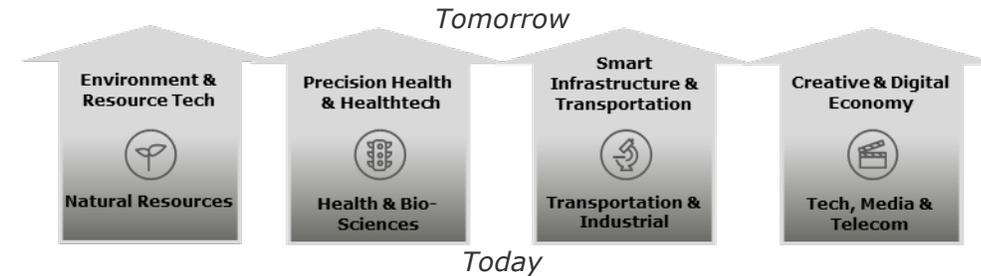
Executive Summary: British Columbia is positioned to lead Canada as a global digital technology supercluster

Looking ahead, BC has the opportunity to create a global supercluster and competitive advantage for Canada by applying its strengths in digital technology to transform industries and create the digital jobs of the future.

- **BC has the opportunity to lead the path to exponential growth.** The foundations of BC's core technology platforms—data connectivity, data analytics, and data visualization—will accelerate the digital economy and propel exponential growth.



- **BC has the opportunity to lead in the transformation of traditional industries.** Digital technology platforms will radically transform traditional industries and fundamentally reshape the manner in which these industries operate.



- **BC has the opportunity to lead collaborations across Canada.** Starting from the West Coast, BC can initiate and engage companies, innovators, and hubs across the country to make the “re-imagined” future a competitive advantage for Canadian industries.

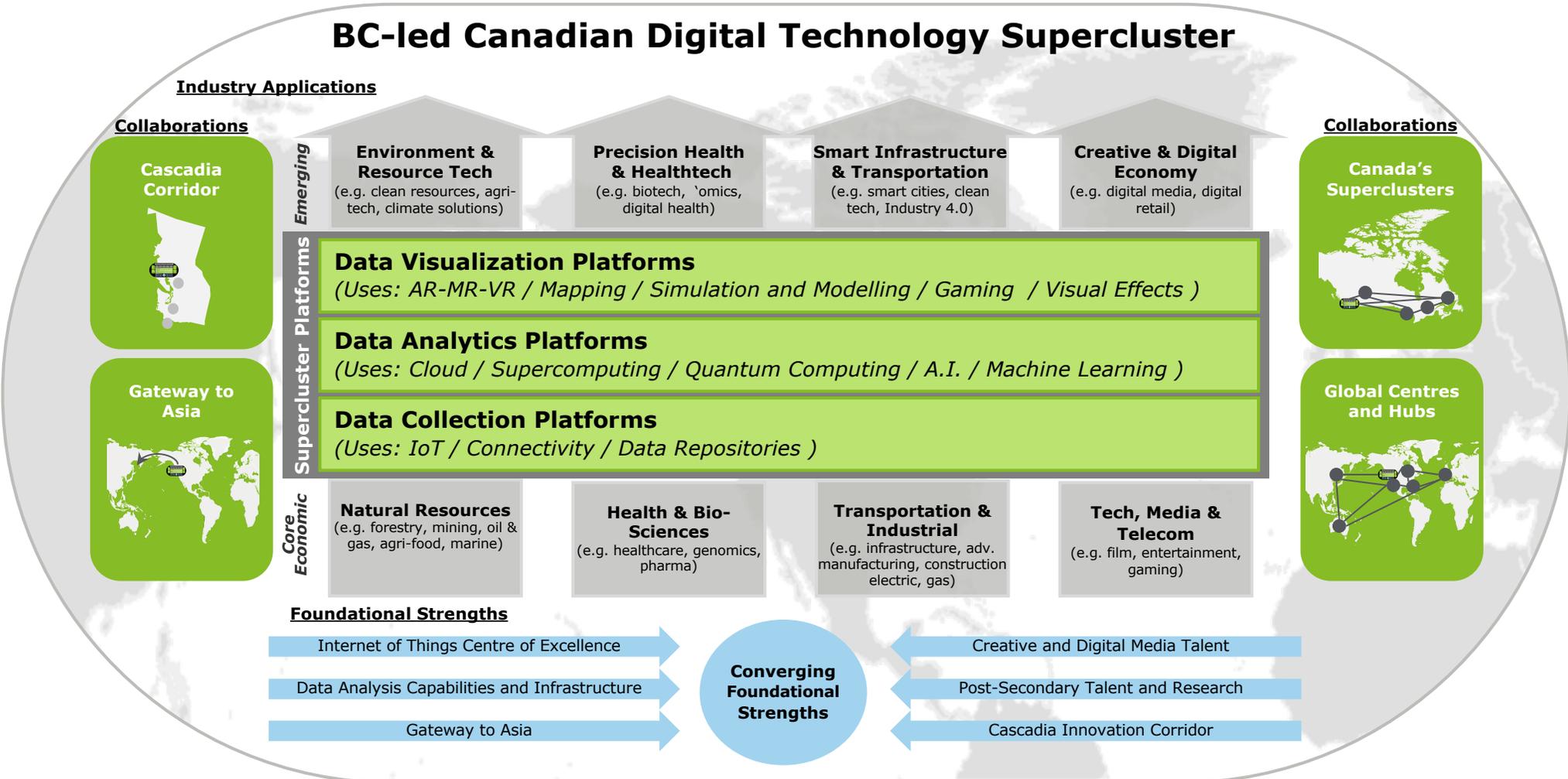


A digital technology supercluster has the potential to bolster collaboration between industry, post-secondary, and public-sector organizations to create a stronger Canadian innovation ecosystem, increase industry-led research and development, and enhance competitive advantage in Canada's core industries. A digital technology supercluster will also bolster exports and international business opportunities through BC's strong connections to Asia, Cascadia, and the US west coast.

The result will be accelerated economic growth, a critical mass of growth-oriented firms, strong job creation, and ultimately increased global competitiveness of Canada's traditional industry sectors and the country as a whole.

Executive Summary: British Columbia is positioned to lead Canada as a global digital technology supercluster

A digital technology supercluster will leverage cutting-edge platform technologies and draw on regional and global collaborative ecosystems to transform traditional industries* into new approaches and business models in the emerging economy. Properly harnessed, this digital technology supercluster will enhance Canada's competitiveness in the global digital economy and secure the digital jobs of our nation's future.



Note: (*) The ability to leverage the technology platforms to transform industries can be extended to industries beyond those indicated in this diagram.

Executive Summary: British Columbia is positioned to lead Canada as a global digital technology supercluster

The digital technology supercluster has 4 components:

1) Enabling technology platforms:

The digital supercluster employs a three-tiered technology platform stack anchored by data collection, data analytics, and data visualization platform technologies, each of which is growing substantially and the combination of which will lead to transformative, exponential growth.

4) Collaborative ecosystems:

The digital technology supercluster capitalizes on BC's geographic advantage to connect resources and market access to:

- Cascadia Innovation Corridor
- Clusters across Canada
- Global centres and hubs
- The fastest-growing economies in Asia

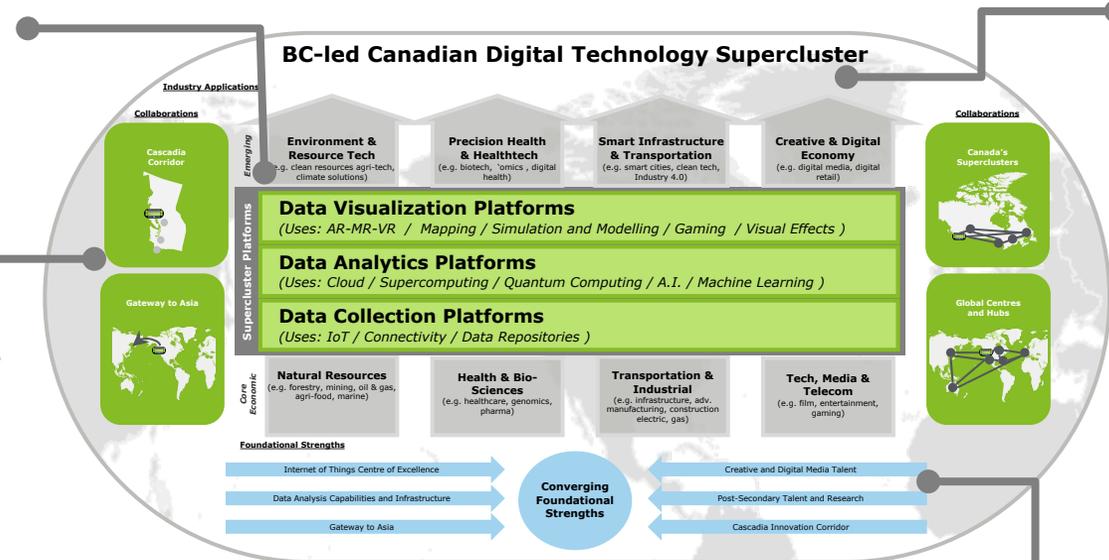
2) Industry applications:

The digital supercluster leverages the technology platforms against a set of core industry applications to transform industries such as*:

- Natural Resources into Environmental & Resource Tech
- Healthcare & Bio-sciences into Precision Health & Health Tech
- Transportation & Industrial into Smart Infrastructure & Transportation
- Tech, Media & Telecom into Creative & Digital Economy

3) Foundational strengths:

The digital technology supercluster leverages assets and capabilities in BC to accelerate innovation in both the enabling technology platforms and the industry applications.



Note: (*) The ability to leverage the technology platforms to transform industries can be extended to industries beyond those indicated in this diagram.

Chapter 1

BC is home to a globally competitive technology sector

Chapter 1: BC is home to a globally competitive technology sector

BC is home to a vibrant, diverse, and successful technology-enabled economy that has been building momentum since the 1960s. Over the past 50 years, BC's tech sector has grown in its contribution to Canada's economy, becoming the country's leading region and sector in job growth in 2016. Today, BC's reputation attracts major global technology players to establish a presence in the province, while the vibrancy of the tech ecosystem has allowed homegrown companies to flourish.

This chapter will present an overview of the province's tech sector in 3 sections. These sections will illustrate that BC has:



1-1

The fastest-growing technology sector in Canada

BC leads Canada in technology-sector GDP growth and job creation and boasts Canada's #1 startup ecosystem, 3 of 5 Canadian billion-dollar startups, and two of Canada's top three universities in software development.



1-2

A long history of pioneering technological innovation

Companies in BC introduced the world's first cellular radio, developed the technology that powered the first broadband internet networks, and commercialized the world's first quantum computer.



1-3

Global companies increasingly attracted to BC

A strong roster of the world's leading tech companies—including Microsoft, Amazon, Boeing, Cisco, Disney, Electronic Arts, GE, Sony, and SAP—as well as homegrown successes like Avigilon, Bardel, BuildDirect, Hootsuite, Slack, and Vision Critical all call BC home.

1-1: BC has the fastest-growing technology sector in Canada

Generating **\$26B**
in revenue/year



>**150,000** tech jobs
(across all sectors)



Employment growth rate >**1.5X**
the Canadian average



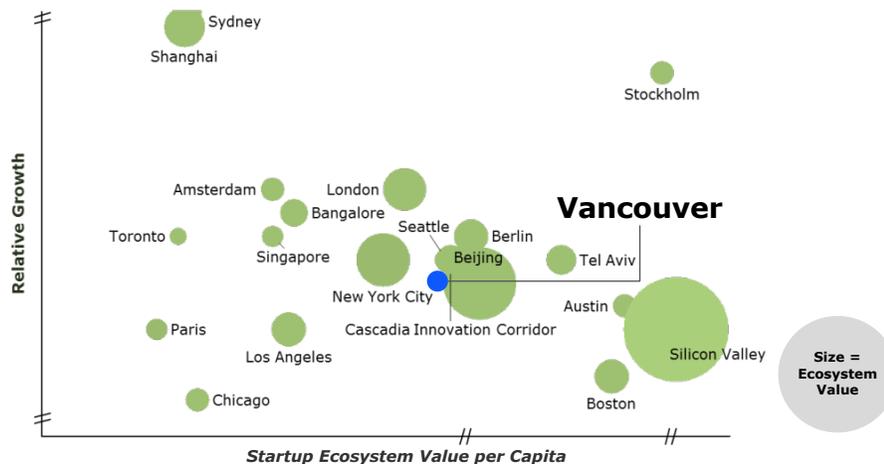
Home to **3/5** of
Canada's unicorns
(Startup with >\$1B valuation)

Growing **2X**
faster than the
provincial economy

Generating \$26 billion a year in revenue, BC has the fastest-growing technology sector in Canada and is meaningfully contributing to economic growth and job creation.

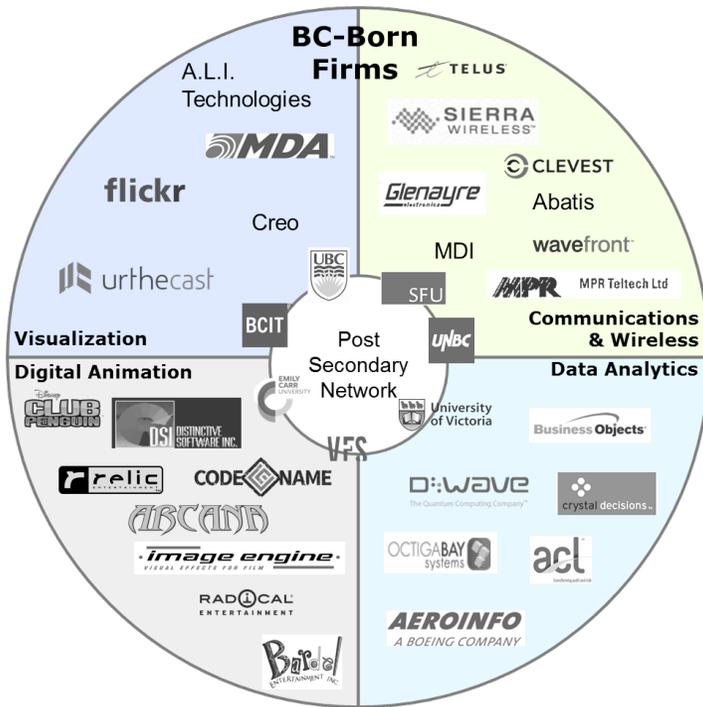
- **Revenue growth has outpaced both the Canadian and US tech sectors in the past decade.** In 2015, BC's tech sector revenue grew twice as fast as the Canadian average.
- **Tech-sector GDP contribution has grown twice as fast as the BC economy as a whole for the past five years.** The tech sector is currently contributing approximately seven percent of the province's GDP annually—a larger contribution than each of forestry, agriculture, mining, oil and gas extraction, finance and insurance, or healthcare and social assistance.
- **With more than 150,000 tech workers across all industry sectors, BC has the fastest growing tech workforce in Canada.** BC's tech employment growth rate was more than one-and-a-half times the Canadian average. This rapid growth has resulted in BC's tech-sector employment representing a 30 percent higher share of the provincial economy compared to other provinces.

Startup Ecosystem Value per Capita and Relative Growth



1-2: BC has a long history of pioneering technology innovation (1 of 2)

The success of BC's tech industry is in part a function of its strong roots. BC has a rich history of developing successful technology companies that span a wide range of applications, including communication and wireless, data analytics, visualization, and digital animation and entertainment.



Legend



Communications and Wireless

- **BC is the birthplace for innovations in communications and wireless.** The first cellular digital packet radio was developed in BC by MPR Teltech, founded in the 1980s to develop innovations focused on data transmission. A transformational success was its breakthrough in high-speed data transmission technology (known as ATM) that powered the initial broadband internet networks. MPR spun out a semi-conductor division that ultimately formed PMC-Sierra, and also eventually Sierra Wireless, the global leader in connectivity hardware and devices for the Internet of Things (IoT). This evolution provided the underpinnings of BC's leadership in the IoT industry today.

Data Analytics

- **BC's vanguard analytics companies and talent have attracted global companies.** Analytics pioneer Crystal Decisions created some of the first tools in enterprise reporting, business, and analysis. Crystal Decisions became Business Objects in 2003 and then in 2008 the company was bought by SAP, which now regards Vancouver as a global analytics centre of excellence. Aero Info is another analytics pioneer, making applications for the aerospace industry. Boeing later bought Aero Info and leveraged its IP to create an analytics platform that now resides in one of Boeing's global analytics centres of excellence, based in Vancouver.

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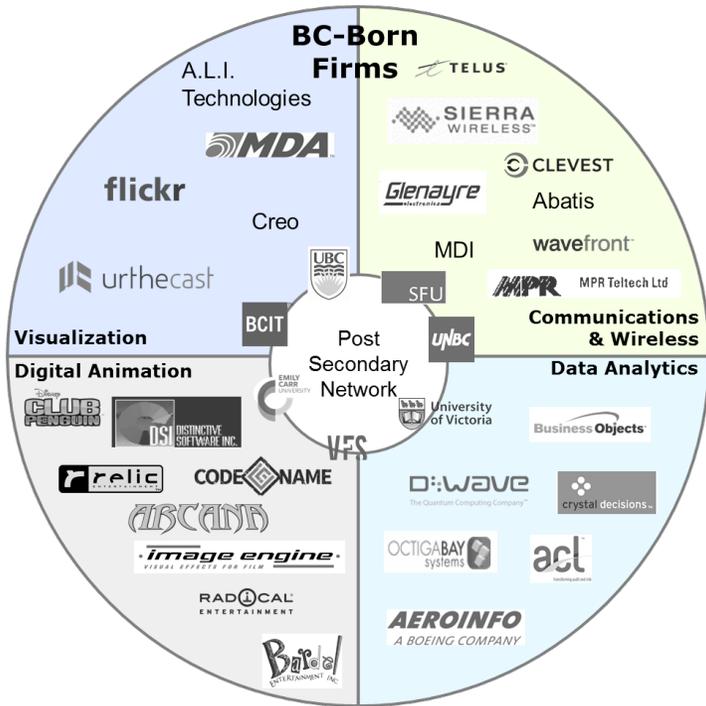
Notable pioneers in BC include:

- **Glenayre Electronics:** produced the earliest commercially available mobile communication devices and held an 80-percent share of the global pager business.
- **Mobile Data International (MDI):** developed wireless data communication technology that motivated Motorola to buy MDI in 1988.
- **Abatis Systems:** developed pioneering internet protocol (IP) software for telecom carriers. It was acquired by Redback and then the international communications giant Ericsson.

Notable pioneers in BC include:

- **D-Wave Systems:** the first company in the world to sell quantum computers.
- **Octiga Bay Systems** (acquired by Cray): created "low-cost" high performance computing system to make supercomputing more accessible.
- **MacDonald, Dettwiler and Associates (MDA):** an early leader in mapping analytics.

1-2: BC has a long history of pioneering technology innovation (2 of 2)



Legend



Visualization

- **BC's early imaging innovations have been used by NASA.** In the 1970s, MDA was the first company to use a digital computer to create images of Earth from satellite radar data. This image-processing technology was used by NASA, the European Space Agency, and the Canadian Space Agency. MDA alumni have gone on to continue to innovate imaging technologies, including digital image printing.

Digital Animation and Entertainment

- **The video game industry has strong roots in BC.** Don Mattrick, one of the world's top video game executives, created Evolution, the first commercially successful Canadian computer game. He later founded Distinctive Software Inc. (DSI), which was considered a "veritable giant" in the industry by the end of the 1980s. DSI was eventually acquired and became EA Canada, one of EA's largest and "most venerable studios." It has been responsible for producing the Need for Speed series, which "went on to become one of the highest grossing Canadian-born intellectual properties ever", as well as notable EA Sport franchises, including FIFA Soccer, NHL hockey, and UFC. FIFA Soccer and Microsoft's Need for Speed are two of the top six global game franchises based on earnings—and both came out of BC.

West Coast Unicorns

- **BC has produced 3 of Canada's 5 "unicorns".** For decades, BC has been developing technology-sector talent. As part of a wider innovation ecosystem, this unique talent has led to the creation of an unmatched number of industry unicorns in Canada—that is, private companies valued at \$1 billion or more. Only five unicorns exist in Canada, and three are products of the BC tech sector.

Notable pioneers in BC include:

- **Creo:** originally manufactured optical tape recorders, then innovated to create digital image printing technology. It was eventually sold to Kodak.
- **Urthecast Corp:** produces Earth-imaging system for geospatial analysis.
- **ALI Technologies:** created PACS technology, which was used to manage and archive medical imaging such as X-rays. The company was acquired by healthcare corporation McKesson.

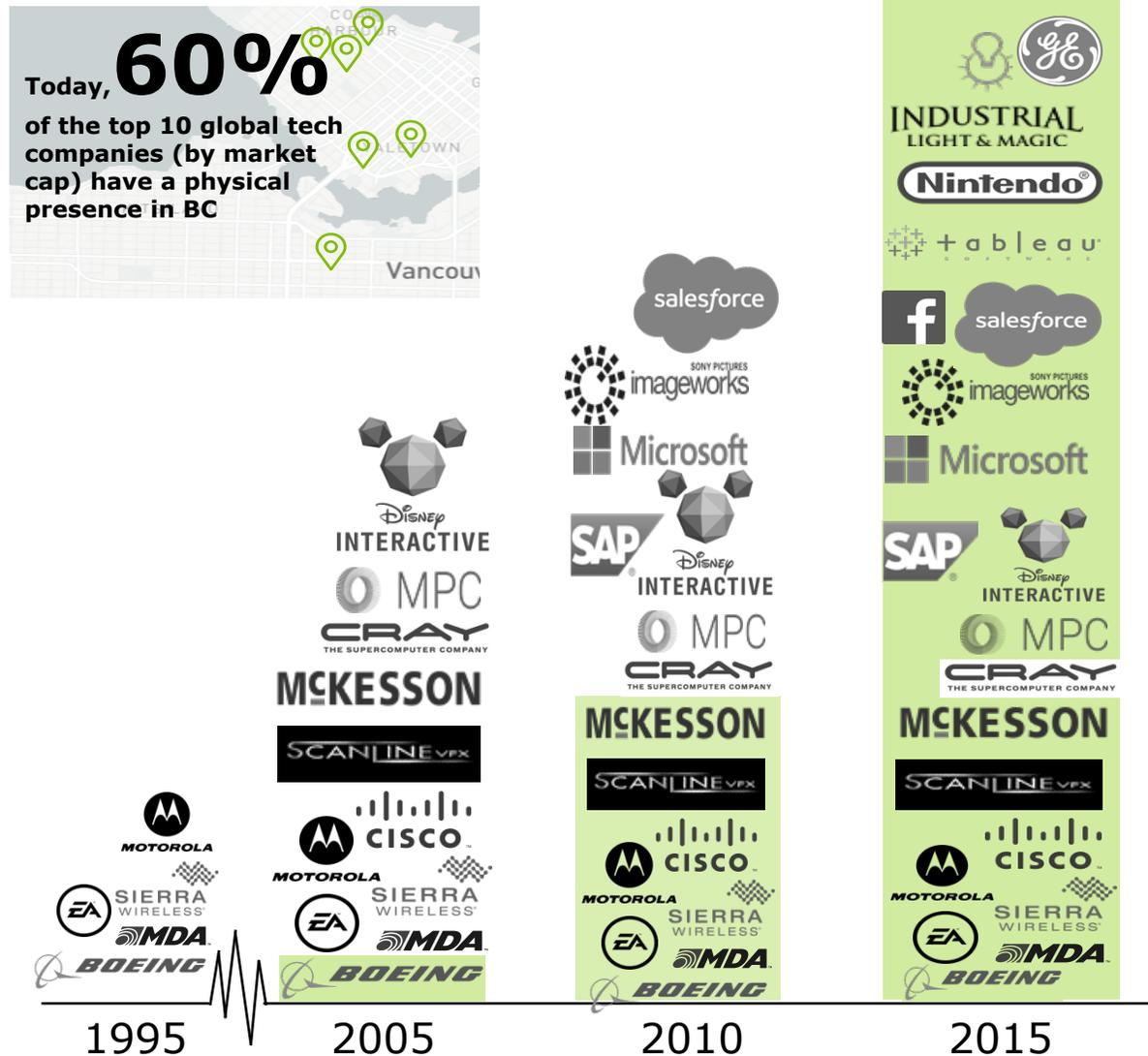
Notable pioneers in BC include:

- **Relic Entertainment:** created the world's first complete 3D real-time strategy game.
- **Radical Entertainment:** produced games for Nintendo, Sega, Microsoft, and Sony systems.
- **Club Penguin:** created a safe, creative, online community for kids; was acquired by Disney.

BC unicorns include:

- **Slack:** a cloud-based collaboration tool developer.
- **Hootsuite:** a social media platform management tool.
- **Avigilon:** a maker of high-definition network video-recording systems.

1-3: Global companies are increasingly attracted to BC (1 of 2)



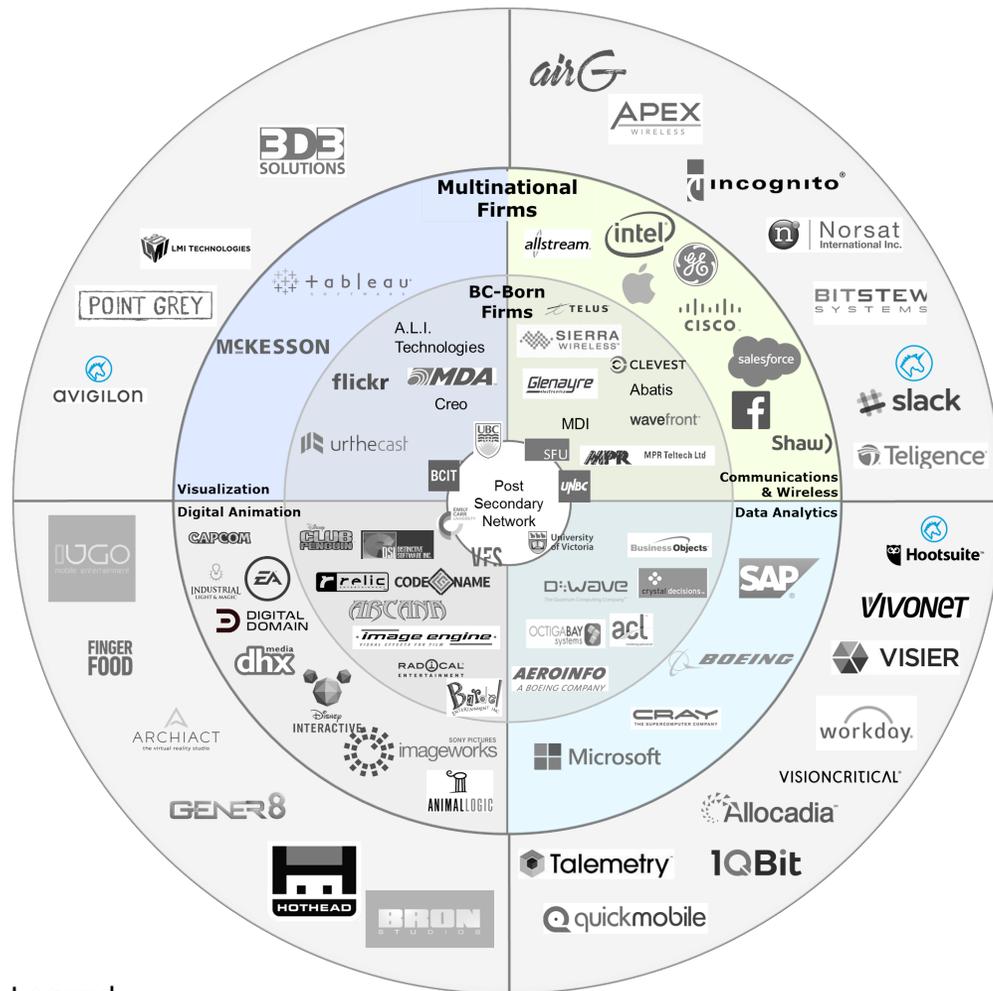
BC has become a preferred destination for major tech companies from around the world. Today, 60 percent of the top 10 global tech companies by market cap (e.g., Microsoft, Amazon, Facebook, IBM, Oracle Microsystems, and SAP) have a physical presence in BC. Vancouver is also home to digital media giants Sony Picture Imageworks, Industrial Light and Magic, Bandai Namco, Nintendo, and Double Negative. BC is also home to large multinational companies such as GE, Cisco, McKesson, Intel, and Samsung.

BC is appealing for its talent quality, relative cost of labour, tax incentives, and geographic location on the west coast of North America.

- **Talent quality is a key part of BC's value proposition.** Post-secondary institutions are graduating talent with in-demand skills to support industry and, with its confluence of industry players, BC has an environment where talent can continue to develop its skills.
- **The relative cost of labour in BC attracts global tech firms.** Tech salaries are 25 percent lower in Canada relative to the US, creating a labour cost advantage. Industry executives indicate that lower-cost labour does not mean lower-quality labour, which reinforces the value of BC talent.

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1-3: Global companies are increasingly attracted to BC (2 of 2)



Legend



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- Vancouver was ranked second in tax competitiveness and overall business costs** among 55 major international cities in 2016. Boston Consulting Group indicated that Vancouver provides an environment where public policy and the business ecosystem are uniquely conducive to innovation.
- BC benefits from its geographic location.** The heart of the new digital economy is on the North American west coast, where BC is ideally located to take advantage. BC is a key player in the Cascadia Corridor, a tech cluster that includes Seattle and Portland. It is also close to the major hubs of San Francisco and LA. Proximity streamlines collaboration and improves the flow of information and people between organizations down the west coast.

Chapter 2

BC has strong foundations in digital technology

Chapter 2: BC has strong foundations in digital technology

Its strong roots in innovation have created the foundational strengths that will propel BC as a global leader in digital technology. Chapter 2 will illustrate the foundations of BC's digital technology capabilities across the following six sections. The foundational strengths described are:



2-1

A world-class creative and digital media talent

Visual effects for the world's top-grossing films (such as Star Wars) are created in Vancouver, and the world's #1-selling video games (including FIFA soccer) are produced in BC.



2-2

A global centre of excellence in the Internet of Things (IoT)

Founded and headquartered in BC, Sierra Wireless is the global leader in connectivity hardware and devices for IoT. Also headquartered in BC is Wavefront, Canada's national centre of excellence for IoT, which is leading the efforts in the commercialization and adoption of IoT innovations.



2-3

World-leading data analysis capabilities and infrastructure

Fortified by top researchers in data science and big data analytics, major companies like Boeing, Finning, and SAP have set up global centres of excellence in the province.



2-4

Post-secondary institutions produce world-class talent and generate world-class research

BC universities attract over \$800 million a year in research funding and account for more than 25 percent of all US patents derived from post-secondary research in Canada.



2-5

A geographic advantage as Canada's gateway to Asia

BC leads Canada in trade with Asia and benefits from strong economic and cultural connections, which allows it to cultivate an unparalleled market access to the world's fastest-growing economies.



2-6

An integral role in the Cascadia Innovation Corridor

BC's central location in the Cascadia corridor offers significant leverage for the province's tech sector, particularly in the critical areas of cross-border talent access, capital access, and distribution/market access to the largest technology market in the world, the US.

2-1: BC has world-class creative and digital media talent

BC has built a world-class talent pool of animators, special effects artists and producers, and user-experience designers. The province, one of the top centres for video game production for a long time, now boasts the highest concentration of digital animation and special effects companies. This has catapulted BC into becoming the leading jurisdiction for 3D artistry, 3D special effects, and 3D games.



% of Canadian digital game companies that are based in BC

60

of visual effects and animation studios producing international blockbusters

World's **LARGEST**

cluster of domestic and foreign-owned studios

Digital Gaming



Animation and Visual Effects



- **BC has the world's largest cluster of visual effects and animation studios.** Renowned for its film industry—it has often been called Hollywood North—BC has developed unique capabilities in computer graphics simulation and special effects and animation, including 3D capability. Over 60 studios are in Vancouver's visual effects and animation industry, making it the world's largest cluster of domestic and foreign-owned studios. These studios have gained international renown through the effects produced for blockbuster films such as Star Wars, LEGO, Lord of the Rings, Deadpool, Spider-Man, Men in Black, and Batman.
- **BC produces many of the world's top video games.** 27 percent of Canadian digital game companies are based in BC. These companies consistently produce the best-selling games in the world, including Need for Speed, FIFA Soccer, NHL Hockey, and Dead Rising 3. Internationally recognized video game companies with a BC presence include Electronic Arts, Microsoft Studios, Nintendo, Relic Entertainment, BANDAI NAMCO, and Capcom.
- **BC is attracting major studios from around the world.** Sony Pictures Imageworks (an Academy Award®-winning visual effects and animation company) relocated its global headquarters to Vancouver, joining a network of leading digital effects studios such as Industrial Light and Magic, MPC, dhx Media, and Animal Logic. Global leaders in augmented, virtual, and mixed reality, most notably Microsoft, are also relocating their development efforts to BC to access the specialized talent in special effects, 3D animation, and game production.

"The talent that you'll find in 3D development across video games, special effects and animation in British Columbia is ideal for the growing VR/MR industry...there's an opportunity for Vancouver to establish itself as a global leader in this sector".

– Edoardo De Martin, Director of Microsoft Vancouver

"We're really putting roots down here because we feel this is where the talent is."

– Ace Fipke, Chief Content Officer, dhx Media

2-2: BC is a global centre of excellence in the Internet of Things

BC's centre of excellence for IoT not only generates new IoT innovations and applications locally but also helps to catalyze innovation and application development across Canada, making it truly a national asset.



Market share in connectivity hardware and devices for IoT

#1



95% of BC has access to **high-speed internet**

IoT Solutions

SIERRA WIRELESS

Schneider Electric

BITSTEW SYSTEMS
From GE Digital

GOLDCORP FINNING DIGITAL
Connect today. Imagine tomorrow.

- **BC is home to the global leader in IoT devices.** Founded and headquartered in BC, Sierra Wireless is the global leader in connectivity hardware and devices for IoT. It is also the world's largest cellular module (connectivity hardware) producer.
- **BC is home to Canada's centre of excellence in IoT.** Wavefront, a national organization headquartered in Vancouver, is Canada's centre for commercialization of mobile and IoT technologies. It works with companies to help launch new business models, change organizational processes, and drive new customer experiences.
- **BC leads in industrial IoT application.** BC-based players are applying IoT innovations to the construction, mining, forestry, real estate, agriculture, energy, and transportation and logistics industries. These applications are enabling companies to more efficiently manage and operate their businesses. Companies driving these applications from BC include Finning Digital, Goldcorp, GE (through the acquisition of BC-based Bit Stew and Wurldtech), and Schneider Electric.
- **BC has the broadband infrastructure to support IoT deployments.** BC-based TELUS has helped to connect 95 percent of the province to high-speed internet. TELUS is also creating a 5G testbed to help accelerate application development for IoT and drastically enhance speed to market.

2-3: BC has world-leading data analysis capabilities and infrastructure

The Pacific Northwest region, including BC, has become the epicentre of cloud computing and as such is leading the massive data revolution. Anchored by companies like Amazon, Boeing, SAP, and Microsoft, and complemented by BC-based leaders Avigilon, BuildDirect, Global Relay, Vision Critical, and Hootsuite, these companies are leveraging the unique strengths of BC's talent pool to revolutionize data analytics, machine learning, and cloud computing.

World's **1st**
commercial quantum
computer made in BC



New supercomputer at
SFU will serve
>11,000
researchers

Cascadia is home to
3 of 5
top cloud
service providers



Analytics



- **BC is home to industry-led analytics centres of excellence.** SAP has a global analytics centre of excellence based in Vancouver. Boeing's global centre for aerospace data analytics is also Vancouver-based. Tableau, a global leader in analytics visualization software, has chosen Vancouver for its first expansion into Canada.
- **BC is an integral part of Cascadia, the epicentre of global cloud computing.** Microsoft, Amazon, and Google (three of the top five cloud service providers) are located within the Cascadia Innovation Corridor. Both Microsoft and Amazon have established a major presence in Vancouver in addition to their Seattle headquarters.
- **BC is at the forefront of data science.** BC researchers have leveraged the province's 30-plus years of longitudinal health data (including cancer data) to generate insights to improve cancer diagnosis and treatment; BC has the best cancer survival rates in Canada. BC-based Zymeworks is also focused on cancer therapeutics, using high-performance computational modeling of proteins and protein engineering. In Victoria, Ocean Networks Canada gathers the same amount of data as the Hubble Telescope and uses the data in its state-of-the-art ocean data management tool for marine analysis decision-making. As the most widely used social media management platform, Hootsuite is a global leader in social media analytics.
- **BC is the commercial leader in quantum computing.** 1QBit and D-Wave are solving industry's most demanding computational challenges by recasting problems to harness the power of quantum computing. D-Wave introduced the first commercial quantum computer and its products are now used by NASA, Google, and Lockheed Martin.
- **BC is home to world-changing research analytics and discoveries.** Understanding the universe is made possible by the analysis of Hubble Telescope data at the Canadian Astronomy Data Centre in Victoria. The structure of space and time is analyzed and explored by TRIUMF, a subatomic physics lab, in partnership with CERN's Large Hadron Collider in Switzerland. TRIUMF is developing isotopes for use worldwide in tens of millions of medical procedures each year. Additionally, the newly developed CEDAR supercomputer at Simon Fraser University will serve more than 11,000 Canadian researchers, giving researchers and innovators the ability to compete and excel globally using big data and computation tools.

"As one of the largest analytics groups within Boeing, we are well suited to house the new Vancouver Labs, which will focus on delivering data-driven solutions at a rapidly increased pace over traditional development."

**– Bob Cantwell,
President, Boeing
Vancouver**

2-4: BC's post-secondary institutions produce world-class talent and generate world class research (1 of 2)

BC is producing research that's driving innovation in the technology sector. The province's post-secondary institutions are developing high-quality, industry-ready talent that's helping BC's tech sector rapidly expand.



25% of Canada's Centres of Excellence for Commercialization and Research are located in BC

\$ 800M

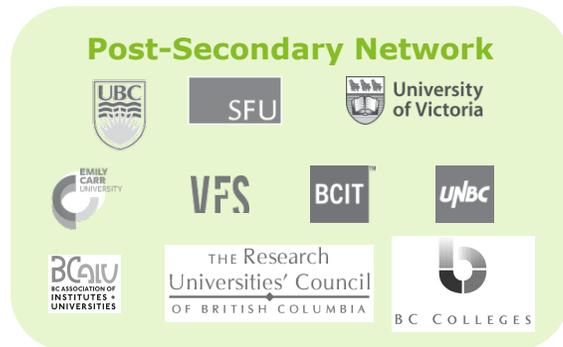
BC attracts \$800M/year in **research funding**

275

companies established through commercialization from UBC and SFU alone



2 of Canada's 5 unicorns were started by BC students



- BC is a hub for world-leading research. 9 Nobel Prize winners are current or former BC university faculty and alumni and more than 25 percent of all US patents** derived from post-secondary research in Canada have come from BC. This research excellence enables BC universities to attract over \$800 million a year in research funding. Between 2001 and 2015, BC universities received larger federal research funding increases than any other province. Furthermore, since 2001, BC's universities have been awarded over \$1.2 billion in funding for research infrastructure and equipment.
- BC universities catalyze new ventures.** The world's first commercially available quantum computer was developed by D-Wave Systems, one of almost 200 companies that has been started through the commercialization of research from the University of British Columbia (UBC) alone. Simon Fraser University (SFU) has spun out more than 75 companies. Two of Canada's five unicorns, Hootsuite and Slack, were started by University of Victoria (UVic) students. The Creative Destruction Lab West hosted by UBC Sauder, entrepreneurship@UBC, SFU's Venture Connection, and the Coast Capital Innovation Centre at UVic play roles in early-stage venture creation, helping companies start up and maximize their commercial impact.
- BC is a leader in research commercialization.** The Centre for Drug Research and Development, Accel-Rx, and Innovation Boulevard support technology incubation and acceleration. International programs, such as the China Canada Commercialization and Acceleration Network (C2CAN) and Zone Startups India, enable national and international collaboration, investor access, and commercialization services. Commercialization capability is also demonstrated by the fact that more than 25 percent of Canada's Centres of Excellence for Commercialization and Research (CECR) are located in BC.

2-4: BC's post-secondary institutions produce world-class talent and generate world class research (2 of 2)

BC is producing research that's driving innovation in the technology sector. The province's post-secondary institutions are developing high-quality, industry-ready talent that's helping BC's tech sector rapidly expand.



2 of top 3 universities in software development in Canada



Increase in available **engineering and computer science** program spaces

Canada's largest graduate co-op placement program



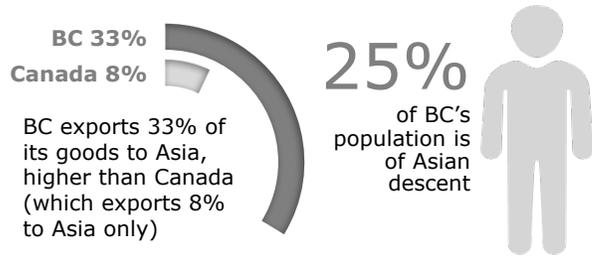
- **BC is home to two of Canada's top three universities (UBC and SFU) in software development.** UBC, SFU, UVic, and UNBC all rank in the top three of their respective categories. To continue to be national leaders, BC universities have evolved their program mix to meet the needs of the technology sector. Between 2006 and 2015, there was a 57 percent increase in engineering and computer science program spaces. Across the province, co-op placements have increased 40 percent over four years to 14,000 in 2015/16. UVic has the largest graduate co-op placement program in Canada.
- **BC universities show unprecedented collaboration.** The Centre for Digital Media, a joint venture of UBC, SFU, the British Columbia Institute of Technology (BCIT), and Emily Carr University of Art + Design, trains graduate students to build agile and effective digital production pipelines and execute projects with industry partners, including Microsoft and EA. The Vancouver Institute for Visual Analytics (VIVA), a joint initiative of BCIT, SFU, and UBC, provides expertise and solutions for visualization applications and connects students with industry partners, such as Boeing, SAP, and Tableau Software. TRIUMF was founded by UVic, SFU, and UBC, and is one of the world's leading subatomic physics laboratories.
- **BC has a growing pipeline of talent that is meeting industry needs.** UBC's Master of Data Science combines high-level computer science and statistics training to give students advanced skills. SFU's Master of Science in Big Data was developed with input from IBM, SAP, Simba Technologies, Tableau, and PHEMI. UVic's Computer Science and Health Information Science program combines studies in healthcare systems and health data with software engineering, operating systems, programming languages, and computer hardware. UNBC's Natural Resources and Environmental Studies Graduate program trains students to address issues related to forestry, mining, and the environment.

Academic Collaborations



2-5: BC has a geographic advantage as Canada's gateway to Asia

BC's strong economic and cultural ties to Asia represent a distinct advantage. Asia has the fastest-growing economies and greatest demand for digital technology solutions—and Canada can leverage BC's connectivity to be more globally competitive.



FDI from Asia into the BC economy from 2013-2016

\$70 billion
(3x more than Alberta and Ontario combined)

Average economic growth from 2000-2015

5.7%

Asia's share of the global GDP contribution in 2025

45%

Anticipated domestic VR market in China by 2020

\$8.5 billion

- **BC leads the country in trade with Asia.** BC exports more than any other province to Asia. 33 percent of all BC's trade is with Asia, compared to only eight percent for Canada as a whole. BC drives 27 percent of Canada's trade with Asia.
- **BC has strong cultural and economic ties to Asia.** Approximately 25 percent (twice the Canadian average) of BC's population is of Asian descent and many have immediate family connections to the Asian continent. As well, BC has received \$70 billion of foreign direct investment from Asia between 2013 and 2016; that's almost three times more than Alberta and Ontario combined.
- **The centrality of the global economy is shifting to Asia.** Asia has the world's fastest-growing economies. From 2000 to 2015, the region averaged 5.7 percent annual economic growth and its share of the global GDP contribution is forecasted to reach nearly 45 percent by 2025. Consumer spending is also on the rise; spending by Asia-Pacific middle classes is projected to reach 59 percent of the global total in 2030, up from 23 percent in 2009. Additionally, the region has a strong appetite for emerging technologies. Asia/Pacific is the region expected to see the greatest IoT spending between 2017 and 2020, and China's domestic VR market is expected to grow exponentially between 2016 and 2020 to US\$8.5 billion annually.
- **BC has helped to develop new structures to facilitate trade with Asia.** AdvantageBC, a BC not-for-profit agency, led a private sector effort to have Canada designated as the first jurisdiction in the Americas to establish a RMB Settlement Hub—a platform that reduces the cost of doing business with Chinese companies. The BC government has been a leader in promoting the international use of the RMB for several years and is the first government outside China to issue an RMB-denominated bond.

2-6: BC is an integral part of the Cascadia Innovation Corridor

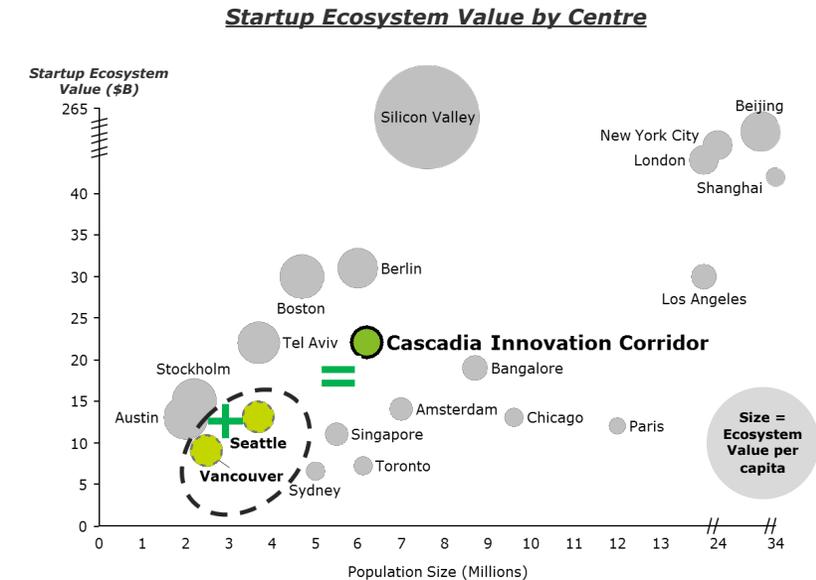
BC's centrality in the Cascadia corridor offers significant leverage for the province's tech sector, particularly in the critical areas of cross-border talent access, capital access, and distribution/market access to the largest technology market in the world, the US.



- BC gains critical mass through participation in Cascadia.** Seattle and Vancouver combined represent a \$22-billion startup ecosystem that is more than three times the size of the Toronto-Waterloo corridor and almost twice the size of the Paris or Singapore ecosystems.
- BC's collaboration within Cascadia improves access to talent.** Cascadia is a global magnet for talent. Seattle is ranked #1 for its tech talent base. 58.9 percent of Seattle residents over 25 years old have college degrees, higher than any other tech centre in North America. Seattle is also a destination for skilled workers seeking to relocate. Seattle had a brain gain of 24,000 tech workers who relocated to Seattle between 2011 and 2015.
- BC's collaboration within Cascadia augments access to capital.** Seattle is ranked as the sixth-largest venture capital (VC) ecosystem in the world. Over the past decade, Seattle firms have attracted \$8.9 billion in VC funding. Participation in the corridor will give Vancouver firms access to more VC firms and significantly more capital to help drive growth.
- BC's collaboration within Cascadia offers significant market access.** The US technology market will continue to grow faster than the global average and will serve as a critical customer base for the BC-based companies.
- BC's collaboration within Cascadia attracts more global companies.** BC has attracted some of the world's most successful tech companies, including Microsoft, Amazon, Boeing, Tableau, and SAP to locate their operations in the province. Combined with growing awareness of the world-class talent base in BC, the Cascadia narrative has contributed to the velocity by which international partners and companies have chosen to locate in BC.

"This is a unique opportunity that can create benefits for people throughout the region for generations to come."

– Brad Smith, President, Microsoft



Chapter 3

A BC-led digital technology supercluster will create the digital jobs of the future

Chapter 3: A BC-led digital technology supercluster will create the digital jobs of the future (1 of 2)

Looking ahead, BC has the opportunity to create a global supercluster and competitive advantage for Canada by applying its strengths in digital technology to transform industries and create the digital jobs of the future.

Chapter 3 will describe the future opportunity for a digital technology supercluster:



3-1

BC has the opportunity to lead the path to exponential growth

The foundations of BC's core technology platforms (data connectivity, data analytics, and data visualization) will accelerate the digital economy and propel exponential growth.



3-2

BC has the opportunity to lead in the transformation of traditional industries

The digital technology platforms will radically transform traditional industries and fundamentally reshape the manner in which these industries operate.



3-3

BC has the opportunity to lead collaborations across Canada

Starting from the West Coast, BC can initiate and engage companies, innovators, and hubs across the country to make the "re-imagined" future a competitive advantage for Canadian industries.

Chapter 3: A BC-led digital technology supercluster will create the digital jobs of the future (2 of 2)

By leveraging its assets and expanding the digital technology supercluster, BC and Canada will continue to be a leader driving the global transition to a digital future. As a leader of this rapid transition and market expansion, BC will enhance Canada's brand and economic competitive advantage on the global stage. Talent and investment will increasingly gravitate to BC and Canada, creating substantial GDP growth and job creation across the country.

This digital technology supercluster has 4 components:

1) Enabling technology platforms:

The digital supercluster employs a three-tiered technology platform stack anchored by data collection, data analytics, and data visualization platform technologies, each of which is growing substantially and the combination of which will lead to transformative, exponential growth.

4) Collaborative ecosystems:

The digital technology supercluster capitalizes on BC's geographic advantage to connect resources and market access to:

- Cascadia Innovation Corridor
- Clusters across Canada
- Global centres and hubs
- The fastest-growing economies in Asia

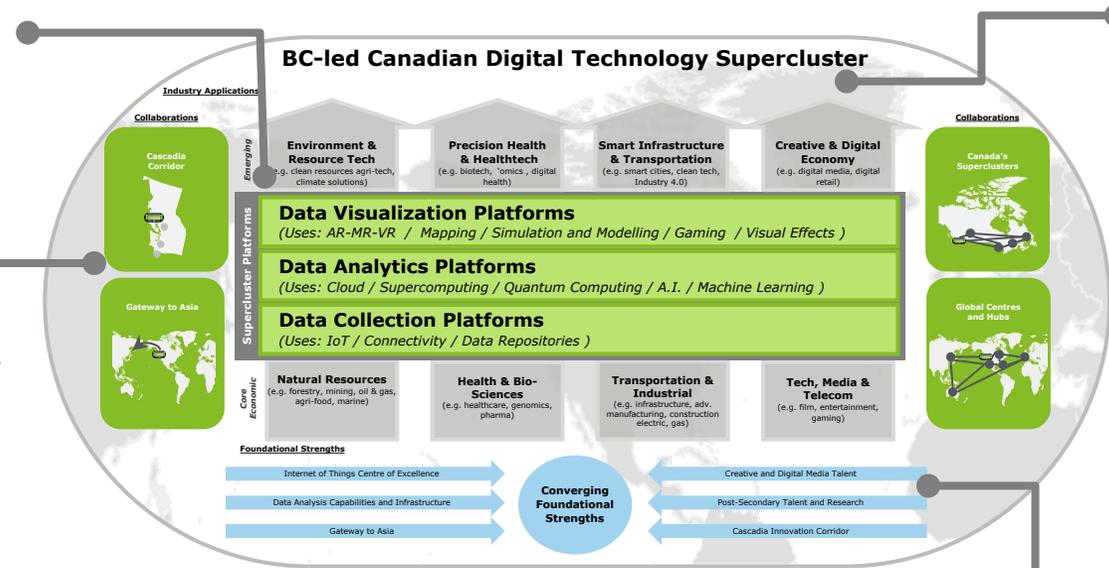
2) Industry applications:

The digital supercluster leverages the technology platforms against a set of core industry applications to transform industries such as*:

- Natural Resources into Environmental & Resource Tech
- Healthcare & Bio-sciences into Precision Health & Health Tech
- Transportation & Industrial into Smart Infrastructure & Transportation
- Tech, Media & Telecom into Creative & Digital Economy

3) Foundational strengths:

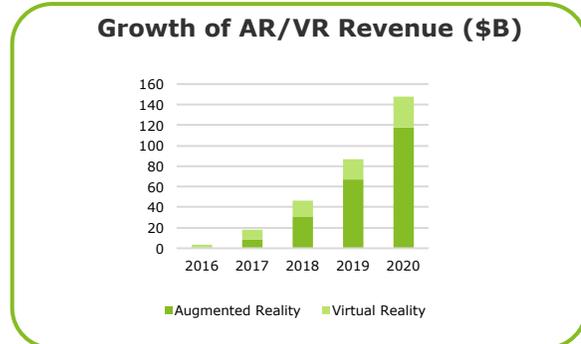
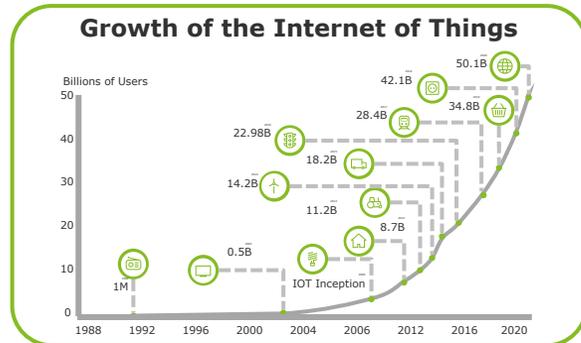
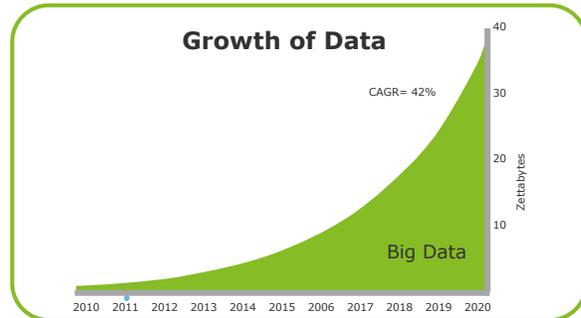
The digital technology supercluster leverages assets and capabilities in BC to accelerate innovation in both the enabling technology platforms and the industry applications.



Note: (*) The ability to leverage the technology platforms to transform industries can be extended to industries beyond those indicated in this diagram.

3-1: BC has the opportunity to lead the path to exponential growth

The World Economic Forum (WEF) indicates that we are in the midst of another industrial revolution, “characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.” This industrial revolution is, “evolving at an exponential rather than linear pace and is disrupting almost every industry in every country.”



The platform technologies of the digital technology supercluster (e.g., data, analytics, and visualization) are expected to drive transformation and accelerated growth over the next decade.

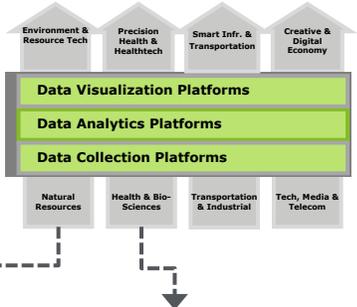
- **The global data inventory will quadruple by 2025 and worldwide revenues for big data and analytics are expected to exceed \$200 billion in 2020.** This is driven by business leaders transitioning their companies into insights-driven organizations. In a Deloitte survey, 96 percent of senior executives across a spectrum of industries and geographies indicated that analytics will become more important to their organizations in the next three years.
- **Growth of analytics will be complemented by growth in data connectivity and intelligent sensors—i.e., the Internet of Things.** IoT devices are expected to surpass mobile phones as the largest category of connected devices in 2018. With the emergence of 5G and other advanced networks, 50 billion intelligent devices are predicted to be connected to the internet by 2020.
- **The AR/VR market is expected to grow from less than \$5 billion in 2016 to \$150 billion by 2020.** In BC specifically, technology developments by Microsoft and Sony, as well as homegrown AR/VR companies like Finger Food Studios, Archiact, and LNG Studios, will help capture the economic opportunity of this exponential market growth.

By investing to accelerate development of a digital technology supercluster built on these platform technologies, Canada has the opportunity to be on the leading edge of exponential technology growth and gain from the associated market opportunities. Furthermore, these platform technologies can help Canadian companies in all industries become more globally competitive. A 2017 Deloitte report indicated that 87 percent of Canadian organizations are not currently prepared to respond and adapt to disruption caused by the “digital” future.

3-2: BC has the opportunity to lead in the transformation of traditional industries (1 of 3)

The digital technology supercluster platforms and technologies have the power to transform traditional industries. The following are examples of how these transformations can bring to life the “re-imagined future”.

Bringing these re-imagined futures to life will require collaboration between players in the enabling technology platforms and the market leaders seeking to transform their markets.



Environment & Resource Tech
(e.g. clean resources, agri-tech, climate solutions)

Imagine how augmented and virtual reality will transform mining. In a mine of the future, engineers and geologists will use virtual and augmented reality to view 3D renderings of mine plans and resource models to optimize the extraction of ore and separation of waste.

Imagine how remotely connected sensors and visualization technologies will help improve forest health. In real time, experts will be able to evaluate forest coverage changes, monitor biodiversity, and track wildfire occurrence and spread. This will enable more efficient resource management, improved disaster response, and ultimately, more commercially competitive forestry companies.

Natural Resources
(e.g. forestry, mining, oil & gas, agri-food, marine)

Precision Health & Healthtech
(e.g. biotech, 'omics, digital health)

Imagine how innovations in data analytics and visualization will transform healthcare delivery to be tailored to each person’s unique needs, circumstance, and...genetics. IoT devices and data analytics could also help predict when something might occur and suggest low-cost preventative therapies and lifestyle approaches.

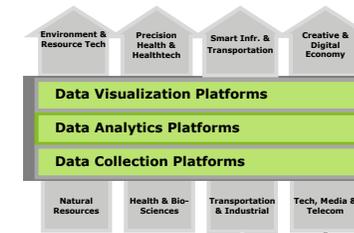
Imagine how the combination of data collection, analysis, and visualization platforms will enable care in remote communities. Patients can capture and transmit health information to healthcare providers and specialists without leaving the comfort of their own home. Rural communities could get access to specialists traditionally only available in large urban centres.

Health & Bio-Sciences
(e.g. healthcare, genomics, pharma)

3-2: BC has the opportunity to lead in the transformation of traditional industries (2 of 3)

The digital technology supercluster platforms and technologies have the power to transform traditional industries. The following are examples of how these transformations can bring to life the “re-imagined future”.

Bringing these re-imagined futures to life will require collaboration between players in the enabling technology platforms and the market leaders seeking to transform their markets.



Smart Infrastructure & Transportation

(e.g. smart transportation, clean tech)

Imagine how IoT and data collection platforms will transform our cities. Multiple modes of transportation could be technologically integrated to optimize the flow of each citizen to their unique destination. This modal integration combined with demand forecasting (leveraging big data) could help optimize the use of critical infrastructure (e.g., parking lots) and resources (e.g., public transit spending).

Imagine how visualization technology also supports city planning and emergency response. City planners could use big data and analytics to simulate the impact of proposed infrastructure changes or events, including new buildings, changes to traffic patterns, or what might happen in an emergency situation.

Transportation & Industrial

(e.g. infrastructure, adv. manufacturing, construction, electric, gas)



Creative & Digital Economy

(e.g. digital media, digital retail)

Imagine how virtual and augmented reality can bring more of the action of movies, television, and videos games to life in our living rooms.

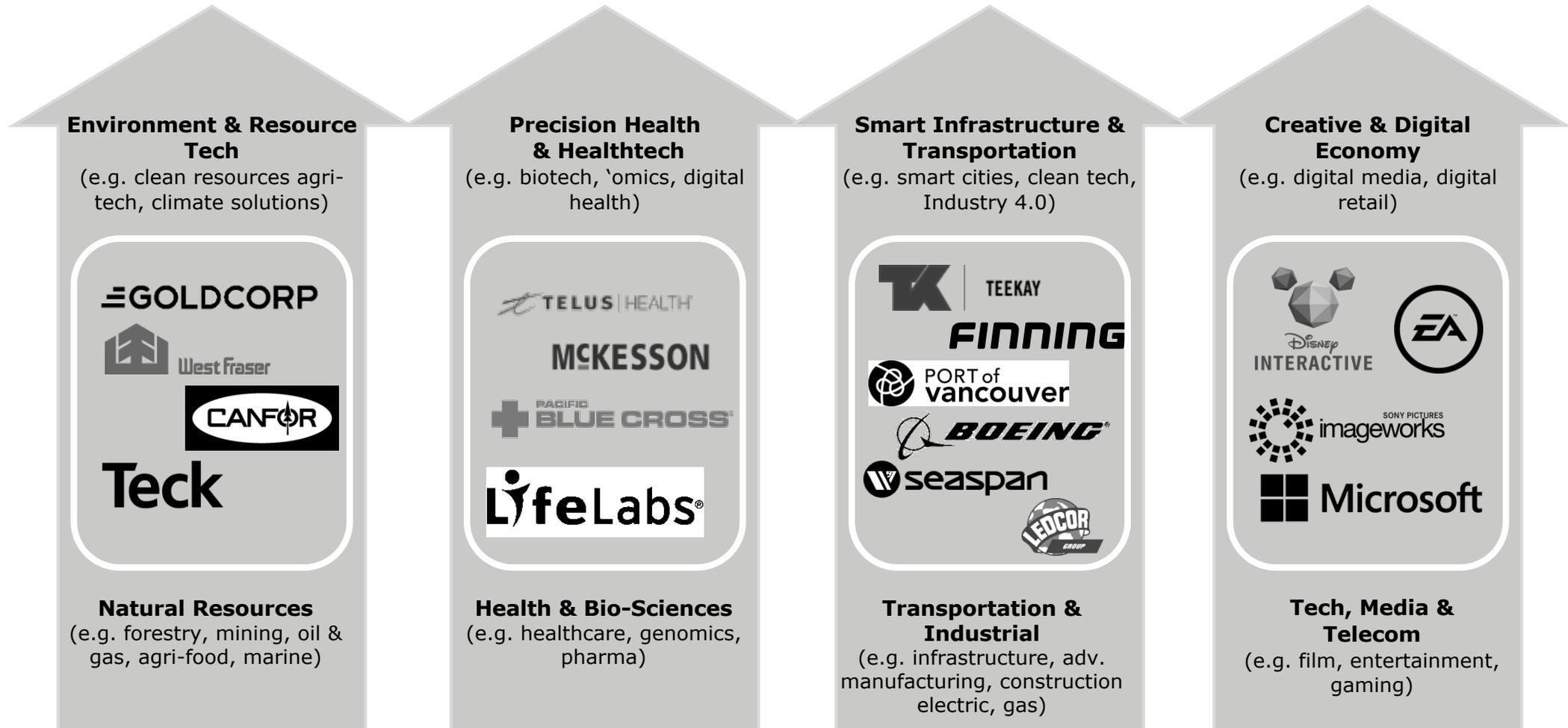
Imagine how the preservation of indigenous language, cultures, and traditions could be supported by digital media technologies. Language and cultural learning apps would be more than just on-screen flashcards: augmented and virtual reality can be used to create immersive learning experiences where a new language and experience becomes a part of everyday life and is explored in context as part of the real world.

Tech, Media & Telecom

(e.g. film, entertainment, gaming)

3-2: BC has the opportunity to lead in the transformation of traditional industries (3 of 3)

Many industry leaders in BC have a history of driving transformational change. These types of organizations could potentially be key drivers of change and innovation in the future.



3-3: BC has the opportunity to lead collaborations across Canada

BC innovators will continue to collaborate with other clusters and hubs across the country to transform industries and make the “re-imagined” futures Canada’s reality. Nationwide collaboration examples include:

Digital Gaming – BC’s digital entertainment companies are actively collaborating with similar centres in Quebec and other areas of Canada.

Potential collaborations:

- Montreal



IoT – Wavefront, headquartered in BC, has created a nationally connected IoT network of companies, generating and sharing innovations across Canada.

Potential collaborations:

- Ottawa
- Waterloo
- Halifax



Health and Biosciences – Genome BC, BC Cancer, and Life Sciences BC are driving genomic research collaboration with counterparts across Canada.

Potential collaborations:

- Toronto
- Montreal



Forestry – FP Innovations and its member companies are driving forest sector innovations from centres in BC, Alberta, and Quebec.

Potential collaborations:

- Edmonton
- Montreal



Infrastructure – GE (through Bit Stew) is deploying smart meters for better energy system management.

Potential collaborations:

- Halifax
- Montreal



Agri-food – Crop Sense is using IoT with artificial intelligence (AI) technology to provide early-stage detection and prevention of crops stress.

Potential collaborations:

- Guelph
- Saskatoon



Marine – Oceans Network Canada uses thousands of sensors to capture data across the Pacific and Arctic oceans and big data analytics to analyze the information to support the marine research community across Canada.

Potential collaborations:

- Halifax



Advanced Manufacturing – Boeing is using its BC-based analytic centres to support efficient advanced manufacturing centres in Manitoba, Ontario, and Quebec. Automotive centres are also using analytics to drive efficiency.

Potential collaborations:

- Winnipeg
- Montreal
- Windsor



Cleantech – BC Cleantech CEO Alliance is creating clean economy innovations in BC (30 percent of all Canadian cleantech companies are based in BC) and sharing them across Canada.

Potential collaborations:

- Montreal, Toronto, Calgary



Mining – Goldcorp is using virtual and augmented reality to view 3D renderings of mine plans and resource models.

Potential collaborations:

- Sudbury



Oil & Gas – Exploration companies are leveraging big data to evaluate how to improve operational efficiencies; methodologies and insights can be translated to operations across Canada.

Potential collaborations:

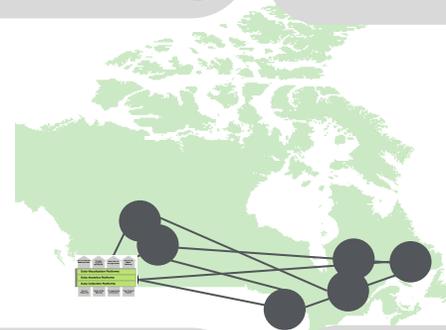
- Calgary



Transportation – The Smart Surrey Strategy is setting a precedent and collecting best practices for other Canadian cities through their work at the Transportation Management Centre.

Potential collaborations:

- Montreal
- Calgary
- Toronto



The national collaboration ecosystem will leverage the platforms and innovating capabilities of the BC digital technology supercluster to transform industries.

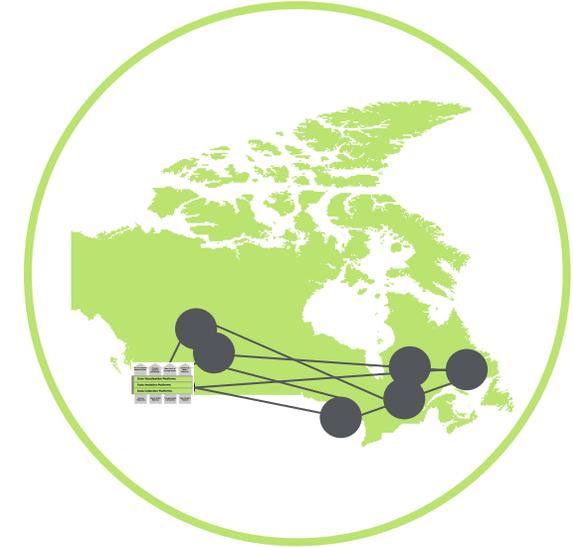
Conclusion

British Columbia is positioned to lead Canada as a global digital technology supercluster

Conclusion: British Columbia is positioned to lead Canada as a global digital technology supercluster

Past, present, and future, the BC digital technology supercluster is an inspiring story.

- **BC's tech industry is leading Canada in technology sector GDP growth and job creation.** This thriving position builds on the momentum created by BC's tech industry trailblazers like MDA, Glenayre Electronics, Mobile Data International, and MPR Teltech. This momentum is gaining as more and more global companies come to BC. Microsoft, Amazon, Boeing, SAP, GE, and Disney are already here.
- **BC's unique combination of foundational strengths set it apart.** BC will continue to leverage its world-class creative and digital media industry, global centre of excellence in IoT, world-leading analytics capabilities, world-class research talent, geographic advantage as Canada's gateway to Asia, and centrality in the Cascadia corridor to accelerate growth of the digital technology supercluster.
- **BC has the opportunity to lead the path to exponential growth.** The supercluster's core technology platforms (data connectivity, data analytics, and data visualization) will follow exponential growth trajectories. Traditional industries will leverage these high-growth supercluster platform technologies to evolve to the "re-imagined" future.



As it grows, the digital technology supercluster in BC will help Canada to:

- **Bolster collaboration between industry, post-secondary, and public sector organizations.**
- **Increase industry-led R&D spending to develop innovations that enhance industrial competitiveness.**
- **Foster domestic and international business opportunities through BC's strong connection to Asian export markets and the collaboration that accompanies partnership in the Cascadia Innovation Corridor.**
- **Create a stronger Canadian innovation ecosystem by working collaboratively with regions and industry players across the country to develop innovations and cross-sectoral applications.**

The result will be accelerated economic growth through revenue generation and job creation, and ultimately increased global competitiveness of Canada's traditional industry sectors and Canada as a whole.

Now is the time to act purposefully to forge Canada's competitiveness in the global digital economy and to secure the digital jobs of our nation's future.

Appendices:

- *Collaborators and Interview Participants*
- *Resources*

Collaborators and Interview Participants:

Collaborators

This report was developed with guidance from:

- BC Tech Association
- Chief Advisor of the Innovation Network
- Research Universities’ Council of BC
- University of British Columbia
- Wavefront
- Deloitte

Interview Participants

The following people were interviewed as an input to this report:

Organization	Name	Title
Boeing	Fadi Deek	Director of Business Development
Creative BC	Pram Gill	CEO
Electronic Arts	Jonathan Lutz	VP, Corporate Financial Planning & Strategy
Finning	Gary Agnew	VP Finning Digital
FPInnovations	Trevor Stuthridge	EVP
Genome BC	Pascal Spothelfer	CEO
HootSuite	Matt Switzer	SVP Strategy & Corporate Development
LifeLabs	Lawrence Mahan	VP Sales and Marketing
LifeLabs	Thomas Marshall	Director Government Relations
Life Sciences BC	Lesley Esford	President
MDA Systems	David Hargreaves	VP, Surveillance and Intelligence
Microsoft	Edoardo De Martin	Director of Microsoft Vancouver
Research Universities’ Council of BC	VPs of Research (group)	VPs of Research
Sierra Wireless	David Climie	VP Investor Relations
SAP	Kirsten Sutton	VP and Managing Director
Schneider-Electric	Jill Tipping	VP Operations and CFO (Solar)
Schneider-Electric	Paul Sikora	Engineering Director
Sony Pictures Imageworks	Michelle Grady	SVP Production
StemCell	Andrew Booth	CCO
TELUS	Josh Blair	EVP
Wavefront	James Maynard	CEO
Zymeworks	Ali Tehrani	CEO

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