



A regional approach to 5G deployment in the Edmonton Metropolitan Region

*Leveraging 5G technology for investment
attraction, workforce development, and
the commercialization of local innovation.*

September 2020



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Edmonton Region 5G Working Group

A group of organizations within post-secondary education, industry, economic development, municipal government, and innovation across the Edmonton Metropolitan Region came together to collaborate on developing a strategy for enhanced 5G initiatives that would catalyze business expansion and attraction, workforce training, innovation and commercialization of new technology in Alberta.

The regional 5G approach that follows contains contributions and insights from the innovative individuals within the organizations listed below and industry partners they are working with.

Sector	Organization
Post-Secondary	Athabasca University Concordia University MacEwan University NAIT NorQuest College University of Alberta
Innovation	Alberta Machine Intelligence Institute (Amii) Food Development Processing Centre
Economic Development	Edmonton Global Edmonton Health City Edmonton Screen Industries Office Edmonton International Airport
Municipal	City of St. Albert City of Beaumont City of Edmonton Strathcona County Sturgeon County

Executive Summary

COVID-19 has raised the stakes for our economy's ability to innovate, adapt, and be globally relevant; but it has also increased the potential for us to capitalize on these global changes.

5G (fifth generation) technology is more than just the next generation of mobile technology: it will bring entirely new ways of using technology and serve as a platform for innovation across all industries. It will enable autonomous systems for aviation and transportation. It will power smart cities, making communities more efficient and sustainable. It will link medical devices, industrial equipment, and agricultural machinery. It will revolutionize productivity and prosperity in jurisdictions who become early adopters.

Thirty-six jurisdictions across the world, both advanced and developing economies, have already deployed early stage 5G networks, and global 5G deployment continues to increase. In the past two years, the United States of America, Austria, the United Kingdom, Finland, and France are some of the countries that have released comprehensive 5G strategies and infrastructure plans.

5G technology is here to stay and if Alberta acts now, we can still be at the forefront of this global technological movement. With the vision and determination to move forward boldly, together, **Alberta can be globally recognized as a place where the world's biggest problems get solved and the best companies are born.**

The first step towards making this vision a reality is to establish strategically located 5G nodes that can maximize usage and benefit across multiple sectors. Each node can offer a multi-purpose use case benefitting a variety of businesses, entrepreneurs, innovators, and workers, netting the strongest return on investment.

Establishing twenty-two strategically placed nodes across the Edmonton Metropolitan Region over the next four years would support enhanced 5G initiatives for:

1. Airports, Aircraft and Autonomous Systems
2. Interactive Digital Media
3. Health and Life Sciences
4. Industrial Process Automation and Commercialization
5. Smart Cities and Smart Government
6. Smart Farming

These nodes would stimulate business expansion and attraction; workforce development; innovation and commercialization; and position the province for billions of dollars in global opportunity.

This can be enabled by government, in partnership with industry, academia, and non-profit organizations through **four key actions**:

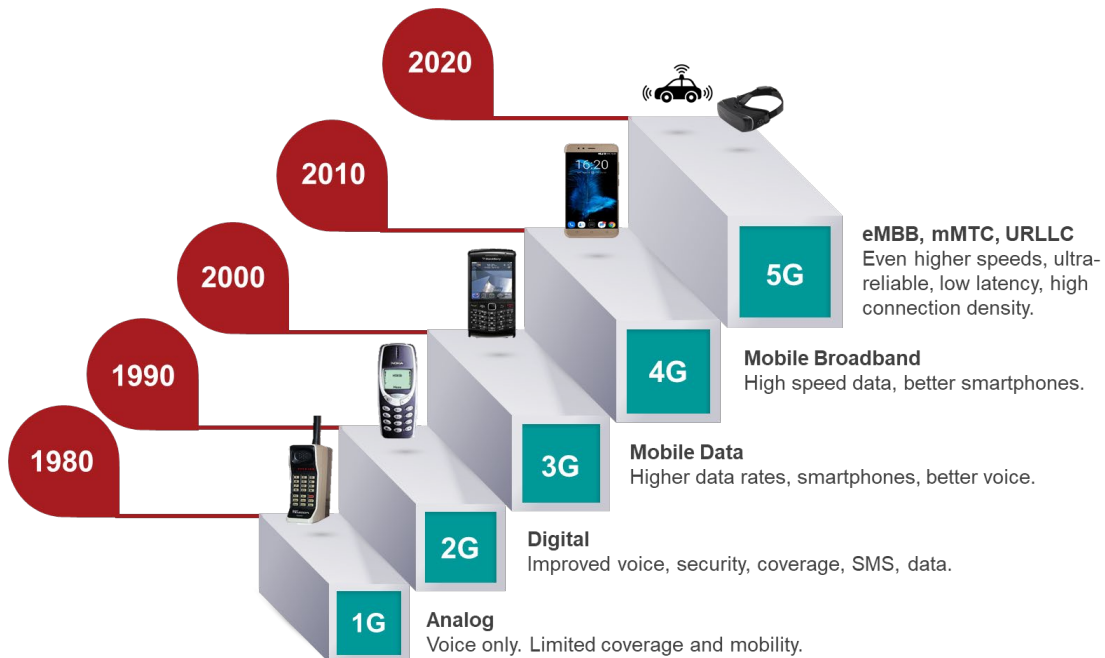
1. Develop an Early Adopter Strategy
2. Invest in Infrastructure for Innovation
3. Remove Regulatory Barriers
4. Train a 5G-Ready Workforce

Background

Why 5G, Why Now?

1G brought the very first cell phones, 2G introduced texting, 3G allowed mobile online connection for the first time, and 4G delivered the higher speeds mobile devices have today. As more users come online with multiple connected devices, 4G networks have just about reached the limit of what they are capable of managing, at a time when users need more data and multiple devices connected.

5G will be able to handle one thousand times more traffic than today's 4G networks and will be up to ten times faster than 4G LTE. 5G will be the foundation for the next generation of innovation including autonomous driving, virtual reality, and the Internet of Things.



5G = Bigger, Better, Faster

Speed: 4G can only muster about 1.5 Gigabits per second of data throughput, while 5G can manage up to 2-3 Gigabits per second.

Latency: 4G suffers from around 100 milliseconds in response delay, or latency. 5G reaction time can be as low as 10 milliseconds, which makes interactions and response times instant.

Dense Connections: In a given square kilometer, 4G can only manage to connect about one tenth the number of devices that 5G can.

5G = Safe and Secure

Health questions come up around 5G's use of microwave frequencies; however, microwaves are already emitted by cell phones, cordless phones, wireless ear buds, and just about anything with Wi-Fi. Even 5G's highest frequencies are considered by scientists to be non-ionizing radiation. 5G's emissions are far below those of x-rays, gamma rays and cosmic radiation.

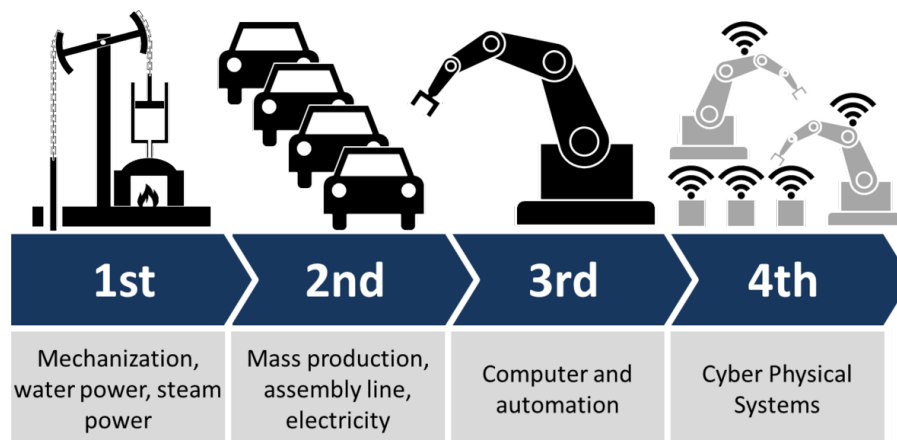
The United Kingdom conducted consultation on human exposure to Electromagnetic Field Emissions (EMF) and the tests failed to find health risks. The Center for Disease Control and Prevention in the United States also indicated there is no scientific evidence to support concerns about 5G and health risks.

5G marks the beginning of a new era of network security with the introduction of International Mobile Subscriber Identity (IMSI) encryption, making it more secure than 3G and 4G. All traffic data which is sent over 5G radio network is encrypted, integrity protected and subject to mutual authentication between each device and the network.

5G = The Future

Not only is 5G safe and reliable, it is an infrastructure and technology that could unlock the untapped potential of the future economy. 5G is more than the next generation of wireless technology; it will introduce an entirely new way of using technology that is not possible today. 4G's speed and data capacity propelled society into the app economy and expanded the use of mobile video.

Industrial Revolutions and Enabling Technology



5G will be a vital platform for innovation by:

- Enabling autonomous cars by providing real-time awareness of every other car, bike, pedestrian, and traffic signal around. Self-driving cars will require a continuous stream of data and the quicker that information is delivered to autonomous vehicles, the better and safer they can run.
- Powering Smart cities so that almost anything that is electric can also be connected and aware. When a bridge needs repair, it can tell those who need to know, right away.

- Providing a platform for the Internet of Things (whose market is set to triple by 2025) and linking and controlling not just robots, but also medical devices, industrial equipment, and agricultural machinery.
- Providing the range, reliability, flexibility, mobility, security, predictability, and speed that Industry 4.0 needs to succeed.

With 5G, industry can:

- scale up and reconfigure on a dime;
- connect workers to save lives;
- boost productivity;
- predict and respond to meet demand; and
- automate, analyze, and optimize in real time.

Overview

Opportunity for Alberta

5G represents an incredible opportunity for Alberta's economy both as a support to and exit from an economic crisis, and as a competitive advantage for the province's economy going forward. It is an economic accelerant and investment opportunity being seized upon by governments and economies around the globe. This technology is here to stay and if Alberta acts now, we can still be at the forefront of this global technological movement.

Key economic benefits of implementing 5G technology in Alberta would include:

- increasing Alberta's global competitiveness;
- improving Alberta's value proposition for foreign direct investment;
- creating immediate jobs in the construction and telecommunication sectors;
- unlocking economic opportunity for Alberta's strength sectors (i.e. energy, agriculture, manufacturing, health, aerospace, transportation and logistics, and finance);
- providing new post-secondary training programs and student recruitment opportunities;
- encouraging productivity improvements across all sectors; and,
- enabling government to modernize, digitize and achieve efficiencies.

The benefits of 5G far outweigh the costs, making this an infrastructure investment that not only generates immediate economic activity, but also a lasting economic impact. 5G will act as a platform upon which Albertans and Canadian will be able to innovate and build new ways of working.

Vision 2025

Alberta's Innovation Corridor is a **global** test bed for developing and commercializing innovative technology applications and solutions to the world's biggest problems.

Recommendations

1. Develop an Early Adopter Strategy

The Government of Canada and Government of Alberta develop a five-year strategy for immediate 5G deployment and include 5G infrastructure funding in capital budget allocations.

The Government of Canada and Government of Alberta utilize the Edmonton Metropolitan Region's 5G node approach as a pilot or test case in the implementation of a provincial and national strategy.

The Government of Canada and Government of Alberta collaborate with partners to develop and implement a public education initiative on 5G.

2. Invest in Infrastructure for Innovation

The Government of Alberta establish an Enhanced 5G Initiative Infrastructure Fund of \$100 million over four years to establish 5G nodes.

Criteria for accessing the fund should include:

- applicants are a consortium or partnership between industry, academia and/or government/non-profit;
- successful consortia or partnership applicants will include cash and in-kind contributions; and
- the proposed project will leverage public infrastructure for the benefit of business expansion, investment attraction, workforce development and technology development and commercialization.

3. Remove Regulatory Barriers

The Government of Canada review existing telecommunication regulation and amend it to enable innovation, economic growth, and global competitiveness, specific to 5G deployment.

The Government of Canada find ways to release more spectrum capacity and release it earlier to act as a catalyst for economic growth.

The Government of Alberta advocate to the Government of Canada for regulatory modernization and expedited release of increased spectrum capacity.

4. Train a 5G-Ready Workforce

The Government of Alberta and Government of Canada support the development of upskilling and reskilling programming at colleges and polytechnics in the Edmonton Metropolitan Region, in partnership with relevant private sector companies for:

- Small Cell antenna installation;
- 5G construction best practices;
- 5G equipment specifications;
- 5G infrastructure design; and,
- distributed antenna systems and fiber work.

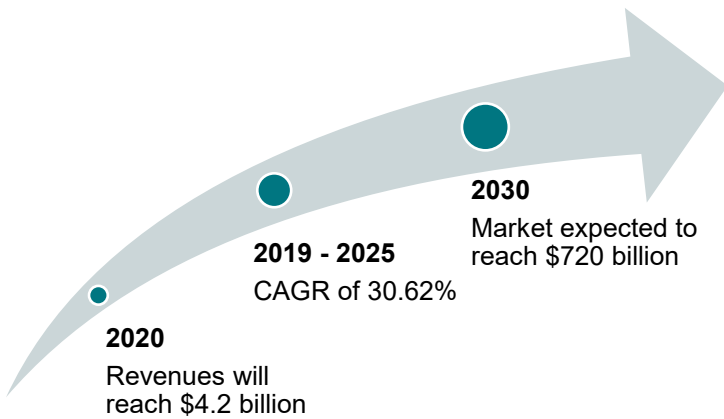
5G Global Outlook

Canada lags most of the world's nations, both advanced and developing economies, in deploying early stage 5G networks. Globally there are already over 15,000 5G deployments from 136 different operators. The map below depicts partial, regional deployments of 5G across the world.ⁱ This lag allows Alberta an opportunity to be a leader in Canada for 5G deployment, creating a significant competitive advantage for the province in attracting global investment and opportunity.

Partial, regional deployments of 5G across the world



The global 5G market is expected to surge over the next five to ten years reaching \$720 billion by 2030.ⁱⁱ



GLOBAL SPOTLIGHT ON 5G

USA (2018)

- National Cyber Strategy: work with private sector to facilitate evolution of 5G and lay groundwork for innovation beyond the next-generation advancements

AUSTRIA (2018)

5G Strategy for Austria

- Launch 5G in all state capitals by end 2020
- Become 5G pilot country by early 2021
- Nationwide coverage of 5G by end 2025

UK (2016-2019)

- Group of 5G research centres
- 5G testbeds and trials 2018-2019
- National Infrastructure report 2018 – outlines 5G projects

GERMANY (2016)

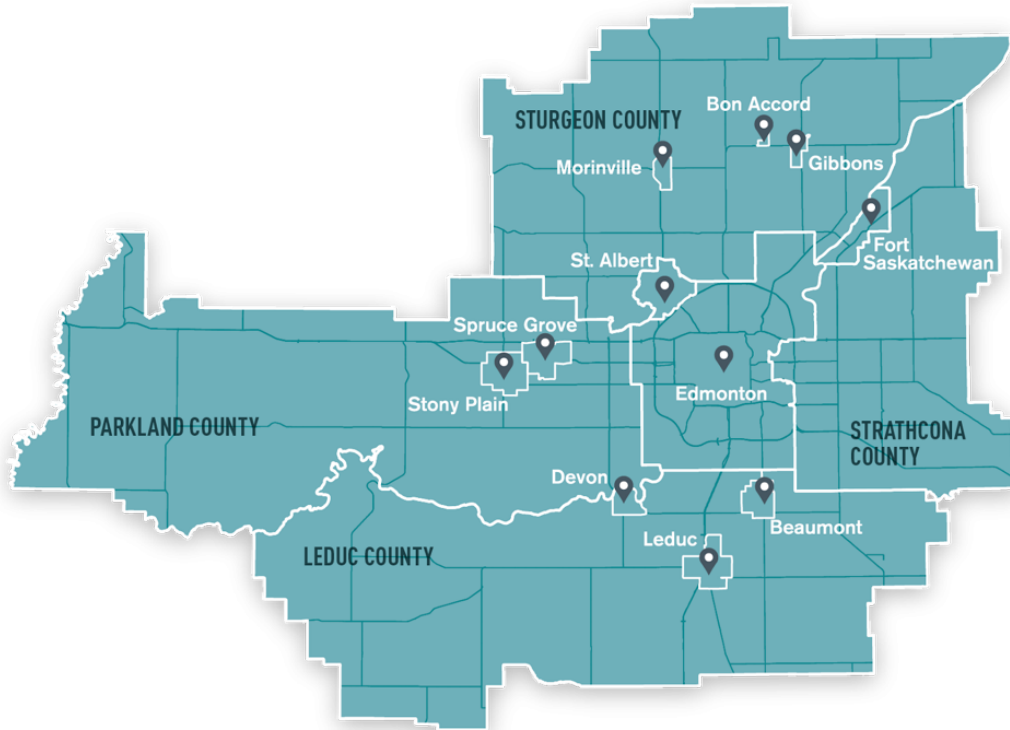
- National 5G strategy with context, actions, rollouts over the period to 2025
- 5G research initiatives in 5G research centres

FINLAND (2019)

- Turning Finland into the world leader in communications networks – Digital infrastructure strategy to 2025

The Edmonton Metropolitan Region

While 5G technology boasts innovation and capabilities previously unimaginable, the Edmonton Metropolitan Region, which includes the municipalities shownⁱⁱⁱ below as well as the post-secondary institutions and firms within their boundaries, have taken a strategic approach to its suggested implementation by focusing on its ability to enhance the Region's existing areas of expertise and increase the competitiveness of its core competencies.



5G will be an important piece of the innovation ecosystem and support development of technology and commercialization of research. It will also be a valuable differentiator for the Region and increase the value proposition and to attract new investment.

The Edmonton Metropolitan Region is an ideal hub for 5G technology nodes with existing collaborative partnerships across its member municipalities, and between private-sector business, academia and all levels of government. These strong industry-government-academia partnerships will ensure maximum benefit to Alberta businesses, students, and entrepreneurs.

These partnerships combined with leading edge next generation technology would act as a beacon for foreign direct investment into the Region and province. The global recognition that the Region has for skilled talent developed through top post-secondary institutions and innovation entities like the Alberta Machine Intelligence Institute (Amii) are strong attractants to the area and critical to the advancement and commercialization of innovative technology on a global scale.

5G Installation

Technical Specifications

5G requires a much denser network of physical transmission devices; in other words, far more towers, antennae, and other devices to be installed than a 4G network. Conventional cell networks, such as those operating 3G or 4G/LTE, use microwave spectrum. The physical infrastructure of 5G, however, is much smaller and less intrusive than existing cell phone towers. Conventional cell networks, such as those operating 3G or 4G/LTE, use microwave spectrum. 5G uses even smaller millimeter waves.^{iv} As the name might suggest, they are many times smaller than their 4G equivalent, and measure only millimeters in size. Tens of thousands more devices can join the network simultaneously, because the “space” required for each device is significantly less. Smaller wavelengths support a bigger online business community.

5G’s small waves require higher frequency spectrum to transmit. The more spectrum, the more data that can transmit faster across the network. Spectrum refers to the radio waves that keep us all connected. It is a public resource – just like water – and exists everywhere in the country. How spectrum is used and by whom is regulated by the Government of Canada. Over the past 12 years, the Government of Canada has designed spectrum auctions that “set aside” up to 40% of the available spectrum exclusively for regional providers. Once owned, the spectrum licences last up to 20 years whether the owner chooses to deploy it or not.

The auction has been delayed to June 2021 due to the COVID-19 pandemic. This delay puts Canada farther behind the rest of the world in 5G deployment and creates uncertainty with investors and their capital planning. Meanwhile, in the race for a 5G future, countries like China are launching 5G networks ahead of schedule and on a spectrum North America cannot yet match. Elsewhere across the world, 23 countries have auctioned or allocated C-band spectrum (3300-4200 MHz frequency range) since 2015.

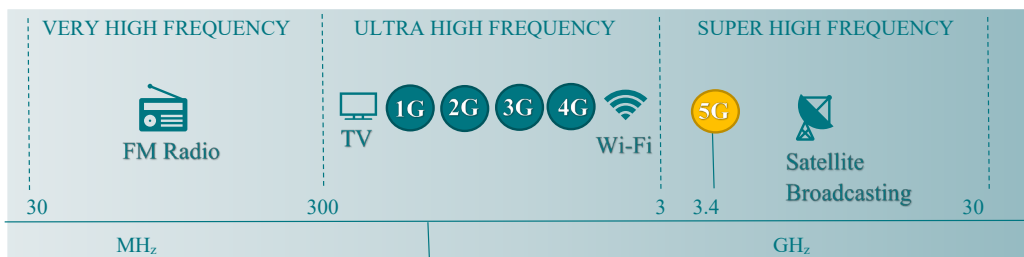
REMOVE REGULATORY BARRIERS

RECOMMENDATIONS

The Government of Canada review existing telecommunication regulation and amend it to enable innovation, economic growth, and global competitiveness, specific to 5G deployment.

The Government of Canada find ways to release more spectrum capacity and releasing it earlier to act as a catalyst for economic growth.

The Government of Alberta advocate to the Government of Canada for regulatory modernization and expedited release of increased spectrum capacity.

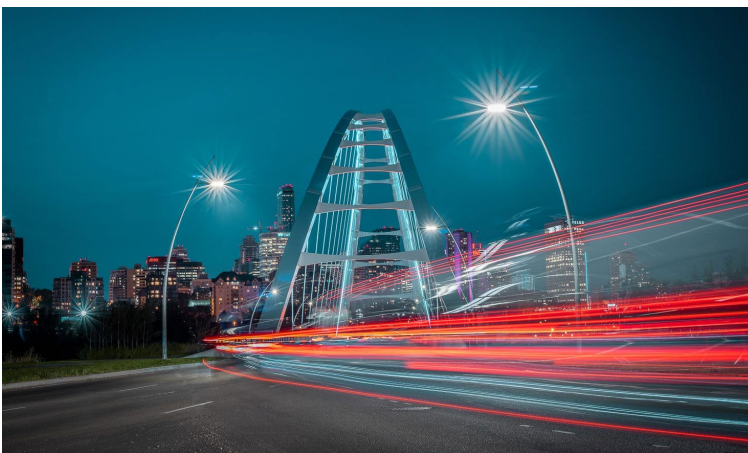


Infrastructure

To avoid transmission of the shorter wavelengths being impeded by physical obstacles, 5G uses Small Cells – miniature portable stations. They require a small amount of power to run and can even operate off battery power. To be effective, Small Cells usually need to be in proximity to existing network towers such as those used for telephones. In cities, it is estimated that a Small Cell would need to be installed approximately once every 250 meters to support an effective 5G network.⁹

For the City of Edmonton, with an area of 684 km², approximately 2,750 Small Cells would need to be installed and deployed to ensure full 5G coverage. A truly province-wide expansion of 5G, to yield the widest set of economic benefits—like precision agriculture, mass adoption of the Internet of Things, and integrated health devices would require 2.7 million Small Cells across Alberta’s expansive 661,848 km² landscape.

The cost of such an undertaking would be prohibitive, especially when considering population distribution in Alberta. A targeted deployment would generate substantial economic benefits while minimizing costs associated with a broad-based deployment. At this stage of deployment, the Edmonton Metropolitan Region suggests identifying key locations within the Region that could act as 5G hubs, thereby maximizing the economic benefits of such technology and maintaining a first mover advantage in 5G innovation and investment attraction.



INVEST IN INFRASTRUCTURE FOR INNOVATION

RECOMMENDATION

The Government of Alberta establish an Enhanced 5G Initiative Infrastructure Fund of \$100 million over four years to establish 5G nodes. Criteria for accessing the fund should include:

- Applicants are a consortium or partnership between industry, academia and/or government/non-profit;
- Successful consortia or partnership applicants will include cash and in-kind contributions; and
- The proposed project will leverage public infrastructure for the benefit of business expansion, investment attraction, workforce development and technology

Labour

Effectively building and deploying the 5G network will require telecommunications professionals trained to install, troubleshoot and maintain all needed components, such as: Small Cell antenna installation, 5G equipment specifications, 5G construction best practices, 5G infrastructure design, and distributed antenna systems and fiber work.

Talent development for 5G infrastructure building is not yet offered in Canada. In the USA, where 5G rollout has already begun, post-secondary institutions are offering programs to support training for 5G infrastructure installation, deployment, and maintenance. For example, Aiken Technical College, in South Carolina, offers a 12-week program in tower installation.

Alberta's polytechnics and regional colleges would be well-situated to deliver programming, similar to programming already delivered in some US colleges, where 5G installation is taught in courses ranging from 12 weeks to 2 years that boast an impressive 100% after-completion employment rate.^{vi}

Investing in the initial development of courses, perhaps to be shared among all Alberta technical colleges, would quickly pay dividends for getting Albertans back to work, improving Alberta's telecommunication infrastructure and attracting students from across Canada and North America. As deployment of 5G expands across North America and the rest of the world, this could provide private sector partnership and student recruitment opportunities for Alberta's post secondary institutions.



TRAIN A 5G-READY WORKFORCE

RECOMMENDATION

The Government of Alberta and Government of Canada support the development of upskilling and reskilling programming at colleges and polytechnics in the Edmonton Metropolitan Region, in partnership with relevant private sector companies for:

- Small Cell antenna installation;
- 5G construction best practices;
- 5G equipment specifications;
- 5G infrastructure design; and
- Distributed antenna systems and fiber work.

5G Economic Impact

Employment Growth

The 5G and telecommunication sector, broadly defined as the communication engineering construction, communications equipment manufacturing and telecommunications sector, employed by direct, supply chains and income accounted for more than 26,800 people in Alberta in 2016. The direct contribution of the sector was \$5.1 billion, and through supply-chain and income effects, supported up to \$7.1 billion of economic output in the province.

A one-time doubling of the sector from 5G capital and operations spending would raise Alberta's employment level by over 30,000 jobs. This would positively impact all sectors of the economy.

The estimated economic impact of 5G deployment in Canada will reach \$40B of annual GDP uplift by 2026, with 250,000 permanent jobs added to the economy in the same timeframe. *(Source: Accenture)*

Alberta needs a piece of the growing pie.

Unlocking Opportunity in Existing Sectors

Digital tools such as cloud computing, Internet of Things, big data, and data analytics are primary sources of competitiveness and major creators of economic wealth for businesses in today's economy; data is the new currency. With 5G, these opportunities for wealth creation can be brought to Alberta. They can also make Alberta's existing backbone industries including agriculture, healthcare, construction, manufacturing, and resource extraction much more productive and competitive in the following ways.

Improving Capacity of Healthcare Devices

Proponents of the Internet of Things maintain that healthcare devices connected to 5G internet could represent substantial benefits for healthcare outcomes—eliminating opportunities for measurement error in drug dispensation, integrating device readings with patients' medical teams, and constantly monitoring health data.

DEVELOP AN EARLY ADOPTER STRATEGY

RECOMMENDATIONS

The Government of Canada and Government of Alberta develop a five-year strategy for immediate 5G deployment and include 5G infrastructure funding in capital budget allocations.

The Government of Canada and Government of Alberta utilize the Edmonton Metropolitan Region's 5G node approach as a pilot or test case in the implementation of a provincial/national strategy.

The Government of Canada and Government of Alberta collaborate with partners to develop and implement a public education initiative on

Asset Tracking for Manufacturing

The hyper-connected network of devices would increase visibility over incoming and outgoing components and goods in the supply chain. Asset tracking means knowing exactly how many components are being produced at manufacturing sites throughout Alberta, how many units are being exported, and where shortages and surpluses are arising so resources can be redistributed, all in real time.^{vii}

Precision Agriculture

Precision agriculture is a farming management technique that aims to micro-optimize agricultural processes and practices through the massive collection, analysis, and utilization of data about soil, crops, labour, weather, pesticides and more. A major example of 5G's potential benefit is canola, one of Alberta's most prominent crops, of which 90% is exported to markets around the world. The application of precision agriculture can reduce pesticide costs by up to 85%, which is the equivalent of up to \$360 Million in savings annually.^{viii} The average oilseed farmer could be expected to see upwards of \$40,000 in savings annually.

Supporting Oil and Gas Sector Innovation

5G will allow for effective monitoring of remote sites in real time. If 5G is deployed along pipelines or at well sites, it can provide constant feedback, allowing spills or vulnerabilities to be discovered the moment they occur, rather than days or weeks later. This is a significant step forward in reducing spillage and support environmental protection.

Increasing Export Competitiveness and Participation in Global Supply Chains

Supply chains in all industries would benefit from the machine intelligence applied through 5G. 5G would allow seamless information transfer across the globe—allowing inventory needs to be immediately assessed, communicated, and met. Reducing the length of time between anticipating a shortage, creating sufficient product, and deploying that product to market would represent a massive value proposition for Alberta in the global export market.

Smart Building, Smart Construction

Construction is the third largest component of Alberta's economy, comprising 8.81% of its GDP in 2019 for a value of \$29.4 billion. Smart Buildings are coming to the forefront in the construction industry. According to Fortune Business Insights, "The global smart building market size stood at USD 43.64 billion in 2018 is projected to reach USD 109.48 billion by 2026, exhibiting a CAGR of 12.6% during the forecast period."

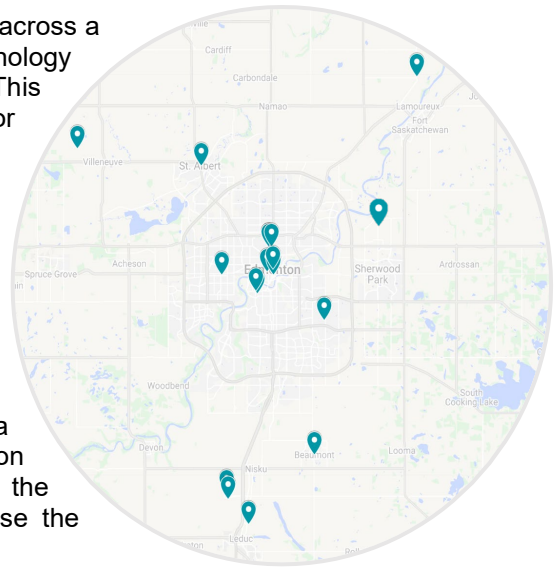
With its high-bandwidth, greater reliability, and data-rich connectivity, 5G will enable a wide variety of new products and services in the architecture, engineering, and construction industry. These include real-time energy modeling and load balancing, monitoring and adjustment of indoor air quality, light control for energy efficiency, enhanced security for all tenants and more efficient facilities management.

Edmonton Region 5G Use Cases

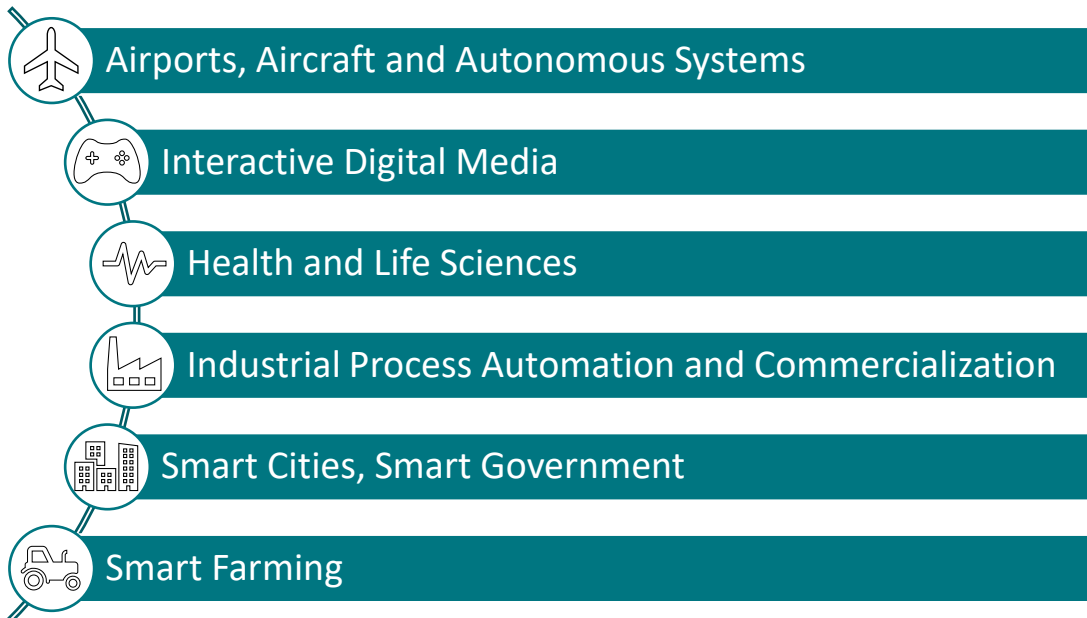
Overview

The ability for 5G to handle multiple use cases, across a variety of industries is what makes the technology particularly transformational and exciting. This regional strategy presents six key use cases for 5G that demonstrate initiatives which can be adopted and implemented immediately and over the next five years as 5G becomes more widely deployed. These use cases also present the proposed 5G hubs that would maximize the immediate economic benefits of the technology and provide a prioritization of where Small Cells could be first installed and piloted.

The Edmonton Metropolitan Region has taken a strategic approach to its suggested implementation of 5G by focusing on its ability to enhance the Region's existing areas of expertise to increase the competitiveness of its core competencies.



These enhanced 5G initiatives include:



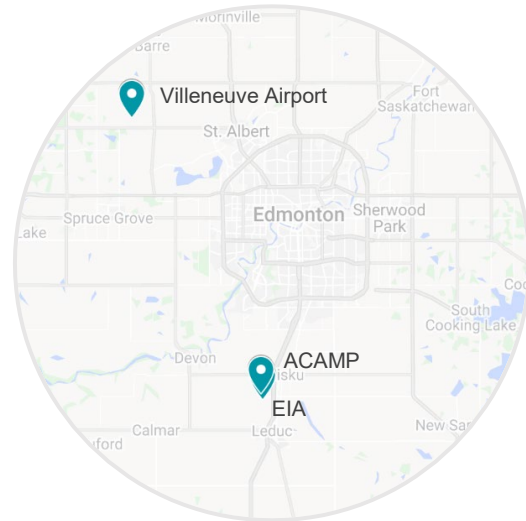
Enhanced 5G Initiative: Airports, Aircraft and Autonomous Systems

Focus Areas

- Digitization of the airport
- Development, testing and commercialization of autonomous systems and drone technology
- Advanced training and simulation for the aviation industry

5G Node Locations

- Alberta Centre for Advanced MNT Products (ACAMP)
- Edmonton International Airport (EIA)
- Villeneuve Airport



The 5G Opportunity

Edmonton International Airport (EIA) is dedicated to serving as a regional economic driver with safety and security, jobs, and regional prosperity as its primary drivers. As part of this mission, EIA is a catalyst for technological innovation, development, and commercialization. The airport has published a strategic plan, the “Innovation Expansion” which describes how technology and data will be leveraged to improve the passenger experience and to allow for growth in air service within the current infrastructure footprint of the airport. These goals require investments in the Internet of Things (IoT) which require advanced capabilities related to data and connectivity. LTE, 4G, and 5G foundations are pre-requisites for this enablement.

Through a unique partnership with the Alberta Centre for Advanced MNT Products (ACAMP), EIA sets itself apart from its peers by encouraging on-site innovation and the development, implementation, and retention of advanced technology capability and capacity in Alberta.

ECONOMIC OPPORTUNITY

The unmanned aerial vehicle (UAV) sense and avoid systems market size is expected to be valued at \$3.7 billion USD by 2022.

The Autonomous Vehicle Market is expected to grow and reach \$60 billion by 2030.

(Sources: Statista and Research and Markets)

Innovation Driven

In 2017, ACAMP joined forces with the Alberta Aerospace and Technology Centre (AATC) at EIA to help Alberta businesses enter the viable and fast-developing autonomous transportation and systems market.^{ix} This partnership provides the Edmonton Metropolitan Region with a significant competitive advantage, as one of the most anticipated applications of 5G is in the area of autonomous vehicles and vehicle technology to support the future of autonomous systems.

EIA leads its peers in autonomous technology with systems already in use at the airport; most notably the use of autonomous security all-terrain vehicles, developed through ACAMP, that patrol the perimeter of the security fence that surrounds EIA's secure airside land.^x The ability to develop and pilot innovative technology within the Edmonton Metropolitan Region and then successfully implement it at a world-class airport, EIA, makes a compelling case for widespread commercialization. The innovation ecosystem that exists at EIA provides an enviable opportunity for the Region to showcase its global leadership in autonomous systems.

Workforce Development

EIA also owns and manages the Villeneuve Airport located in Sturgeon County. The Villeneuve Airport serves as a premier general aviation airport and the primary flight-training facility for the Region and as such, is acutely focused on ensuring the Region's ability to sustain and grow the aviation industry in Alberta. A key element of supporting the expansion of the aviation industry is the ability to meet the demand of trained aircraft pilots and the Villeneuve Airport is committed to the delivery of state-of-the-art aviation training and flight simulations. To continue to be an industry leader in training the next generation of pilots and aviation workers, access to the latest technology to develop programming and training is critical.

Why 5G?

Airports are increasingly leveraging technology to drive efficiencies and manage processes within the terminal and to communicate key events with stakeholders within the aviation ecosystem. EIA is focused on building a platform that leverages sensors, data and connectivity that will allow for the automation of machines and infrastructure within the terminal and the airport city environment to improve maintenance and ensure reliable operations. Through this sensor network, data on key business events including flight schedule changes, passenger flows, and aircraft movements can be collected to improve the passenger experience and communicate transparently with stakeholders as required.

EIA, Villeneuve Airport and ACAMP are uniquely positioned as ideal hubs to leverage the capabilities of emergent 5G technology as they relate to innovation, testing and commercialization in the aircraft and autonomous system industry. The continued focus on technology and innovation in this space represents a diversification of the regional economy while providing for much needed new investment.

On-Site Development

Investing in critical infrastructure related to connectivity at key innovation hubs, like EIA, including ACAMP, and the Villeneuve Airport, provides a key prerequisite that will not only allow the aviation ecosystem to manage information flows securely to ensure appropriate performance of business processes, but also enable the on-site development and testing of technology that has never been possible before.

Critical Infrastructure

Driverless vehicles, drones and robotics will rely heavily on the speed and reliability that 5G offers to reach their full potential for commercialization. The ability to collect and analyze the massive amounts of real-time data being generated by these autonomous systems is greatly enhanced by 5G with faster transmission time, lower latency and high bandwidth which are critical factors when developing, commercializing, and using autonomous systems.

Building the infrastructure related to connectivity, networks, and data (LTE, 4G and 5G) is a critical pre-requisite to allow EIA to manage the information flows securely and to ensure appropriate performance of business processes.

Other Uses

The use cases possible within the airport, airport city and innovation space are endless and the those described below are only representative examples. While 5G alone will not enable these, a hybrid connectivity model that includes 3G, LTE, 4G, and 5G will.

Airside Vehicle Asset Tracking

This project will monitor a wide range of mobile equipment at EIA for key data points including location, movement, maintenance status, and more. This data can then be synchronized with existing and new EIA systems to improve safety, security, and operations efficiencies. 5G will allow EIA to capture and analyze this data much more effectively.

Body Cam Viewing and Recording

As airport security becomes increasingly reliant on smart technology, the amount of data being collected by airport authorities is growing at incredible rates. A large amount of this data comes from cameras and the ability to quickly capture, review, and analyze its information is critical to the safety and security of the airport. 5G will allow airports to securely and reliably transmit and analyze data from various systems faster and more effectively than before.

Drones and Remotely Piloted Aircraft

EIA is engaged in several initiatives involving the development and use of drones and autonomous vehicles, including remotely piloted aircraft. Innovations in this space use high bandwidth for high-volume data capture, surveying, analyzing, precision mapping, and Light Detection and Ranging (LiDAR) imaging, which will be supported by 5G's low latency and high-speed capability.

Potential Industry Partners

EIA works with many partners on initiatives connected to large bandwidth data collection and transfer, analysis, and the telecommunications infrastructure that supports this work. Key partners include collaborating municipalities, government, entrepreneurs, private sector telecommunications companies, infrastructure developers and other stakeholders as projects come to fruition.

Key Outcomes

Investment Attraction



Housing the innovation and development of technology enabled by 5G in the Edmonton Metropolitan Region allows the area to reap the economic rewards of commercialization by acting as an early adopter.

Adoption and Commercialization of Technology



With state-of-the-art facilities to develop, test and pilot the latest aircraft and autonomous technology, the Edmonton region is well positioned to take a leading role in this fast-growing industry.

Workforce Development



Employing, training, and developing local talent in this specialized space allows the Edmonton area to differentiate itself with knowledgeable human capital in an emerging tech market.

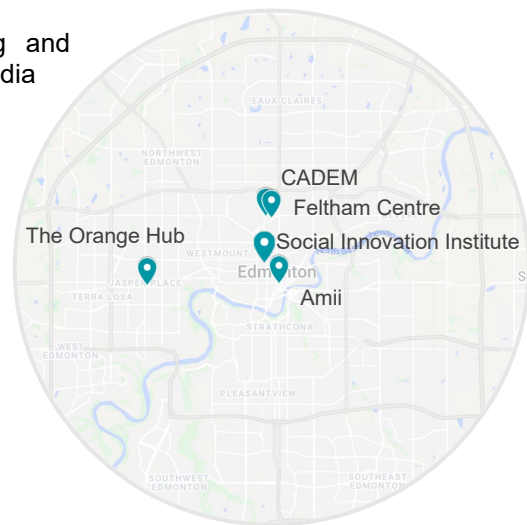
Enhanced 5G Initiative: Interactive Digital Media

Focus Areas

- Incubation and acceleration of interactive digital media and other creative technology
- Development of immersive learning and training programs related to digital media

5G Node Locations

- The Orange Hub, Edmonton Screen Industries Office
- Feltham Centre, NAIT
- Social Innovation Institute, MacEwan University
- Centre for Applied Disaster and Emergency Management (CADEM), NAIT
- Alberta Machine Intelligence Institute (Amii)



The 5G Opportunity

The Edmonton Metropolitan Region is a world leader in video games, serious games, and interactive digital media. Combining a powerhouse of international experts in artificial intelligence (AI), machine learning, and computer science with a robust and diverse arts and creative community, the Edmonton region is positioned as the ideal place to develop, test and commercialize innovations in digital media.^{xi}

Edmonton is also home to a cluster of world-class digital talent supported by the Alberta Machine Intelligence Institute (Amii), which supports a top 5 globally ranked Artificial Intelligence and Machine learning research program at the University of Alberta, and the Edmonton Screen Industries Office which acts as a catalyst, a cultivator and a stimulator for the screen media industries in the Edmonton Metropolitan Region. The impressive technology advances taking place in the Edmonton Metropolitan Region are at the forefront of internationally recognized AI research and game development.

ECONOMIC OPPORTUNITY

Worldwide revenue generated from interactive digital media grew by \$5 Billion USD between 2018-2019 and is expected to have grown nearly another \$5 Billion between 2019-2020.

(Source: Statista)

Economic Impact

The economic potential for the interactive digital media sector is significant and growing. Even the more traditional audiovisual (film/TV) sector is now using video game engines to create environments in virtual studios that require a smaller footprint for physical production, eliminating the need for large soundstage facilities while at the same time upping onscreen production values.

Film & TV production volume in Canada in 2019 was CAD \$9.3 billion, a 5.8% increase over 2018. The industry generated 180,900 full-time equivalent jobs, a 2.4% increase over 2018 and represented CAD \$12.8 billion in GDP impact in Canada, a 5.2% increase over 2018. It also attracted CAD \$5.7 billion in foreign investment, a 4.9% increase over 2018.^{xii}

The Video Game sector in Canada directly contributed an estimated CAD \$2.6 billion to GDP in 2019. The sector also generated CAD \$1.9 billion in indirect and induced impacts. The total GDP contribution is estimated to be \$CAD 4.5 billion, which is 20% higher than 2017.^{xiii}

The global virtual and augmented reality market in 2019 was estimated to be USD \$16.8 billion and is expected to top USD \$34 billion by 2023. Canada is expected to have the fastest growth rate in the industry over the next few years.^{xiv} By 2022, the Canadian augmented and virtual reality market is expected to reach a market size of USD \$8 billion,^{xv} eclipsing the more traditional screen industries.

Edmonton's Opportunity

New products and opportunities are emerging within the screen industries as local, national, and international technology companies rapidly expand and change the landscape. The Edmonton Region, home to the Edmonton Screen Industries Office, is well positioned to capitalize on innovation and remain an important player across the full spectrum of screen industries and interactive digital media, adding an exciting dimension to the economy of the Edmonton Region and the Province of Alberta.

Edmonton is also home to Athabasca University which currently offers a Certificate in Game Development and Programming and a Machine Learning badge program. These programs help to fuel the innovation pipeline of the interactive digital media ecosystem that exists in the Edmonton Region.

Why 5G?

Real-Time Interaction

From digital games to animation and digital effects, 5G technology will push the limits of what is currently thought to be possible. 5G's low latency means that interactive gameplay occurs in real-time with no lag time between a gamer's input and the resulting response in the game, creating a unique and personalized gaming experience for every player. This real-time interaction is even more critical when adding elements like virtual reality and augmented reality. Streaming videos will download in an instant and frustrating buffering delays will be a relic of the past.

High Density

5G technology supports up to a 100x increase in traffic and device capacity compared to existing 4G infrastructure. This increase in volume allows for immersive experiences using high definition (HD) video, Augmented Reality (AR) and Virtual Reality (VR). This could include real-

time, close up viewing experiences of sporting events or concerts from viewers mobile phone or VR device, from the angle of their choosing.

Global Business Attraction

Outside of gaming, 5G provides the ability for digital media developers and creators of all kinds to use the world-class facilities and talent in Edmonton with the ability to send huge amounts of data and uncut video files direct from the set or location back to their offices or studios anywhere in the world. This removes a significant barrier that previously existed when content was being created in one location and needed to be immediately reviewed or edited in another.

Other Uses

Centre for Applied Disaster and Emergency Management (CADEM), NAIT

As the most advanced centre of its kind in Canada, the Edmonton-based CADEM provides hands-on training and innovative solutions that reflect current global best practices in emergency management.^{xvi} CADEM's cornerstone is an Emergency Coordination Centre (ECC) Simulation Lab, tailor-built to provide an immersive learning environment that enables users to model real-life scenarios, refine processes, collaborate, and enhance their ability to mitigate, prevent, prepare for, respond to, and recover from emergency and disaster events.

Located in NAIT's Productivity and Innovation Centre, CADEM is capable of delivering on-the-ground details of events virtually anywhere on the planet through a complex web of information supplied by internet cameras, maps, and drones. Reliant on state-of-the-art technology, the introduction of 5G technology into the ECC Simulation Lab, and its ensuing innovation, would ensure the lab remains a world-class innovation and training facility in the heart of Edmonton.^{xvii}

Social Innovation Institute, MacEwan University

At the MacEwan University Social Innovation Institute, entrepreneurs are connected to experts and innovators to create positive change locally, regionally, and globally. Courses, support organizations, action labs, digital tools are provided to students as they develop and activate social innovation ideas. 5G will become an essential factor in the early stages of generating, developing, and communicating new ideas and its unique Small Cell infrastructure lends itself to implementation in remote communities, isolated areas, and vulnerable populations. Access to 5G technology will allow post-secondary institutions, like MacEwan University, to support the development of social innovation in a way that was previously not possible.

Potential Industry Partners

Audiovisual

- Alberta Media Production Association (AMPIA)
- The Film and Video Arts Society of Alberta (FAVA)
- DOC Alberta
- Women in Film and Television Alberta (WIFT-A)
- Alberta Media Arts Alliance Society (AMAAS)

Interactive Digital Media

- Digital Alberta
- Interactive Arts Alberta

Key Outcomes

Investment Attraction



The ability to transfer large amounts of data quickly on 5G networks removes a significant geographic and technological barrier that global companies wanting to use the world-class facilities and talent in Edmonton previously had to contend with. Companies seeking to locate to a jurisdiction with an existing skilled labour pool will be drawn to Edmonton because of its cluster of integrated digital media companies as well as its local expertise in AI and machine learning.

Adoption and Commercialization of Technology



The Edmonton region has proven its global strength in digital media innovation and commercialization; early adoption of 5G will enable the Region to continue to lead the way into the next generation of digital technology. If the Edmonton Metropolitan Region had 5G capacity, it would have a competitive advantage over jurisdictions that lacked it.

Workforce Development



Post-secondaries in Edmonton have shown their ability to adapt to the growing demand for talent in gaming and digital media, and digital-based simulations and training, and are expected to continue to do so as the digital media and gaming industry becomes more advanced. In terms of retention, skilled local labour will no longer have to relocate to larger centres in order to seek career opportunities where there is advanced technology like 5G.

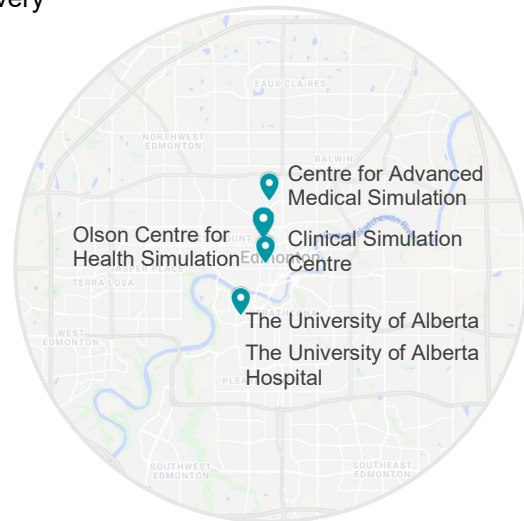
Enhanced 5G Initiative: Health and Life Sciences

Focus Areas

- Health and medical technology testing and commercialization
- Immersive learning for healthcare delivery

5G Node Locations

- The University of Alberta
- The University of Alberta Hospital, Alberta Health Services
- Centre for Advanced Medical Simulation, NAIT
- Olson Centre for Health Simulation, NorQuest College
- Clinical Simulation Centre, MacEwan University



The 5G Opportunity

The Future of Healthcare

With an aging population, healthcare systems around the world are undergoing transformational changes to address issues of cost, access, and quality. A key area for reform is in the way community care services are delivered. Efforts are being made to direct more services into the community and thus away from expensive tertiary centres, caring for patients in their homes longer rather than in extended care centres and hospitals, and an increased focus on wellness and disease prevention.

Technologies such as virtual care, AI, machine learning, robotics, precision medicine, and big data will all play a part in transforming our system. This digitization paired with a growing movement around consumer health, and instant access to one's health status, will define the future of our healthcare ecosystems. The intersection of new technologies and increased healthcare demands presents a unique opportunity for entrepreneurs, industry leaders, educators, and healthcare professionals to collaboratively change and improve the face of healthcare.^{xviii}

ECONOMIC OPPORTUNITY

The Health Artificial Intelligence (AI) market is expected to grow at a compound annual growth rate of 40% between 2017-2023 – reaching \$12.2 Billion.

Healthcare Augmented and Virtual Reality market is expected to grow at 36% between 2016-2026 – reaching \$10.82 Billion.

(Sources: Medgaget, Research and Markets)

Alberta: A Global Health Hub

With Canada's largest integrated healthcare system and access to world renowned healthcare facilities, the Alberta healthcare system provides a unique data asset that fosters ground-breaking research and innovation. Alberta is recognized nationally and globally for expertise in neurology, diabetes and islet transplantation research, cancer research and treatment, bone and joint research and vaccines for infection diseases and cardiology.

The health ecosystem is a core component of the Edmonton Metropolitan Region's economy and contributes to nearly 7.5% of its GDP.^{xix} The Edmonton Region is a centre for medical device research and commercialization with the Edmonton region's health accelerator, TEC, ranked as one of the leading business incubators in North America. Edmonton's Health City focuses on transforming those health innovations into solutions that have commercial application and relevance.

At the University of Alberta, leading health research, world-class talent, and specialized hospitals, feed a pipeline of innovation particularly in-patient care. The University of Alberta's Faculty of Medicine and Dentistry is focused on delivering data driven, precision health projects that focus on predicting and preventing diseases, achieving more accurate diagnoses, and providing targeted care for each patient's circumstances and lifestyle.

In collaboration with Alberta Health Services, the University of Alberta formed the Northern Alberta Clinical Research Centre designed to help these organizations to conduct clinical research, develop new treatments, and bring them to the market for human use. This unique partnership has developed a growing body of expertise in administering and facilitating clinical trials and research.

With a leading research institution as the foundation for innovation and a strong health innovation ecosystem, the Edmonton Region has all of the components to establish an iterative cycle of health research and development, validation, implementation, and commercialization.

Innovation

A commitment to the latest technology and to maintaining an ecosystem that fosters innovation in the health sector, creates an opportunity for the Edmonton Metropolitan Region to become a global hub for health technology testing and commercialization. Alberta's diverse population and integrated healthcare system is a strong draw for health companies to innovate in the Region, and with 5G's ability to transfer massive amounts of data at high speeds, barriers that may have previously prevented companies from working in Alberta have been eliminated.

Wearable devices, secure online health consultations and remote procedures like robotic surgery will improve resource efficiency and meet growing consumer demand for convenience, confidentiality, and access. The technological transformation of the healthcare sector provides opportunities for the Edmonton Region, and its established network of health focused organizations, to foster existing relationships and develop new private sector relationships that benefit the entire health ecosystem.

Why 5G?

Disruptive technology is needed to complement cost-effective service models that will bend the health cost curve. 5G enables the development of new technologies that will significantly impact system costs and transform the way health care is delivered in Alberta and beyond.

Ultra-Reliability

While 5G has exciting applications across all sectors, it is perhaps most critical in healthcare, where a patient's life can depend on network reliability and real-time data transfer. The ability for hospitals to mine, in-house, massive amounts of data means that a patient's medical history and real-time condition is at the physician's fingertips, who can then make informed, data driven decisions on care. Eventually, 5G will be leveraged for remote consultations and even remote procedures, including surgery, which will be enabled by 5G's guaranteed performance and reliability.

Training and Workforce Development

Augmented and Virtual Reality (AR/VR) has the capability of being used to create seemingly real-life scenarios, including surgery and other clinical situations, that have been previously too dangerous or too difficult to replicate for training in a safe controlled environment. This technology can be leveraged to support education and training environments within post-secondary institutions and in healthcare facilities, thereby significantly increasing quality of training through the creation of meaningful simulated environments.

For example, at the NAIT Centre for Advanced Medical Simulation, shown to the right, a 6,000 square foot state-of-the-art interactive and interdisciplinary learning centre offers true-to-life work experiences for students and partners that transform patient care through medical simulation, education, technology and applied research.^{xx} Developed in partnership with CAE Healthcare, this facility has also been certified as a CAE Healthcare Centre of Excellence and provides training for Alberta-based, Canadian, and international partners.



Similarly, the Olson Centre for Health Simulation at NorQuest College uses leading edge technology and advanced simulation to train front line healthcare workers and improve patient safety and quality of care without exposing patients to unnecessary risk. NorQuest College offers over twenty post-secondary programs focused on health and community studies, with one of the largest Health Care Aide and Practical Nurse programs in the country. NorQuest is also home to a living lab, which is a collection of projects involving physicians and a multi-disciplinary team with the objective is to experiment with new products, services and business models to demonstrate how technology can be used to improve patient outcomes and reduce healthcare costs. NorQuest College is undertaking a bold and integrated approach to training, innovation, research, and clinical care by developing a living lab framework for community and continuing care.^{xxi}

The Clinical Simulation Centre (CSC) at MacEwan University is a state-of-the-art clinical lab and simulation learning space. The facility is a specially designed clinical environment in which students can safely integrate theory into practice from a range of clinical programs including

nursing, therapy assistant, social work, police and investigations and acupuncture. Students use specialized technology to build on clinical experience and enhance learning, and integrated audio, video and software are used to exercise critical thinking through collaborative and reflective learning. The CSC consists of two floors, containing eight labs. The centre is dedicated to interdisciplinary simulation-based learning. Each lab is equipped with the equipment, supplies and specialized technology to create a unique learning environment. The goal of the Clinical Simulation Centre is to enable authentic simulation experiences that maximize student knowledge and skills, and therefore increase patient safety.^{xxii}

The health system requires ongoing learning for professional accreditation, retraining as technology changes, and advanced learning for advancement in many health care professions. Virtual post-secondary institutions like Athabasca University are already focused on delivering remote education and partnerships with Edmonton hospitals could leverage 5G technology to provide on-site training and professional development to health professionals in their place of work.

The concept of AR/VR in these scenarios is not novel; however, the advancement to 5G will minimize latency issues often experienced in this application and enhance medical training and research.

From the private sector, Enhanced Learning Incorporating eXtended Reality (ELIXR) is a non-profit organization born from the University of Alberta's Rehabilitation Robotics Lab. It endeavours to improve the human condition by creating and leveraging virtual and augmented reality (extended reality; XR) technology and simulations to drive forward the educational and training value of these solutions and the economic development potential this technology could catalyze in the Region. Members of ELIXR are derived from the post-secondary sector, private sector, and other membership-based entities. By creating an Edmonton-based platform for subject matter experts from these diverse sectors to converge, there is significant opportunity to create and share content within the Region and to broader markets.

Commercialization of Technology

Health City is nationally incorporated non-profit headquartered in Edmonton working municipally and nationally to achieve its mandate of health transformation and economic development. To date, Health City has spearheaded several innovative initiatives highlighting the application of digital health solutions, leveraging novel technological applications, including artificial intelligence, synthetic data, point-of-care medical devices, and home health monitoring solutions in home and in community-based care settings.^{xxiii} The goal is to leverage regionally developed innovations and validate them locally to prepare them for global export. A prime exemplar of this is the recent project that Health City led on remote diagnostic imaging with local company MEDO.ai the company has recently secured FDA clearance and is currently developing plans for US export.^{xxiv xxv}

Innovation in medical devices, virtual care and home health monitoring platforms are novel applications that will make inroads in care by improving diagnosis and patient experience. The advancement of network infrastructure like 5G will better enable the advancement, commercialization, and adoption of these technologies as they promise to change the health landscape as we currently understand it.

This July, Health City announced a new home health monitoring trial in partnership with the Alberta Central Zone Primary Care Networks (PCNs), TELUS Health, Boehringer Ingelheim (Canada) Ltd., Alberta Innovates, and Alberta Health Services (AHS).^{xxvi} This initiative aims to test the efficacy of virtual monitoring to care for a large number of patients in their own homes mainly in rural locations. This project has a “bring your own device” protocol that enables

regional companies to validate their solutions at the PCN and leverage that data towards provincial procurement and export.

This trial sets a new standard for home health care in Alberta, and for Canada, and it can be rapidly expanded to other parts of the province and nation. The ability to transfer large amounts of data and a reliable network will be essential and 5G will enable this transformation to occur.

Importantly, improvements to infrastructure that accelerate the creation and democratization of these technologies will increase access to care in urban, rural, remote and First Nations communities throughout Alberta, providing alternative modalities to health care providers beyond already-overburdened acute care centres in major municipalities.

Alberta has a rich and unique health dataset that has is a tremendous advantage providing the ability to conduct research, test and validate products, conduct simulations, and analyze the results at a significant scale. However, accessing this data has proven to be extremely difficult and frustrating for companies. Unfortunately, delays in meaningful progress have resulted in companies being discouraged and turning to other jurisdictions where data accessibility is a key priority.

Health City has developed a ground-breaking synthetic data platform alongside its partners at the Institute for Health Economics (IHE), the University of Alberta and Alberta Innovates along with industry partners. Synthetic health data is generated through statistical methods that mimic the properties of the original dataset but are not linked in any way to the original patient data, thereby protecting patient privacy and avoiding possible contraventions of the Alberta Health Information Act and the Office of the Information Privacy Commissioner of Alberta is part of the project team. This innovative platform would make data accessible to conduct research, test and validate products, conduct simulations, and perform analysis; providing substantial benefits to local and international companies driving the new health economy. Edmonton is the first to implement this kind of model in Canada - a significant competitive advantage in how we retain and attract next generation health companies to our region.

Potential Industry Partners

Members and organizations apart of the Edmonton area's health innovation ecosystem, have pre-existing relationships with a number of stakeholders and businesses who would benefit from the introduction of 5G networks and its ensuing innovation. These stakeholders include, but are not limited to:

- health start-ups (Medo.AI);
- small-medium enterprises in the wearable device space (mmHg, Health Gauge);
- virtual care providers (MedROAD);
- MNEs (Boehringer Ingelheim, Merck, and Telus);
- key support from primary care networks; and,
- pharmaceutical companies.

Key Outcomes

Investment Attraction



The strengthening of the health ecosystem of the Edmonton Region and continued investment in the latest technology, proves the Region's commitment to health innovation and as an ideal development and testing ground for the private sector.

Adoption and Commercialization of Technology



The existing strong health and medical infrastructure in the Edmonton Region promotes, not only the development, but the testing and implementation of innovative technologies, demonstrating value and thereby accelerating their path to global commercialization.

Workforce Development



As the Edmonton Region continues to invest in the health innovation space and successfully attracts private sector investment, local talent is gaining expertise and training with the latest technology in a growing and rapidly changing market.

Enhanced 5G Initiative: Industrial Process Automation and Commercialization

Focus Areas

- Applied research to benefit Alberta's key industry sections
- Testing and commercialization of new technology, process innovation and subsequent the application of those tools

5G Node Locations

- Productivity and Innovation Centre, NAIT
- Sturgeon Industrial Park
- Strathcona Industrial Park
- Alberta Machine Intelligence Institute (Amii)
- Edmonton International Airport (EIA)



The 5G Opportunity

The Edmonton Region's growing advanced manufacturing ecosystem features the evolution of traditional industrial processes as well as the development and implementation of innovative technology, high-tech and automation. In fact, 35% of manufacturers in Alberta have already implemented digital technology, and the Edmonton Metropolitan Region is home to nearly 40% of Alberta's manufacturing output.^{xxvii}

Edmonton is also home to the Northern Alberta Institute of Technology (NAIT), one of Canada's leading polytechnics. NAIT's new Productivity and Innovation Centre offers a 190,000 square foot facility, one of the largest innovation spaces in North America, for product testing, technology adoption, training, innovation and research and growth in the industrial sector.^{xxviii}

ECONOMIC OPPORTUNITY

The market for Innovations in programming, sensors and artificial intelligence for the energy sector is expected to grow at an annual compound growth rate of 22.49% between 2019-2024 and reach \$7.78 Billion USD.

Internet of Things (IOT) applications in manufacturing will generate \$1.2-\$3.7 Trillion of global economic value by 2025.

(Source: Research and Markets)

Regional Partnerships

The ability to develop, test and validate innovative technology within the City of Edmonton at a world-class polytechnic gives the Region a significant competitive advantage in terms of workforce development. Furthermore, the proximity of regional industrial parks, like the Sturgeon Industrial Park and the Strathcona Industrial Park, mean innovative technology can be implemented and used to attract and retain industrial tenants.

Why 5G?

Industrial digitalization is well underway and as industrial processes become more competitive, the need to innovate becomes increasingly important, and a critical factor to success. To boost production and enhanced outputs, industrial processes are rapidly moving towards sophisticated automation, artificial intelligence and robotics, all of which rely on the network characteristics provided by 5G. High reliability, increased capacity and low latency will support critical processes and connectivity in the digitalization of manufacturing.

Competitive Advantage

With projects becoming increasingly complex, manufacturing, and industrial processes are under constant pressure to become more efficient and more accurate. Integrating 5G technology into tomorrow's smart industrial parks will drive organizations to continue to innovate to meet the growing demands of intelligent manufacturing and while 5G technology will act as a competitive advantage, it will eventually be a requirement.

5G will extend far past the capabilities of earlier generations of mobile communication and provide industrial processes of all sizes and complexities massive system capacity, low latency, and ultra-high reliability. With these capabilities and by innovating and rethinking their end-to-end processes, manufacturers have the ability to capitalize on the benefits of 5G and drive significant value.

Smart Industry

5G will allow for the continued automation of machinery and robotics in industrial settings, thereby reducing margins of error and driving profitability. 5G's ability to host large numbers of devices in a small area will enable manufacturers to assess and reconfigure their entire process integrating smart logistics. Additionally, 5G will enable the ability to simulate factory processes and provide training to the workforce in no-risk simulations, off the factory floor. 5G's ultra-reliability means that manufacturers, and tenants of the Region's industrial parks, will have full confidence in their smart systems at all times.

Potential Industry Partners

Members and organizations of the Edmonton Region's advanced manufacturing cluster have well-established relationships and partnerships with global companies that would be attracted to, and benefit from, the introduction of 5G technology and the resulting innovation that it enables. By leveraging these existing relationships and supporting 5G innovation, the Edmonton Region is well positioned to attract new tenants to its industrial parks providing the Region with a significant competitive advantage and economic benefit.

Targeted tenants may include those in:

- Chemical manufacturing;
- Industrial fabrication;
- Construction and contracting;
- Energy services and supply;
- Agribusiness processing; and,
- Advanced manufacturing.

Key Outcomes

Investment Attraction



As industrial processes are driven to become more efficient, advanced technology systems that support smart factories will be a requirement to attract and retain industrial tenants.

Adoption and Commercialization of Technology



The world-class innovation centre at NAIT and the Region's industrial parks, allow for the development, testing, and adoption of advanced technology in industrial processes to take place right in the Edmonton Region.

Workforce Development



The facilities at NAIT not only allow for the development of advanced technology innovation but hands-on training of the workforce that will maintain these regional systems.

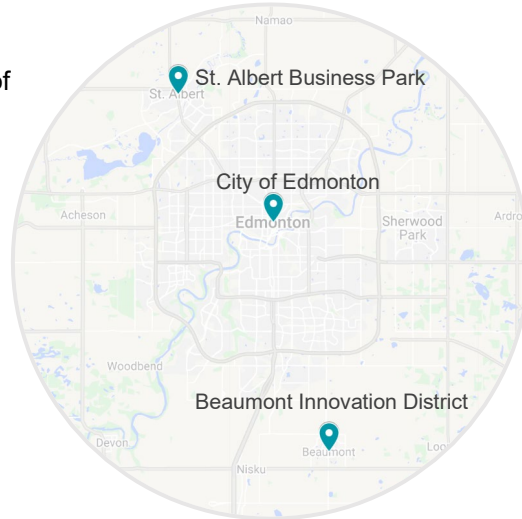
Enhanced 5G Initiative: Smart Cities, Smart Government

Focus Areas

- Support in developing Urban Internet of Things (IoT) sensors
- Encourage the enablement of sustainable smart cities through open data

5G Node Locations

- Beaumont Innovation District
- St. Albert Business Park
- City of Edmonton



The 5G Opportunity

A “Smart City” is a municipality that uses big data and cloud computing to collect information about its operations, incidents and alerts across multiple departments to improve service delivery, drive innovation and build efficiencies. The huge volume of data points generated by citizens, sensors and assets allow administration to monitor traffic and parking, water, wastewater, storm water, bus and rail stops, and more. This would also allow municipalities to make adjustments, or allow systems to make adjustments on their own, as needed. Cities can leverage this smart framework to find significant efficiencies which is beneficial to funders, taxpayers and citizens.^{xxix}

Smart cities put data and digital technology to work to make better decisions and improve the quality of life. More comprehensive, real-time data gives agencies the ability to watch events as they unfold, understand how demand patterns are changing, and respond with faster and lower-cost solutions.^{xxx}

ECONOMIC OPPORTUNITY

The Smart Cities market will be worth \$820 Billion globally by 2025.

(Sources: Markets and Markets)

Municipal Innovation

Advanced connectivity will spur the technological innovation that enables these objectives by complementing a city’s physical infrastructure, providing connectivity to digital infrastructure, and transforming them to “Smart Cities.”

The adoption of 5G will help enable a wide range of municipal innovation and applications in the following areas:

- **Transportation:** Traffic management, autonomous vehicles, rail/transit maintenance
- **Healthcare:** Connected ambulance, remote care, wearables

- **Agriculture:** Crop and soil management, autonomous vehicles
- **Energy Management:** Smart grid, smart street lighting
- **Water/Waste Management:** Smart metering
- **Municipal Services:** Smart parking meters, garbage collection, snow removal
- **Public Safety:** Smart policing, disaster management
- **Rural Connectivity:** Fixed wireless access, efficient broadband rollout to underserved areas^{xxx1}

Beaumont Innovation District

The City of Beaumont has positioned themselves as a municipal leader in the identification and pursuit of business partnerships by marketing the potential for economic growth, city-building and innovation within its municipal boundaries. By presenting itself as a municipality that is supportive of innovation, Beaumont hopes to attract the interest of international technology and innovation investors to further their technology-forward strategy.

Beaumont envisions developing their city core into the downtown Beaumont Innovation District, or “sandbox”, where technology can be developed, tested and deployed to accelerate development and commercialization. Their vision includes investments in foundational infrastructure including 10gig fiber, 5G networks, open access and community Wi-Fi. Beaumont’s vibrant live-work setting will serve as a sandbox for 5G advancements, smart city innovations and Internet of Things (IoT) developers.^{xxxii}

Regional Partnerships

The unabashed pursuit of innovation in Beaumont is a benefit to the entire Edmonton Metropolitan Region; by attracting global companies to develop and test technology in Beaumont, surrounding municipalities will be able to pilot the cutting-edge technology in their own jurisdictions. From the City of Edmonton to the City of St. Albert, companies that come to the area to innovate have access to diverse communities to test their technology in real situations.

Why 5G?

Cities of the Future

Smart City technologies will help cities optimize their services and encourage data-driven decision making. 5G will be a critical enabling technology for this evolution, and the smart cities of the future will rely on this technology to operate. Looking ahead, technology will become a key component of municipal strategy, city planning, and an important driver of economic development.

Data Access

5G will play a critical role in allowing information gathered through sensors to be securely transmitted in real time. With increased speed and decreased latency, city administrators across all functions will be able to leverage the capabilities of 5G to quickly analyze large amounts of real-time data to make informed decisions about service delivery, asset management and infrastructure maintenance.

Potential Industry Partners

Beaumont seeks to leverage Smart City solutions to connect and improve infrastructure, manage resources more efficiently, and improve the quality of life for residents and visitors alike. Principal partners include industry leaders in construction, engineering, geospatial analysis and telecommunications; companies, with a drive to embed these promising technologies into the fabric of municipal life.

Key Outcomes

Investment Attraction



Open data sharing and the ability to innovate and test new technology within the Edmonton Metropolitan Region, positions the area as an ideal location for Smart City technology development and investment.

Adoption and Commercialization of Technology



With progressive municipalities that are already implementing smart technology, innovations and new technology can be tested, proven, and refined within the Edmonton Region, thereby accelerating wider commercialization.

Workforce Development



By housing the development of smart technology within the Region, the area also unleashes the potential to create jobs, diversify Alberta's economy, and capitalize on the strengths of our young, highly educated population of business-friendly, technologically minded entrepreneurs.

Enhanced 5G Initiative: Smart Farming

Focus Areas

- Precision agriculture for improved farm management, including the measurement of crop inputs, soil, moisture, weather, inventory, and more.
- Robotics and drones for smart farm equipment, pest and disease detection, and autonomous tractors

5G Node Locations

- Surrounding rural communities
- University of Alberta
- Alberta Bio-Processing Innovation Centre
- Alberta Food Processing and Development Centre



The 5G Opportunity

ECONOMIC OPPORTUNITY

The smart agriculture market value is expected to reach \$22 Billion by 2025 globally.

The Agriculture Internet of Things (IOT) market will be worth \$34.7 Billion by 2027.

(Sources: Meticulous Research, Markets and Markets)

The Right Place

Canada is one of the leading nations in agriculture technology with well established agriculture technology clusters in robotics and drones, precision agriculture, innovative foods, novel farming systems, and agriculture commerce. In fact, Canada is one of the preferred countries for agriculture technology investment in precision agriculture, novel farming systems, and robotics and drones.^{xxxiii}

Surrounded by high-quality agricultural land, the Edmonton Region is home to a flourishing food and agricultural ecosystem. With state-of-the-art research and development facilities, and a rising advanced technology sector, the Region hosts the entire sector value chain, including high-quality primary production and a cluster of processing plants.

The Region benefits from active collaboration between firms, academia, and research institutions which helps to drive automation and digitization in the sector. The strong network that exists in the Edmonton Region ensures innovation remains a top priority in one of the province's key industries and includes:

- The University of Alberta, Alberta's largest academic and research institution, houses a dedicated faculty for food and agriculture the Faculty of Agricultural, Life, and

Environmental Sciences (ALES), an entire graduate department dedicated to the advancement of food and nutritional science. The department is the first of its kind in North America, reflecting the integration of many disciplines.

- The Alberta Food Processing and Development Centre includes a modern, fully equipped pilot plant and laboratory facility positioned to strengthen and promote Alberta's food sector capabilities. It is staffed with experienced food scientists, engineers and technologists who work with entrepreneurs to develop and fine-tune their products.
- The Alberta Bio-Processing Innovation Centre offers critical product development and scale-up support for the food and agriculture sector.

Minimizing Risk

The agriculture industry is unique in that small and sudden changes can devastate profits and yields for an entire season. 5G provides farmers with the real-time ability to closely monitor their land and then make adjustments to protect their crops. New technology in these rural areas will enable the industry to develop and implement innovative practices and revolutionary farming, providing much needed security and predictability.

The farming and agriculture industry is under constant pressure to maximize yields, minimize wastage, and manage costs. The increasing focus on efficiency and sustainability is driving the food and farming industry to innovate. Agriculture technology is playing an increasingly significant role to reduce loss and overhead while adding more predictability, and profit, to the industry.

Why 5G?

Precision Agriculture

Precision Agriculture, also called smart farming, focuses on maximizing outputs by minimizing inputs including water, fertilizer, and herbicides. This is the ability to apply precise treatments to crops, so instead of treating an entire field the same, farmers can give each row exactly what it needs.

As investment for rural broadband and 5G deployment increases, new opportunities will arise for connected farms. Sensors and the use of IoT devices are already helping monitor and manage livestock and crop production. 5G technology will allow farms to integrate smart machinery, sensors and automated systems into a real-time dataset that can be quickly analyzed and used to make critical decisions.

To realize the significant benefits that IoT can bring to the agriculture industry, the network must have the capacity to host a large number of connected devices. 5G offers the high device density and network speed required to receive large amounts of real-time data to fully utilize the capabilities of agriculture monitoring. Additionally, with 5G's Small Cell infrastructure, farm's may be able to create and use their own 5G networks before widespread deployment.

Robotics and Drones

The global agricultural robots' market was recently valued at \$4.1 billion. Major equipment manufacturers like John Deere are rolling out new models and new machines, like a new crop-

spraying drone. Drone camera footage can help to identify concentrated areas of weeds and analyze optimal harvest times based on the colour and size of each row of crops.^{xxxiv}

Investment and momentum in farm automation and robotics continue to show promise when it comes to addressing the continued and growing labor shortages in agriculture, as well as taking over tedious pre and post harvest analytics. 5G's high bandwidth, support for a huge number of sensors communicating simultaneously, and low latency, will enable autonomous monitoring and harvesting, allowing farmers to more efficiently allocate their time.

Potential Industry Partners

The Edmonton Region hosts a flourishing food and agricultural ecosystem and is the gateway to leading innovative practices and revolutionary farming. Existing active collaboration between firms, academia, and research institutions is driving automation and digitization in the sector. Industry partners in the agriculture technology space could include:

- **Agrivalue Processing Business Incubator (APBI):** a Leduc-based multi-tenant facility. APBI provides the infrastructure and services to support the establishment and growth of new companies and new business ventures in Alberta. The APBI meets federal food-regulation requirements, enabling resident companies to market their products nationally and internationally.
www.alberta.ca/agrivalue-processing-business-Incubator
- **Canadian Agri-Food Automation and Intelligence Network (CAAIN):** a group of technology and agri-food companies, universities, colleges, and research institutions working together to create new technological solutions for Canada's agricultural and food producers. CAAIN brings together technology and agri-food companies focused on creating and integrating automated and digitized solutions in Canada's agri-food sector. Our projects focus on using techniques in artificial intelligence, advanced sensor technologies, hyperspectral imaging, and blockchain applications to increase the productivity of Canadian agri-food producers.
www.caain.albertainnovates.ca
- **Olds College:** in collaboration with its industry and sector partners, is converting the whole of its farming operation to a Smart Farm: an interconnected environment through which the college is leveraging its land (2,000 acres), existing agriculture operations, and applied research programming, in order to provide a product development and demonstration venue to accelerate agriculture technology and agri-food development. At the same time, the Smart Farm serves as a cutting-edge learning environment for students, producers, and the agriculture sector.
www.oldscollege.ca/olds-college-smart-farm
- **Protein Industries Superclusters:** Based in the Prairies and with more than 100 industry members, the Protein Industries Supercluster will use plant genomics and novel processing technology to increase the value of key Canadian crops, such as canola, wheat and pulses that are coveted in high-growth foreign markets, such as China and India, as well as to satisfy growing markets in North America and Europe for plant-based meat alternatives and new food products.
www.proteinindustriescanada.ca

Key Outcomes

Investment Attraction



To remain competitive, Alberta's agriculture and food industries need to accelerate the development, adoption, and commercialization of new technologies, products, and services. With a focus on innovation, Alberta's large-scale agriculture, concentration of research and development facilities, and strong AI knowledge base attract investments into the Region.

Adoption and Commercialization of Technology



With ample access to high-quality farm land, the Edmonton Region has the ability to pilot and prove new agriculture technology being developed in the Region, thereby accelerating its path to broader commercialization, both in the Region and beyond.

Workforce Development



As the agriculture industry evolves, the need for retraining and upskilling becomes critical to ensure the workforce can keep pace with changing technology. Keeping pace with changing technology will ensure the Region's agricultural industry maintains its global relevance and sustained community benefits.

Appendix 1: FAQ

Frequently asked questions about 5G

Q What is 5G?

A 5G is the 5th generation of wireless technology, a significant evolution of today's 4G LTE wireless networks. 5G will provide the infrastructure to allow for more data and connectivity, the Internet of things with billions of connected devices, and tomorrow's innovations in various fields such as healthcare, public safety, transportation, agriculture, and smart cities. 5G will operate in both the lower frequency spectrum (below 6 GHz) as well as at higher frequencies called millimetre wave spectrum (above 6 GHz).^{xxxv}

While current networks focus primarily on data transmission (i.e. throughput), 5G networks are being designed to not only provide faster transmission speeds but also to ensure more widespread coverage, to handle more connected devices and traffic types, and to support different use cases. 5G will connect infrastructure, vehicles, sensors, buildings, machinery, and people in a way that will change the way we work, play, and interact.^{xxxvi}

Q How is 5G different from 4G?

A Compared to 4G LTE, 5G offers three significant upgrades: connection speeds 10 times faster, much lower latency and the ability to connect a massive number of devices simultaneously.^{xxxvii}

Q What is latency?

A Latency is the delay between sending and receiving information. The lower the latency, the closer to real-time your data transfer is. In some cases, 5G can analyze data and react faster than human reaction time, making it a critical factor for autonomous vehicles, Virtual Reality immersive experiences, and remote surgical operations.

Q Are there harmful health effects from 5G mobile wireless networks?

A Radiofrequency (RF) energy used for mobile phones, base stations and other wireless services have been studied for decades. There are no established health risks from the RF waves used in 5G networks in accordance with applicable safety standards.^{xxxviii} The World Health Organization confirms that there is no substantive evidence that adverse health effects, including cancer, can occur in people exposed to RF levels at or below the limits set by international standards.^{xxxix}

Q Are specific populations (children, pregnant women, sick and elderly people) at higher risk from RF waves?

A The guidelines set out by the International Commission of Non-Ionizing Radiation Protection (ICNIRP) use a range of mechanisms to ensure that all people are protected from RF Radiofrequency Electromagnetic Fields (EMF) exposure. One of these is the use of reduction

factors, which ensures that the restrictions are far lower than are required to cause adverse health effects for all people.^{xi}

Q Who determines what level of RF exposure is safe?

A As an independent non-profit organization, the ICNIRP provides scientific advice and guidance on the health and environmental effects of non-ionizing radiation (NIR) to protect people and the environment from detrimental NIR exposure.^{xii}

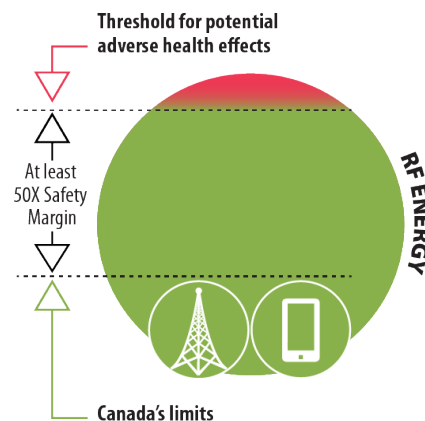
Q Are Canada’s RF standards similar to those in other countries?

A Canada’s approach to RF safety is among the most stringent in the world. Health Canada has established guidelines for safe exposure to RF energy, known as Safety Code 6, which uses very conservative limits set at least 50 times below the threshold of any potential adverse health effects.

Canada’s science-based safety standards are consistent with the safety standards used in other parts of the world, including the United States, the European Union, Japan, Australia, and New Zealand.^{xiii}

Q What amount of RF exposure is considered safe?

A Exposure to RF energy below the Canadian limits is safe. The limits are set far below the threshold (at least 50-fold safety margin) for all known established adverse health effects. Health Canada has incorporated several tiers of precaution into the limits to ensure safety, including a conservative threshold for the occurrence of adverse health effects, the use of worst-case exposure scenarios and an additional safety margin beyond the threshold.^{xiiii}



Q Is 5G technology linked to the cause of coronavirus?

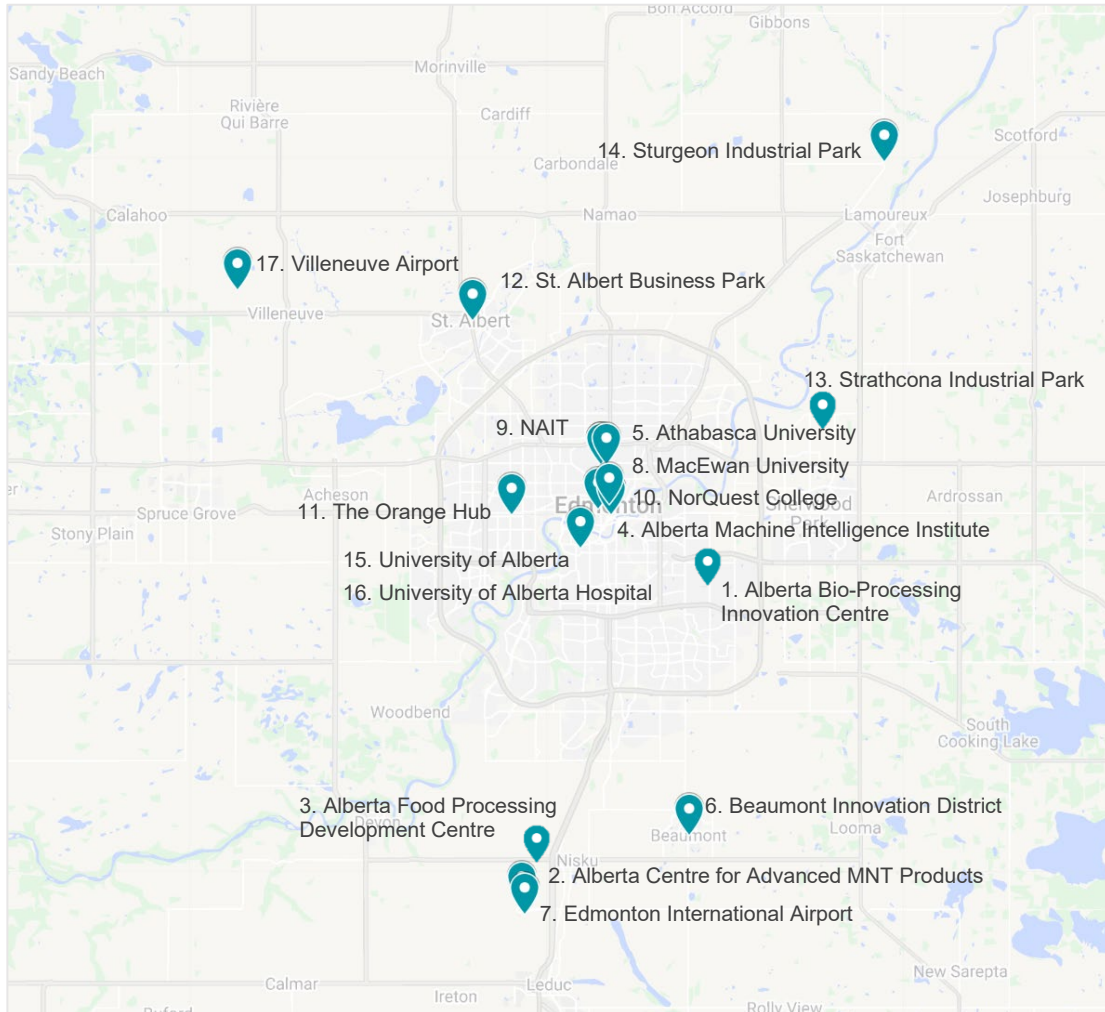
A A worldwide online conspiracy theory has attempted to link 5G cell phone technology as being one of the causes of the coronavirus. Many cell towers have been set on fire as a result. 5G technology does NOT cause coronavirus.^{xliv}

Q What is a “Smart City”?

A Communities that tap into the power of 5G connectivity will be able to transform how people live, learn, work and play in countless ways, driving improvements across transit, utilities, public Wi-Fi access, emergency preparedness and beyond. From smart traffic lights that cut congestion to smart buildings that save energy, 5G will open nearly limitless opportunities for innovation.^{xlv}

Appendix 2: 5G Hub Locations

The following map displays the Edmonton Metropolitan Region's key 5G hub locations. Expedited 5G deployment in these initial locations would enable the use cases included in this document and yield the greatest financial benefits. A brief description of each of the suggested hubs follows.



1. Alberta Bio-Processing Innovation Centre

5520 36 Street NW

Edmonton, Alberta T6B 3P3

www.alberta.ca/agriculture-and-forestry

The Bio Processing Innovation Centre (BPIC) provides essential product development and scale-up support for fibre cleaning and refinement, grain fractionation, separation, extraction, polymerization, and extrusion. With a natural health product (NHP) licence from Health Canada, the facility can also work with cosmetic/personal care products and NHPs.

2. Alberta Centre for Advanced MNT Products (ACAMP)

3623 44 Avenue East 101
Edmonton International Airport, Alberta T9E 0V4
www.acamp.ca

A unique industry-led advanced technology product development centre that entrepreneurs count on to move their innovation from proof-of-concept to manufactured product by providing access to multidisciplinary engineers, technology experts, unique specialized equipment, and industry acumen.

3. Alberta Food Processing and Development Centre

6309 45 Street
Leduc, Alberta T9E 7C5
www.alberta.ca/food-processing-development-centre

The Food Processing Development Centre is a modern, fully equipped pilot plant and product development laboratory facility. It is staffed with experienced food scientists, engineers and technologists who work with entrepreneurs to develop and fine-tune their products.

4. Alberta Machine Intelligence Institute (Amii)

1101, 10065 Jasper Avenue NW
Edmonton, Alberta T5J 3B1
www.amii.ca

Amii partners with start-ups, SMEs, and enterprise companies to support their needs as they explore and drive AI/ML adoption in their work. Their Project Management, Science, and Education teams come together to provide expertise and hands-on support for their industry partners.

5. Athabasca University Edmonton

Peace Hills Trust Tower
12th Floor, 10011 109 Street
Edmonton, Alberta T5J 3S8
www.athabascau.ca

AU is Canada's leading online university, offering flexible distance learning with online courses, degree programs, and professional development options.

6. Beaumont Innovation District

Downtown Beaumont, Alberta
www.beaumont.ab.ca

Located just nine kilometres east of the Edmonton International Airport, Beaumont has 20,000 citizens and is known as one of the fastest-growing communities in Canada. The city is building a reputation as a place that's open to new tech ideas and entrepreneurship, and its municipal government has a can-do attitude — it's even poised to become one of North America's first 10 Gigabit cities.

7. Edmonton International Airport (EIA)

1000 Airport Road
Edmonton International Airport, Alberta T9E 0V3
www.flyeia.com

Edmonton International Airport's mission is to drive the Region's economic prosperity through aviation and commercial development.

8. MacEwan University

10700 104 Avenue NW
Edmonton, Alberta T5J 4S2
www.macewan.ca

Clinical Simulation Centre

Robbins Health Learning Centre
10700 104 Avenue NW
Edmonton, Alberta T5J 4S2
www.macewan.ca/.../ClinicalSimulationCentre

The Clinical Simulation Centre (CSC) at MacEwan University is a state-of-the-art clinical lab and simulation learning space. The facility is a specially designed clinical environment in which students can safely integrate theory into practice.

Social Innovation Institute

11-167A Roundhouse, Allard Hall
11100 104 Avenue NW
Edmonton, Alberta T5K 1M9
www.macewan.ca/.../SocialInnovationInstitute

The MacEwan University Social Innovation Institute connects students with experts and innovators who support their commitment to positive change locally, regionally, and globally. The Institute offers programs, provides learning opportunities, and hosts events that help people learn about and engage in social innovation.

9. Northern Alberta Institute of Technology (NAIT)

11762 106 Street NW
Edmonton, Alberta T5G 2R1
www.nait.ca

NAIT Productivity and Innovation Centre (PIC)

10210 Princess Elizabeth Avenue NW
Edmonton, Alberta T5G 0Y2
www.nait.ca/pic

NAIT's Productivity and Innovation Centre features solutions for business innovation, much of which relates to productivity, including product testing, technology adoption, productivity, and innovation, applied research and more.

NAIT's Centre for Applied Disaster and Emergency Management (CADEM) is the most advanced centre of its kind in the country. The CADEM Simulation Lab allows incident teams to work through simulations of incidents to improve knowledge and skills. CADEM

is capable of delivering on-the-ground details virtually anywhere on the planet through a complex web of information supplied by Internet cameras, maps, or drones.

www.nait.ca/cadem

NAIT Feltham Centre (formerly the Centre for Applied Technology)

11763 106 Street
Edmonton, Alberta T5G 2R1

Centre for Advanced Medical Simulation: a state-of-the-art interactive and interdisciplinary centre that gives students in the School of Health and Life Sciences the opportunity to practice clinical situations in a safe and controlled environment. The Simulation Centre offers over 6,000 square feet of learning space with true-to-life work experiences for students and partners with a wide array of immersive learning spaces including 9 specialized theatres, 4 elevated control rooms, 5 ground control rooms and multiple breakout rooms to debrief and view simulations as they happen.

www.nait.ca/centre-for-advanced-medical-simulation

10. Olson Centre for Health Simulation, NorQuest College

Singhmar Centre for Learning
10215 108 Street NW
Edmonton, Alberta T5J 1L6

www.norquest.ca/olson-centre-for-health-simulation

The Olson Centre for Health Simulation uses simulation to improve patient safety, quality of care, health care, and human services education. Simulation promotes skills acquisition, aids development of clinical judgment, and teaches students about complex situations with lifelike examples. It provides an invaluable safety net for learning, allowing students to acquire and develop critical-thinking and decision-making skills without exposing clients to unnecessary risk.

11. Edmonton Screen Industries Office, The Orange Hub

10045 156 Street NW
Edmonton, Alberta T5P 2P7

www.edmonton.ca/the-orange-hub

Based out of The Orange Hub, The ESIO catalyzes the development, growth and sustainability of companies, entrepreneurs, and craftspeople in the Edmonton screen media industries. Screen industries includes the full range of screen-based entertainment, education, and training – from mobile, television, Internet streaming and theatrical release inclusive of live action, animation, and interactive video games.

12. St. Albert Business Park

St. Albert, Alberta

www.stalbert.ca/business-parks

Located on the western edge of St. Albert, bounded by Carrot Creek on the west, Ray Gibbon Drive on the east, Township Road 540A on the north and Big Lake on the south, Lakeview Business District has been designated as the City's next Business Park. With 250 (617 acres) of greenfield development, the area will help to generate non-residential

tax revenue and provide jobs for the City of St. Albert. Development is expected to begin in the next five to seven years.

13. Strathcona Industrial Park

North of Yellowhead ACUP
Strathcona County, Alberta

Located between Sherwood Drive and Highway 21, along the Yellowhead Highway (Hwy 16) are ~300 acres of land that is planned for commercial, light, and medium industrial use. The mix of bare land and premium serviced business parks provides the perfect opportunity to derive location advantages from complimentary sectors. In addition to urban servicing and major highway adjacency is the presence of both CP and CN rail lines. The area is adjacent to a highly educated workforce and all amenities. Currently an Area Concept Plan, Strathcona County is working with developers on lot parcels.

14. Sturgeon Industrial Park (SIP)

55202 AB-825
Sturgeon County, Alberta T5L 5C1
www.startinsturgeon.ca

Sturgeon Industrial Park (SIP) is Sturgeon County's primary medium industrial serviced district. SIP is an ideal location for the following industries: advanced manufacturing; agricultural processing and food production; cold storage; contract packaging/co-packing; conversion and plastics manufacturing; industrial hemp decortication and hemp-based manufacturing; pulse fractionation; transportation and logistics.

15. University of Alberta

116 Street and 85 Avenue
Edmonton, Alberta T6G 2R3
www.ualberta.ca

The University of Alberta is a Top 5 Canadian university and one of the Top 150 in the world, known for world-class research and innovative discoveries. The university offers top quality undergraduate and graduate programs.

16. University of Alberta Hospital (UAH), Alberta Health Services (AHS)

8440 112 Street NW
Edmonton, Alberta T6G 2B7
[www.albertahealthservices.ca\[... \]](http://www.albertahealthservices.ca[...])

The UAH is one of Canada's leading clinical, research and teaching hospitals, treating over 700,000 patients annually from across western and northern Canada. It is also home to the Stollery Children's Hospital. This "hospital within a hospital" concept allows the two facilities to share resources and equipment while meeting the specialized needs of all its patients. The two facilities provide diagnostic and treatment services for adults and children, including specialized services in cardiac sciences, neurosciences, surgery, medicine, renal, critical care, emergency and trauma care and a state-of the art burn unit.

17. Villeneuve Airport

Sturgeon County, Alberta T0G 0J0
[www.flyeia.com\[... \]villeneuve-airport](http://www.flyeia.com[...]villeneuve-airport)

As the nexus of world-class road, rail and air infrastructure, the Villeneuve Airport in Sturgeon County is a premier destination for industry-led innovation and investment. The airport is poised to drive economic diversification and increase prosperity for the Edmonton Metropolitan Region. Villeneuve Airport's aviation and land assets paired with regional strengths in the agriculture, advanced manufacturing, petrochemical, transportation, and logistics industries are a formidable combination for economic development, job creation and investment attraction.

Sources

- ⁱ Ookla 5G Map. (n.d.). Retrieved from <https://www.speedtest.net/ookla-5g-map>
- ⁱⁱ Jiang, Dr Luyun, Dr James Edmondson and Dr Khasha Ghaffarzadeh. 5G Technology Market and Forecasts 2020-2030. Retrieved from <https://www.idtechex.com/en/research-report/5g-technology-market-and-forecasts-2020-2030/753>
- ⁱⁱⁱ Edmonton Global. Edmonton Metro Region. Retrieved from <https://edmontonglobal.ca/metro-region/>
- ^{iv} Nordrum, A., Clark, K., & IEEE Spectrum Staff. (2017, January 27). Everything You Need to Know About 5G. Retrieved from <https://spectrum.ieee.org/video/telecom/wireless/everything-you-need-to-know-about-5g>
- ^v TrendForce. (2018, March 14). TrendForce: Small Cell Deployment. Retrieved from <https://techblog.comsoc.org/2018/03/14/trendforce-small-cell-deployment-to-reach-2-838m-units-in-2018-4-329m-units-in-2019-for-cag-of-52-5/>
- ^{vi} Programs of Study: Tower Installation. (n.d.). Retrieved April 6, 2020, from <https://www.atc.edu/Study/Programs-of-Study/Technical-Education/Tower-Installation>
- ^{vii} IHS Markit. (2019, November). The 5G Economy. Retrieved from <https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study-2019.pdf>
- ^{viii} Accenture Strategy in collaboration with the Canadian Wireless Telecommunications Association. Accelerating 5G in Canada: Benefits for Cities and Rural Communities.
- ^{ix} Edmonton International Airport. (2017, September 19). Alberta Centre for Advanced MNT Products joins Alberta Aerospace and Technology Centre at Edmonton International Airport. Retrieved from <https://www.acamp.ca/wp-content/uploads/2017/09/ACAMP-joins-the-Alberta-Aerospace-and-Technology-Centre-Sept-19-2017.pdf>
- ^x Edmonton International Airport. (2018, July 25). New autonomous security vehicle set to patrol EIA's perimeter fence. Retrieved from <https://flyeia.com/corporate/media/news/new-autonomous-security-vehicle-set-patrol-eias-perimeter-fence/>
- ^{xi} Edmonton Global. (n.d.). Game Development and Digital Media. Retrieved from <https://edmontonglobal.ca/games-edmonton/>
- ^{xii} Canadian Media Producers Association. (2020, April 2). CMPA's Profile 2019 highlights economic capacity of Canadian media production industry before COVID-19. Retrieved from <https://cmpa.ca/press-releases/cmpas-profile-2019-highlights-economic-capacity-of-canadian-media-production-industry-before-covid-19/>
- ^{xiii} Entertaining Software Association of Canada. (2019, November 18). Video Game Development Industry Contributes \$4.5b To Canada's Economy. Retrieved from <http://theesa.ca/2019/11/15/video-games-contribute-to-canadas-economy/>
- ^{xiv} Stevanovic, Ivan. (2019, December 4). 30 Virtual Reality Statistics for 2020. Retrieved from <https://kommandotech.com/statistics/virtual-reality-statistics/#:~:text=The%20global%20virtual%20and%20augmented,top%20%2434%20billion%20by%202023.>

-
- ^{xv} Tankovska, H. (2020, August 27). Projected size of the augmented and virtual reality market in Canada 2018 and 2022. Retrieved from <https://www.statista.com/statistics/866903/canada-augmented-virtual-reality-market-size/#:~:text=Projected%20size%20of%20the%20augmented,in%20Canada%202018%20and%202022&text=The%20statistic%20shows%20a%20forecast,of%208%20billion%20U.S.%20dollars>.
- ^{xvi} Faulder, L. (2019, December) Master of disaster, NAIT's Josh Bowen is ready for any emergency. Retrieved from: <https://edmontonjournal.com/news/insight/liane-faulder-master-of-disaster-naits-josh-bowen-is-ready-for-any-emergency>
- ^{xvii} Centre for Applied Disaster and Emergency Management. (n.d.). Retrieved from <https://www.nait.ca/industry/training-certification/centre-for-applied-disaster-emergency-management>
- ^{xviii} NorQuest College. (n.d.). NorQuest Living Laboratory.
- ^{xix} Edmonton Global. (n.d.). Life Sciences. Retrieved from https://edmontonglobal.ca/wp-content/uploads/2019/10/Life-Sciences-FactSheet_STC.pdf
- ^{xx} NAIT. (n.d.). Centre for Advanced Medical Simulation. Retrieved from <https://www.nait.ca/centre-for-advanced-medical-simulation>
- ^{xxi} NorQuest College. (n.d.). Olson Centre for Health Simulation. Retrieved from <https://www.norquest.ca/resources-services/facilities/olson-centre-for-health-simulation.aspx#:~:text=The%20Olson%20Centre%20for%20Health,learning%20and%20real%2Dlife%20experience>.
- ^{xxii} Clinical Simulation Centre. (n.d.) Retrieved from <https://www.macewan.ca/wcm/SchoolsFaculties/HCS/CentresandInstitutes/ClinicalSimulationCentre/index.htm>
- ^{xxiii} Joseph, R., Bruni, A., Carvelho, C. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/32787603/>
- ^{xxiv} AIT News Desk. (2020, May 26). Local Company Uses AI to Bring Screening to The Point of Care. Retrieved from <https://aithority.com/technology/life-sciences/local-company-uses-ai-to-bring-screening-to-the-point-of-care/>
- ^{xxv} CBJ Newsmakers. (2020, June 16). Medo.AI Receives FDA Approval to Automatically Detect Hip Dysplasia, Preventing the Leading Cause of Early Hip Osteoarthritis and Hip Replacement Surgery. Retrieved from <https://www.cbj.ca/medo-ai-receives-fda-approval-to-automatically-detect-hip-dysplasia-preventing-the-leading-cause-of-early-hip-osteoarthritis-and-hip-replacement-surgery/>
- ^{xxvi} Labine, J. (2020, July 26). 'Information in front of us:' Home-based health monitoring trial for rural patients. Retrieved from <https://edmontonjournal.com/news/local-news/information-in-front-of-us-home-based-health-monitoring-trial-for-rural-patients>
- ^{xxvii} Edmonton Global. (n.d.). Advanced Manufacturing. Retrieved from https://edmontonglobal.ca/wp-content/uploads/2019/10/Advanced-Manufacturing-FactSheet_STC-1.pdf
- ^{xxviii} NAIT. (n.d.). Productivity and Innovation Centre. Retrieved from <https://www.nait.ca/nait/about/our-campuses/main-campus/productivity-and-innovation-centre>
- ^{xxix} Thales Group. (n.d.). Secure, sustainable smart cities and the IoT. Retrieved from <https://www.thalesgroup.com/en/markets/digital-identity-and-security/iot/inspired/smart-cities>

-
- xxx Woetzel, J., Remes, J., Boland, B., Lv, K., Sinha, S., Strube, G., . . . Tann, V. V. (2018, June 5). Smart cities: Digital solutions for a more livable future. Retrieved from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future>
- xxxii Woetzel, J., Remes, J., Boland, B., Lv, K., Sinha, S., Strube, G., . . . Tann, V. V. (2018, June 5). Smart cities: Digital solutions for a more livable future. Retrieved from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/smart-cities-digital-solutions-for-a-more-livable-future>
- xxxiii Donohue, K. (2020, July 23). How Beaumont Is Changing the Game for Innovation in Canada. Retrieved from <https://www.innovatingcanada.ca/business-and-economy/how-beaumont-is-changing-the-game-for-innovation-in-canada/>
- xxxiiii Wavteq Corporate Intelligence Unit. (n.d.). Cluster Activity. <https://www.wavteq.com/experience/sectors/services-technology/>
- xxxv Wavteq Corporate Intelligence Unit. (n.d.). Cluster Activity. <https://www.wavteq.com/experience/sectors/services-technology/>
- xxxvi Government of Canada. (n.d.). Radiofrequency Energy and Safety. Retrieved from <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11467.html#s2>
- xxxvii Canadian Wireless Telecommunications Association. (2019, August 8). Setting the Record Straight on 5G Wireless & RF Safety. Retrieved from <https://www.cwta.ca/blog/2019/08/08/setting-the-record-straight-on-5g-wireless-rf-safety/>
- xxxviii Stone, M. (2020, February 24). What Is 5G? A Beginner's Guide. Retrieved from <https://insights.samsung.com/2020/02/24/what-is-5g-a-beginners-guide-2/>
- xxxix Canadian Wireless Telecommunications Association. (2019, August 8). Setting the Record Straight on 5G Wireless & RF Safety. Retrieved from <https://www.cwta.ca/blog/2019/08/08/setting-the-record-straight-on-5g-wireless-rf-safety/>
- xl World Health Organization. (n.d.). Electromagnetic fields and public health: Radars and human health. Retrieved from <https://www.who.int/peh-emf/publications/facts/fs226/en/#:~:text=Radars%20usually%20operate%20at%20radio,that%20are%20called%20RF%20fields.&text=An%20SAR%20of%20at%20least,fields%20in%20this%20frequency%20Orange.>
- xli ICNIRP. (n.d.). FAQ. Retrieved from <https://www.icnirp.org/en/rf-faq/index.html>
- xlii ICNIRP. (n.d.). FAQ. Retrieved from <https://www.icnirp.org/en/rf-faq/index.html>
- xliii Canadian Wireless Telecommunications Association. (2019, August 8). Setting the Record Straight on 5G Wireless & RF Safety. Retrieved from <https://www.cwta.ca/blog/2019/08/08/setting-the-record-straight-on-5g-wireless-rf-safety/>
- xliiii Government of Canada. (n.d.). Radiofrequency Energy and Safety. Retrieved from <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11467.html#s2>
- xliv FEMA. (n.d.). Coronavirus Rumor Control. Retrieved from <https://www.fema.gov/disasters/coronavirus/rumor-control>
- xlv Let's 5G. (n.d.). 5G FAQ. Retrieved from <https://lets5g.com/learn-more/>