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FUEL FOR INNOVATION

Canada's Path in the Race to 5G

New generations of wireless technology have always ushered in a wave of economic growth by improving the way people live and work. With the transition to 5G, wireless connectivity will be faster, ultra-reliable, and offer higher capacity. This will make way for new, innovative applications that fundamentally change the role that mobile technology plays in the lives of Canadians.

Today, there are 28 million unique mobile subscribers in Canada[1] and nearly 98.5% LTE network availability[2]; Canadians are already highly "connected" on one of the world's fastest networks[3]. With this as a starting point, many are wondering what 5G will bring to Canadians that is truly differentiated from current experiences and services. By delivering up to 20 Gigabits-per-second peak data rates and a 10x decrease in end-to-end latency to <1ms[4] , 5G will unlock entirely new ways that Canadians interact with their devices, businesses, and the world around them.

The question is just how much of an impact will 5G have on the Canadian economy, and in what ways will these economic benefits materialize for Canadians?

Fuel for Innovation: Canada's Path in the Race to 5G

A comprehensive study conducted by Accenture found that the adoption of 5G technology in Canada will propel innovation across industries and significantly improve Canadians' quality of life and the economy to the tune of a nearly $40B annual GDP uplift by 2026[5]. The benefits will be felt not only in national GDP, but also in terms of Canadian jobs. It is estimated that by this same time close to 250K permanent jobs will be added to the Canadian economy[6].

Contribution of 5G to Canadian Economy

Incremental GDP Contribution from 5G

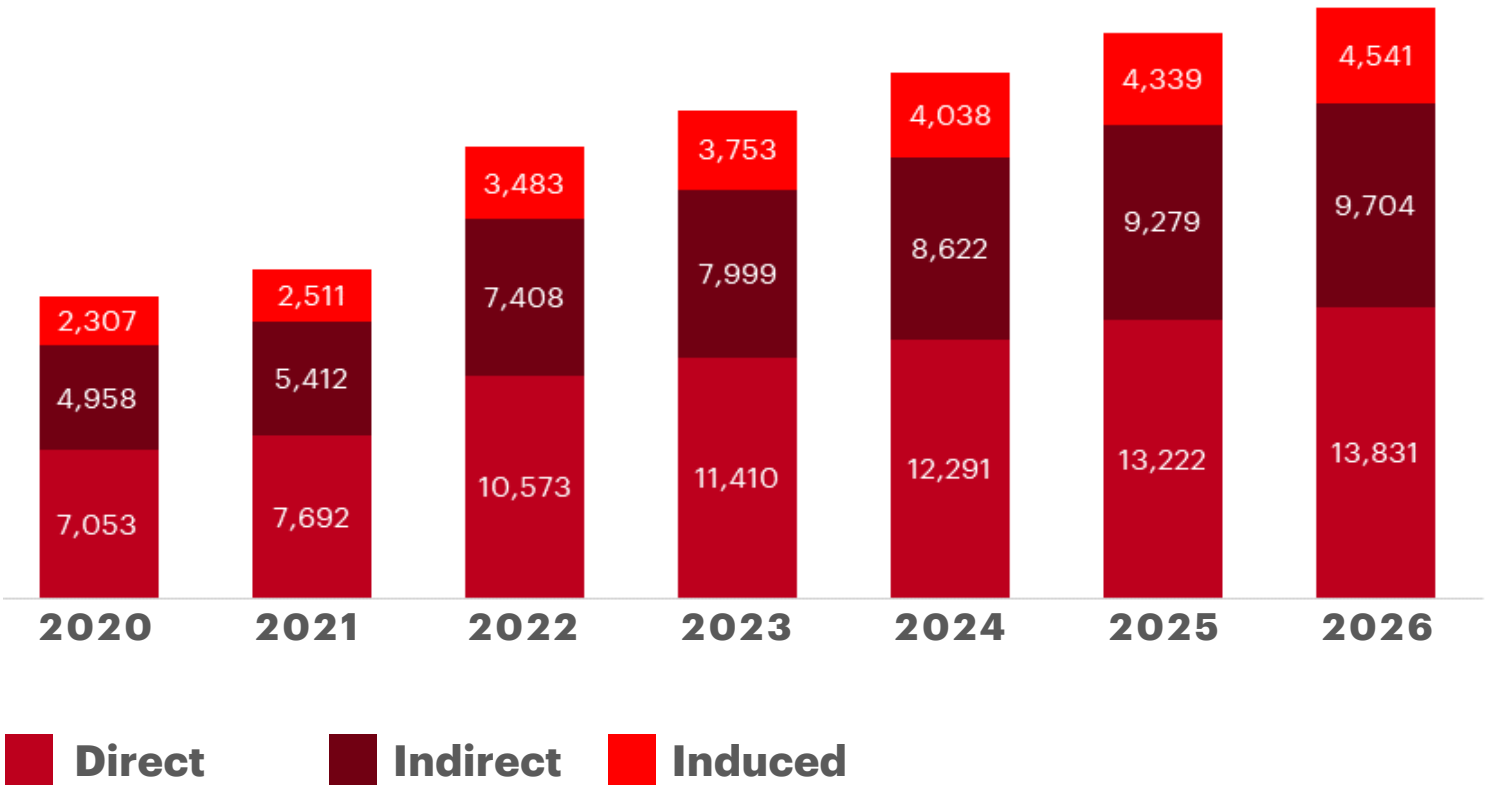
Sustained Job Creation Due to 5G

Capital Investment by Carriers from 2020 to 2026

For carriers that are building out their network capabilities, it is estimated that $26B will be spent to invest specifically in 5G network infrastructure and adoption[7]. Investment in the 4G LTE, LTE Advanced Pro, and Licensed Assisted Access (LAA) LTE is expected as the underpinning of the evolution to 5G networks. This infrastructure investment will result in short-term construction and engineering job creation.

Specifically, a total of 154K temporary, direct, indirect, and induced jobs[8] will be created between 2020 and 2026. At its peak of 28k, this is equivalent to the number of full time employees supported by some of Canada's top employers[9].

Short-term job creation from 5G network build-out

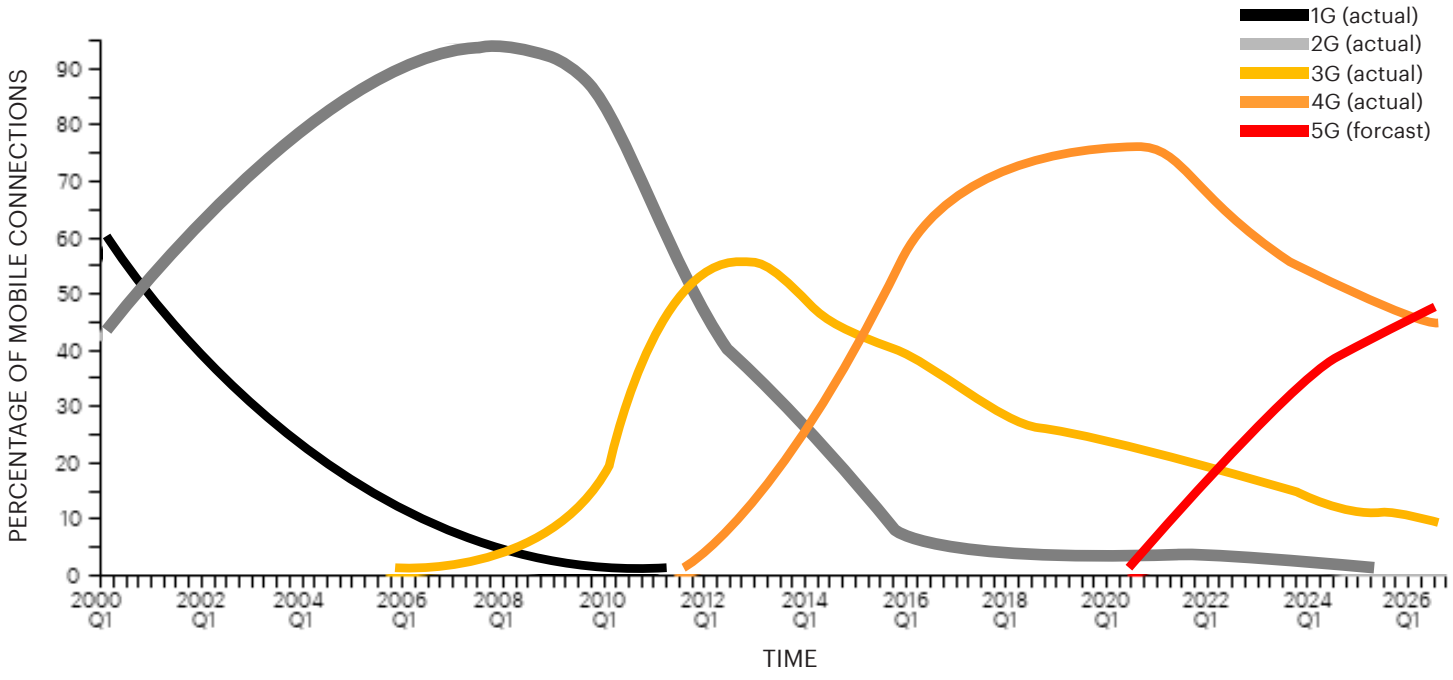


This economic growth – both in terms of GDP and jobs – is a result of the increase in competitiveness that Canada will experience from transitioning to a new generation of mobile technology. Analysis conducted by Accenture on the shift across the last 4 generations of network technology from 2000 and 2017 showed a statistically significant correlation between adoption of wireless technologies and Canada's GDP[10]. When looking at the share of mobile connections by network technology as a percentage of the Canadian population, all technologies display the traditional S-shaped adoption curve.

The rollout of 5G in Canada will be gradual starting in 2020 with over 16M 5G connections expected by the end of 2026[11]. Although rollout in Canada may not mimic the speed of deployment that is predicted in the U.S. and China, it is expected that the share of 5G connections as a proportion of the total Canadian population will be nearly 50% by 2026[12].

Shift in adoption of new generation of wireless network technology

Percentage of Canadian Mobile Connections by Network Technology Over Time



The benefits that come from the widespread adoption of 5G will be experienced not just by Canadians living in urban areas, but also by rural residents who currently experience a lack of access and/or lower service levels. Today, approximately 84% of Canadian households have access to fixed broadband internet services that meet CRTC's target speeds[13], but this varies significantly between the urban and rural population; 39% of rural households have access to this kind of service, versus 96% in urban areas[14]. As the definition of broadband evolves to higher speeds[15], Canada will need continued investment to keep pace with global leaders and rising expectations of Canadians.

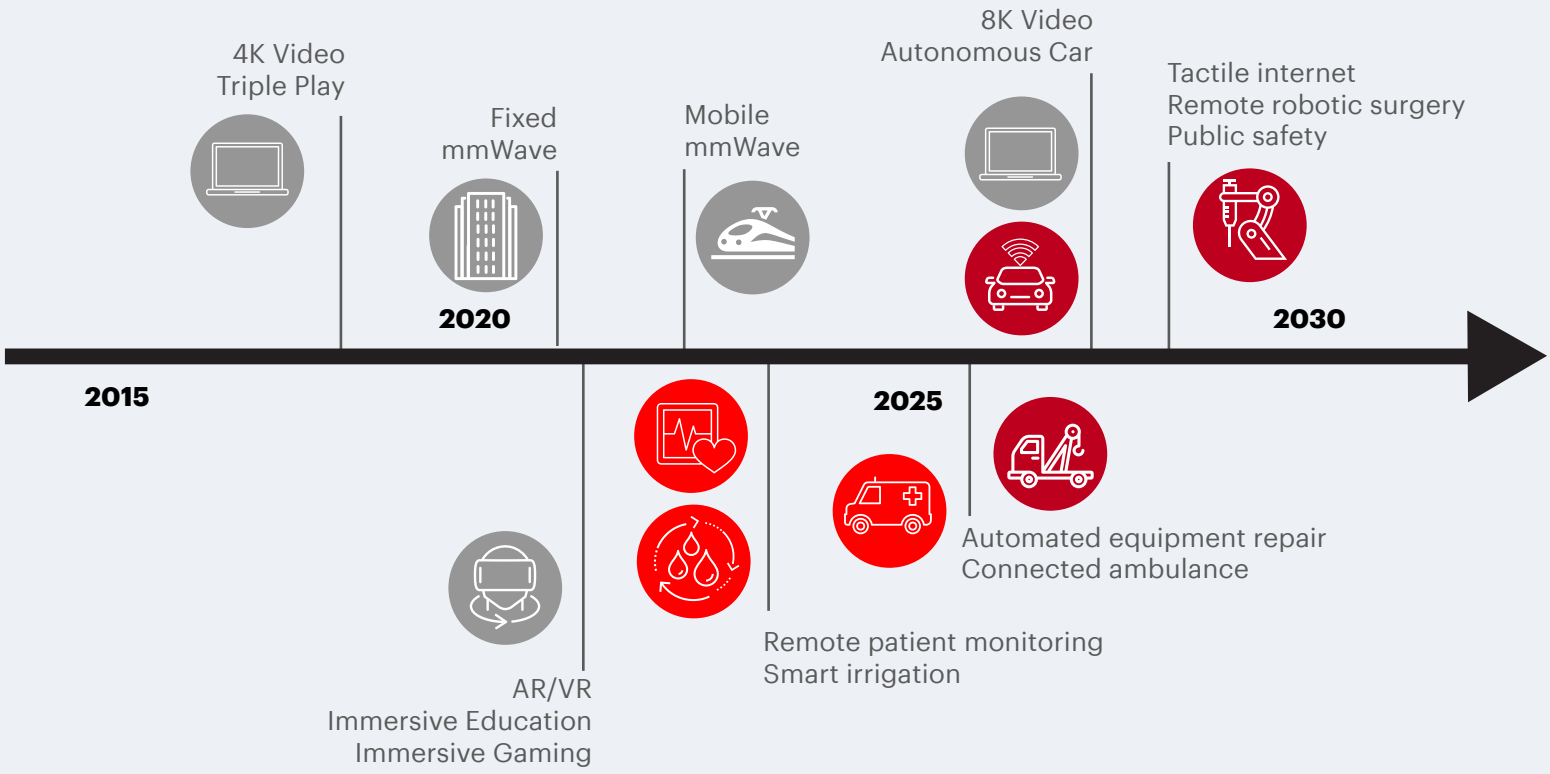
With the advent of 5G, there is an opportunity to not only close this gap between rural and urban access, but also keep stride with evolving expectations of speeds and capacity. Given the cost to deploy Fiber to the Premises (FTTP) in rural markets, carriers may look to leverage wireless as opposed to fixed lines for this 'last mile connectivity'. It is estimated that 5G-based Fixed Wireless Access (FWA) can reduce the initial cost of establishing last-mile connectivity by as much as 40% in comparison to FTTP[16]. In addition, 5G can significantly accelerate rollout times by eliminating the need to lay cables as required for FTTP rollouts[17].

Accenture estimates that this could translate to **$2.2B** in upfront cost savings if 5G FWA replaced FTTP deployment for all remaining Canadian households lacking broadband access at target speeds[18].

Increasing broadband penetration rates in Canada have an incremental benefit beyond those already estimated for 5G, as access is provided to training, education, and employment.

Accenture estimates that the increase in broadband penetration will add $5B in GDP and 100K jobs materializing from benefits such as increased productivity and digital literacy[19]. This will also lay the foundation for enabling services that rely on enhanced mobile broadband, such as online training and education that will become more video-based and interactive.

The Evolution of 5G Capabilities in Canada Over Time



eMBB: Enhanced Mobile Broadband

mMTC Massive Machine Type Communications

URLLC: Ultra Reliability & Low Latency Communications

The benefits that 5G will bring to Canadians are a function of its transformative characteristics. While 4G was traded mostly on the basis of data buckets, 5G will be traded on specific application needs, including faster speeds, low power requirements, and ultra-low latency. **Latency is the new currency**. Just as the characteristics of 4G propelled innovative developments, such as the smartphone and the app economy, to the forefront, 5G will act as a platform upon which Canadians can build new, innovative services. The benefits will materialize for citizens and businesses across the country through areas such as health, entertainment, energy, safety, and education, to name just a few. While many use cases are likely to emerge based on an analysis of overall impact and feasibility, Accenture has explored the potential economic benefits resulting from a select set of 5G use cases in Canada.

	High Rural Applicability		High Urban Applicability	
5G Use Case	 Precision Agriculture	 Predictive Maintenance	 Immersive Entertainment	 Connected Ambulance
What it Means	Use of sensors for soil, crop, livestock, smart irrigation, connected machinery to increase efficiency	Use of pervasive sensors for predictive maintenance and edge computing for automated repair	Leveraging HD video, Augmented and/or Virtual Reality to provide immersive fan experiences	Enhanced, interactive communication between awaiting Emergency team and remote paramedics
Example Benefit	**$270M** in annual savings from smart irrigation on blueberry farms	**20%** reduction in maintenance costs through predictive maintenance	**$17M** of incremental revenue for a VR *Hockey Night in Canada* experience	Potential to improve health outcomes for **7,303** stroke patients in ON

As the business case for leveraging 5G to upgrade connectivity becomes clearer, there are locations that dramatically increase and accelerate the value of such deployments; for example, rural communities focused on agriculture or the oil sands may be likely starting places for network deployments. In an urban setting, many 5G use cases tend to focus on smart cars and smart cities, but a couple that may be top of mind in Canada are in the entertainment and healthcare sectors.

PRECISION AGRICULTURE

With nearly 7%, or $111.9B, of Canada's GDP coming from the agriculture and agri-food system, the economic benefits that precision agriculture can yield for the Canadian economy are significant[20]. The United Nations predicts that food production must double by 2050 to meet the demand of the world's growing population and that innovative strategies are needed to reach this mark[21]. 5G represents an opportunity to increase agricultural productivity in a way that benefits not just the farming business but society more broadly.

5G is a key enabler of precision agriculture, which is a technology-driven management approach to farming that rests on utilizing data to measure, analyze, and respond to crops in real time to preserve resources and boost yields. Although some of the technology, such as satellites and drones for field monitoring, have been around for years, 5G will enable farmers across Canada to utilize this data to optimize decision-making in real-time and at scale.

Large farms of 5,000+ acres can expect to see significant economic gains through reduced input prices of $24.50 USD per acre and increased output gains of $42 per acre[22]. By applying these figures to Canadian farms of a relative size and scale[23], the farming business could achieve economic gains of **$3.3B CAD**, with approximately $1.2B attributable to input price reductions and approximately $2.1B attributable to yield increases.

A specific example of this involves leveraging the Internet of Things (IoT) to optimize irrigation systems via data collected from remote sensors, allowing farmers to specify where water resources should be directed, in what volume, and for how long, all from their laptop or mobile device. One area of Canadian farming with high potential for smart irrigation is blueberries, as this is one of Canada's most grown fruits. Research has shown that the implementation of remote sensors around farming areas allowing for better monitoring of soil conditions to optimize irrigation has the potential to reduce the volume of water used by 70%[24]. By applying this figure to Canada – based on Accenture analysis of acreage of blueberry farms at a provincial level, plant type (highbush vs. lowbush), growing days, and current water requirements – it is estimated that blueberry farmers could look to save 74.3B imperial gallons of water per year, leading to approx. **$270M** in annual, recurring cost savings.

With Canada expected to continue being a leading exporter of key agriculture commodities, Canadian farmers can play a large part in leveraging the power of 5G to boost global food production[25].

PREDICTIVE MAINTENANCE IN THE OIL SANDS

Canada is expected to produce five million barrels a day of crude by 2020, maintaining its position as one of the world's top producers of oil and natural gas[26]. In an increasingly competitive market, Canadian oil and gas operators can take advantage of advancements in network speeds and capacity to increase safety and efficiency of operations. The use of IIoT (Industrial Internet of Things) sensors combined with real-time HD video can help companies make smarter and more proactive decisions when it comes to maintenance. Through a 5G network slice, connection reliability and information security can be improved. Picture a typical oil sands site with massive machinery for mining, processing, and extraction. With the complex nature of operations, oil and gas operators often need to take their operations offline and perform maintenance on their equipment or facilities due to 1) an unforeseen fault or failure, 2) a regularly scheduled maintenance event or 3) the prediction of an imminent risk or threat. A reduction in unplanned downtime and reduction in the risk of catastrophic disasters associated with equipment or facilities failures can have a massive impact to the bottom line, employee safety, and the natural environment in which these companies operate.

Accenture research has found these companies continue to experience as much as 6% production loss annually per asset due to unplanned maintenance. By establishing a centralized operations control centre, oil and gas companies can concentrate the knowledge and intelligence of operations engineers to better predict and resolve problems before they arise. These tools are not new, but the demands of industrial monitoring and remote operations technology have begun to reach the limits of existing communication networks. This is where 5G comes into play, allowing oil and gas operators to deploy more pervasive sensors and monitoring devices to transmit even more data in real-time through a more reliable infrastructure. These applications could reduce maintenance costs by as much as **20%** through a reduction in unplanned maintenance, more efficient utilization of human capital (assigning engineers in a targeted manner to prevent issues from arising) and more efficient utilization of physical assets (reducing time offline for regular maintenance) [27].

As 5G is deployed in remote sites, where oil sands operations are typically located, there will be a continued shift of computing power to the edge of the network. This means faults and failures can be predicted with lower latency and even automatically repaired, powered by the real-time processing offered at the edge of the network instead of the core.

Efficiency is only one benefit to oil and gas companies when considering the applications powered by 5G. Using wearables to detect worker fatigue and using real-time location analysis to quickly track where a worker is situated can improve workers' safety and even save lives; this is another huge benefit of the network capabilities that 5G will bring to scale[28].

IMMERSIVE ENTERTAINMENT

A perfect opportunity for the average consumer to experience the higher network throughput and capacity offered by 5G is during major entertainment events in high density event venues. With 5G supporting a 100x increase in traffic capacity and network efficiency compared to 4G, immersive fan experiences based on High Definition (HD) mobile video, Augmented Reality (AR) and Virtual Reality (VR) hardware, content, and features will soon be commonplace. 4G LTE densification efforts already underway throughout Canada are helping to address some of the challenges these venues face when traffic spikes and network demands temporarily increase, but will pale in comparison to the possibilities unlocked by 5G small cells.

Consider sitting in the upper bowls of a 50,000-seat stadium, being able to catch a real-time close-up view of every pitch from the point of view of the home plate umpire on a smartphone or VR device. Fixed stadium cameras can capture content, stream the 4K video via a 5G network to an on-premise edge server – rather than all the way back to the core network. A software solution can then stitch the different camera angles together in real-time or even create volumetric VR content in mere milliseconds. The greatly reduced latency and high-performance computing performed at the edge of the network means no seat is a bad seat. The ability to see the action on demand from multiple angles also unlocks a potentially monetizable, enhanced experience for fans watching from home whether it be through VR or a big screen TV simultaneously streaming the main action with a synchronized overlay locked on your favorite players.

Beyond simply charging for access to such immersive experiences, the opportunities to monetize these capabilities are endless, with many business models likely to emerge as these technologies advance. In a given season, a MLB team could see an additional $4M[29] in revenue just from increases in merchandise spend – through targeted marketing based on which players fans have been zooming in on – and higher value ticket sales for future games – from fans having a VR experience allowing them to see the game from a different angle. Another monetization opportunity for teams or entire leagues involves an at-home VR experience, such as that already being offered by the NBA's NextVR app, at a price of $6.99 for a courtside experience per game[30]. If this sort of feature was offered for *Hockey Night in Canada*, this could result in incremental revenue of **$17M** for the service provider[31].

CONNECTED AMBULANCE

Ambulatory services in Canada are an important part of the overall patient care process and starts the intake process into the hospital care system for a number of citizens. The enhanced mobile broadband and low latency characteristics of 5G can enable a 'connected ambulance' that will act as a mobile emergency room with medical equipment and wearables, enabling storing and real-time streaming of patient data to emergency department teams at the hospital. The key will be how 5G can reduce the workflow during times of critical need.

Continuous collection of patient data and real-time video transmission can enable awaiting Emergency Department staff to remotely monitor patients for conditions otherwise not easily detected, such as skin pallor, which can then support better decision making by paramedics in treating patients while on route. In critical situations, and with 5G capabilities enabled by ultra-low latency, a future evolution of the enhanced and immediate care could involve performance or assistance with a life-saving remote with oversight by a doctor located elsewhere but connected to the same platform. Interactive, enhanced, and quick communication between the medical professional teams and the remote paramedics can lead to significant improvements in emergency medical care and improve patient outcomes[32].

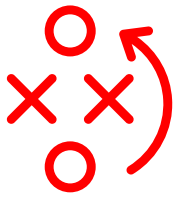
In Ontario, for example, approximately one million patients are transported by land or air ambulance annually[33]. Of these, 54,915 were admitted as stroke patients[34]. The risk-adjusted 30-day mortality ratio for these patients is 13.3%; therefore, if enhanced care, based on connected ambulance technology, could be provided to these patients, there is an opportunity to reduce this rate and positively impact over **7,303** stroke patients in the province of Ontario[35]. With 100,000 critically ill patients requiring immediate emergency transportation in Ontario, the benefits of a connected ambulance would clearly be felt by many citizens[36].

The cost impacts are also substantial – if enhanced treatment in the ambulance could lead to a 20% reduction in the average length of a hospital stay for even 10% of patients currently transported in an ambulance, this could result in savings to the healthcare system of **$140M**[37].

Enabling Success of 5G in Canada

The key factors that will impact 5G timelines and success in Canada include the modernization of deployment rules and fees, spectrum availability and allocation, and maintaining a stable regulatory environment that encourages investment.

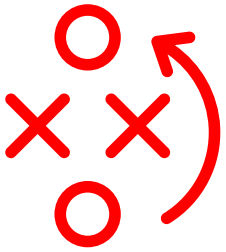
01. Modernize Deployment Rules and Fees



02. Spectrum Availability and Allocation

03. Encourage Investment

01. Modernize Deployment Rules and Fees



Many of the existing rules, regulations, and fees governing the deployment of wireless infrastructure were established years ago to address the siting of 200-foot tall cell towers. 5G will require a greater density of small cells using much smaller equipment, often compared to the size of a shoe box. There is likely to be up up to 273,000 of these small cells deployed across Canada over the next 5 to 7 years in comparison to the network of approximately 33,000 large towers that were deployed over the period of more than 20 years.

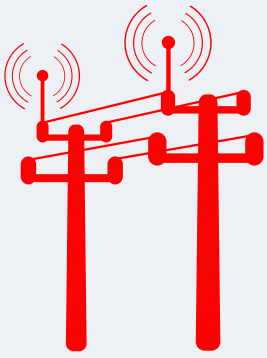
Small cell deployment will require more precise cell positioning and a larger number of siting approvals, albeit a much smaller impact per site. As small cells are typically affixed to buildings, utility poles, street lights, and other street furniture, fair and reasonable access to these sites will be required to meet target deployment timelines. In addition, modernization and streamlining of relevant administrative processes will be important for enabling 5G deployment; this includes shorter approval timelines, appropriate exemptions, and reasonable and non-discriminatory fees for accessing and using government infrastructure.

5G AND SMALL CELLS ARE DIFFERENT FROM 4G AND REQUIRE A NEW REGULATORY APPROACH

LARGE TOWERS & BUILDING ANTENNAS

Permit process unsuitable for Small-Cell tech, requiring 10-100x permits

Existing per-site rental fees make 5G economically unfeasible



SHOE BOX SIZED SMALL CELLS ON LAMP POSTS & UTILITY POLES

5G Small-Cell Tech is less obtrusive but needs up to 100x small antennas

02. Spectrum Availability and Allocation

Availability, allocation, and effective use of spectrum will be key to the successful introduction of 5G in Canada. As 5G natively supports all spectrum types (licensed, unlicensed, and shared) and bands (low, mid, high), this technology is expected to get the most out of every bit of spectrum[38]. Nevertheless, the freeing up of spectrum and the technological advancements to deliver improved spectral efficiency will be key to unlocking the spectral adaptability of 5G.

With the first global 5G standards having been specified, consensus is forming over what spectrum bands will be most important for early 5G deployment[39]. These bands broadly consist of mid-band spectrum around 3500 MHz and high-band, or mm-wave, spectrum (above 6GHz), such as bands between 24 and 29 GHz, as well as higher frequency bands[40]. The mid-band spectrum will be used for enhanced mobile broadband, while the high-band spectrum will be used in small cell deployments to support increases in data traffic. The Spectrum Outlook published by Innovation, Science and Economic Development Canada (ISED) in June of 2018, indicates that 3500 MHz spectrum will be released in Canada for flexible use in late 2020[41]. The appropriate release and allocation of key spectrum bands in Canada will be important in fueling the innovative services that rely on 5G commercial deployments.

03. Encourage Investment

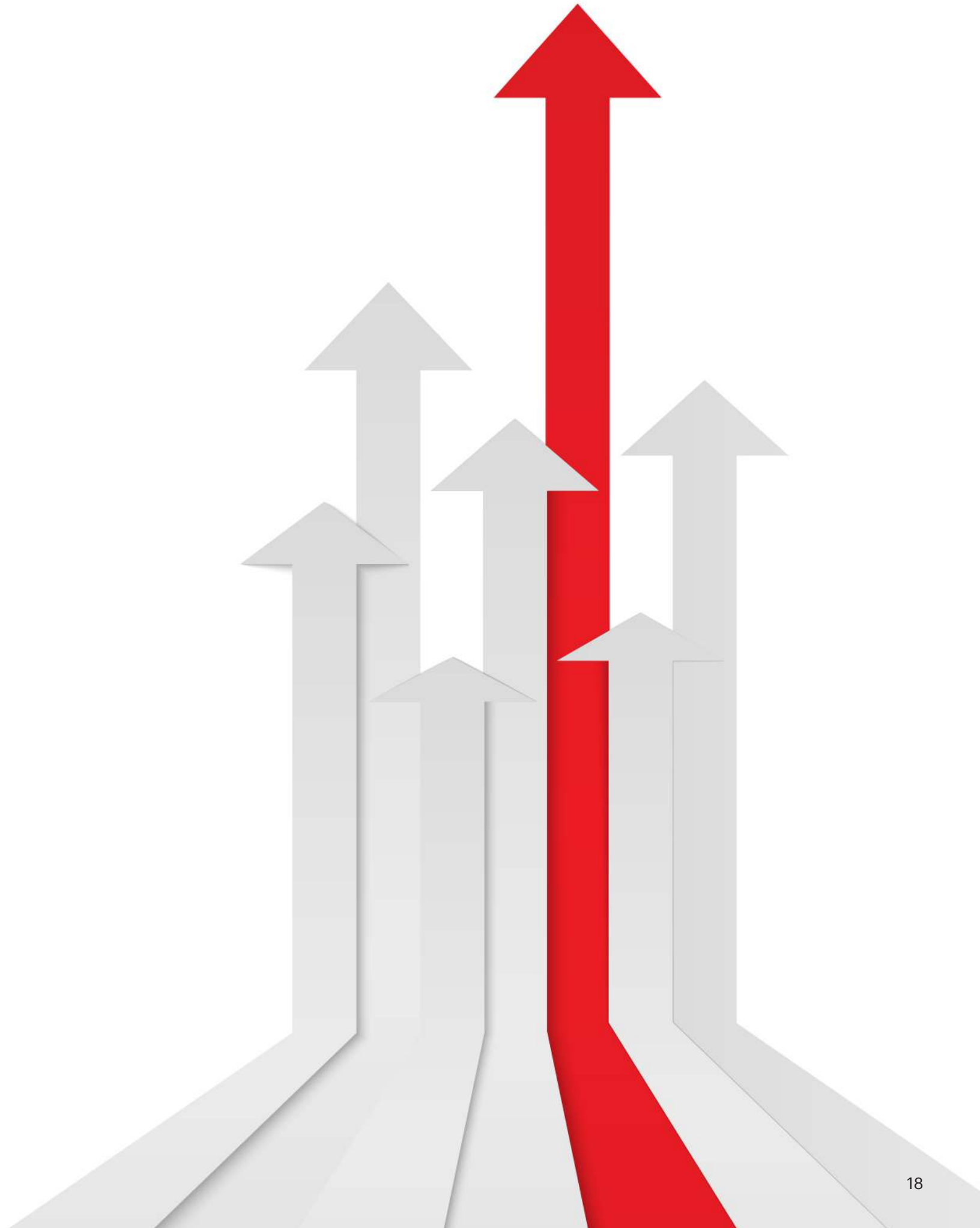
Canadian facilities-based wireless operators have invested close to $50 billion – excluding spectrum fees – since the mid-1980s to build Canada's wireless infrastructure[42]. This has led to top-tier global 4G performance, now serving as a strong foundation for deploying 5G networks[43]. 5G deployment in Canada will likely require another $26B investment over a seven-year period, most of which is expected to be made by Canada's facilities-based wireless operators. For this level of investment to be maintained, a stable regulatory environment and a clear path to reasonable returns is necessary.

Furthermore, with the exponential growth in bandwidth and capacity, carriers will need continued investment to redefine network operations, considering areas such as virtualization, mobile edge computing, and aggregation, to meet the new demands.

Canadian industry leaders, government representatives, and other key ecosystem partners will need to come together to drive commercialization of innovative 5G-services. With a competitive OEM community and facilities-based carriers who invest more in their networks as a percent of revenue than any other G7 country[44], Canada offers an environment where this is possible. Public-private partnerships, such as ENCQOR or the 'Evolution of Networked Services thorough a Corridor in Quebec and Ontario for Research and Innovation' will nurture and fuel this innovation; through ENCQOR, $400-million will be invested over 5 years to bring together a pre-commercial corridor of 5G wireless technologies[45]. Collaboration across universities, industry, and government can help accelerate and scale investments so that the benefits of 5G are felt by all Canadians.

Canada has successfully grown and attracted some of the world's top talent by leading on the global innovation stage in areas like Artificial Intelligence, Quantum Computing, and Blockchain. With initiatives such as ISED's superclusters, $950 million will be invested in fields such as Digital Technology and Advanced Manufacturing[46]. It is these types of initiatives that are helping to bring together disparate parties and technologies to invent solutions that are made possible by 5G.

By continuing to cultivate a collaborative environment for industry, government, and start-up community stakeholders, Canada can develop the ecosystem required to bring both the economical and societal benefits to life with 5G. Canada's path in the race to 5G is at the forefront of wireless technology and the innovations it supports.



About this Research

Through a comprehensive study, commissioned by the CWTA and conducted by Accenture Strategy and Accenture's Network practice with support from Accenture Research, an economic model was created to estimate the contribution of 5G wireless adoption to the Canadian economy. Macro-economic data from StatsCan (Canada's National Statistical Agency) and wireless adoption data from GSMA Intelligence were used in this analysis. This study uses quarterly data between 2000 and 2017, for a total of 72 observations.

The time series economic model (ARIMA model) created includes variables on economic factors such as household consumption, government investment, trade and employment (data from StatsCan) and wireless quarterly net additions (defined as the number of new mobile connections, based on data from GSMA Wireless).

This type of model estimates the impact of each variable on GDP change. This model does not attempt to capture the causal relationship on GDP, but offers insight on the correlation between wireless adoption and economic growth. Wireless adoption can be the result of two factors: (1) existing consumers (population that has already adopted mobile technology) may "upgrade" to a new device and, hence, adopt the newest technology available at the time of the upgrade (this is the equivalent of a substitution effect between wireless technologies), (2) new consumers may enter the market, representing an incremental increase of the overall population of mobile users.

Standard economic software was used for the calculation of the model.

NOTES

[1]GSMA Intelligence, Canada Market Data

[2]CRTC Communications Monitoring Report, 2017

[3]https://opensignal.com/reports/2018/02/state-of-lte

[4]https://www.qualcomm.com/invention/5g/what-is-5g

[5]This is based on the difference between StatsCan GDP projections and the GDP predicted through the Accenture-developed ARIMA model developed showing a $34.5B incremental GDP impact due to 5G adoption; in addition, there is a $5B impact that is incremental to this from an increase in broadband penetration due to the option of using 5G Fixed Wireless Access as a substitute for fixed lines to connect the last mile from the fiber network into the home, thereby increasing broadband penetration by 2.53% according to Accenture analysis, resulting in an annualized GDP impact of $39.5B by 2026

[6]This is based on the difference between StatsCan Employment projections and the Employment forecasted by applying an Employment Elasticity of 0.46 to the GDP output from the ARIMA model developed showing a 141,343 employment increase; in addition, there is a 100,389 jobs impact that is incremental to this from an increase in broadband penetration due to the option of using 5G Fixed Wireless Access as a substitute for fixed lines to connect the last mile from fiber network into the home, thereby increasing broadband penetration by 2.53% according to Accenture analysis, resulting in an annualized jobs increase of 241,732 by 2026

[7]Based on assumption that 10-15% of wireline CapEx and 50-75% of wireless CapEx will be allocated to 5G; an average of 82% of forecasted CapEx between 2020 and 2026 is for Wireline and 18% for Wireless; CapEx categories include Hardware, Engineering Services, and Construction plus Site Acquisition

[8]Direct effects constitute economic contribution or jobs created directly within the wireless industry; indirect effects constitute economic contribution or jobs from adjacent industries as a result of supplying goods or services to the wireless industry; and induced effects constitute economic contribution or jobs resulting from household spending based on income received from working in the wireless industry or for a supplier to the wireless industry; Indirect and induced employment figures as a result of construction were calculated using industry specific employment multipliers from Stats Canada

[9]http://www.canadastop100.com/national/

[10]Model output demonstrated that a 10% increase in mobile net addition from one quarter to the next generates, on average, a 0.6% increase in GDP

[11]GSMA forecast

[12]GSMA forecast combined with Accenture analysis

[13]50 Mbps download and 10 Mbps upload

[14]https://crtc.gc.ca/eng/publications/reports/policymonitoring/2017/cmr5.htm

[15]https://www.theglobeandmail.com/report-on-business/crtc-rules-high-speed-internet-a-basic-telecom-service/article33405960/

[16]http://www.snstelecom.com/5gfwa

[17]http://www.snstelecom.com/5gfwa

[18]Calculated as 40% reduction in estimated FTTP deployment costs of $1000/urban household and $2000/rural household for deploying to remaining 61% of rural households and 4% of urban households lacking broadband access at CRTC target speeds. This does not take into account differences in Operating Expenditures between Fibre and Wireless deployments which will impact total cost of ownership. Cost estimates received from https://www.theglobeandmail.com/technology/gadgets-and-gear/with-fibre-internet-the-future-is-here-but-not-for-most-canadians/article4255358/ and http://bbpmag.com/2011mags/marchapril11/BBP_MarApr_CostOfFiber.pdf

[19]The economic estimates by providing broadband access to consumers through 5G wireless assumes the share of the population that currently doesn't have access to broadband internet will be the same at the time of 5G deployment, and that 5G will be a substitute for wireline broadband. It also assumes consumers who don't have access to the technology will adopt it at the same rate as those who do have access. Estimates of the economic impact are based on previous studies of the economic benefits of broadband covering employment and GDP. These calculations assume the 4% of Canadian households lacking broadband access – with broadband conservatively defined as minimum of 10 Mbps/ 1 Mbps – gain access and adopt at current rates, for an increase in penetration of 2.53% and applying research showing that a 10% increase in this can lead to a 0.9% to 1.5% increase in GDP growth and a 1% increase in penetration can lead to 0.2% to 0.3% increase in employment. Using the low end of these benefit ranges to be conservative, the increase in GDP and Employment for 2026 are $4.96B and 100,389 jobs respectively, https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf

NOTES

[20]http://www.agr.gc.ca/eng/about-us/publications/economic-publications/an-overview-of-the-canadian-agriculture-and-agri-food-system-2017/?id=1510326669269

[21]https://www.un.org/press/en/2009/gaef3242.doc.htm

[22]Thompson Reuters

[23]Based on farms of 2000 to 3499 acres and farms above 3500 acres using data from StatsCan http://www5.statcan.gc.ca/cansim/a47

[24]https://www.lanner-america.com/blog/smart-farming-iot-5g-agriculture/

[25]https://www.oecd.org/canada/Canada-AGR-Outlook-country-note.pdf

[26]https://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/energy-conference-outlines-future-for-canadas-oil-and-gas-sector/article36540935/

[27]https://www.accenture.com/t20170628T011740Z__w__/us-en/_acnmedia/PDF-54/Accenture-Strategy-A-New-Way-Forward-POV.pdf#zoom=50

[28]https://www.accenture.com/t20170417T112318Z__w__/us-en/_acnmedia/PDF-23/Accenture-Perspectives-Energy-July-2016-transcript.pdf

[29]Average 27.7K attendance | 20% adoption in the stadium | $75 average merchandise cost | 10% incremental merchandise sales from fans adopting | $33 average ticket price | 5% incremental sales from fans adopting

[30]https://www.nextvr.com/nba/

[31]26 Hockey Nights in Canada, average viewership of 1.8M for 7pm game and 560K for 10pm game, 4% uptake rate, $6.99 per VR experience per game, https://www.thestar.com/sports/hockey/2017/06/14/nhl-tv-ratings-bounce-back-with-success-of-leafs-other-canadian-teams.html, https://www.sportsnet.ca/hockey/nhl/nhl-2017-18-season-hockey-night-canada-schedule/

[32]http://extendedcampus.cit.ie/contentfiles/case-studies/DellEMC%20and%20RedZinc.pdf

[33]https://www.thestar.com/news/canada/2017/06/05/ontario-plans-new-ambulance-system-to-better-prioritize-patients.html

[34]http://www.health.gov.on.ca/en/pro/programs/emergency_health/land/stroke_methodology.aspx

[35]http://www.health.gov.on.ca/en/pro/programs/emergency_health/land/stroke_mortality.aspx

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