

The evolution of Canada's telecom industry and the growing digital economy

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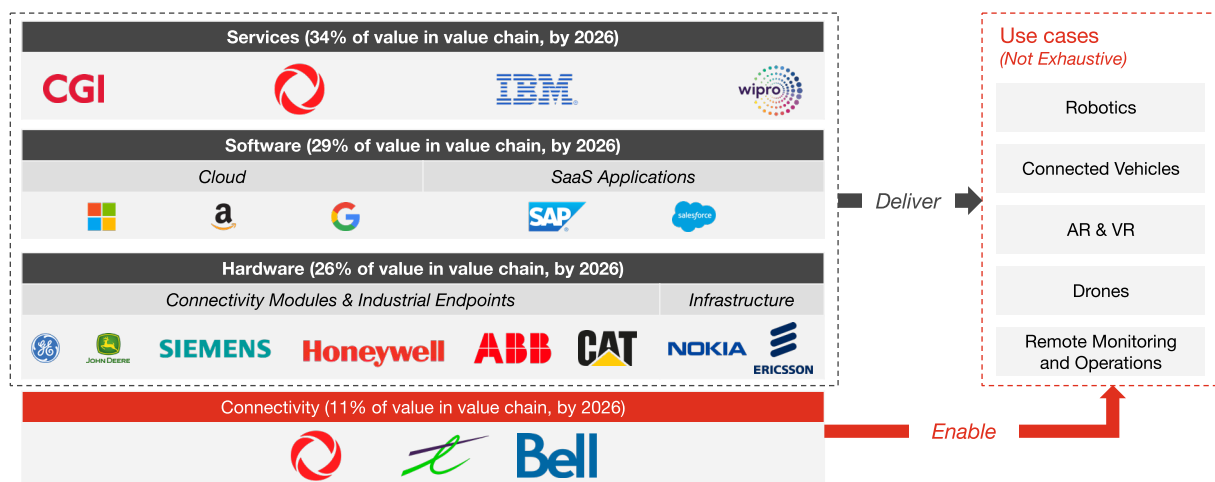
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Executive summary

Canadian mobile network operators (MNOs) are small compared to their global peers, their suppliers and the large multinational competitors of the new digital economy. The digital economy is being enabled by a technology stack of hardware, software and service providers (Exhibit 1) that are creating value through new use cases involving technologies such as robots, connected vehicles and drones. Connectivity, and the MNOs that deliver it, are critical to enabling the digital economy, including the deployment of 5G networks, which will require significant capital investment from MNOs.

Exhibit 1: Connectivity enables the next generation of digital economy applications and tools

Digital Economy Technology Stack



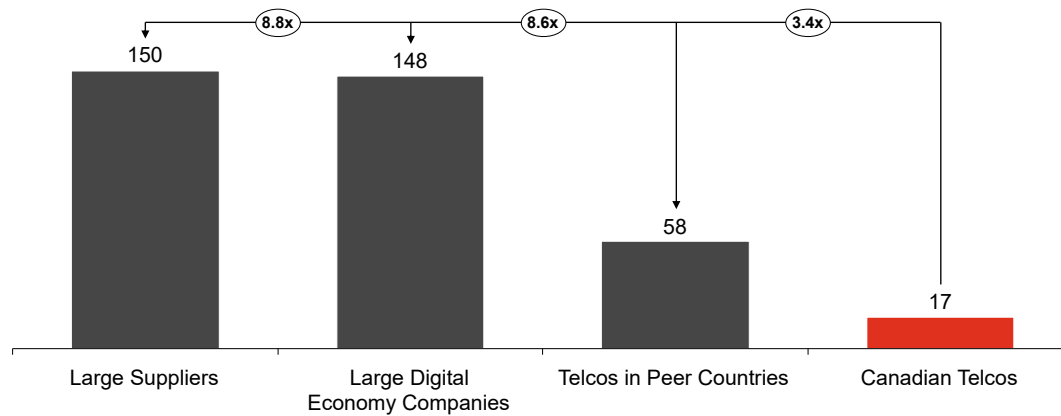
Source: PwC Analysis, IDC

Canadian MNOs are smaller in comparison to global peers in the G7, Australia and South Korea – on a revenue basis, Canada's largest telco is around 10 times smaller than leading US telco AT&T, and around 6 times smaller than leading European provider Deutsche Telekom.¹ On average, the three largest Canadian telcos generated approximately three and half times less revenue than the leading telcos in the G7, South Korea and Australia (see Exhibit 2). Similarly, Canadian telcos are undersized compared to some of their main suppliers. As shown in Exhibit 2, the average revenue of six of the most important telecommunications suppliers is approximately nine times larger than that of the three largest Canadian telcos. This hampers the ability of Canadian telcos to negotiate better prices. Canadian MNOs are also faced with the highest capital expenditures to revenue ratio at 18% (US and Australian averages are 13%).² The comparatively small scale of Canadian MNOs and their relatively higher network capital costs create challenges for MNO's ability to invest in the 5G connectivity required to enable the digital economy.

¹ PwC Analysis, based on data from S&P Capital IQ

² PwC Analysis, data from S&P Capital IQ

Exhibit 2: Average Annual Revenue of Canadian Telcos, Select Suppliers, Select Multinational Competitors in the Digital Economy, and Telcos in Peer Countries (CA\$ Billions, 2016-2020)



Source: S&P Capital IQ
 Note: The "Large Suppliers" and "Large Digital Economy Companies" categories are composed of select multinationals and are composed of 6 and 11 companies respectively. The "Telecommunications Companies in Peer Countries" is composed of the largest Mobile Network Operators totaling 21, in the G7, South Korea and Australia. The group of "Canadian Telcos" is limited to BCE Inc, Rogers Communications and TELUS Corp. For full lists, see Section 2

The digital economy represents the end-to-end digitization of business processes and every-day activities, and is achieved by integrating connectivity, software and hardware. The improvements in connectivity delivered by 5G will further accelerate the growth and impact of the digital economy, through enabling use cases that will deliver a range of economic, environmental and societal benefits.

The value created by the digital economy is forecasted to be primarily shared across hardware, software and service providers (Exhibit 1). These companies rely on connectivity for delivery but do not invest in network infrastructure. These solutions providers, such as large multinationals (e.g., service providers like IBM, software providers like Amazon, and hardware providers like ABB) are forecast to capture approximately 89% of the value created by 5G, with connectivity's share being approximately 11%. These large multinationals' global scale, and concentration of financial and human capital (for example, Apple generates more than 14 times the annual revenue of the largest Canadian telco) allow them to compete aggressively in the 5G-enabled solutions markets. As shown in Exhibit 2, the average revenues generated by 11 large multinationals that compete in the digital economy are approximately nine times larger than those of the three largest Canadian telcos. The impact of multinationals aggressively competing can be observed by the consolidation of the media industry, where in response to pressure from over the top (OTT) providers (e.g. Netflix) Disney acquired Fox, AT&T merged with Time Warner (AT&T have since spun-off Time Warner to Discover), and Viacom merged with CBS.

The telecommunications industry's role within the economy has shifted. Previous generations (3G, 4G) of connectivity supported the information economy, enabling communication, knowledge sharing and information storage. In contrast, 5G connectivity represents the enablement of the digital economy by providing the fast transfer of vast amounts of data needed to more fully digitize, optimize and automate existing processes and deliver new solutions. In Canada, the deployment of 5G and the enablement of the digital economy is forecasted to deliver significant economic, environmental and societal benefits, including:

- Economically, an estimated increase in Canadian GDP by \$94 billion annually by 2035.

- Environmentally, optimize operating conditions and minimize inputs of existing industrial processes to reduce emissions and water consumption.
- Socially, improve the quality of social services while reducing the cost of delivery.

Within this context, there is a global trend of consolidation in the telecommunications industry. For example, M&A deal value in the telecommunications industry totalled CA\$263 billion in 2020, a CA\$195 billion increase in value from 2019.³ Notably, T-Mobile's acquisition of Sprint in the US is forecasted to provide over US\$40 billion of synergies that can be invested in 5G deployment. In Canada too, scale is a key enabler of Canadian MNOs' ability to deploy 5G networks at pace. Larger scale operators are able to generate the cash flow to deploy 5G networks, and have the national reach and capabilities to deploy networks across urban and rural geographies.

This context has implications for how the telecommunications industry needs to be considered within regulatory frameworks. For previous generations of connectivity, Canadian regulators prioritized the establishment of a competitive framework for affordable consumer outcomes and the connectivity needs of the information economy. However, in the 5G era, a broader mandate that supports the needs of the digital economy (near-ubiquitous high-speed coverage, low-latency connectivity), while providing a competitive framework for affordable consumer prices, is needed. Delivering on this mandate would require regulators to consider:

- shifting the regulatory and policy lens to consider the broader digital economy;
- ensuring Canada has a healthy telecommunications industry, with well-capitalized MNOs that have the scale to make the required investments in 5G networks;
- addressing regulatory barriers that negatively impact 5G deployment such as spectrum allocations and complex regulations for access to passive infrastructure; and
- setting clear and predictable guidelines on security practices related to 5G networks.

In the 4G era, Canada was a leader in the rollout of 4G connectivity, in part due to its healthy telecommunications industry. Peer countries whose network operators were in poorer financial health had a slower 4G deployment, and lower 4G adoption rates. Recognizing that the telecommunications industry is a key enabler of the digital economy and the lessons from the 4G era, a healthy telecommunications industry is needed in Canada where scale operators are able to fund the deployment of 5G. The need for scale among Canadian MNOs is further accentuated by the higher costs of 5G networks where there is a potential increase of up to 71% in total cost of ownership and the conditions of the digital economy where the vast majority of value pools are in markets dominated by large multinationals (software, hardware and services). The potential increase in the cost of ownership is driven by the need for greater capital investment to fund infrastructure and increased operational costs associated with the increased data traffic and maintenance requirements.

³ Data from S&P Capital IQ

1: The telecommunications industry is a core enabler of the digital economy

Connectivity, notably 5G, sits at the centre of the growing digital economy. The expansion of the digital economy enabled by 5G connectivity has three implications:

- The role of the telecommunications industry is shifting towards being the core enabler of the digital economy.
- The enablement of use cases in the digital economy is forecasted to bring significant economic, environmental and societal benefits.
- The deployment of 5G is forecast to be more expensive, and the return on investment for MNOs is more uncertain, than previous generations.

The telecommunications industry a core enabler of the digital economy through 5G

5G is ushering in a new era in which connectivity will support a growing number of consumer and business applications in the digital economy. This places connectivity at the centre of this growing digital economy, which is revolutionizing how businesses operate and how people interact with each other.

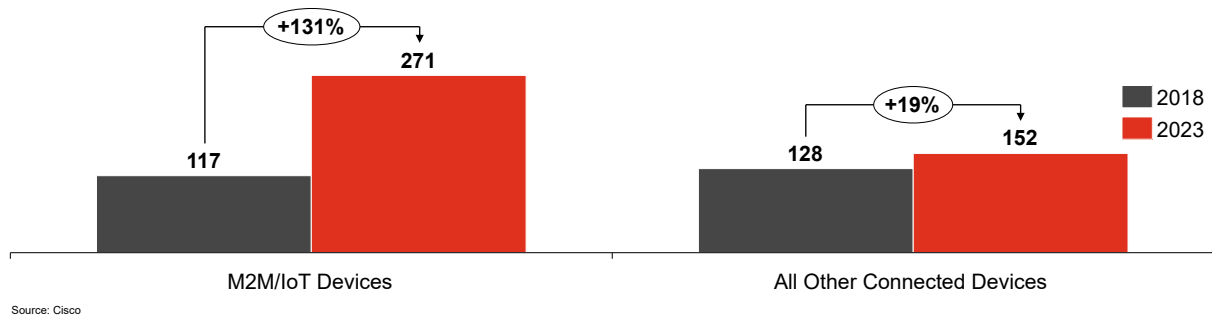
The digital economy represents the end-to-end digitization of business processes and everyday activities, and is achieved by integrating connectivity, software and hardware.

The increased importance of connectivity, driven by the expected benefits from 5G-enabled technologies has led to an evolution in the role of the telecommunications industry. Previous generations (3G, 4G) of connectivity supported the information economy, enabled communication, knowledge sharing and information storage. In contrast, 5G represents the enablement of the digital economy by providing the fast transfer of vast amounts of data needed to increase the digitization, optimization and automation of existing processes and deliver new solutions.

The growth of the digital economy is evidenced by the forecasted 131% growth in the number of M2M/IoT devices (e.g., sensors needed to enable Industry 4.0 solutions) from 2018 to 2023. In contrast, all other connected devices (e.g., tablets, smartphones) are expected to grow by around 19% over the same time period (Exhibit 3).⁴ This expected increase in M2M and IoT connections demonstrates the integral role connectivity has in supporting the digital economy.

⁴ PwC Analysis, based on data from Cisco. 2020. "Cisco Annual Internet Report (2018–2023) White Paper".

Exhibit 3: Growth in mobile devices in Canada from 2018 to 2023 (Millions of devices)



5G is the next generation of connectivity that is expected to deliver faster connections (up to 20 times the speeds of 4G and 10 times the connection density), increased network capacity (up to 100 times the traffic capacity of 4G), ultra-low latency and improved reliability (up to 10 times lower latency than 4G), and enhanced security with improved security protocols.

The benefits of 5G-enabled technologies are expected to be broad, providing both consumer and business applications and impacting the majority of industries. Notably, deploying these solutions is important to keep Canadian businesses competitive, especially in industries that are highly exposed to global competition such as manufacturing and agriculture, and is an important enabler of Canada meeting environmental commitments and improving the delivery of social services. The forecasted benefits of 5G can be categorized as follows:

- *Economic Impact of 5G:*
 - 5G is estimated to increase annual GDP by \$94 billion by 2035 in Canada.⁵ 5G technologies will enable gains in productivity, important for keeping Canadian businesses competitive in industries that are subject to international competition such as manufacturing and agriculture.
 - Examples of 5G use cases that enable productivity gains include the use of remote monitoring of assets in industrial operations, which can help prevent failures and reduce downtime.⁶ A more specific example includes the use of train-to-train communications and IoT devices by railway operators to allow for more trains on existing tracks and optimized operations.⁷
- *Environmental Impact of 5G:*
 - 5G-enabled technologies leverage vast amounts of collected data in real time to optimize processes, which in turn will help to reduce emissions and water consumption.
 - An example of a 5G-enabled technology that reduces Canada's environmental footprint is the use of precision agriculture techniques. By deploying connected sensors to track moisture content, and using this data to automate farm irrigation, farmers can reduce water consumption on their farms. In North America, precision agriculture has already decreased water consumption by 4%, with the potential to achieve a further 21% decrease when implemented more broadly.⁸

5 PwC Analysis

6 GSMA. 2020. "Edge computing in the 5G era: Technology and market developments in China"

7 Thales. 2021. "Welcome to the 5G Railway"

8 Association of Equipment Manufacturers. "Environmental benefits of precision agriculture".

- *Societal Impact of 5G:*
 - 5G-enabled technologies can improve the quality of social services (such as education, healthcare and transportation) while reducing the cost of delivery.
 - For example, in healthcare, tele-operated surgical robots can enhance the capabilities of surgeons and allow for the remote delivery of care by experts operating remotely.⁹ Another healthcare example is the use of enhanced remote patient monitoring, which can reduce healthcare costs and improve patient outcomes.¹⁰ In transportation, the widespread use of autonomous vehicles could reduce car accidents by 34% or more.¹¹
 - 5G connectivity can also help to close the rural-urban digital divide by delivering connectivity to more rural areas through the use of fixed wireless access (FWA) technology. FWA allows operators to provide a comparable and cost effective (with potential cost reductions up to 74%¹²) substitute for wireline connectivity.

9 Tian, W. et al. 2020. "Telerobotic Spinal Surgery Based on 5G Network: The First 12 Cases". *Neurospine*.

10 Taylor ML et al. 2021. "Does remote patient monitoring reduce acute care use? A systematic review". *BMJ Open*.

11 Litman, T. 2021. "Autonomous Vehicle Implementation Predictions". *Victoria Transport Policy Institute*.

12 GSMA. 2018. "Fixed Wireless Access: Economic Potential and Best Practices".

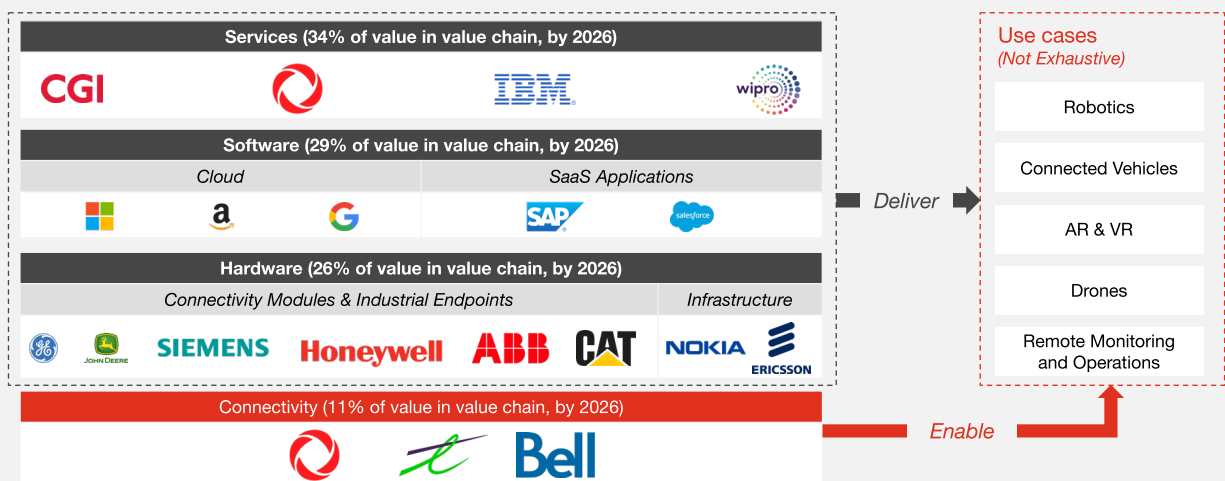
In focus - The digital economy technology stack

In the digital economy, the deployment of 5G connectivity will enable solutions that are forecasted to deliver economic, environmental and societal benefits. The digital economy technology stack (Exhibit 4) on which these solutions are based is composed of:

- **Services:** The initial IT and installation services (e.g., project-based services, consulting, systems integration) and ongoing services (e.g., managed services, support and training and related network interfaces). Examples of leading companies in this market include IBM, Oracle and CGI.
- **Software:** Programs used to enable solutions such as data processing applications to organise and access information, data analytics software, and software required for end-user input. Examples of leading companies include Amazon, Microsoft and Google.
- **Hardware:** Solution endpoints (e.g., sensors, IoT devices), computing hardware (e.g., edge computing hardware) and telecommunications infrastructure. Leading companies of hardware vary by application and industry. For example, in the automotive industry, large OEMs such as Mercedes, Volvo and General Motors are building autonomous vehicles. In the industrial sector, companies such as Siemens and ABB provide smart sensors that offer a range of capabilities including temperature, proximity, image, light, pressure and humidity monitoring.
- **Connectivity:** Enables the digital economy technology stack by allowing for the transfer of large amounts of data between all points in the stack including sensors, gateways, routers, applications and platforms. The improvements in connectivity that 5G delivers will allow for larger and faster data transfers while connecting a larger number of devices together, thereby enabling improved solutions. In Canada, connectivity is primarily provided by the largest three mobile network operators, Rogers, Bell and TELUS, as well as a number of regional MNOs.

Exhibit 4: Connectivity enables the next generation of digital economy applications and tools

Digital Economy Technology Stack



Source: PwC Analysis, IDC

Deploying 5G will be more expensive than previous generations

While delivering significant socio-economic benefits, 5G is also forecasted to be more expensive than previous generations, with the total cost of ownership (TCO) estimated to be 23% to 71% higher than for 4G networks. This increase in TCO is creating uncertainty for network operators when assessing the return on investment from network deployment and is primarily driven by three factors:

- The deployment of 5G infrastructure requires greater capital investment from network operators than previous generations due to the large number of installations required (macro cells and small cells which are expected to grow 3% and 25%, respectively, until 2025¹³) and the need for additional backhaul infrastructure.
- 5G networks need to reach near-ubiquitous coverage throughout the country (both rural and urban areas) quickly to enable nation wide use cases.
- The increased data traffic enabled by 5G will render 5G networks more expensive to operate as networks will be expected to handle more traffic than previous generations of connectivity.

In addition to being more expensive than previous generations of connectivity, the new set of use cases that are made possible by 5G are reshaping the competitive landscape for Canadian MNOs. The new ecosystem introduces competition to MNOs from hardware, software and service providers whose offerings are supported by connectivity, but who do not invest directly in the national network infrastructure they use. Notably, while connectivity is a key enabler of the integration of the digital economy technology stack, the share of value is forecasted to represent only approximately 11% by 2026 (see Exhibit 4 in *In focus* on the digital economy technology stack). Conversely, the larger value pools of software, hardware and services are forecasted to account for approximately 89%. Share in these value pools is likely to be dominated by leading multinational solution providers such as Google, Siemens, ABB and GE.

These dynamics have created an environment where MNOs are investing heavily in expensive 5G networks to enable the digital economy, while the returns from doing so are uncertain and they compete in an expanding ecosystem that includes some of the world's largest multinationals.

13 GSMA. 2019. "The 5G Guide"

2: Canadian MNOs are relatively small compared to international peers, suppliers and new competition

Canadian MNOs are relatively small when compared to global telecommunications peers due to the small customer base in Canada. In addition, they are faced with comparatively higher capital expenditures due to Canada's relatively dispersed population.

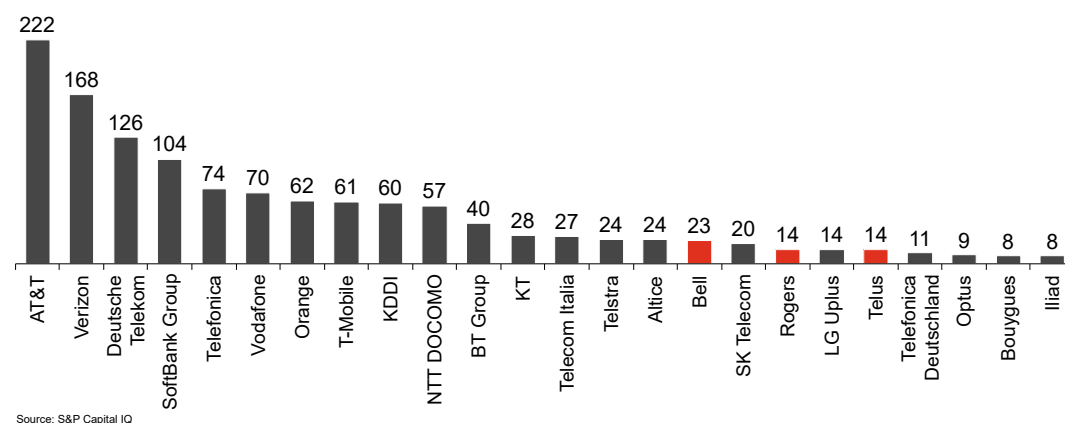
Canadian MNOs are also smaller when compared to other players in the digital economy:

- Canadian MNOs are subscale when compared to leading competitors in the digital economy, some of which are the largest multinationals in the world. These multinationals dominate the digital economy markets where the largest value pools exist, namely software, hardware and services. For example, Apple and Amazon generate more than 14 times the annual revenue of the largest Canadian MNO.
- When compared to some of their key suppliers, Canadian MNOs are also small, which limits their bargaining power for key inputs across the value chain.

Canadian MNOs are smaller than their global peers and key suppliers

On a revenue basis, Canadian MNOs are smaller than their global peers (see Exhibit 5, which shows major MNOs operating in the G7, South Korea and Australia and their revenues). This revenue disparity is largely due to Canada's relatively small population. On a cost basis, Canada's low population density and large geographical footprint requires more infrastructure than peer countries (for example, compared to Japan, which has a highly concentrated population and a small land mass), yielding a relatively high cost per subscriber. Notably, Canadian MNOs have the highest CAPEX to revenue ratio at 18% (Weighted average for leading telcos 2016 to 2020) when compared to operators in the G7, Australia and South Korea (for example, the US average is 13% and Australia average is 13%).¹⁴

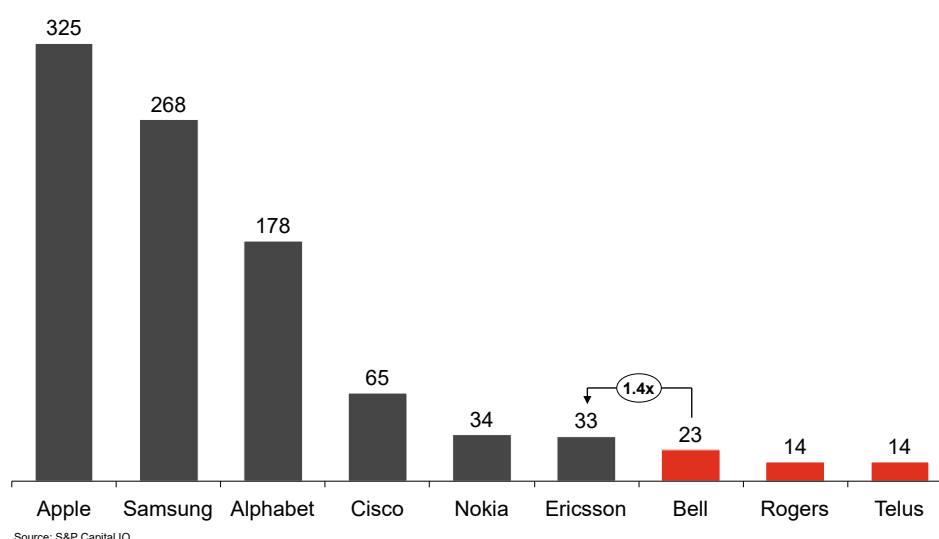
Exhibit 5: Average Annual Revenue among largest operators in the G7 + Australia + South Korea (CA\$ Billions, 2016-2020)



¹⁴ PwC Analysis, data from S&P Capital IQ

The revenues of Canadian MNOs are smaller than those of key suppliers (Exhibit 6) on which they rely for products and services. For example, telecommunications hardware supplier Ericsson generates more than 1.4 times the annual revenue of the largest Canadian MNO. The relatively smaller size of Canadian MNOs places them at a disadvantage, which may make it challenging for Canadian MNO's to form strategic partnerships with suppliers. Moreover, this size imbalance better positions large suppliers to capture larger shares of value on device sales compared to MNOs. For example, Apple and Samsung had gross profit margins of 42% and 34% from the iPhone 7 and Samsung Galaxy S7 sales respectively while distribution and retail only captured approximately 15%-20% of value for each device.¹⁵

Exhibit 6: Average annual revenue of Canadian Telcos and select suppliers (CA\$ Billions, 2016-2020)

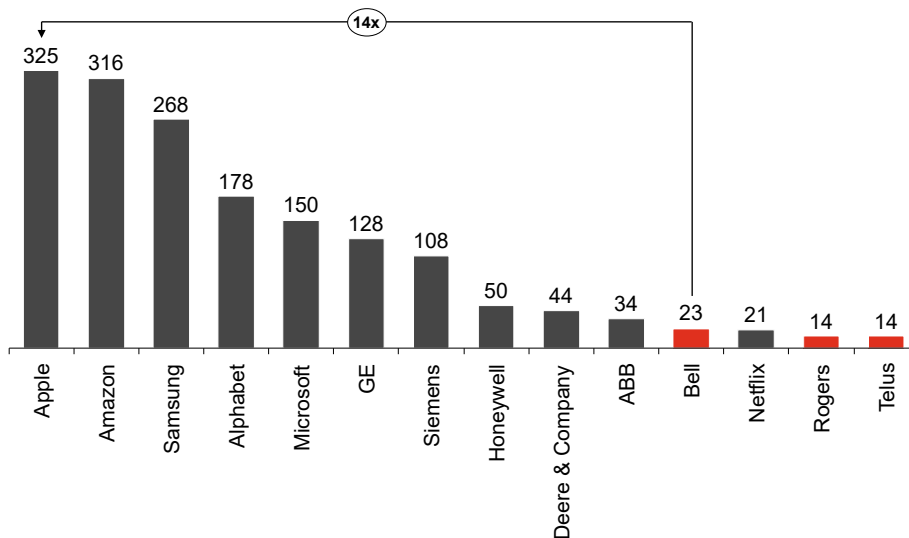


Multinationals competing in the new digital economy are significantly larger than Canadian MNOs

In the digital economy, Canadian MNOs compete with a range of software (e.g., Amazon, Microsoft), hardware (e.g., Ericsson, Nokia) and service providers (e.g., IBM, Oracle). The competitive landscape is not limited to traditional competitors of the digital economy, but also includes large companies such as ABB and Deere & Company, which build industry-specific solutions that are increasingly reliant on connectivity. Within this competitive landscape, Canadian MNOs are small (see Exhibit 7) with a significant gap in revenue relative to their large multinational competitors. For example, Apple's revenue was, on average, 14 times larger than that of the largest MNO in Canada from 2016 to 2020. This revenue gap could potentially widen as multinationals' total revenue increases at a greater rate than MNOs (for example, Apple's annual revenue increased approximately CA\$85 billion from \$283 billion to \$368 billion, averaging \$325 billion from 2016 to 2020. In comparison, the largest MNO in Canada generated total revenue of \$23 billion in 2020). As discussed in Section 1, by 2026, software, hardware and services are expected to capture 89% of the digital economy's value pool while connectivity's share of the value pool is limited to the remaining 11%. Large multinationals, such as Google and Amazon, are able to leverage their large financial and human capital to deliver market leading products and solutions (e.g., autonomous vehicles, virtual reality) to dominate the markets they focus on.

¹⁵ World Intellectual Property Organization (WIPO). 2017. "Intangible Capital in Global Value Chains".

Exhibit 7: Average Annual Revenue of Canadian Telcos and Multinational Competitors (CA\$ Billions, 2016-2020)



Source: S&P Capital IQ

Technological disruption could further alter the competitive landscape of the digital economy for MNOs. Two examples of such disruption are low earth orbit (LEO) satellites and embedded SIM technology (eSIM).

- **LEO satellites** - Constellations of LEO satellites can provide broadband internet and connect personal and IoT devices. The satellites aim to provide near ubiquitous coverage and reach underserved areas, serving customers such as transportation companies and governments. The technology requires significant upfront investment and ongoing costs. Large companies such as SpaceX and Amazon, have already entered the satellite internet market, which is forecasted globally to grow to over US\$400 to US\$500+ billion by 2040.¹⁶
- **eSIM** - embedded SIM is a SIM card that cannot be removed from the device. With the eSIM, changing profiles on a device does not require the user to physically swap SIM cards. eSIM technology could be used by equipment manufacturers to disintermediate MNOs—meaning that equipment manufacturers such as Apple would own the customer relationship and dictate revenue splits.

The aforementioned large multinationals are in a strong position to gain from this disruption, should they choose to use the significant financial and human capital resources they have available.

¹⁶ Morgan Stanley. 2021. "A New Space Economy on the Edge of Liftoff"

3: Globally there is a trend of consolidation in the telecommunications industry

Globally, telcos have sought to use M&A to create value and address industry trends including slowed core revenue growth, increased competition and increased capital expenditure on next generation connectivity networks such as 5G. Notably, regulatory decisions announced in 2020 approving large-scale mergers in both the US and Europe demonstrate that regulators' attitudes are shifting towards incentivizing and supporting large scale telcos that are capable of funding the next generation connectivity networks required for the digital economy.

The global telecommunications industry has consolidated over the last decade

Telecommunications companies globally have faced slowed growth in core revenue areas over the last decade as subscriber penetration has peaked, connectivity has faced commoditization and multinationals such as Apple and Facebook have disrupted the market through over-the-top solutions (e.g., FaceTime, WhatsApp). As a result, the market capitalizations of telecommunications companies have underperformed compared to other industries. Global mobile telecom service providers' average EBITDA/EV multiple was flat at around 6-7x from 2015 to 2020. Over the same period, the average EBITDA/EV multiple for data centre and infrastructure providers increased from around 15x to 20x.¹⁷ Flat valuation multiples have seen value creation efforts focus on a mix of expense reduction efforts (efficiency measures, productivity improvements and digitization efforts) and M&A. Within M&A, the majority of value creation has been focused on freeing up capital to fund network upgrades and development through gaining scale synergies (consolidation).

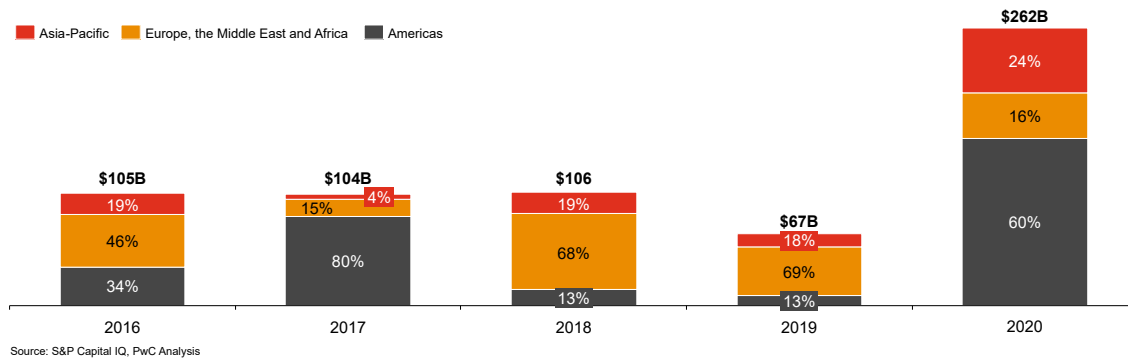
The impact of multinationals offering over the top solutions can also be observed in the consolidation of the media industry. Over the past 5-years, in response to pressure from OTT providers (e.g., Netflix) there have been three large transactions in the US between traditional media players. Disney acquired Fox for US\$71 billion, AT&T merged with Time Warner in a deal worth US\$81 billion (AT&T have since spun off Time Warner in a \$43 billion deal to Discover), and Viacom merged with CBS for US\$11.8 billion.¹⁸

M&A deal value in the telecom industry totalled CA\$645 billion from 2016 to 2020 (see Exhibit 8) with the majority of deals occurring in mature markets that have consolidated – for example, in the Americas which accounted for around 47% of cumulated global deal value from 2016 to 2020. 2020 saw a significant increase in M&A activity with \$261 billion worth of deals, representing about 7% of global M&A activity for the year, and a \$196 billion increase in the deal value of 2019. The large increase in 2020 was driven by the closing of the T-Mobile and Sprint merger in the US (see below).

¹⁷ PwC Analysis, data from S&P Capital IQ

¹⁸ PwC Analysis; Data from S&P Capital IQ

Exhibit 8: Total telecom deal value, by region, 2016 to 2020 (CAD Billions)



Regulatory decisions and major mergers demonstrate regulators' changing views

The approvals of three large mergers in the US, UK and Australia show that regulators will support industry consolidation if there are opportunities for synergies that provide for accelerated network deployment.

- 1. T-Mobile's acquisition of Sprint in the US** - T-Mobile and Sprint set out that the merged company would be able to leverage complementary spectrum and cell sites to unlock over US\$45 billion of synergies. These synergies would allow the merged company to invest nearly \$40 billion to deliver a nationwide 5G network and next-generation services. The combined network would be superior to each company's individual network and would create expanded capacity, lowering costs for American consumers. Ultimately, the Department of Justice and FCC approved the merger as the benefits to America outweighed the costs. As part of the approval, the Department of Justice required the newly merged entity to sell Boost Mobile, Virgin Mobile, Sprint's branded prepaid business and \$3.6 billion of 800 MHz spectrum to Dish. The FCC approved the merger on the condition that the merged entity deploy 5G to 97% of Americans within 3 years of the merger closing, with 90% of Americans having access to speeds of 100 Mbit/s or greater.
- 2. The merger of Virgin Media (Liberty Global) with O2 (Telefónica)** - The 50-50 joint venture brought together Virgin Media, one of the UK's largest broadband network providers, and O2, the UK's largest mobile platform to create a large fixed and mobile competitor. In investor presentations and submissions to Britain's Competition and Markets Authority (CMA), the 50-50 joint venture set out that by merging, they would realize the scale required to be innovation leaders in the "changing digital landscape" and would invest £10 billion in the UK over the next five years, enabling them to better support "the Government's digital and connectivity goals". The CMA approved the deal without remedies. Martin Coleman, CMA panel inquiry chair, stated: "We are reassured that competition amongst mobile communications providers will remain strong and it is therefore unlikely that the merger would lead to higher prices or lower quality services". Liberty Global CEO Mike Fries and Telefónica chief José María Álvarez-Pallete released a joint statement stating "We are now cleared to bring real choice where it hasn't existed before, while investing in fibre and 5G that the UK needs to thrive".

3. **The merger of TPG Telecom and Vodafone Australia** - The \$15 billion (AUD) merger of “equals” brought TPG Telecom (focused on the fixed market) and Vodafone Hutchison Australia (focused on the mobile market) together in 2020. Announced in 2018, the merger was initially rejected by the Australian Competition and Consumer Commission (ACCC) in 2019 on the grounds that it would harm customer affordability; however, TPG and Vodafone appealed the ACCC’s decision to the Federal Court. The Federal Court threw out the ACCC ruling finding that *“adding more mobile players to a market did not necessarily create more competition if those new players were not strong competitors with the incumbents”*. Vodafone Hutchison Australia chief executive Inaki Berroeta said the court decision was a good outcome stating *“We have ambitious 5G rollout plans and the more quickly the merger can proceed, the faster we can deliver better competitive outcomes for Australian consumers and businesses”*.

4: Canada needs to ensure its telecommunications industry can support the needs of the digital economy

As the importance of the digital economy grows, Canada needs MNOs with the scale capable of funding 5G networks with national coverage. The need for scale is accentuated by the relatively higher costs of 5G networks, the dispersed geography of Canada, the need for near-ubiquitous coverage in urban and rural areas, and the new competitive landscape of the digital economy.

The role of the telecommunications industry is evolving towards being a primary enabler of the digital economy and, with this context, Canada's regulatory approach also needs to evolve. While affordability should remain a key priority, regulators also need to consider the necessity of 5G for the economic development of Canada and the changing competitive landscape that includes large multinational service providers.

A healthy Canadian telecommunications industry is important for Canada's digital economy

Connectivity is an important enabler of the digital economy. To deliver 5G connectivity, Canada needs to maintain a healthy telecommunications industry that is capable of making the required investments to meet the connectivity needs of the economy and society.

Canada was a leader in the rollout of 4G, in part, due to the health of its telecommunications industry.¹⁹ Canadian MNOs were able to deliver high 4G network quality relative to peers by making significant capital investments, having, on average, the largest average ratio of capital expenditure to revenue among large MNOs operating in the G7, South Korea and Australia.²⁰ Important lessons from the rollout of 4G can be drawn for Canada today:

1. **Facilities-based competition was favourable to 4G rollouts as Canada, the US, the UK and Australia deployed 4G before global peer countries.** Conversely, countries that implemented service-based competition had slower rollouts of 4G networks. In the 5G era, Canada must continue to ensure that facilities-based competition is promoted to facilitate the early and broad deployment of 5G.
2. **Countries with decreases in Average Revenue per User (ARPU) prior to deployment of 4G saw slower rollouts that were correlated with long-lasting slow adoption of next generation networks.** Network operators in countries that saw decreases in ARPU, in part due to service-based competition, had less confidence in the business case for significant 4G investments. Delayed investment in 4G led to slower rollouts that resulted in slow adoption of 4G. The difference in adoption between Canada (and other countries that relied on facilities-based competition such as the US and Australia) and countries that relied on service-based competition remained years after rollouts began. This suggests that it is difficult and takes much longer to close the gap in adoption once a country falls behind in network deployment.

¹⁹ PwC. 2020. "Understanding the likely impacts of MVNOs in Canada, Part 2: Impact on Canada's Transition to 5G".

²⁰ PwC. 2020. "Understanding the likely impacts of MVNOs in Canada, Part 2: Impact on Canada's Transition to 5G".

Scale will also be a key enabler of Canadian MNOs' ability to deploy 5G networks at pace. Scale supports:

1. **The ability of MNOs to fund the increased cost of 5G:** Larger scale operators are better positioned to generate the cash flow and take on debt to build and deploy 5G networks. The cost of 5G is significantly higher than previous generations of connectivity due to increased capital costs (e.g., rollout of small cells, backhaul infrastructure) and higher ongoing operational costs (e.g., energy and maintenance requirements).
2. **The ability of the telco to fund and deliver 5G connectivity across Canada's dispersed geography:** Canada's dispersed geography, weather and challenging landscape are all contributing factors that make it challenging to roll out and maintain telecommunications networks. This is evidenced by the significantly higher ratio of capital expenditure to revenue for Canadian MNOs relative to their global peers.²¹
3. **The ability of MNOs to fund 5G deployment in an ecosystem where the largest participants are not the companies investing in the 5G network:** A greater share of value is shifting towards companies that use software, hardware and services to provide 5G-enabled solutions, but that do not contribute to the deployment of the networks. Connectivity's smaller share of value makes the business case for network investment more uncertain for Canadian telcos. Greater scale could enable Canadian MNOs to better compete with multinationals and capture a larger share of value in the digital economy, which in turn helps fund network investments.

Telecommunications policies should evolve with the role of industry

For previous generations of connectivity (3G, 4G), Canadian regulators prioritized the establishment of a competitive framework for affordable consumer outcomes, the enforcement of regulations to protect consumer interest and connectivity for all. In the 5G era, regulators need to consider a broader mandate that supports the needs of the digital economy (near-ubiquitous high-speed coverage, low-latency connectivity), supports a competitive framework for affordable consumer prices, enforces regulations to protect consumer interests and establishes network security rules and ways to enforce them (see Exhibit 9).

Canada's policy mix has historically focused on introducing more competition to the telecommunications industry. Notable policy examples include spectrum set asides, mandated wholesale MVNO access and mandated third party internet access (TPIA). Set aside policies that guarantee spectrum for smaller firms outside the main MNOs have at times been implemented during spectrum auctions with the aim to increase the level of competition throughout the country. Industry Canada has also previously instituted caps²² on the amount of spectrum the largest MNOs can bid on to ensure smaller companies can obtain spectrum licences. In the case of MVNO access, the CRTC has mandated network operators to provide network access to regional providers that have invested in network infrastructure and have spectrum licences.²³ Telecommunications companies are also mandated to provide TPIA through a wholesale model to companies that do not own infrastructure.²⁴

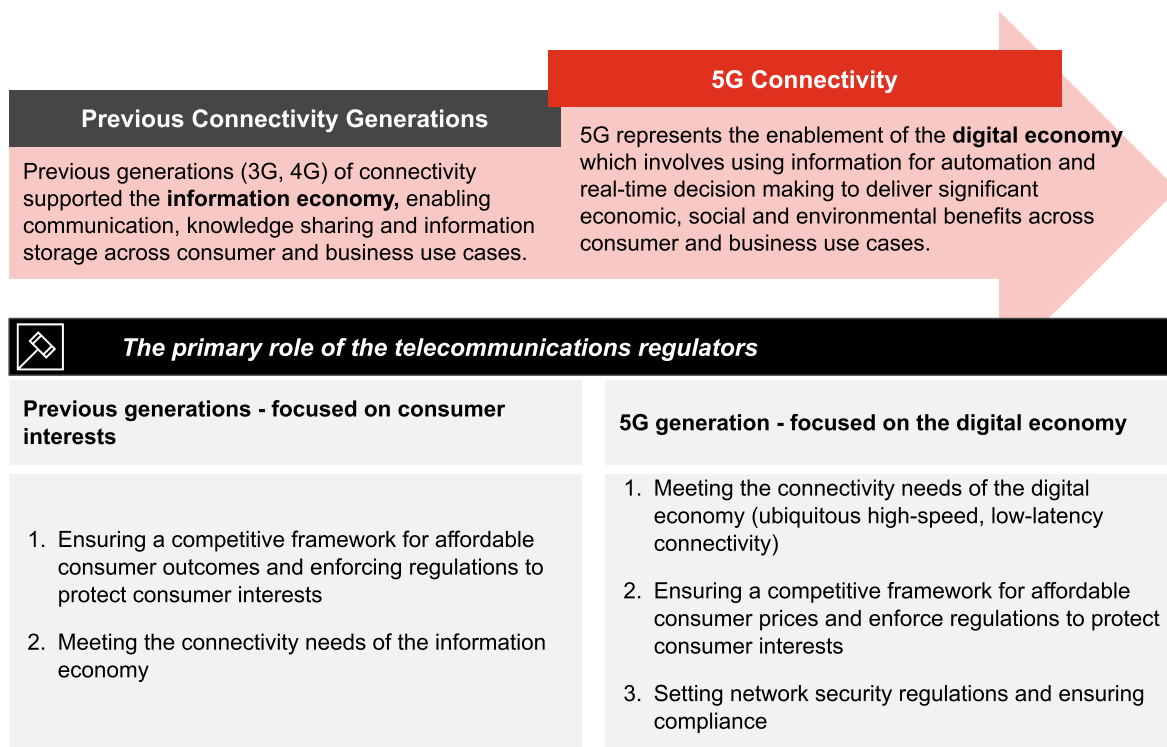
21 PwC. 2020. "The importance of a healthy telecommunications industry to Canada's high tech success"

22 Pellegrini, C. 2015. "Rogers Communications Inc, BCE Inc nearly shut out of wireless spectrum auction because of cap rules". *Financial Post*.

23 Evans, P. 2021. "CRTC to allow small wireless carriers to piggyback on Big 3 networks". *CBC*.

24 Blackwell, S. 2018. "Report on Regulation of Fixed Wireline Wholesale Access to High-Speed Networks in Canada and Other Countries". *Giganomics Consulting Inc*.

Exhibit 9: Canada's telecommunications regulatory approach needs to evolve with the role of the industry



Source: PwC Analysis

As a result of competitive pressures and this regulatory focus, Canadian prices for mobile services have trended downwards since 2016. Data from the CRTC on the average lowest reported price shows mobile price plans in 2019 were 37% lower than 2016 levels for the most expensive plan category (5 GB, unlimited minutes, unlimited SMS). Over the same time period, the smallest relative decrease among the other plans was 35% for the "2 GB" plan.²⁵ More recently, cellular CPI in August 2021 showed that, on a year-over-year basis, prices for cellular services declined by 18.9%.²⁶ While prices have come down, data consumption has increased, resulting in a net reduction in spending per GB of data (compounded decrease of 22.5% between 2015 and 2019).²⁷

The price decrease and improved affordability point to a healthy level of competition among telecommunications companies in the mobile services industry. This is evidenced by the following recent industry trends:

1. *Flanker/challenger brands are gaining market share:* Flanker brands of the major MNOs in Canada, which typically offer plans with lower prices, have increased their penetration rates from 20% to 26% from 2015 to 2019.²⁸
2. *The introduction of unlimited plans by MNOs to gain market share:* Canada's other large MNOs followed Rogers in providing unlimited data plans, which pushed Average Revenue per User (ARPU) down as they competed for market share.

²⁵ CRTC.2020. Datasets from "Communications Monitoring Report".

²⁶ Statistics Canada Consumer Price Index, August 2021

²⁷ PwC Analysis, data from CRTC Communications Monitoring Report 2020

²⁸ CRTC. 2020. "Communications Monitoring Report".

3. *The race to deploy market leading 5G networks:* MNOs are aggressively competing to provide a 5G network that is market leading in order to capture business and customers, and to be the connectivity partner of choice for leading players in the new digital economy. This was also seen in Canada with fixed broadband fibre competition.

In light of the growing digital economy, telecommunications regulators in Canada need to consider the broader impact of connectivity. While affordability should remain a primary focus, Canadian regulation and policy priorities also need to consider how to best incentivize 5G deployment to maintain Canada's global competitiveness and ensure that Canadian businesses and consumers have access to the same 5G-enabled technologies as global peers. Regulators and policy makers could consider the following four levers:

1. *Shifting the regulatory and policy lens to consider the broader digital economy*
 - A view on the broader competitive landscape of the digital economy should be considered as Canadian MNOs are increasingly competing with large multinationals that are able to use their large pools of financial capital and human resources to aggressively compete but that do not invest in the national network infrastructure that enables the delivery of their solutions. Regulators should also consider connectivity's growing importance, notably 5G for the digital economy. Consumer affordability should be balanced with the need for a healthy telecommunications industry that can deploy the required 5G networks.
2. *Ensuring Canada has a healthy telecommunications industry, with well-capitalized MNOs that are able to make the required investments in 5G networks*
 - 5G networks are significantly more expensive to build than previous generations of connectivity, with the potential total cost of ownership being up to 71% more than 4G.²⁹ Regulators should promote competition that ensures that MNOs are incentivized to maintain and expand the telecommunications networks in Canada. Regulations should seek to reduce undue uncertainty for the deployment of 5G and create an economic environment where 5G networks can be deployed at pace and scale.
3. *Addressing regulatory barriers that negatively impact 5G deployment*
 - Barriers such as slow spectrum allocations and complex regulations for access to passive infrastructure are slowing Canada's 5G deployment. For example, the current regulatory process requires MNOs to negotiate with individual municipal governments, each with their own rules and regulations, to attach small cells to existing structures such as lamp posts. To complement other economic development efforts in Canada, a regulatory regime that accelerates 5G infrastructure deployments would be beneficial. For example, the Federal Communications Commission (FCC) in the US has instituted caps on review periods by states and municipalities for small cell installations.³⁰
4. *Setting a clear telecommunications security policy*
 - Canada should seek to provide a clear and predictable guideline on security practices related to 5G networks to create a stable regulatory regime. In peer countries, network security has been an important consideration, demonstrating recognition of the importance of networks and the sensitive information that they carry.

Combined, these four regulatory levers will support a healthy telecommunications industry that enables MNOs to meet the financial challenges of deploying 5G networks while limiting the regulatory barriers currently associated with building telecommunications infrastructure. Future regulatory frameworks that incorporate these levers will be key to unlocking the forecasted economic, environmental and societal benefits of 5G.

²⁹ GSMA. 2019. "5G-era Mobile Network Cost Evolution".

³⁰ FCC. 2018. "FCC 18-133: Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment"



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