The Socio-Economic Impacts of 5G

Prepared for TELUS Communications Inc.

Executive Summary

Deetken Insight

Deetken Insight was commissioned by TELUS to complete a comprehensive review of published research about 5G and its potential socio-economic impacts, with a particular focus on Canada. Access the full report including a bibliography here: https://deetken.com/socio-economic-impacts-of-5g/. We provide no opinion, attestation, or other form of assurance with respect to the completeness, accuracy, fair presentation, and findings from research of others that are presented in the report.

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Executive Summary

5G provides the network foundation for the next generation of digital technologies and services that will advance Canada's standard of living and help address key challenges including climate change.

Deetken Insight was commissioned by TELUS to complete a comprehensive review of published research about 5G and its potential socio-economic impacts, with a particular focus on Canada. The research highlights a compelling value case for a robust nationwide 5G network. Because of its 10-fold performance improvements over 4G, 5G will drive economic growth across sectors and improve quality of life across communities. Given the right conditions, 5G and 5G-enabled technologies will:

- Increase economic growth across **all sectors**, delivering an estimated 16% of GDP growth by 2036 while supporting growth in high-paying digital economy jobs
- Reduce **greenhouse gas emissions** up to 20% and deliver other environmental benefits such as more sustainable agricultural practices
- Increase the productive capacity of **rural communities** through the deployment of 5G fixed wireless access (FWA) where last-mile fibre is not feasible
- Improve **healthcare** system performance, including enabling the expansion of rural and virtual care models
- Deliver new interactive capabilities built on augmented and virtual reality and artificial intelligence that enhance the **quality of life** for older Canadians and those living with disabilities
- Increase crop yields and optimize water, pesticide, herbicide, and fertilizer use for the **agriculture** sector

The report presents an exhaustive overview of emerging use cases and the potential economic and socio-economic benefits of 5G in eleven sectors. It also describes what steps the public sector, mobile network operators, and other industry stakeholders should take to accelerate the successful deployment and adoption of 5G. Chief among these steps are:

- The **speedy release of spectrum** that enable the majority of high value use cases that bring benefits to all sectors and to rural and other underserved communities; and
- The development of a **digital infrastructure strategy and three-year roadmap**, led by the federal government, that lays a path toward achieving success targets with respect to 5G infrastructure deployment and adoption across urban and rural communities.

An ambitious yet coordinated approach to the rollout of 5G is critical to ensuring the benefits are achieved while also ensuring Canada's 5G networks and the applications that run on them are reliable and resilient. And yet Canada, despite the benefits of 5G, is behind its global peers in its deployment and adoption to date. Urgent action is required to get Canada back on track and demonstrate global leadership in 5G. Digital innovation, enabled by 5G, should be a **cornerstone of Canada's prosperity and sustainability agendas**.

Key Takeaways

5G is the fifth-generation wireless mobile network technology that delivers substantial performance improvements over the current 4G technology.

Launched in early-adopter markets in 2018, 5G technology will provide 10 times or greater performance in data speed, latency, traffic capacity and other characteristics compared to 4G. Because of these performance advantages, 5G widens the scope of what is possible in terms of new digital services such as artificial intelligence and augmented and virtual reality. It also provides the capability to massively scale connectivity between a multitude of devices and sensors, enabling the Internet of Things (IoT) and related applications such as self-driving vehicles.

The capabilities of 5G will unlock fundamentally new sources of value across *all* sectors of the economy.

The improvements of 5G over 4G provide for value-generating use cases across sectors. Whereas 4G enhanced the consumer experience and brought benefits mostly to industries that served applications to smartphone devices (such as online shopping, online advertising, and ride-hailing services), 5G promises benefits to health, agriculture, energy, manufacturing, government, and other sectors. It enables technologies such as autonomous vehicles, remote-operated robots, virtual and augmented reality, artificial intelligence, and machine learning to be deployed safely and with precision in urban and remote locations.

5G could deliver an estimated 16% of Canada's Gross Domestic Product (GDP) growth by 2036.

5G and the innovation it enables will create economic growth through increases in productivity, the efficiency with which inputs are used to create output. Productivity matters because it is by far the most significant driver of Canada's standard of living as measured by growth in GDP per capita, which itself is strongly correlated over the long run with wage growth. In a 2021 forecast, the OECD places Canada last among advanced economies in GDP per capita growth between 2020 and 2030. Finding ways to increase productivity, including the deployment and adoption of 5G, is critical to correcting this course. 5G drives productivity growth by making it easier and cheaper to use technologies that run on mobile and fixed networks. For example, 5G is a necessary factor to make it economical to build self-driving vehicle systems or deploy remote-operated robots for mineral extraction. Based on published estimates and independent modelling by Deetken, 5G will enable real GDP growth in Canada of $30 billion to $50 billion by 2030 and $100 billion to $120 billion by 2036. The midpoints of these ranges represent roughly 14% of economic growth by 2030 and 16% of growth by 2036.

5G also helps enable high-quality job growth.

According to the Information and Communications Technology Council (ICTC), employment growth in the digital economy will continue to outpace employment growth in the general economy and will account for roughly 11% of total employment in Canada by 2025. Average earnings in the wireless sector are almost 25% higher than in the wider business sector.

5G will help reduce greenhouse gas emissions by up to 20%.

Many 5G use cases have commercial viability because they reduce energy requirements, such as smart electricity grids, smart transportation systems to optimize traffic patterns and reduce congestion, smart buildings to optimize energy use, and enhanced capabilities for remote work and machine operation. A corollary benefit of the reduction in energy usage is a decline in GHG emissions to the extent these energy requirements are currently met by burning fossil fuels. Put simply, without universal connectivity to high-quality networks, Canada will be unable to meet its climate targets.

5G will deliver health and other social benefits.

Social benefits of 5G include more effective and efficient healthcare service delivery and higher agricultural productivity to feed a growing global population. 5G also creates opportunities for new software applications to enhance the quality of life for traditionally disadvantaged populations, including older citizens and those living with disabilities.

5G will help reduce digital divides impacting rural and other underserved communities.

5G-enabled fixed wireless access (FWA) will allow network operators to deliver wireless ultra-high-speed broadband internet to homes and businesses in rural, remote, and Indigenous regions where last-mile fibre is unfeasible. This infrastructure will help ensure the same level of performance and access to leading digital services is available to all communities. 5G FWA eliminates the need for costly deployment of deep-fiber fixed access infrastructure while also offering peak rates that few fixed technologies can match. By delivering broadband over newly available 5G networks, telecommunications operators can help bridge the digital divide and offer connectivity to a broader population and reach underserved areas.

Canada is lagging its peers in the deployment of 5G.

Despite its market-leading performance in 4G and the transformational benefits of 5G, Canada is lagging its peers in the deployment of 5G. Compared to the U.S., Germany, Japan, Italy, Australia, and South Korea, Canada's 5G spectrum allocations for mid- and high-band frequencies are one to five years behind. 5G deployment in Canada has been limited to low-band networks, largely due to low-band 5G networks being cheaper to deploy on a non-standalone basis alongside existing 4G networks, and because, until recently, only low-band 5G spectrum has been available for use.

5G adoption and harnessing the value of 5G depends on a host of factors, such as innovation partnerships to test new technologies and a robust workforce with relevant skills.

Most of the use cases reviewed for this report are in their infancy. There are complementary technologies such as edge computing that will need to be integrated into the 5G ecosystem. Partnerships between government, regulatory bodies, mobile network operators, other industry sectors, and research institutions will be critical to build and test new ideas using 5G as the platform. Mechanisms to ensure network resiliency and access to critical services in case of outages are required to build business and consumer confidence. A reskilling of the workforce for a digital economy is essential to success. Organizations will need to experiment and adjust their

business and operating models to leverage new technologies. These and other factors are necessary to achieve the value proposition of 5G. Deployment of the underlying network infrastructure presents a separate set of challenges, including the need for mobile network operators to make the necessary capital investments. Estimates suggest the total cost of ownership for Canadian 5G networks could be over 50% more expensive than for 4G networks.

To ensure that Canadians realize the full benefits of 5G, Canada urgently needs a national digital infrastructure strategy. The federal government in collaboration with key 5G ecosystem stakeholders and other levels of government, should develop a comprehensive and integrated three-year digital roadmap to enable the 5G network. This roadmap should **address seven key outcomes for 5G deployment and adoption**:

1. **Timely access to 5G relevant spectrum** across all bands with **expedited clearing/repurposing of bands** that are currently in use by other services
2. Reinforcement of **resilient network infrastructure** with appropriate coverage, bandwidth, latency and reliability, supported by government investments to achieve key objectives such as equitable access and performance across urban, rural and remote communities
3. Availability of **connected devices, software and applications** to take full advantage of the capabilities of 5G that are compatible with local spectrum allocation and in line with harmonized global standards.
4. Regulatory flexibility to support network operators' development of **tiered services** with differentiated pricing and service levels that are targeted to different market segments and key sectors through partnership models among 5G ecosystem participants
5. Creation of **unified national standards** for spectrum, network hardware, endpoint devices, security, privacy, software and applications that are strongly interlocked with global standards to support the timely and responsible deployment and adoption of 5G
6. Intensification of current **network security and data privacy** policies to address new vulnerabilities introduced with 5G (e.g., unintended leaks of personal or security data, authentication attacks, location discovery, etc.)
7. Definition and implementation of a **performance management framework,** including operational and sector specific metrics, to track the performance and socio-economic contributions of 5G with the leadership of federal agencies including the Canadian Radio-television and Telecommunications Commission (CRTC) and Statistics Canada who can design, coordinate and monitor progress.

This report provides detailed actions that key stakeholders such as government and mobile network operators should undertake to achieve these outcomes. Similar coordinated approaches as proposed in this report are currently in place in jurisdictions such as the United Kingdom, Finland, and China. The report also outlines a set of metrics to form the basis of a performance measurement framework per outcome #7 above.

Moving forward with this strategy will demonstrate Canada's continued global leadership and competitiveness in telecommunications services.

Canada has proved itself a global leader in 4G performance and nationwide availability. The stakes are high for Canada to achieve the same level of excellence in the future with next-generation 5G technology. This technology is at the heart of the next wave of digitalization that will drive much-needed productivity gains while also reducing GHG emissions and delivering other socio-economic benefits. The scale of transformation is significant. For example, Canadian wireless network operators will need to spend approximately $26 billion to deploy 5G infrastructure.

Conclusion

It is crucial that government and stakeholders understand the importance of 5G in enabling the next wave of digital innovation. A coordinated approach to develop a three-year roadmap with key success measures is a necessary next step for Canada to catch up to its peers and achieve the considerable economic, environmental, and social benefits made possible by 5G networks.