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# Connecting Canadians through resilient networks

The impact of the telecom sector  
in 2022 and beyond

November 2023



**pwc**

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# Executive summary

The telecommunications (telecom) sector is important within the Canadian economy, contributing almost \$77B in direct GDP and 724,000 jobs in 2022.<sup>1</sup> As the broader Canadian economy continues to digitize, the sector's delivery of enhanced connectivity is becoming increasingly important and has the potential to contribute an additional \$112B to Canada's overall GDP by 2035.<sup>2</sup>

Canadians are becoming increasingly reliant on connectivity to conduct business, learn, play and stay connected, with the average annual download/upload traffic per mobile data subscriber per month increasing by 4.6 gigabits (GB) since 2016.<sup>3,4</sup> Since 2019, the average monthly download traffic per Internet access subscriber has increased by 189.6 GB.<sup>5</sup> For Canadian enterprises, the need for high-quality networks is becoming increasingly important, as 76% of CEOs say their number one priority is to automate systems and processes,<sup>6</sup> leveraging a variety of Internet-based use cases. Consumers' and businesses' expectations for data and quality come as cellular and Internet access service prices are declining. Notably, between September 2022 and September 2023, cellular and Internet access service prices declined by 17.2% and 7.8%, respectively, while over the same period, CPI of all items increased by 3.8%.<sup>7</sup>

A growing reliance on connectivity is increasing Canadians' expectations of telecom services. To meet these expectations, the telecom sector is continuing to invest in expanding access to high-quality networks, with 99.7% of Canadians having access to mobile network coverage where they live or conduct business in 2021, and 93.5% of households having access to 50/10 Mbps high-speed broadband Internet in 2022.<sup>8,9,10</sup>

Over the past five years, the Canadian telecom sector has invested an annual average of \$12.1B of capital to expand and enhance network infrastructure,<sup>11,12</sup> representing approximately 18.6% of average revenue, which is higher than the 14.2% average across peer telecoms in the USA, Japan, Australia, and Europe.<sup>13,14</sup> Through this investment, the telecom sector has advanced coverage of 5G connectivity across Canada, reaching 87.8% of the population in 2021.<sup>15</sup> Delivering enhanced connectivity requires overcoming a number of Canadian-specific factors of production, such as population dispersion, cold weather, economies of scale and high spectrum costs. In addition, recent interest rate rises have made debt financing more expensive, increasing the cost of capital for the telecom sector, adding another challenge to funding critical network investment.

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1 PwC Analysis, Statistics Canada, S&P Capital IQ.

2 PwC Analysis, IHS Markit, Statistics Canada.

3 CRTC *Current Trends—Mobile Wireless*.

4 According to the CRTC, mobile data traffic refers to data downloaded and uploaded on a monthly basis per data subscriber (i.e. from smartphones). Data from mobile broadband devices and machine-to-machine connections are excluded. Prior to 2021, data subscribers included mobile phone and mobile broadband subscribers, and machine-to-machine connections.

5 CRTC *Current Trends—High Speed Broadband*.

6 PwC's *26th Annual Global CEO Survey, 2023*, "Winning today's race while running tomorrow's".

7 Statistics Canada, 2023, *Consumer Price Index—average annual, not seasonally adjusted*.

8 Government of Canada—*High Speed Internet Access Dashboard*.

9 CRTC *Current Trends—Mobile Wireless*.

10 Some Canadian provinces expect to reach ubiquitous connectivity earlier than 2030. For example, Quebec reached 100% high-speed broadband Internet availability in 2022, Ontario and PEI intend to reach 100% by 2025, Alberta and British Columbia by 2027, and New Brunswick and Newfoundland and Labrador by 2030.

11 The largest six telecoms in Canada were sampled and include Bell, Rogers, SaskTel, Shaw Communications, TELUS and Vidéotron.

12 S&P Capital IQ.

13 S&P Capital IQ.

14 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

15 CRTC *Current Trends—Mobile Wireless*.

# Executive summary

The telecom sector invests in network resiliency, with more recent investments focused on addressing the impact of severe weather events on the network. According to the United Nations (UN) and the Intergovernmental Panel on Climate Change (IPCC), emissions and greenhouse gasses (GHGs) have caused global surface temperatures to rise, resulting in frequent severe weather events.<sup>16</sup> Canada's climate is considered to be warming twice as fast as global averages.<sup>17</sup> Severe weather events typically result in infrastructure damage. Notably, catastrophic insured losses resulting from severe weather events in Canada increased by 17.5% per annum between 2006 and 2021.<sup>18,19</sup> For the telecom sector, severe weather events have already cost millions of dollars in network damages and ongoing investments are being made to prepare for the future.

The telecom sector will continue to make important contributions to the prosperity of Canada through contributions to GDP, jobs and investments into critical network infrastructure. The importance of these investments, and a healthy telecom sector that is capable of making them, is further highlighted by the need for networks that can withstand severe weather events and meet network reliability and access challenges.

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<sup>16</sup> United Nations–Climate Change 2023 Synthesis Report–Sixth Assessment Report.  
<sup>17</sup> Government of Canada, 2023, *Canada's climate is warming twice as fast as global averages*.  
<sup>18</sup> Catastrophic insured losses are defined as losses that total at least \$30M, previously defined as \$25M.  
<sup>19</sup> IBC, *Facts of the Property and Casualty Insurance Inquiry in Canada, 2022*.

# Introduction

This report was prepared by PwC and commissioned by the Canadian Telecommunications Association (CTA) as part of an annual series examining the economic impact of the telecom sector. The report outlines the economic impact of the telecom sector on the Canadian economy in 2022 and provides a view of the network demands and costs that the sector is experiencing, along with investments in network resiliency.

Global inflationary pressures rose in 2022.<sup>20</sup> Since 2020, Canadian businesses have been experiencing supply chain challenges, which were worsened by the conflict in Ukraine in 2022.<sup>21</sup> Ongoing supply chain challenges added to the rise in goods and service prices when the Canadian economy reopened with heightened consumer demand in the spring of 2022.<sup>22</sup> To manage domestic inflation, the Bank of Canada increased interest rates ten times from 0.25% to 5.0%, between March 2022 and July 2023, while the Consumer Price Index (CPI) rose 3.8% year over year to September 2023.<sup>23,24</sup> Amidst this high inflation in Canada, cellular and Internet access service prices declined by 17.2% and 7.8% between September 2022 and September 2023, respectively, highlighting that the telecom sector is providing deflationary price pressure and increased value to Canadian consumers.<sup>25</sup>

Beyond providing cellular and Internet access services, the telecom sector is a key enabler of the Canadian economy. In 2022, the telecom sector contributed nearly \$77B in direct GDP and supported 724,000 jobs.<sup>26</sup> Canadian households, businesses and governments are increasingly reliant on connectivity and have higher needs and expectations for network quality, availability and resiliency. As the economy continues to digitize, the sector's delivery of enhanced connectivity becomes increasingly important, with the potential to contribute an additional \$112B to Canada's GDP by 2035.<sup>27</sup> To meet network needs and expectations, the telecom sector maintains ongoing network investment costs that are greater than in the USA, Japan, Australia, and Europe.<sup>28,29</sup> Higher network investment is attributable to Canadian-specific factors of production.

20 Bank of Canada, 2022, *What's happening to inflation and why it matters*.

21 Statistics Canada, 2023, *Analysis on supply chain challenges and conditions in Canada, first quarter of 2023*.

22 Bank of Canada, 2022, *What's happening to inflation and why it matters*.

23 Bank of Canada, 2023, *Bank of Canada raises policy rate 25 basis points, continues quantitative tightening*.

24 Statistics Canada, 2023, *Consumer Price Index, average annual, not seasonally adjusted*.

25 Statistics Canada, 2023, *Consumer Price Index, average annual, not seasonally adjusted*.

26 PwC Analysis, Statistics Canada, S&P Capital IQ.

27 PwC Analysis, IHS Markit, Statistics Canada.

28 S&P Capital IQ.

29 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

# 1. The telecom sector is an important contributor to the Canadian economy

The telecom sector is an important contributor to Canadian GDP and jobs, contributing nearly \$77B in direct GDP and supporting 724,000 jobs across industries in 2022.<sup>30</sup> Beyond direct economic contributions, the telecom sector made \$323M in charitable contributions and paid \$2.7B in corporate income taxes.<sup>31,32</sup> Furthermore, expansion of the digital economy through adoption of use cases supported by the deployment of enhanced connectivity has the potential to contribute an incremental \$112B to Canada's GDP by 2035.<sup>33</sup>

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30 PwC Analysis, Statistics Canada, S&P Capital IQ.

31 The largest six telecoms in Canada were sampled, and include Bell, Rogers, SaskTel, Shaw Communications, TELUS and Vidéotron.

32 S&P Capital IQ, Publicly available Annual Reports.

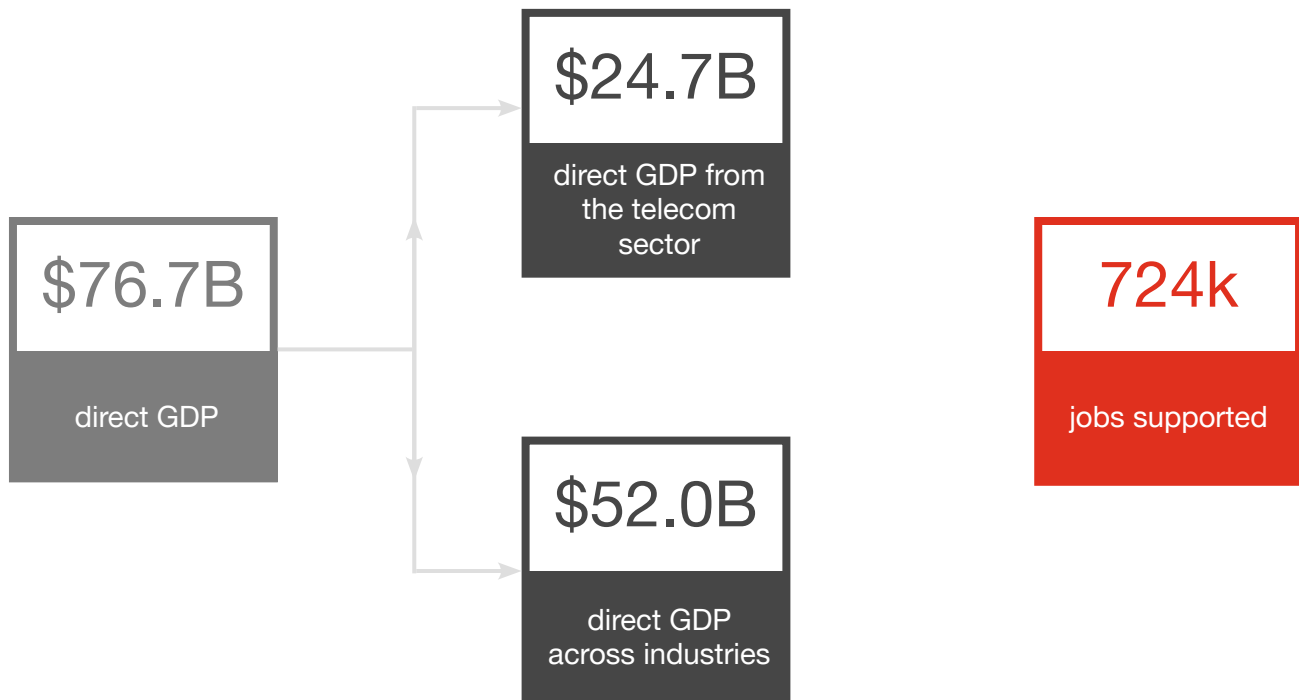
33 PwC Analysis, IHS Markit, Statistics Canada.

## 1. The telecom sector is an important contributor to the Canadian economy

### The telecom sector contributes to Canadian GDP, jobs, corporate taxes and delivers a range of community initiatives

In 2022, the estimated direct GDP contribution and jobs supported by the telecom sector through increased connectivity across other industries was up to \$76.7B and 724,000 jobs, respectively (Exhibit 1).<sup>34</sup> Direct GDP contribution includes \$24.7B from the telecom sector's value chain<sup>35</sup> and up to \$52.0B in direct impact due to the increase of sales and output from other industries through the addition of incremental wireless and wireline connections.<sup>36,37</sup> Further, the telecom sector directly provided over 113,000 jobs in 2022,<sup>38</sup> spending over \$12.3B<sup>39</sup> in salaries and benefits, most of which was reinvested by employees back into the Canadian economy.<sup>40</sup>

**Exhibit 1: Telecom sector's estimated contribution to the Canadian economy in 2022, with all values related to direct effects**



Sources: PwC Analysis, Statistics Canada, S&P Capital IQ.

<sup>34</sup> PwC Analysis, Statistics Canada, S&P Capital IQ.

<sup>35</sup> The term "value chain" refers to businesses activities and processes that are involved in creating a product or providing a service.

<sup>36</sup> PwC Analysis, Statistics Canada, S&P Capital IQ.

<sup>37</sup> The value chain for the telecommunications sector includes the communication service providers (CSPs) themselves (driving direct impact), the suppliers of CSPs (driving indirect economic impact) and the labour employed in the supply chain (driving induced economic impact).

<sup>38</sup> Employees from TELUS' subsidiaries are not included in headcount calculation.

<sup>39</sup> Salary calculation includes TELUS subsidiaries.

<sup>40</sup> PwC Analysis, Publicly available Annual Reports and Corporate Responsibility Reports.

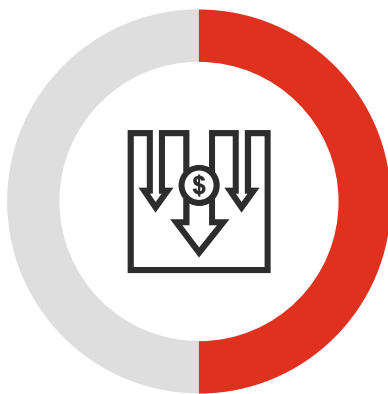
## 1. The telecom sector is an important contributor to the Canadian economy

The full economic impact of the telecom sector extends beyond the direct contribution of the value chain and includes the indirect contributions from the immediate supply chain and induced contribution from employee spending (Exhibit 2). In 2022, the Canadian telecom sector's direct economic impact of its value chain was \$24.7B to GDP and 123,000 jobs.<sup>41</sup> The direct economic contribution resulted in increased business-to-business activity, generating indirect contributions of \$13.3B towards GDP and supporting an additional 137,000 jobs.<sup>42</sup> The combination of direct and indirect effects resulted in increased consumer spending and household income, which created induced contributions of \$11.4B towards GDP and 103,000 jobs.<sup>43</sup>

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### Exhibit 2: Canadian telecom sector's direct, indirect and induced contribution to Canadian GDP (CA\$B, 2022)

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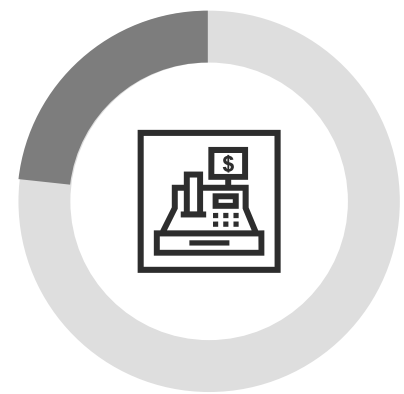
Direct

**\$24.7B**



Indirect

**\$13.3B**



Induced

**\$11.4B**

Sources: PwC Analysis, Statistics Canada, S&P Capital IQ.

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<sup>41</sup> PwC Analysis, Statistics Canada, S&P Capital IQ.

<sup>42</sup> PwC Analysis, Statistics Canada, S&P Capital IQ.

<sup>43</sup> PwC Analysis, Statistics Canada, S&P Capital IQ.



## 1. The telecom sector is an important contributor to the Canadian economy

In addition to the direct benefits provided to Canada's economy, the telecom sector paid approximately \$2.7B in corporate income taxes<sup>44,45</sup> and made approximately \$323M of charitable contributions in 2022.<sup>46,47</sup> A range of initiatives were supported by charitable investments, including:

- **Bell** Let's Talk Diversity Fund has raised \$4.5M since 2020 to support culturally informed mental health services.<sup>48</sup> In 2022, Bell donated \$8.2M in mental health funding through Bell Let's Talk day and pledged an additional \$10M in funding by 2025.<sup>49</sup>
- **Québecor (Vidéotron)** donated \$40M along with the Foundation Chopin Péladeau to Université de Montréal to support young Quebec entrepreneurs, and donated \$1M toward HEC Montréal to support Quebec start-ups with digital strategies.<sup>50</sup>
- **Rogers** contributed \$76M towards 850 charities, 350 Ted Rogers scholarships, 50K Ted Rogers Community Grants, and text-to-donate campaigns.<sup>51</sup>
- **SaskTel** contributed close to \$3M towards non-profit and charitable organizations, community associations, events and other partnerships across 214 communities in Saskatchewan.<sup>52</sup>
- **Shaw** raised \$17.5M for over 250 Alberta youth charities in its Shaw Charity Classic PGA Tour.<sup>53</sup>

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44 The largest six telecoms in Canada were sampled, and include Bell, Rogers, SaskTel, Shaw Communications, TELUS, and Vidéotron.

45 S&P Capital IQ, Publicly available Annual Reports.

46 Publicly available Annual Reports and Corporate Responsibility Reports.

47 The largest six telecoms in Canada were sampled, and include Bell, Rogers, SaskTel, Shaw Communications, TELUS, and Vidéotron.

48 BCE Inc., Bell Let's Talk, 2022.

49 BCE Inc., Annual Financial Report, 2022.

50 Vidéotron's Financial Documentation, 2022.

51 Rogers' Annual Report, 2022.

52 SaskTel, SaskTel Cares, 2022.

53 Rogers, ESG Impact Reports, 2023.

## 1. The telecom sector is an important contributor to the Canadian economy

### The telecom sector's investments into enhanced connectivity expands the digital economy, enabling economic growth

Since first being introduced in 2021, the telecom sector has advanced coverage of 5G connectivity across Canada to reach 87.8% of the Canadian population.<sup>54</sup> Widespread access to 5G, powered by the telecom sector, will continue to enable the digital economy, underpinning an ecosystem of use cases that are delivered across a technology stack of hardware, software and service, all of which rely on high-quality and reliable connectivity. Expansion of the digital economy through the adoption of use cases supported by the deployment of enhanced connectivity (i.e. 5G) has the potential to contribute an incremental \$112B to Canada's GDP by 2035.<sup>55</sup> All major industries are expected to benefit, as the enhanced connectivity provided by the telecom sector enables faster connections, increased capacity, improved reliability and enhanced security. Notable examples include the transportation and warehousing, manufacturing, mining, oil and gas, and finance and insurance sectors (Exhibit 3).<sup>56</sup>

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54 CRTC *Current Trends—Mobile Wireless*.

55 PwC Analysis, IHS Markit, Statistics Canada.

56 PwC Analysis, IHS Markit, Statistics Canada.



## 1. The telecom sector is an important contributor to the Canadian economy

### Exhibit 3: Examples of the benefits derived from enhanced connectivity across sampled sectors



#### Transportation and warehousing

**Freight monitoring** allows for improved customer satisfaction and enhanced visibility to supply chains through the remote-monitoring of conditions, such as temperature, from centralized control centres.

#### Manufacturing



**Connected worker smart devices** improve communication between workers and sensors to improve workers' safety.

**Predictive maintenance analysis** enables operators to use real-time monitoring for the detection of early maintenance.



#### Mining, quarrying, and oil and gas

**Drones and remote operated vehicles (ROVs)** are used to conduct autonomous maintenance and reduce operational downtime.

**Digital twins** allow site operators to test and deploy assets in a computerized model of sites, to ensure safety and productivity.

#### Finance and insurance



**Smart banking** is enabled by 5G and benefits can include AI-powered cameras and smart terminal machines to improve customer interactions and manage costs.

For the deployment of enhanced connectivity, including 5G, to contribute an incremental \$112B to Canada's GDP by 2035,<sup>57</sup> a healthy telecommunications industry in Canada, where operators can generate free cash flow and take on debt required to fund critical network investment, is needed.

57 PwC Analysis, IHS Markit, Statistics Canada.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

Canadian businesses and consumers are increasingly reliant on connectivity to support a range of activities. As reliance increases, expectations for the delivery of high-quality connectivity also increases. To meet growing connectivity demands, the telecom sector must continue to invest in its networks, which are important to support Canadian innovation and global competitiveness.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

### The telecom sector invests in expanding and enhancing network coverage across Canada

#### Closing the rural/urban digital divide

Connectivity is increasingly central to daily life; it enables business activity and allows for Canadians to work, study, consume content and stay in touch with family and friends. In 2022, the largest six telecoms in Canada invested \$13.3B in capital expenditures to fund the expansion and enhancement of broadband Internet and wireless connectivity across the country.<sup>58,59</sup> As a result of private and public investments, high-speed 50/10 Mbps unlimited broadband Internet coverage is available to 93.5% of Canadian households and mobile wireless coverage reaches 99.7% of the Canadian population's homes and businesses.<sup>60,61</sup> To further increase coverage, investment by the telecom sector, as well as public and private funding approaches to reach the hardest-to-serve communities, are required.

Across rural communities, government and telecom sector investments have enabled 50/10 Mbps unlimited broadband Internet access to increase from 37.2% in 2017 to 62.0% in 2021, closing the rural/urban digital divide.<sup>62</sup> Further increases are anticipated with a range of new projects underway, or in the planning stages, to provide for increased rural connectivity.<sup>63</sup> In particular, the Canadian telecom sector has made investments into expanding and enhancing connectivity within First Nations reserve areas and Indigenous communities (see In focus below). These investments enable communities and businesses to participate in the digital economy and provide access to important online services such as healthcare and education.

The Canadian Radio-television and Telecommunications Commission (CRTC) estimates that, based on current levels of investment from the private and public sector, the telecom sector is on track to meet the CRTC's target of 98% 50/10 Mbps unlimited broadband Internet availability in Canada by 2026 and 100% by 2030,<sup>64,65</sup> along with ubiquitous mobile coverage across homes, businesses and major transportation roads by 2026.<sup>66</sup>

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58 S&P Capital IQ.

59 The largest six telecoms in Canada were sampled, and include Bell, Rogers, SaskTel, Shaw Communications, TELUS, and Vidéotron.

60 Government of Canada—*High Speed Internet Access Dashboard*.

61 CRTC *Current Trends—Mobile Wireless*.

62 CRTC *Current Trends—High-Speed Broadband*.

63 CRTC *Current Trends—High-Speed Broadband*.

64 Government of Canada—*High Speed Internet Access Dashboard*.

65 Some Canadian provinces expect to reach ubiquitous connectivity earlier than 2030. For example, Quebec reached 100% high-speed broadband Internet availability in 2022, Ontario and PEI intend to reach 100% by 2025, Alberta and British Columbia by 2027 and New Brunswick and Newfoundland and Labrador by 2030.

66 CRTC *Current Trends—Mobile Wireless*.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment



### In focus

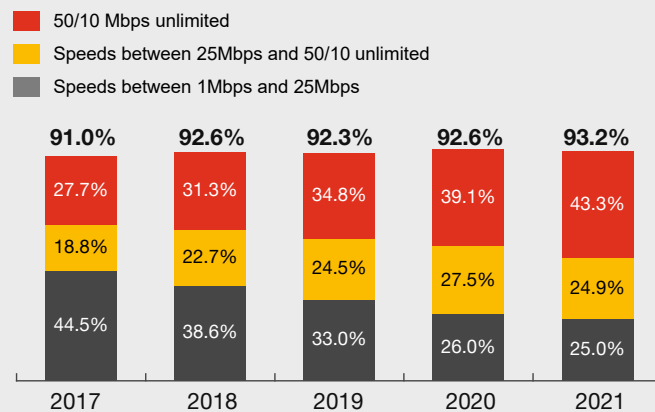
The telecom sector is investing in bringing high-quality network access to First Nations reserve areas and Indigenous communities

In 2021, 93.2% of First Nations reserve areas had access to the Internet,<sup>67</sup> with 43.3% (Exhibit 4) of this access being high-speed 50/10 Mbps unlimited broadband.<sup>68</sup> This is well below the national average of 93.5%.<sup>69</sup>

The 43.3% represents a 15.6 percentage point increase since 2017 as the telecom sector has invested in several initiatives to improve high-quality connectivity in Indigenous communities (Exhibit 5).<sup>70</sup>

Further government and telecom sector investment will be required to connect underserved Indigenous communities.

**Exhibit 4: Availability of wireline services by speed in First Nations reserve areas (% , 2017–2021)**



Source: CRTC *Current Trends—High Speed Broadband*.

**Exhibit 5: Sample of telecom sector investments to deliver improved connectivity in Indigenous communities in 2022**

<b>Northwestel</b>	Northwestel sold its Yukon fibre-to-the-home (FTTH) assets to a group of 13 Yukon First Nation development corporations. The fibre assets that connect homes and businesses across the territory are Indigenous-owned and are expected to provide ongoing economic benefits for Yukon First Nations in the decades to come.
<b>Rogers</b>	Rogers invested \$1.4M to expand fibre across 30km <sup>2</sup> of underserved area in the Mississaugas of the Credit First Nation. Additionally, 12 towers were constructed along the “Highway of Tears” between Prince Rupert and Prince George, to enhance wireless connectivity and safety for Indigenous women and girls.
<b>SaskTel</b>	SaskTel partnered with Beaver River Broadband, a majority Indigenous-owned Internet Service Provider (ISP), to meet the 50/10 Mbps high-speed benchmark across Indigenous communities in Saskatchewan. Additionally, 5G connectivity was enabled on 143 towers in Regina, covering 44 new communities, including four First Nations communities.

Sources: Cision, 2022, “Yukon’s fibre-to-the-home assets now Indigenous-owned as Northwestel and 13 First Nations companies form new partnership,” Rogers ESG Report 2022, Sasktel 2022–2023 Annual Report.

67 CRTC *Current Trends—High-Speed Broadband*.

68 CRTC *Current Trends—High-Speed Broadband*.

69 Government of Canada—*High Speed Internet Access Dashboard*.

70 CRTC *Current Trends—High-Speed Broadband*.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

### Consumers and businesses are increasingly reliant on connectivity for daily activities

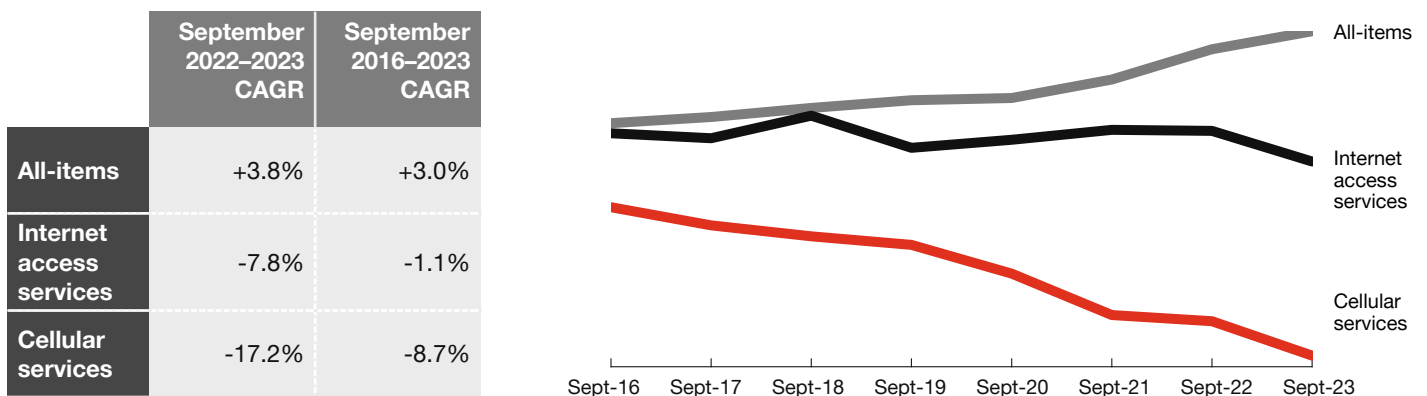
#### Increase in consumer data usage and speed

Wireless mobility enables the essential on-the-go connection to work, school and home life. Increased demand for always-on connectivity can be observed by the 1.6M increase in mobile phone subscriptions between Q3 2021 and Q3 2022.<sup>71,72</sup> On a monthly average basis, Canadians are consuming more data than ever before. Since 2016, the average annual download/upload traffic per mobile data subscriber per month has increased by 4.6 GB, supported by the availability of large and unlimited data plans.<sup>73,74</sup>

Demand for wireline Internet has also increased, with an additional 2.4M households subscribing to high-speed broadband Internet since 2014, and 60% of total subscribers having a 100/10 Mbps or higher Internet speed plan, compared to only 40% in 2019.<sup>75</sup> As more Canadians subscribe to higher speed Internet, more data is being consumed, with the average monthly download traffic per Internet access subscriber increasing by 189.6 GB, since 2019.<sup>76</sup>

As data consumption has risen and subscriptions to high-speed broadband Internet increased, the price of cellular and Internet access services in Canada have declined (Exhibit 6). Between September 2022 and September 2023, cellular and Internet access service prices declined by 17.2% and 7.8%, respectively.<sup>77</sup> During the same period, the CPI of all items increased by 3.8%,<sup>78</sup> highlighting that the telecom sector is providing deflationary price pressure and delivering increased value to Canadian consumers.

**Exhibit 6: CPI annual average, not seasonally adjusted, all-items vs. cellular and Internet access services (September 2016 – September 2023)**



Source: Statistics Canada, 2023, *Consumer Price Index – average annual, not seasonally adjusted*.

71 CRTC *Current Trends–Mobile Wireless*.

72 According to the CRTC, the drop in subscribers beginning 2021 is explained by a change in methodology. Starting in 2021, mobile phone subscriptions exclude subscriptions to ‘mobile broadband’ and ‘other plans for mobile connected devices’.

73 CRTC *Current Trends–Mobile Wireless*.

74 According to the CRTC, mobile data traffic refers to data downloaded and uploaded on a monthly basis per data subscriber (i.e. from smartphones). Data from mobile broadband devices and machine-to-machine connections are excluded. Prior to 2021, data subscribers included mobile phone and mobile broadband subscribers, and machine-to-machine connections.

75 CRTC *Current Trends–High Speed Broadband*.

76 CRTC *Current Trends–High Speed Broadband*.

77 Statistics Canada, 2023, *Consumer Price Index–average annual, not seasonally adjusted*.

78 Statistics Canada, 2023, *Consumer Price Index–average annual, not seasonally adjusted*.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

### Canadian businesses increasingly rely on high-quality connectivity

Canadian enterprises are increasingly investing in advanced technologies,<sup>79,80</sup> with 62% of Canadian enterprises adopting at least one type of advanced technology in 2022,<sup>81</sup> and according to PwC's 2023 Annual Global CEO Survey, automating systems and processes is the number one priority for 76% of CEOs.<sup>82</sup> To support Canadian businesses and help them realize the benefits of these investments, the telecom sector needs to deliver high-quality connectivity. Further, the success of Canadian businesses in the digital economy can play an important role in supporting Canada's global competitiveness and helping Canada close the "innovation gap."<sup>83</sup> For instance, in the Canadian utilities and manufacturing sectors, Internet-based applications are being adopted to perform new functions and improve existing ones (see In focus below).



#### In focus

The Canadian utilities and manufacturing sectors adopt Internet-based applications to perform new and improve existing functions

**The utilities sector** today is challenged by aging electrical equipment and the need to extend the life of assets to ensure a safe and reliable grid.<sup>84</sup> To meet the growing demands of the electrical grid, continuous asset monitoring is required.<sup>85</sup> The use of Internet-enabled smart sensors and thermal cameras can prevent failures by providing up-to-date analysis.<sup>86</sup> The utilities sector relies on high-quality connectivity to enable these sensors and cameras.<sup>87, 88</sup> In addition, condition-based maintenance applications enable the utilities sector to reduce the need for truck rolls and physical inspections, reducing overall maintenance costs and improving the reliability and safety of the grid.<sup>89</sup>

**The manufacturing sector** has been challenged with disrupted supply chains, and a shortage of raw materials.<sup>90</sup> To address these challenges, manufacturers are revisiting operating models and adopting digital supply chains. According to PwC's Global 2023 Digital Trends in Supply Chain Survey, 53% of manufacturers have adopted a cloud-based common data platform within supply chain operations, and 53% have adopted Internet of Things (IoT) connected devices in supply chain operations.<sup>91</sup> Across capabilities, the manufacturing sector relies on high-quality Internet connectivity to enable smart devices or systems for 50% of industrial equipment, and 46% of on-premise security.<sup>92</sup>

79 In the Survey of Advanced Technology (SAT), Statistics Canada defines advanced technology as one that performs a new function that significantly improves an existing function performed by a more commonly used technology.

80 For the purpose of the SAT, 50 advanced technologies were selected and divided into 15 distinct technology domains, including advanced material handling, supply chain and logistics technologies, advanced business intelligence technologies, Artificial Intelligence technologies, Internet of Things, virtual reality, augmented reality, mixed reality technologies and advanced medical devices, among others.

81 Statistics Canada, 2022, SAT.

82 PwC's 26th Annual Global CEO Survey, 2023, "Winning today's race while running tomorrow's".

83 According to OECD and TD Economics, Canada's R&D spending as a percentage of GDP has declined over the past 20 years, lagging, notably, behind global peers in the G7. In 2021, Canada's investment in R&D as a percentage of GDP was roughly half that of the USA, Germany, and Japan.

84 Power, *Connected Plant*, 2023, "How Utilities Can Achieve Automated, Condition-Based Grid Maintenance to Boost Safety and Grid Reliability".

85 Power, *Connected Plant*, 2023, "How Utilities Can Achieve Automated, Condition-Based Grid Maintenance to Boost Safety and Grid Reliability".

86 Power, *Connected Plant*, 2023, "How Utilities Can Achieve Automated, Condition-Based Grid Maintenance to Boost Safety and Grid Reliability".

87 Statistics Canada, *Applications related to Internet-connected smart devices or systems, by industry and enterprise size*, 2022.

88 Statistics Canada ranks utilities data as "B" for "very good" data quality in comparison to "A" for "excellent" data quality, or "C" for "good" data quality.

89 Power, *Connected Plant*, "How Utilities Can Achieve Automated, Condition-Based Grid Maintenance to Boost Safety and Grid Reliability", 2023.

90 PwC Study, *Digital Factory Transformation Survey: Investments are booming, but implementation is lagging behind*, 2022.

91 PwC's 2023 *Digital Trends in Supply Chain Survey*, "How manufacturers can adopt digital supply chains".

92 Statistics Canada, 2022, *Applications related to Internet-connected smart devices or systems, by industry and enterprise size*.



## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

### To meet growing connectivity demands, ongoing network investment is required

To meet connectivity demands from businesses and consumers, the Canadian telecom sector makes ongoing investments into the network. Compared to international peers, these investments are relatively high due to a range of factors such as geography, weather and spectrum costs.

- **High population dispersion:** Canada is the second largest country by landmass<sup>93</sup> and has a population density of four (4) people per square kilometer.<sup>94</sup> Relative to countries such as the UK, Germany and France, Canada's small population is spread across a large landmass. This results in dispersed network infrastructure that is more expensive to deploy and service than small and densely populated areas that require fewer towers and less fibre. Notably, higher population dispersion has led to Canadian telecom operators building approximately 50% more cell towers per capita than Australia.<sup>95</sup>
- **High spectrum costs:** Spectrum costs are paid as one-time fees at auction and as ongoing license costs. Canada has the highest spectrum costs across peer countries.<sup>96</sup> Canada's auction of the 3500 MHz spectrum, which is key for 5G networks, generated a record \$8.9B.<sup>97</sup>
- **Weather patterns:** Canadian telecoms face the unique challenge of extreme cold winter weather, therefore, limiting underground construction work. Underground fibre can only be laid for wireline and wireless backhauling during warmer months. Additionally, Canada experiences catastrophic insured losses as a result of severe weather events across the country; in 2022, Canada experienced \$3.1B in losses.<sup>98,99,100,101</sup>
- **Economies of scale:** The largest three Canadian telecoms are smaller than the largest telecoms in peer countries on a three-year average annual revenue basis.<sup>102</sup> For example, Rogers is 13.5 times smaller than AT&T in the USA.<sup>103</sup> Economics of scale generate efficiencies, including bargaining power with suppliers.
- **Labour costs:** Canadian unit labour cost<sup>104</sup> increased by 18.2% to 133.8 between Q3 2020 and Q3 2023.<sup>105</sup> Rising labour costs directly impact network deployment and operating expenses, compounded by higher labour costs during peak warmer months for construction work.

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93 Britannica, Geography & Travel, Canada.

94 World Population Review, Canada Population 2023.

95 World Bank, Cellmapper.net. 2019.

96 PwC, 2020, *The importance of a healthy telecommunications industry to Canada's high tech success.*

97 Reuters, 2023, *Canada's Spectrum Auction raises \$7.2 bln as firms gear for high-speed Internet.*

98 Catastrophic insured losses are defined as losses that total at least \$30M, previously defined as \$25M.

99 Insurance Bureau of Canada–Severe Weather Centre, 2023, CatIQ.

100 The amount of insured damage does not include uninsured losses.

101 The amount of insured damage is an estimate provided by CatIQ.

102 S&P Capital IQ.

103 S&P Capital IQ.

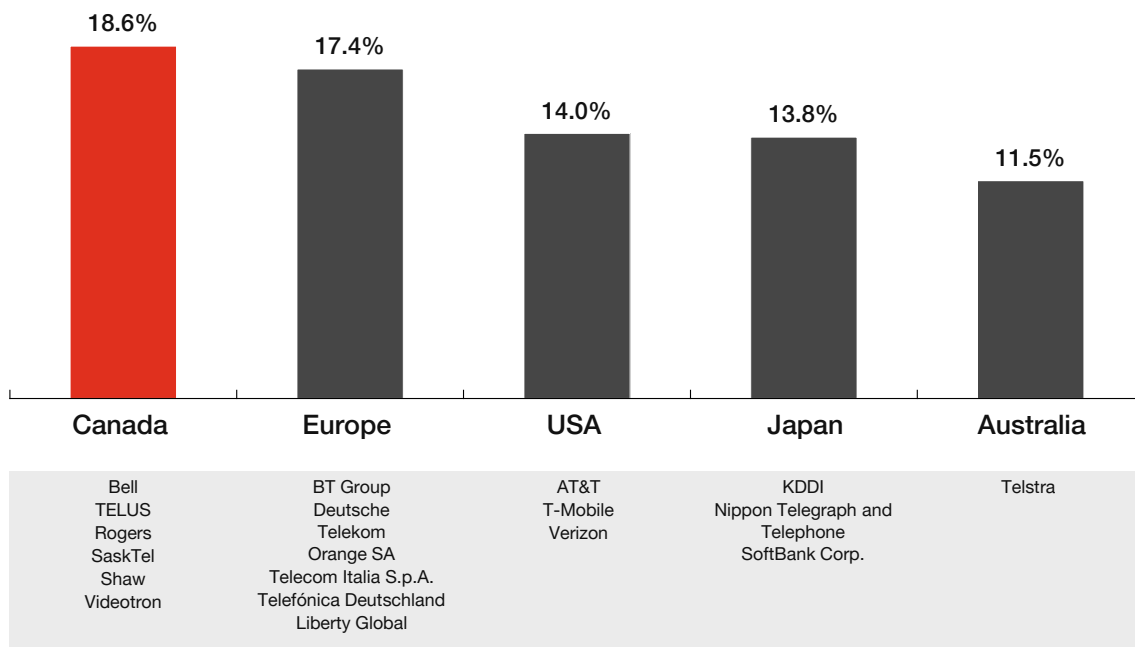
104 Unit labour cost measures the cost of labour input required to produce one unit of output, and equals labour compensation in current dollars divided by the real output. It is calculated as the ratio of labour compensation per hours worked and labour productivity. Unit labour cost increases when labour compensation per hour worked increases more rapidly than labour productivity. It is widely used to measure inflation pressures arising from wage growth.

105 Statistics Canada, 2023, *Indexes of business sector labour productivity, unit labour cost and related measures, seasonally adjusted.*

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

These high-cost factors of production are also reflected in the higher capital intensity ratios that Canadian telecoms maintain compared to global peers. Over the past five years, the Canadian telecom sector has invested an annual average of \$12.1B of capital to expand and enhance network infrastructure,<sup>106,107</sup> representing approximately 18.6% of average revenue, which is higher than the 14.2% average across peer telecoms in the USA, Japan, Australia, and Europe (Exhibit 7).<sup>108,109</sup> Notably, the Canadian telecom sector's capital intensity is 4.6 percentage points higher than the USA and 7.1 percentage points higher than Australia.<sup>110,111</sup> In addition to higher factors of production, recent rises in interest rates make debt financing more expensive for the telecom sector, placing further pressure on the sector's ability to invest capital into networks that are critical for Canadian businesses and consumers.<sup>112</sup>

**Exhibit 7: Average capital intensity for major telecoms in Europe, the USA, Japan, and Australia (% , 2018–2022)**



Sources: S&P Capital IQ, Annual Financial Reports, 2018–2022. Note: Telecoms based in France, Germany, Italy, and the UK are aggregated into Europe due to cross-border operations.

106 The largest six telecoms in Canada were sampled and include Bell, Rogers, SaskTel, Shaw Communications, TELUS and Vidéotron.

107 S&P Capital IQ.

108 S&P Capital IQ.

109 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

110 S&P Capital IQ.

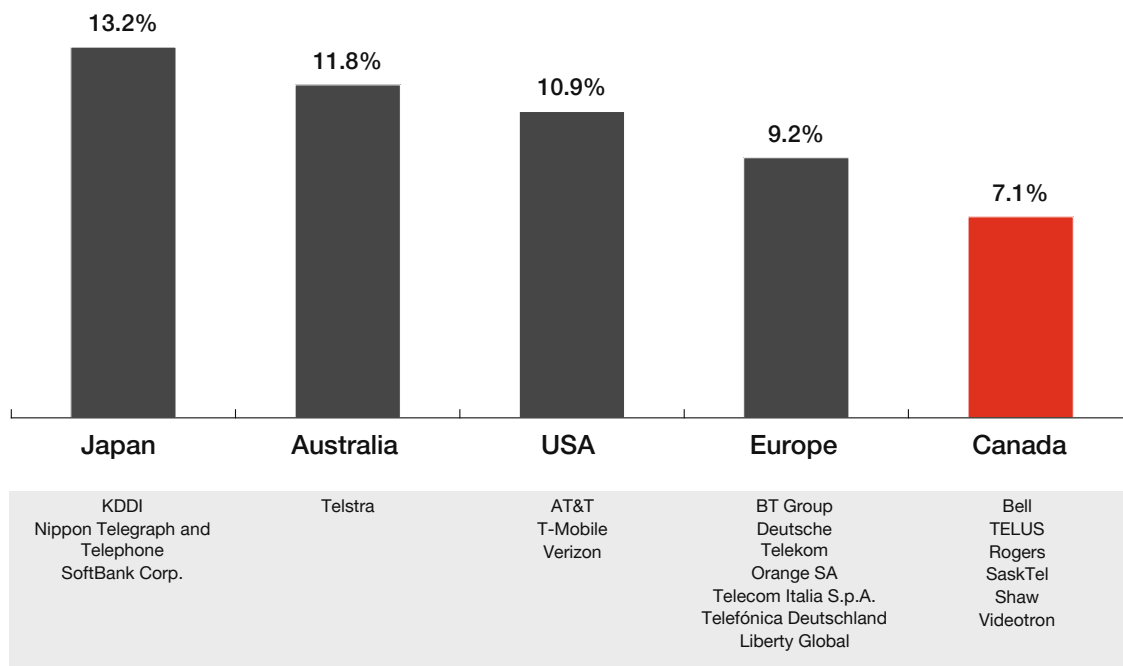
111 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

112 Bank of Canada, *Benchmark Bond Yields*, 2019–2023.

## 2. The telecom sector is facing elevated network demand that requires ongoing network investment

On a Free Cash Flow (FCF) basis, Canadian telecoms have a 5-year average of 7.1% FCF of total revenue, which is below the average of 11.3% across peer comparators in the USA, Japan, Australia, and Europe (Exhibit 8).<sup>113,114</sup> While some observers note that Canada's telecom sector maintains higher earnings before interest, taxes, depreciation and amortization (EBITDA) margins than global peers, after adjusting for differences in capital investment, Free Cash Flow (FCF) ratios are comparable.<sup>115,116</sup>

**Exhibit 8: Average free cash flow to revenue ratio for telecoms in Japan, Australia, the USA and Europe (% , 2018–2022)**



Sources: S&P Capital IQ, Annual Financial Reports, 2018–2022. Note: Telecoms based in France, Germany, Italy, and the UK are aggregated into Europe due to cross-border operations.

113 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

114 S&P Capital IQ, Annual Financial Reports, 2018–2022.

115 Sampled operators include: AT&T, Bell, BT Group, Deutsche Telekom, KDDI, Liberty Global, Nippon Telegraph and Telephone, Orange, Rogers, SaskTel, Shaw, SoftBank Group, T-Mobile, Telecom Italia, Telefónica Deutschland, Telstra, Telus, Verizon, and Vidéotron.

116 S&P Capital IQ, Annual Financial Reports, 2018–2022.

### 3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

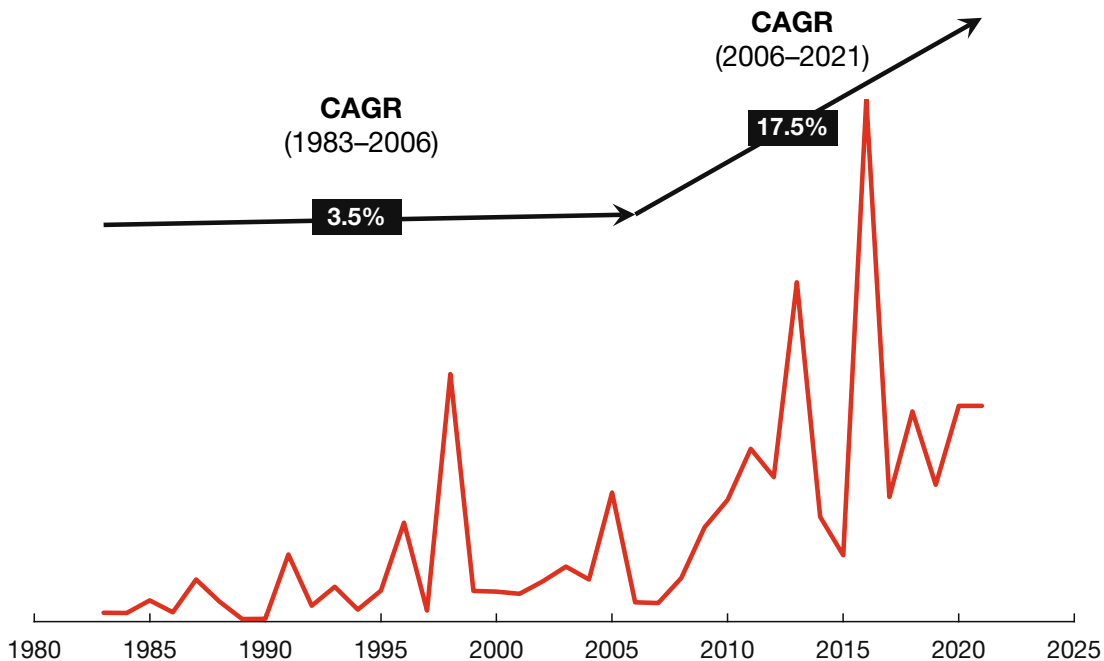
Emissions and greenhouse gasses have caused global surface temperature to rise, resulting in more extreme weather. Severe weather events can have adverse impacts on telecom networks, costing millions of dollars. Further, during the immediate aftermath of extreme weather events, telecom networks serve as a lifeline to the public. Heightened expectations for network reliability and access requires additional telecom sector investment to manage climate-related risks and strengthen networks.

3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

## Global surface temperatures are rising, resulting in more extreme weather that impacts critical infrastructure

The United Nations (UN) and the Intergovernmental Panel on Climate Change (IPCC) state that human-caused climate change is impacting weather extremes and resulting in large economic and societal losses.<sup>117</sup> The impact on Canada is a concern for all Canadians, as the country’s climate is warming twice as fast as the global average, resulting in hotter temperatures, more frequent severe weather events and changes to precipitation and wind patterns.<sup>118,119</sup> Notably, catastrophic insured losses<sup>120</sup> resulting from severe weather events in Canada increased by 17.5% per annum between 2006 and 2021 (Exhibit 9).<sup>121</sup> In 2022, Canada experienced \$3.1B in catastrophic insured losses from severe weather events,<sup>122,123</sup> including from the Ontario and Quebec derecho (\$1B in catastrophic insured losses) and Hurricane Fiona (\$800M in catastrophic insured losses) (see In focus below).<sup>124</sup>

**Exhibit 9: Catastrophic insured losses in Canada, accounted for loss adjustment in 2021 dollars (CA\$M, 1983–2021)**



Source: IBC, 2022 Facts of the Property and Casualty Insurance Inquiry in Canada, 2022.

117 United Nations, *Climate Change 2023 Synthesis Report, Sixth Assessment Report*.  
 118 Government of Canada, 2023, *Canada’s climate is warming twice as fast as global averages*.  
 119 Government of Canada, 2023, *Developing Climate Resilient Standards and Codes*.  
 120 Catastrophic insured losses are defined as losses that total at least \$30M, previously defined as \$25M.  
 121 IBC, *Facts of the Property and Casualty Insurance Inquiry in Canada, 2022*.  
 122 Insurance Bureau of Canada–Severe Weather Centre, 2023.  
 123 The amount of insured damage is an estimate provided by CatIQ.  
 124 Insurance Bureau of Canada–Severe Weather Centre, 2023.

3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

## Severe weather events are putting telecom networks at risk

Severe weather events and other disasters damage telecom infrastructure, increasing total cost of ownership and overall capital expenditure on network infrastructure, for example:

- **Hurricanes and tornadoes:** High winds from hurricanes and tornadoes can damage cell towers and aerial lines and have the potential to collapse heavier aerial copper cables.<sup>125</sup> Falling debris from trees and surrounding infrastructures can also damage telephone poles and cables.
- **Flooding:** Severe storms can cause flooding and erosion, which can expose cables and create accessibility challenges for repair and restoration crews.<sup>126</sup> Meanwhile, droughts can change tower stability.<sup>127</sup>
- **Lightning:** The height and conductivity of cell towers can be a target for lightning strikes. Lightning has the potential to damage transmitters and other tower components.<sup>128</sup>
- **High temperatures:** Cooling systems in base stations are strained by high temperatures and heatwaves, increasing the chance of failures and reducing infrastructure lifespan.<sup>129</sup>
- **Fires:** Telephone poles have the possibility of catching fire, and electronics, cables and other combustible equipment can react to smoke, having the potential to catalyze the spread of fire.<sup>130</sup>

Importantly, these weather events present similar risks to power utilities on which telecom networks rely.

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125 Fierce. Telecom. 2022. *Here's how AT&T, Verizon, Consolidated are prepping their networks for climate change.*

126 DTN, 2020, *Weather Intelligence for Telecoms.*

127 DTN, 2020, *Weather Intelligence for Telecoms.*

128 Research Gate, 2007, *Issues concerning lightning strikes to communication towers.*

129 DTN, 2020, *Weather Intelligence for Telecoms.*

130 Risk Logic, 2021, *Fire and Property Loss in the Telecommunications Industry.*

### 3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk



#### In focus

Over the past year, severe weather events in Canada have damaged telecom infrastructure, requiring millions of dollars in repair and restoration

**Hurricane Fiona** made landfall in 2022 and is the costliest weather event ever recorded in Atlantic Canada, sending over 100 km/hour winds across Atlantic Canada and Eastern Quebec.<sup>131</sup> Over 600,000 homes were without power.<sup>132</sup> Bell recorded \$30M of damage and 2,500 hours of overtime to respond to the disaster, as the hurricane damaged 1,500 telephone poles, thousands of kilometers of cable and 50 cellphone towers.<sup>133</sup> As global warming continues, there is potential for hurricane intensity to grow, as the global proportion of tropical cyclones that reach Category 4 and 5 levels are projected to increase.<sup>134</sup>

**Quebec wildfires** in 2023 damaged over 5.2M hectares of land, a third of total hectares burned across Canada at the time of reporting.<sup>135</sup> Ten thousand people were displaced,<sup>136</sup> and Montreal experienced the worst air quality in the world.<sup>137</sup> The severity of the Canadian wildfire season was exacerbated by Canada's warmest two-month period, May and June 2023.<sup>138</sup> Quebec's forest fires were seven times more likely to occur as a result of climate change and human-induced warming made the fires 50% more intense.<sup>139</sup> Fires damaged TELUS' fibre optic network in several spots, and Bell's infrastructure was damaged with expected costs in the several million dollars.<sup>140</sup> Maintaining service requirements during severe weather events can require transporting generators on helicopters, transporting portable cell towers and predicting the spread of wildfires to apply fire retardant in time.<sup>141</sup>

<sup>131</sup> IBC BAC, 2022, Hurricane Fiona.

<sup>132</sup> Government of Canada, *Canada's Top 10 Weather Stories of 2022*.

<sup>133</sup> Globe and Mail, 2023, *Telecoms are a lifeline when disaster strikes, but climate change is putting infrastructure at risk*.

<sup>134</sup> NOAA, 2023, *Global Warming and Hurricanes*.

<sup>135</sup> CNN, 2023, *Weather that drove Eastern Canada's devastating wildfires made twice as likely by climate change*.

<sup>136</sup> Reuters, 2023, *Where are the Canadian wildfires and are they under control*.

<sup>137</sup> Global News, 2023, *Montreal air quality ranks worst in the world as officials urge people to stay indoors*.

<sup>138</sup> CNN, 2023, *Weather that drove Eastern Canada's devastating wildfires made twice as likely by climate change*.

<sup>139</sup> World Weather Attribution, 2023, *Climate change more than doubled the likelihood of extreme fire weather conditions in Eastern Canada*.

<sup>140</sup> Globe and Mail, 2023, *Telecoms are a lifeline when disaster strikes, but climate change is putting infrastructure at risk*.

<sup>141</sup> Globe and Mail, 2023, *Telecoms are a lifeline when disaster strikes, but climate change is putting infrastructure at risk*.

3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

## Canada is building resilient telecom networks to address risk

As extreme weather, cyber threats and other accidents create increased network risks, the Government of Canada, the CRTC and the telecom sector are placing an increased focus on network resiliency. In September 2022, at the request of the Minister of Innovation, Science and Industry, Canadian telecoms entered into a Memorandum of Understanding (MOU) on Telecommunications Reliability. The MOU parties<sup>142</sup> agreed to establish protocols for emergency roaming, mutual assistance and communication to the public and Government Authorities in the event of major network outages, including:<sup>143</sup>

- **Emergency roaming protocols:** The emergency roaming protocol ensures that MOU parties provide emergency roaming to others when experiencing a critical network failure.<sup>144</sup> Emergency roaming consists of domestic voice, text and data roaming services on an emergency basis.<sup>145</sup>
- **Mutual assistance protocols:** The mutual assistance protocol ensures that MOU parties provide assistance when experiencing a critical network failure, and may include the sharing of physical assets, equipment, logistical support, staff or human resources, services, access to 9-1-1 networks and licensed spectrum.<sup>146</sup>
- **Emergency Network Outage Communications Protocols:** The protocol requires MOU parties to provide the public and Governmental Authorities with key network outage information in the case of a critical network failure.<sup>147</sup> Communications should be timely, relevant, understandable and presented in a clear and accessible manner.<sup>148</sup>

In February 2023, the Government of Canada and Innovation, Science and Economic Development (ISED) Canada advanced a Telecommunications Reliability Agenda.<sup>149</sup> The CRTC also introduced its own notification expectations that require all Canadian telecom carriers to notify the CRTC and ISED of major service outages and submit a comprehensive post-outage report, as of March 2023.<sup>150</sup>

Further, the telecom sector convened the Canadian Telecommunications Network Resiliency Working Group (CTNR-WG) to develop recommendations aimed at reducing the likelihood of severe network outages and mitigating its impact.<sup>151</sup> The CTNR-WG includes representation from Canadian Telecommunications Service Providers (CTSP) and members of ISED.<sup>152</sup> As of March 2023, the CTNR-WG established a series of recommendations (Exhibit 10) to improve network resiliency, availability and reliability through: network diversification; resilient infrastructure and supply chains; and the rapid assessment of network issues.<sup>153</sup>

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142 MOU parties include Rogers, Bell, TELUS, Eastlink, Cogeco, SaskTel, Shaw (including Freedom Mobile), Tbaytel, Telesat, Vidéotron, Xplornet and Zayo.

143 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

144 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

145 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

146 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

147 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

148 Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*.

149 Government of Canada, 2023, *A Telecommunications Reliability Agenda*.

150 CRTC, 2023, *Telecom Notice of Consultation CRTC 2023-39*, "Call for comments—Development of a regulatory framework to improve network reliability and resiliency - mandatory notification and reporting about major telecommunications service outages".

151 Canadian Telecommunications Network Resiliency Working Group, 2023, *Telecommunications Network Resiliency in Canada: A Path Forward*.

152 Canadian Telecommunications Network Resiliency Working Group, 2023, *Telecommunications Network Resiliency in Canada: A Path Forward*.

153 Canadian Telecommunications Network Resiliency Working Group, 2023, *Telecommunications Network Resiliency in Canada: A Path Forward*.



3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

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## Exhibit 10: Recommendations from the CTNR-WG on Telecommunications Network Resiliency

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Network diversification	Resilient infrastructure and supply chains	Rapid assessment of network issues
<ul style="list-style-type: none"> <li>Establish redundant pathways: facilities supporting main fibre access should have physically diverse routes between infrastructure, especially for emergency services.</li> <li>Identify and mitigate single points of failure: aim for geographic diversity; where essential equipment is co-located, elements should be physically separated.</li> </ul>	<ul style="list-style-type: none"> <li>Resilient physical structures: indoor and outdoor structures should be constructed to withstand weather events and the loss of power supply.</li> <li>Underground installation: opt for underground communication cables that can be protected from degradation and natural disasters.</li> <li>Resilient supply chains: equipment should be sourced from reliable suppliers.</li> </ul>	<ul style="list-style-type: none"> <li>Rapid assessment: establish robust processes and practices to enable the rapid assessment of network issues.</li> <li>Service continuity plans: establish plans that support strong communication and responsiveness in the event of outages.</li> </ul>

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Source: Canadian Telecommunications Network Resiliency Working Group, 2023, *Telecommunications Network Resiliency in Canada: A Path Forward*.

As the climate changes and government regulations evolve, the telecom sector continues to invest in enhancing network resilience across the recommended areas of network diversification, resilient infrastructure and supply chains and the rapid assessment of network issues (Exhibit 11). Notable investments include upgrading core network facilities to support robust backup systems with less potential for downtime, and more redundancy and capacity for future scalability.<sup>154</sup> Other investments include improving generator capacity across key sites in the case of a commercial power outage.<sup>155</sup> Proactive steps have also been taken with fuel providers to secure fuel prior to storms.<sup>156</sup> In some cases, solar-powered cell towers have been constructed to connect to renewable sources of power.<sup>157</sup> In coastal, flood-prone areas, central offices have been lifted to reduce water damage and in wildfire areas, brush cleaning has helped to prevent flames from engulfing cell sites.<sup>158</sup>

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154 Cision, 2022, *Eastlink invests \$20M in new, state-of-the-art core network facility*.

155 Cision, 2023, *Eastlink continues significant investment in its mobile network*.

156 CBC, 2023, *Utilities on P.E.I. say they've learned from Fiona as Franklin heads towards Atlantic Canada*.

157 Globe and Mail, 2023, *Telecoms are a lifeline when disaster strikes, but climate change is putting infrastructure at risk*.

158 Globe and Mail, 2023, *Telecoms are a lifeline when disaster strikes, but climate change is putting infrastructure at risk*.

3. The telecom sector is focused on resiliency and additional network investment is required to address climate change-related risk

## Exhibit 11: Canadian telecom sector investments into enhancing network resiliency

Network diversification	Resilient infrastructure and supply chains	Rapid assessment of network issues
<ul style="list-style-type: none"> <li>• Wireline and wireless networks use different network infrastructures; with geo-redundancy, disruption on one will not impact the other.</li> <li>• Additional fibre paths protect against simultaneous wireline and wireless outages.</li> <li>• Standalone core separates routing control and customer traffic, preventing core network overload.</li> <li>• Wireless backup services provide redundancy and access across Internet, IP VPN, Ethernet and Wavelength services.</li> </ul>	<ul style="list-style-type: none"> <li>• Fibre-connected cell towers provide unlimited capacity and consistent speed while being less susceptible to extreme weather.</li> <li>• Structural mitigation, such as lifting offices in flood prone areas and brush clearing help mitigate climate-related vulnerabilities.</li> <li>• On-site generators and solar panels enable on-site power, if commercial power is lost, and cell on wheels enables portable connections.</li> <li>• Applying fire retardant on cell towers can help to reduce the risk of flames engulfing infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>• Disaster-recovery protocols help to ensure business continuity in the event of outages.</li> <li>• AI-based network and service layer modeling helps to identify potential network risks.</li> <li>• Scenario analysis is used to assess the resilience of corporate strategy in various climate scenarios.</li> </ul>

Sources: Bell Canada, 2023, "A network Canadians can count on." Rogers Annual Report, 2022. Government of Canada, 2022, *Memorandum of Understanding on Telecommunications Reliability*. TELUS, 2023, Annual Report.



# Conclusion

The telecom sector plays a significant role in the Canadian economy, contributing almost \$77B in direct GDP and supporting 724,000 jobs in 2022.<sup>159</sup> Further, the telecom sector is an important enabler of Canada's digital economy, as its investments in enhanced connectivity have the potential to contribute an incremental \$112B to Canada's GDP by 2035.<sup>160</sup>

The telecom sector's ongoing investments in critical network infrastructure provide for expanded and enhanced coverage. These network investments are made in a relatively high-cost environment, driven by Canada's factors of production, such as low population density, cold weather and high spectrum costs. In addition, consumers' and businesses' changing digital needs are increasing the expectation for more data, speed, reliability and access; while climate change and a focus on network resilience are also increasing the demand for, and importance of, ongoing network investments.

To continue making ongoing investments into telecom networks, Canada needs to maintain a healthy telecom industry that encourages both investment and competition. A healthy industry is characterized by telecom operators having the ability to generate the cash flow and take on the debt financing required to expand coverage and fund network resiliency.

159 PwC Analysis, Statistics Canada, S&P Capital IQ.  
160 PwC Analysis, IHS Markit, Statistics Canada.

# Methodology

## General Canadian telecom sector calculations

The telecom sector, as defined in this report and used in the economic modeling, refers to network operators supplying wireless and wireline connectivity services — excluding television video services and infrastructure, as well as satellite connectivity and other supporting sub-industries. The majority of figures in this report combine data for the major providers, which represent over 99% of the sector's revenues: TELUS, Rogers Communications, Shaw Communications, Bell Canada Enterprises, SaskTel and Vidéotron. Where applicable, analyses were performed using operator figures from the calendar year January 1, 2022 to December 31, 2022. Weather events and government regulations include 2023 events, where applicable. All dollar figures are represented in Canadian dollars using the Bank of Canada exchange rate to the relevant country's currency.

## Economic analysis

The economic impact highlighted in this study represents the telecom sector's contribution to the Canadian economy through its value chain as well as the impact on additional industries that could drive greater sales and increase output due to new wireless and wireline connections.<sup>161</sup> Multipliers used are the 2019 Statistics Canada multipliers for the Information and Culture industry at the national level. In order to show the impact of new connections on other industries, the estimated relationship between increases in connections of mobile and fixed broadband was applied to industry output/sales.<sup>162</sup>

## Incremental impact of 5G analysis

To quantify the potential future impact of 5G on Canadian GDP, IHS Markit projects an industry-by-industry percentage of sales enabled by 5G in 2035. Starting in 2023, leveraging these IHS growth projections, we will estimate, on an industry by industry basis (per Statistics Canada NAICS), the incremental impact of the deployment of 5G-enabled technologies in Canada by 2035.

## Rogers-Shaw merger considerations

Analysis performed on Shaw Communications considers figures from prior to its merger with Rogers Communications in April 2023.

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<sup>161</sup> Media revenue and operating expenditures for Rogers and Bell have been omitted.

<sup>162</sup> Statistics Canada industry NAICS GDP, 2022.

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