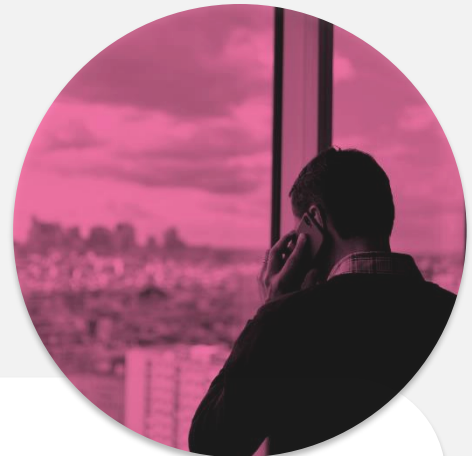


The Benefits of the Wireless Telecommunications Industry to the Canadian Economy



**Prepared for:
The Canadian Wireless Telecommunications Association**

Prepared by Nordicity

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Summary

The Canadian wireless telecommunications industry continues to be an important contributor to Canada’s economic growth and a critical enabler of the digital transformation of the Canadian economy.

The wireless industry plays an instrumental role in our economic prosperity by:

- Contributing to GDP and employment through economic activities generated by the Canadian **wireless ecosystem**;
- Enabling **cross-sector productivity improvements** through advanced wireless network technologies and services leveraged by other sectors; and;
- Augmenting economic growth through **increased wireless service penetration** by improving the way people live and work.

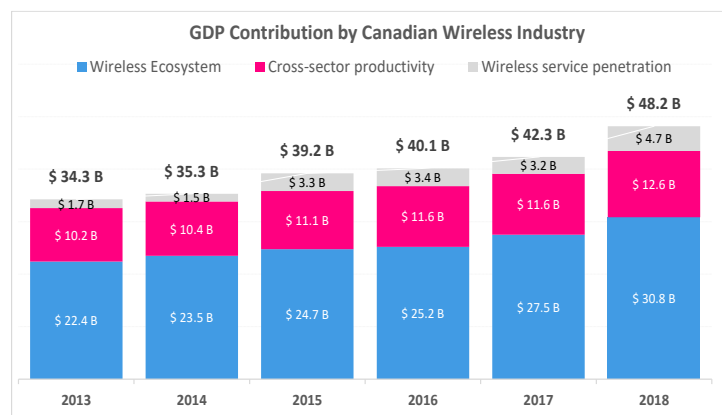
Based on a comprehensive study conducted by Nordicity, it is estimated that in 2018 the wireless industry contributed \$48.2 billion to Canada’s GDP¹ and generated the equivalent of 327,000 full-time jobs. Thus, the GDP contribution of each employee was \$147K.

Summary of Economic Impacts of The Canadian Wireless Industry in 2018



Contribution to GDP increased at an annual compound growth rate of 7.1% - *from \$34.3 billion (2013) to \$48.2 billion (2018).*

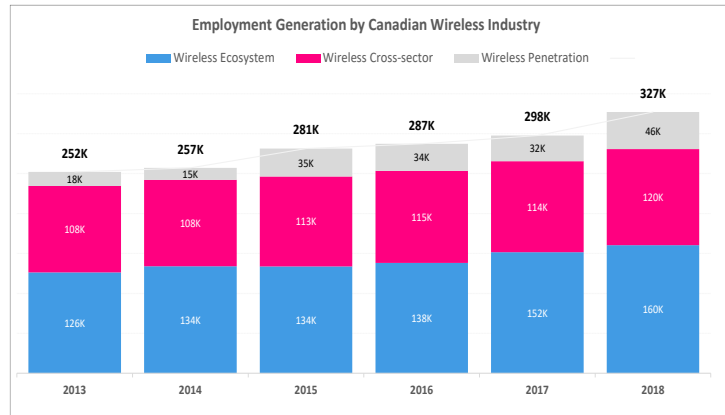
- ~64% of GDP growth was contributed by the wireless ecosystem – *which increased by 6.6% per year - \$22.4 billion (2013) to \$30.8 billion (2018).*
- GDP impact of wireless penetration exhibited a double-digit growth rate of 23.4%, with an average 8%



share of the total impact.

Employment increased at an annual compound growth rate of 5.3% - *increased from 252K (2013) to 327K (2018).*

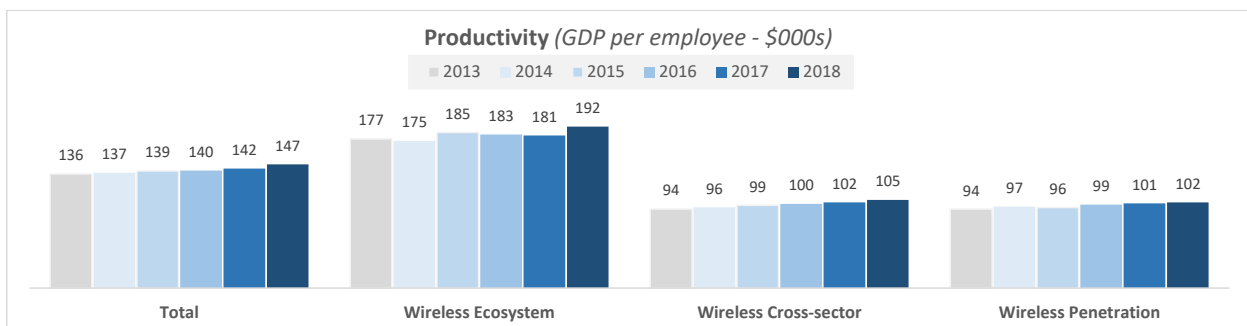
- ~50% of employment was generated by the wireless ecosystem – *which increased by 4.9% per year – 126K (2013) to 160K (2018).*
- The employment impact of wireless penetration exhibited a double-digit growth rate of 21.3%, with an averaged 11% share of the total impact.



Capital Investments by the Canadian mobile network operators increased at an annual compound growth rate of 4.4% - *from \$2.5 billion (2013) to \$3.10 billion (2018).*

Productivity refers to the GDP generated per employee. Overall productivity improvements - enabled by the Canadian wireless industry’s advanced wireless network technologies and services leveraged by other sectors, increased at an annual compound growth rate of 1.6% - *from \$136K (2013) to \$147K (2018).*

- The wireless ecosystem (industry) itself generated the highest ratio of GDP per employee, which also increased by 1.6% per year – *\$177K (2013) to \$192K (2018).*
- The use of wireless technologies and services by other sectors of the Canadian economy resulted in a productivity gain of 2.2% per year – *from \$94K (2013) to \$105K (2018).*
- An increase in the penetration of wireless services also enabled productivity improvements at a rate of 1.7% per year – *from \$94K (2013) to \$102K (2018).*



Note: Due to rounding, numbers presented throughout this report may not add up precisely to the totals provided, and percentages may not precisely reflect the absolute amounts.

1. Introduction

Information and Communication Technology (ICT) has remained at the forefront of major structural changes to the global economic climate in the past few decades. The adoption of next-generation ICT infrastructure leveraging emerging technologies such as 5G networks will further transform and improve the quality of life for its 'digital citizens'. For example, 5G will enable innovative business models across sectors as diverse as transportation, manufacturing, agriculture, logistics, energy distribution, tourism, media and entertainment, healthcare and education. In this context, the role of the wireless industry will be critical in enabling growth and diversification of Canada's future economy.

The launch of commercial 5G networks and services will require substantial new investments on the part of the mobile network operators (MNOs). This investment requirement follows record levels of investment previously undertaken to support the rollout of 3G to 4G networks in recent years.

Background:

The Canadian Wireless Telecommunications Association (CWTA) commissioned this annual study to estimate *The Benefits (GDP and employment) of the Wireless Telecommunications Industry to the Canadian Economy*. Starting from the year 2008, the current report is the 11th iteration of this publication, covering the 2018 calendar year. This report, prepared by Nordicity Group Ltd., provides an independent assessment of the contribution of the wireless telecommunications industry to the Canadian economy as a whole. Accordingly, the economic contributions of the Canadian wireless industry were estimated in terms of GDP, employment impacts (direct, indirect, and induced) and productivity gains.

What's New:

The reports published in the previous years presented annual GDP and employment generated through the economic activities within the **Canadian wireless ecosystem** encompassing *mobile network operators* as well as their suppliers of *network equipment, hardware, software* and associated operational services. The current report also includes the economic benefits enabled by the Canadian wireless industry:

- **Cross-sector productivity benefits:** Gains generated in other economic sectors through the use of advanced wireless network technologies and services; and;
- **Wireless penetration:** Impact on economic growth generated through **increased wireless services penetration** by improving the way people live and work.

Organization of Report:

After a brief description of the methodology provided in Section 2, an economic impact assessment of the Canadian wireless ecosystem is detailed in Section 3. In Section 4, a detailed assessment of the cross-sector benefits is provided, followed by an economic impact analysis of wireless penetration in the Canadian economy in Section 5. Finally, Section 6 provides the conclusion of the study.

2. Overview of Methodology

Our methodology consisted of three components: (i) primary research; (ii) secondary research; and (iii) economic analysis and modelling.

In the first step, Nordicity collected 2018 financial data for the Canadian mobile network operators using a combination of sources including, a survey, published annual reports, Statistics Canada, and the Canadian Radio-television and Telecommunications Commission's (CRTC's) *Communications Monitoring Reports (CMRs)*². The results were calibrated with previous years' results contained in Nordicity's archive of data on the wireless industry – custom-built for this report starting in 2013. The data inputs, after validation and verification, were fed into Nordicity's Economic Impact Analysis (EIA) model to determine the economic impact (GDP, and Employment)³ resulting from economic activities within Canadian *wireless ecosystem*, through *cross-sector productivity improvements*, and increased *wireless penetration*. In addition, Nordicity analyzed employee productivity (GDP per employee) in the wireless ecosystem.

3. Economic Contribution of Canadian Wireless Telecommunications Ecosystem

The main elements of the Canadian wireless telecommunications ecosystem are⁴:

- **End-users**, who drive demand for services and products and obtain value from wireless network operators, applications-content and retail distributors of devices.
- **Service Providers**, who deliver wireless connectivity. This category includes providers of wireless telecommunications services, applications, content, and devices.
- **Suppliers** of wireless network equipment, devices, computer hardware and software, and support services, as well as wireline network operators and developers of wireless applications and content.

In 2018, companies in the Canadian wireless telecommunications ecosystem generated **\$60.12 billion⁵** in revenues, an **increase of 15% from \$52.28 billion in 2017**.

It is encouraging to note that revenue flows grew across the Canadian wireless ecosystem (with the exception of support services which declined 0.3 of 1%) in 2018 as compared to 2017. This overall revenue growth in 2018, was driven, among other things, by an increase in demand for wireless voice and data services (an increase of 7.5% or \$1.7B over 2018)⁶, and despite a steady decline in prices for mobile data usage.⁷

Appendix A shows revenue estimates for the wireless ecosystem. These estimates were prepared using accounting data of the Canadian wireless network operators, and data collected from published sources. Any assumptions made in the estimates were validated using publicly-available data and previous editions of this report.

Appendix B provides an overview of the revenues generated across the Canadian wireless ecosystem.

3.1. Economic Impact Analysis

This section provides an economic impact analysis of the wireless ecosystem on GDP⁸ and employment in Canada. GDP and employment impacts were further used to estimate productivity gains in the Canadian wireless ecosystem⁹.

In the first stage of analysis, industry GDP generated through direct, indirect and induced effects was determined¹⁰. In the second stage, the GDP results were translated into employment figures – measured in terms of FTE jobs. Finally, GDP and FTE results were used to quantify the impact on productivity.

3.2. Impact on Gross Domestic Product (GDP)

The revenue figures provided in Appendices A and B were used to calculate the overall contribution of the Canadian wireless telecommunications ecosystem in 2018 to Canada's GDP.

Direct and indirect GDP estimates were derived as follows:

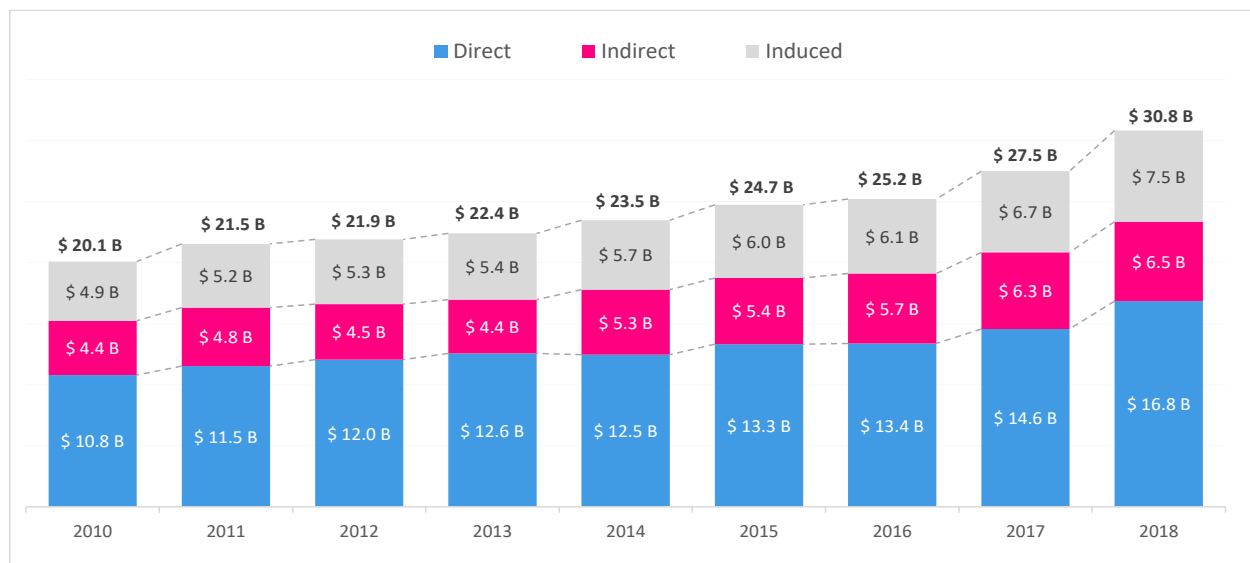
- The revenues within the wireless ecosystem (as shown in Appendix B) were calculated based on the financial data collected by Nordicity.
- For any missing financial data, estimates were developed based on industry averages, historical trends, and re-validation of assumptions used in previous years' reports.
- Estimated revenues were then converted into GDP estimates based on relevant Statistics Canada GDP-to-revenue ratios.

- Finally, estimates were developed for sub-industries in order to calculate the portion of GDP that is retained in Canada¹¹.

The induced effects on GDP by sub-industry were calculated using multipliers from Statistics Canada.

Exhibit 1 (below) provides a comparative view of the contribution of the wireless ecosystem to Canadian GDP in the period 2010-2018.

Exhibit 1: Total GDP contribution of the wireless ecosystem to the Canadian economy, 2010-2018



Source: Nordicity calculations based on data collected from different sources including wireless operators, Statistics Canada, CRTC and ICTC reports and calibrated using Nordicity's historical data archive.

Exhibit 2 (below), shows that in 2018, companies in Canada's wireless ecosystem contributed a total of **\$23.35 billion** to **GDP** through direct and indirect impacts. This represents an increase of \$2.51 billion or 12.1% from \$20.84 billion in 2017. The major contributor to this overall GDP increase was the **\$2.12 billion (or 14.8%) increase in the contribution of wireless network operators to the GDP** (from \$14.33 billion in 2017 to \$16.45 billion in 2018).

Exhibit 2: Direct and indirect GDP generated within the Canadian wireless ecosystem

Sub-industry	2017		2018		Growth
	\$M	%	\$M	%	%
Direct Impact	14,568	70%	16,849	72%	15.7%
Wireless network operators	14,331	69%	16,452	70%	14.8%
Dealers and distributors	200	1%	356	2%	77.6%
Application stores	37	0%	41	0%	12.4%
Indirect Impact	6,266	30%	6,498	28%	3.7%
Content and application developers	912	4%	1,027	4%	12.5%
Wireline network operators	732	4%	755	3%	3.2%
Network equipment suppliers	728	3%	772	3%	6.1%
Hardware and component suppliers	145	1%	155	1%	6.5%
Other suppliers of capital items	113	1%	119	1%	5.1%
Suppliers of support services	3,415	16%	3,404	15%	-0.3%
Device suppliers	220	1%	266	1%	20.6%
Device component suppliers	-	-	-	-	-
Total (Direct + Indirect)	20,835	100%	23,346	100%	12.1%
Induced Impact	6,667	..	7,471	..	12.1%
Total (Direct + Indirect + Induced)	27,502	..	30,817	..	12.1%

Source: Nordicity calculations based on data collected from various sources including wireless operators, Statistics Canada, CRTC and calibrated using Nordicity's historical data archive.

Using Statistics Canada multipliers, GDP generated through the induced economic impact of the Canadian wireless industry was estimated at \$7.47 billion in 2018, an increase of 12.1% from \$6.67 billion in 2017. In 2018, the Canadian wireless ecosystem contributed \$30.82 billion to GDP (including direct, indirect and induced impacts), which represents a 12.1% increase in overall economic benefits from \$27.51 billion in 2017.

3.3. Impact on Employment

The wireless industry creates and supports thousands of jobs across the Canadian economy, and correspondingly, pays wages that are well above the Canadian average¹². Similar to GDP calculations, estimates of jobs generated in the Canadian wireless industry were based on calculations in terms of direct, indirect and induced impacts. The employment estimate is based on total FTE jobs, which equals the number of employees working full-time plus the number of employees working part-time, converted to a full-time equivalent (FTE) basis.

For this purpose, estimates were developed based on data provided in operators' annual reports on salaries and wages, financial costs and revenues, and employment. These employment data were used to calculate the labour share of GDP. In addition, estimates for the labour share of GDP were developed for sub-industries using relevant Statistics Canada data¹³.

In the case of wireless telecommunications operators, the labour share of GDP was then converted into the number of employees for each sub-industry using applicable data provided by Statistics Canada¹⁴.

Exhibit 3 provides a detailed view of employment generated by companies in the Canadian wireless ecosystem through **direct** and **indirect** impacts. In 2018, the Canadian wireless industry was directly responsible for approximately **32,900 FTE jobs** and indirectly responsible for **60,300 FTE jobs**. In addition, the Canadian wireless ecosystem generated **67,100 FTE jobs** through its induced impact, for a grand total of **160,300 FTEs**.

In 2018, employment generated through direct impacts increased by 8.0% or 2,440 FTEs, which is primarily the result of a 9.7% or 2,420 FTEs increase generated by wireless network operators.

Employment generated through indirect impacts decreased by 0.9% or 600 FTEs, which is primarily driven by the decrease in two subsectors including *a decrease of 1,100 FTEs by suppliers of support services, and a decrease of 400 FTEs by network equipment suppliers, partially offset by an increase of 700 FTEs by content and application developers*. The employment generated through induced impact increased by 11.5% compared to 2017. The overall effect of direct, indirect and induced impacts was an increase in employment of 5.8%.

Exhibit 3: Direct and indirect employment generated within the Canadian wireless ecosystem

Sub-industry	2017		2018		Growth %
	FTEs	%	FTEs	%	
Direct Impact	30,531	33%	32,971	35%	8.0%
Wireless network operators	25,021	27%	27,442	29%	9.7%
Dealers and distributors	5,225	6%	5,230	6%	0.1%
Application stores	285	0%	299	0%	4.9%
Indirect Impact	60,842	67%	60,271	65%	-0.9%
Content and application developers	6,949	8%	7,667	8%	10.3%
Wireline network operators	3,280	4%	3,318	4%	1.2%
Network equipment suppliers	9,719	11%	9,281	10%	-4.5%
Hardware and component suppliers	1,305	1%	1,363	1%	4.4%
Other suppliers of capital items	1,148	1%	1,182	1%	2.9%
Suppliers of support services	36,544	40%	35,400	38%	-3.1%
Device suppliers	1,897	2%	2,060	2%	8.6%
Device component suppliers	-	-	-	-	-
Total (Direct + Indirect)	91,374	100%	93,242	100%	2.0%
Induced Impact	60,177	..	67,083	..	11.5%
Total (Direct + Indirect + Induced)	151,550	..	160,325	..	5.8%

Source: Nordicity calculations based on data collected from various sources including wireless operators, Statistics Canada, CRTC and ICTC reports, and calibrated using Nordicity's historical data archive.

3.4. Impact on Productivity

This section provides an analysis of **productivity** in the Canadian wireless ecosystem. Productivity denotes the average GDP generated per FTE in the industry¹⁵. Exhibit 4 below provides a detailed view of productivity in terms of **direct** and **indirect** impacts.

As illustrated in Exhibit 4, **productivity** in terms of direct impacts showed an increase of 7.1% compared to 2017, representing 77.5% increase by dealers and distributors, 7.2% increase by applications stores and 4.7% increase by wireless network operators. These productivity gains likely occurred through optimization of capital and labour inputs. Thus in 2018, overall wireless service demand (output) increased at a higher rate than the increases in labour and capital inputs by wireless network operators.

Furthermore, according to Exhibit 4, most of the sub-sectors of the wireless ecosystem showed productivity gains in terms of direct and indirect impacts in 2018 compared to 2017.

Exhibit 4: Productivity in the Canadian wireless ecosystem

Sub-industry	2017	2018	Growth
	\$	\$	%
Direct Impact	477,149	511,013	7.1%
Wireless network operators	572,749	599,498	4.7%
Dealers and distributors	38,315	67,999	77.5%
Application stores	129,309	138,611	7.2%
Indirect Impact	102,995	107,809	4.7%
Content and application developers	131,295	133,921	2.0%
Wireline network operators	223,143	227,606	2.0%
Network equipment suppliers	74,920	83,206	11.1%
Hardware and component suppliers	111,353	113,580	2.0%
Other suppliers of capital items	98,504	100,544	2.1%
Suppliers of support services	93,455	96,159	2.9%
Device suppliers	116,202	129,054	11.1%
Device component suppliers
Total (Direct + Indirect)	228,015	250,385	9.8%
Total (Direct + Indirect + Induced)	181,468	192,218	5.9%

Source: Nordicity calculations based on data collected from different sources including wireless operators, Statistics Canada, CRTC and ICTC reports, and calibrated using Nordicity's historical data archive.

4. Cross-sector Productivity Benefits

Advancements in cellular network technologies not only improve productivity in the wireless industry, but the use of mobile services also enables more efficient production of output by other industries. That is, all other economic sectors of Canada are increasingly leveraging mobile wireless services to augment their economic contribution.

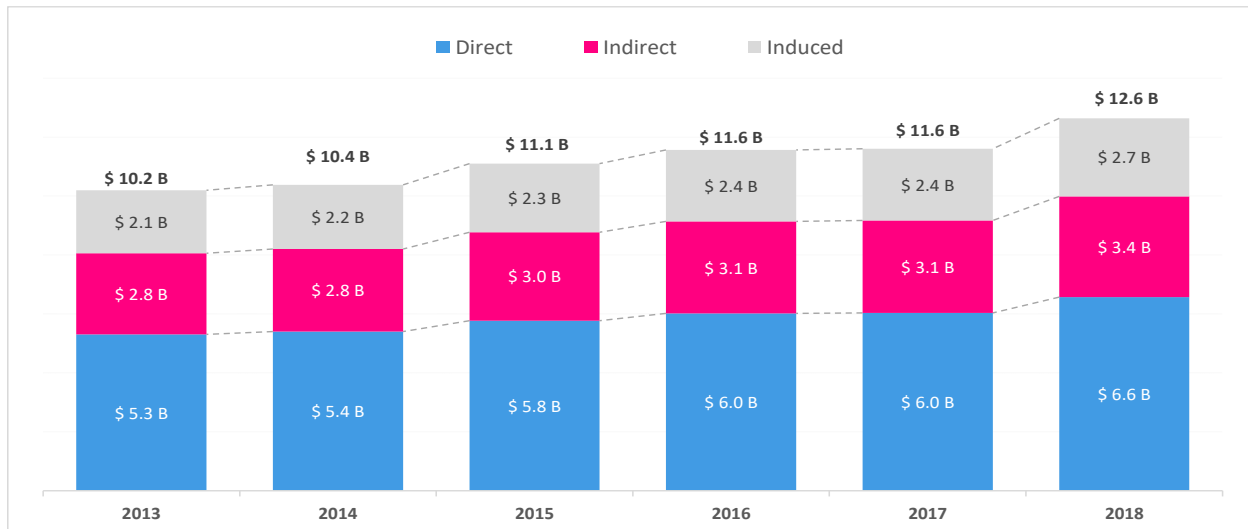
The position of the wireless industry in the value chain determines the economic value emerging from its linkages (downstream and upstream) with other industries. That is, the expenditure on mobile telecommunications services by other industries represents one of the several critical inputs other sectors need to produce their final output (goods and services). In this sense, the supply of wireless services to the different sectors of the Canadian economy partially contributes to GDP and employment generated by the other industries.

Based on the most recent “*Supply and Use tables of goods and services*” published by Statistics Canada¹⁶, Nordicity estimated the supply of wireless services per year to the following twenty sectors, for the period 2013-2018.

- i) *Agriculture, forestry, fishing and hunting*
- ii) *Mining, quarrying, and oil and gas extraction*
- iii) *Utilities*
- iv) *Construction*
- v) *Manufacturing*
- vi) *Wholesale trade*
- vii) *Retail trade*
- viii) *Transportation and warehousing*
- ix) *Information and cultural industries (excluding wireless telecommunications)*
- x) *Finance and insurance, real, rental, leasing*
- xi) *Professional, scientific and technical services*
- xii) *Management of companies and enterprises*
- xiii) *Administrative and support, waste management and remediation services*
- xiv) *Educational services*
- xv) *Health care and social assistance*
- xvi) *Arts, entertainment and recreation*
- xvii) *Accommodation and food services*
- xviii) *Other services (except public administration)*
- xix) *Public administration*
- xx) *Other non-profit organizations serving household*

Based on the share of wireless services to the total input used by the above twenty sectors to produce their respective outputs for the period 2013-2018, Nordicity estimated GDP (direct, indirect and induced) values using Input-Output Multipliers published by the Statistics Canada. The resulting GDP impact values represent the portion of GDP generated by these sectors that was enabled by mobile wireless services, as shown in Exhibit 5 below.

Exhibit 5: GDP Impact of cross-sector productivity improvement enabled by wireless services 2013-2018



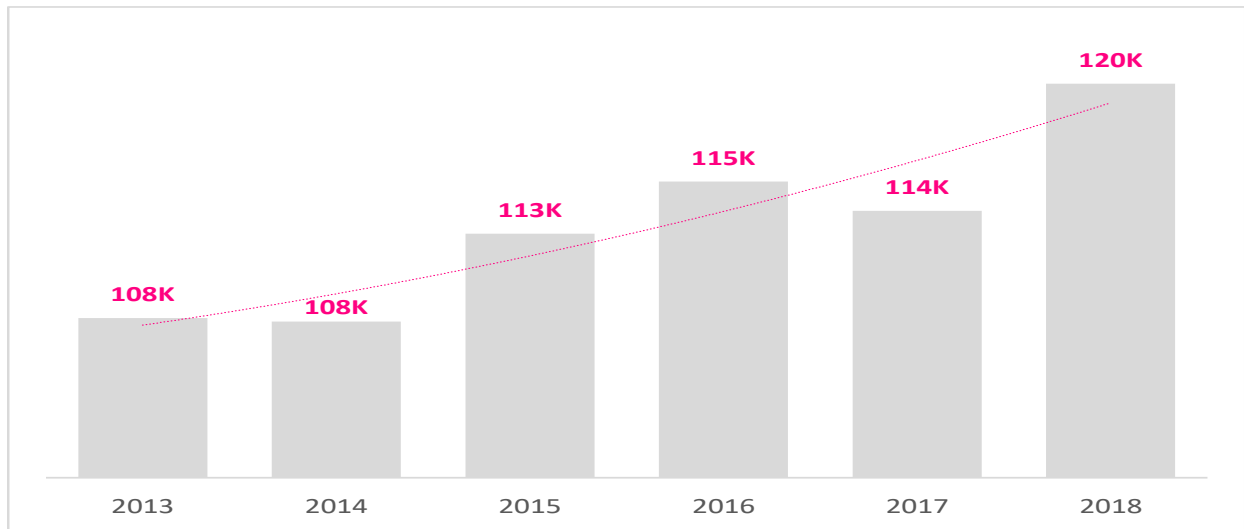
As shown in Exhibit 5 above, the cross-sector productivity improvement GDP impact by wireless services increased from \$10.2 billion in 2013 to 12.6 billion in 2018, corresponding to an annual average increase of 4.4%.

Over 70% of the 2018 GDP impact was generated in seven key sectors as shown below.

Economic Sector	Wireless Productivity Improvement GDP Impact Share in 2018
Finance and insurance, real estate, rental, and leasing	22.1%
Information and cultural industries (excluding wireless telecom.)	9.8%
Wholesale trade	9.2%
Health care and social assistance	8.8%
Professional, scientific and technical services	8.1%
Transportation and warehousing	8.0%
Administrative and support, waste management and remediation services	6.3%
Sub-total	72.2%
Remaining 13 sectors	27.8%
Total	100.0%

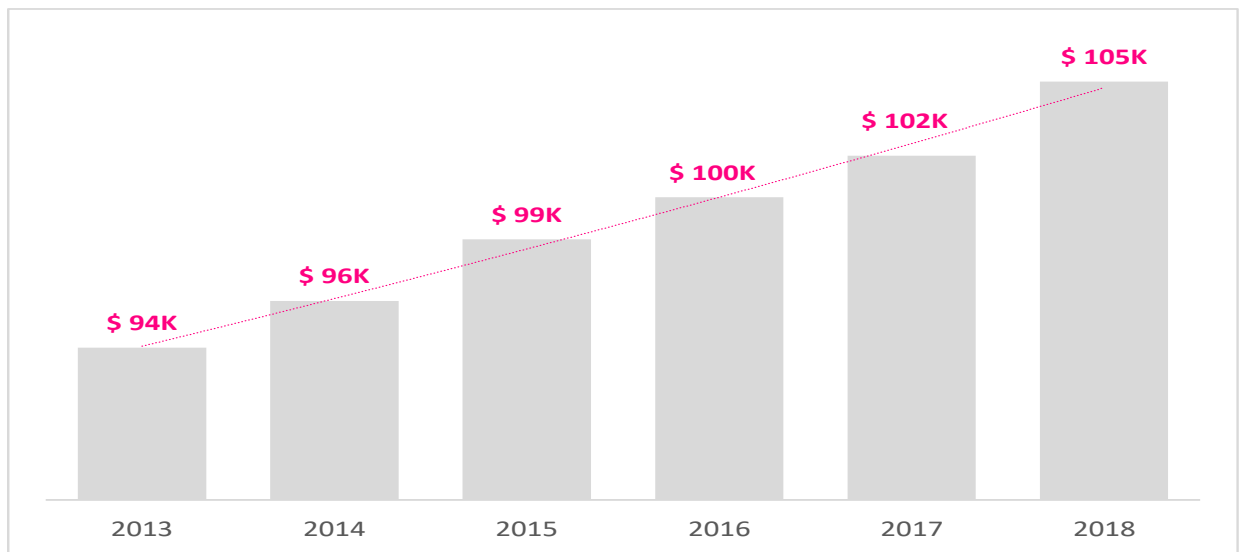
The corresponding employment impacts of cross-sector productivity improvements enabled by wireless services, is shown in Exhibit 6 below. These employment impact estimates were developed based on the contribution of labour to Gross Value Added within the 20 economic sectors (listed above)¹⁷.

Exhibit 6: Cross-sector productivity employment impact enabled by wireless services 2013-2018



The increase in employment due to cross-sector productivity improvements generated 120,000 FTE jobs in 2018 in comparison with 108,000 FTE jobs in 2013. Correspondingly, over the 2013-18 period, the annual average growth was 2.1%. Wireless cross-sector productivity also generated overall economic efficiency improvements via increases in GDP and employment impacts. These productivity gains increased at an average annual rate of 2.2% from \$94,000 GDP per employee in 2013 to \$105,000 in 2018, as shown in Exhibit 7 below.

Exhibit 7: Cross-sector productivity (GDP per employee) enabled by wireless services 2013-2018

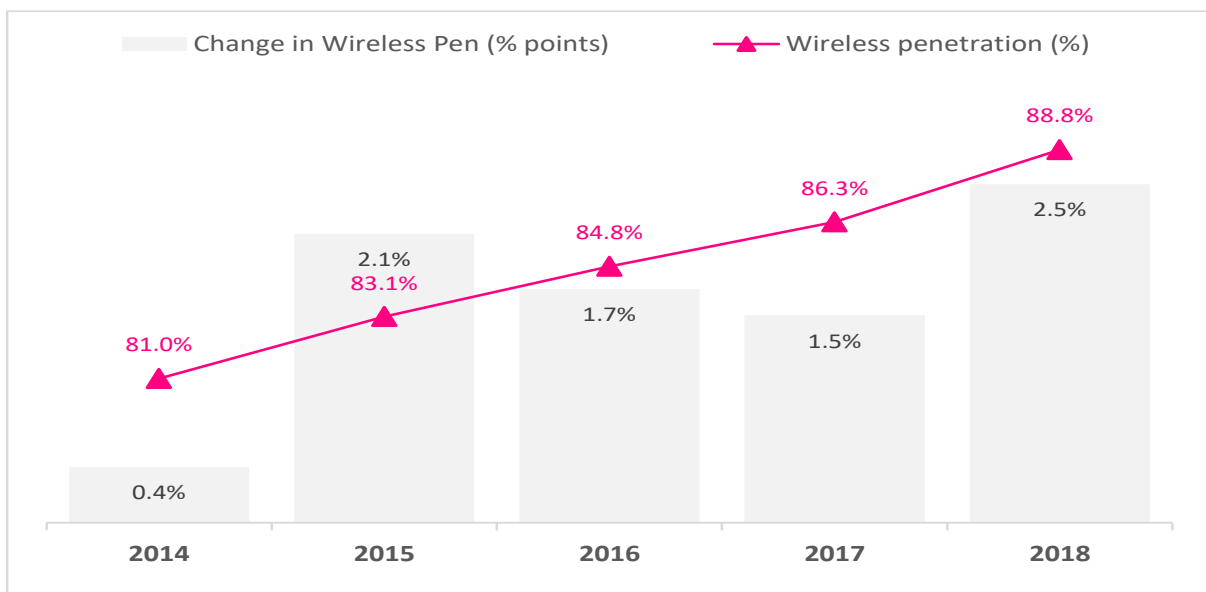


5. Economic Benefits of Wireless Penetration

The penetration of wireless services, particularly wireless broadband services provide a strong stimulus to a country’s economic development and therefore have an important direct impact on GDP (Gross Domestic Product) of a country. There are several empirical studies in the literature that strengthen this view. For example, *Edquist et al. (2018)*, based on data from 135 countries, concluded that, on average, a 10 per cent increase in mobile broadband adoption causes a 0.8 per cent increase in GDP¹⁸.

As shown in Exhibit 8 below, wireless penetration in Canada was 88.8% in 2018, increasing from 80.6% in 2013.

Exhibit 8: Wireless penetration in Canada 2014-2018

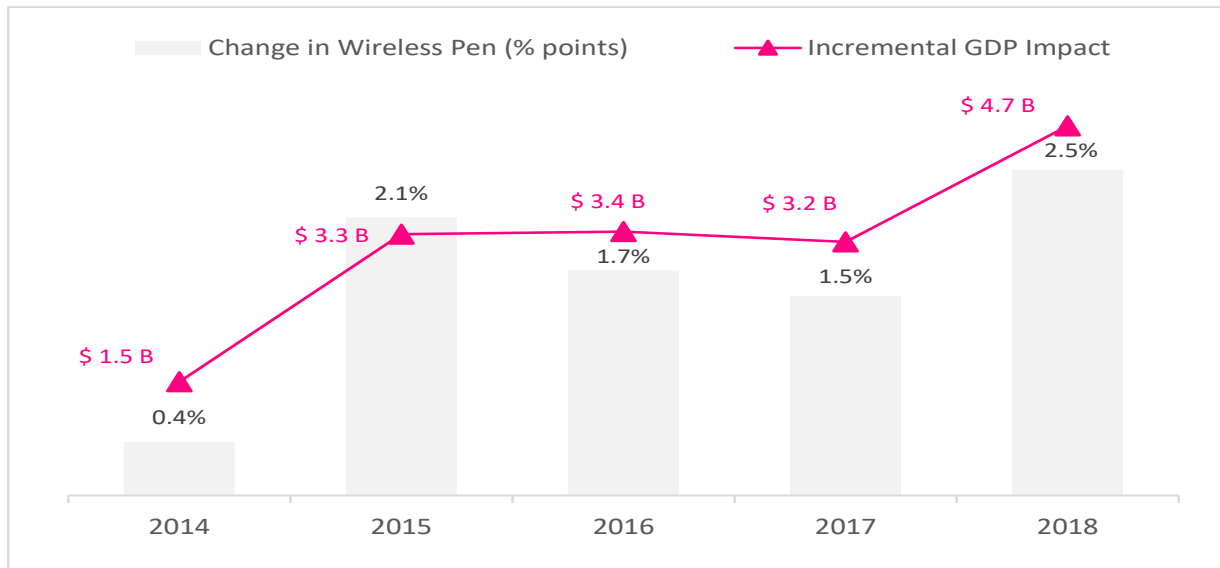


Source: International Telecommunications Union

The increase in wireless penetration was 0.4% (2014), 2.1% (2015), 1.7% (2016), 1.5% (2017) and 2.5% (2018).

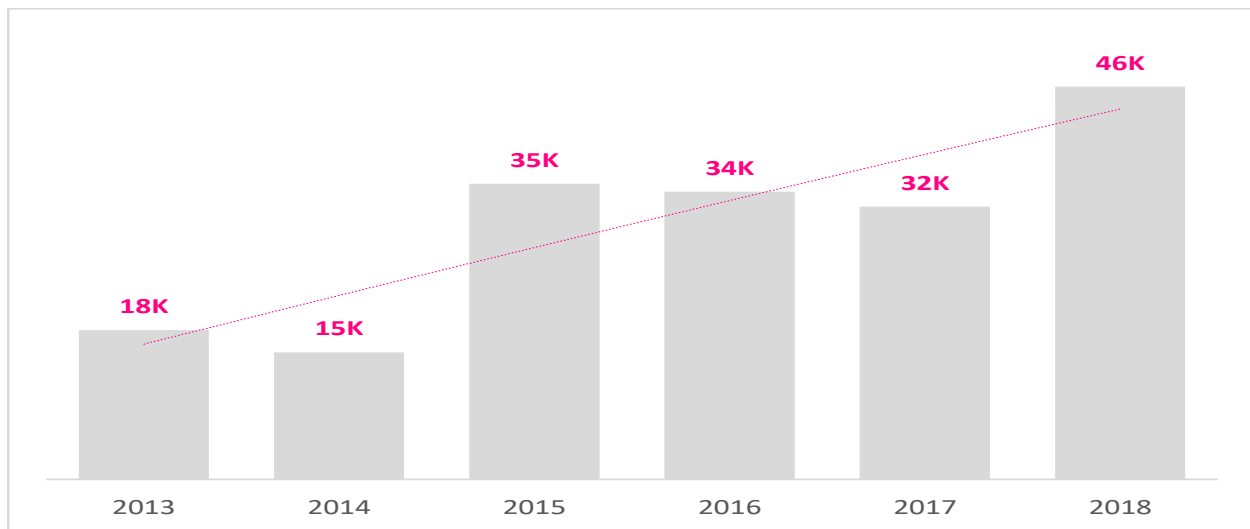
Nordicity conducted an extensive review of relevant literature and empirical studies to develop a methodology to estimate the growth effect of wireless penetration in Canada. Nordicity estimated the GDP growth effect of the increase in wireless penetration since 2013¹⁹. These estimates were developed using the Gruber et al (2010)²⁰ empirical model, which was based on data from 192 countries - including Canada. Accordingly, annual GDP impact was estimated for the period 2015-2018, based on the calculation of the share of mobile penetration relative to the Canadian economic (GDP) growth, as shown in Exhibit 9 below.

Exhibit 9: Incremental GDP impact vis-à-vis increase in wireless penetration in Canada 2014-2018



The employment impact of wireless penetration was measured using similar approach employed to arrive at cross-sector productivity FTE jobs estimates as shown in Exhibit 10 below.

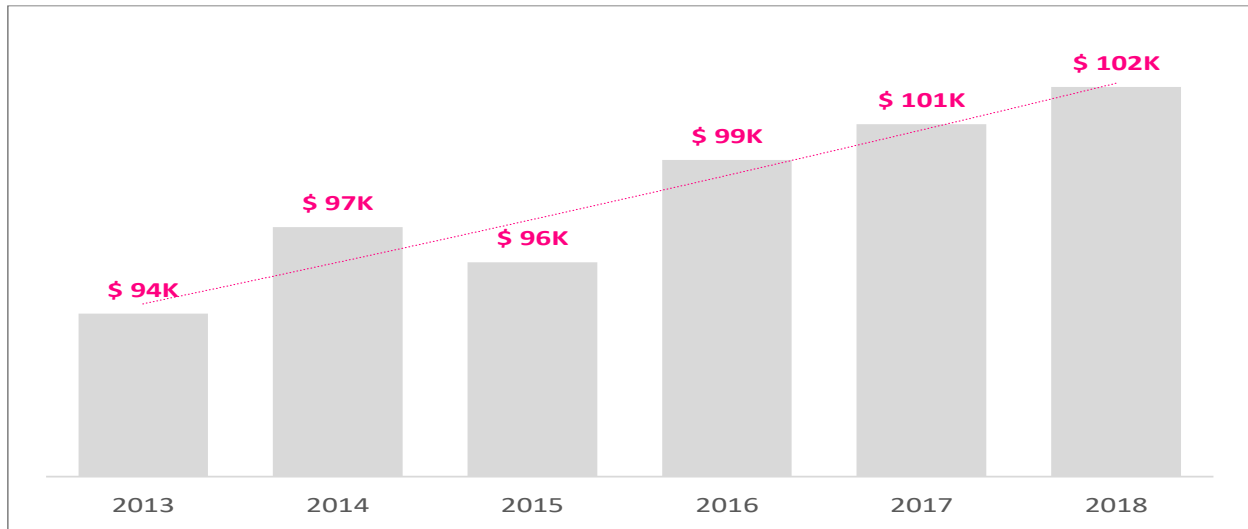
Exhibit 10: Employment Impact of increase in wireless penetration in Canada 2014-2018



The increase in employment owing to deepening of wireless penetration, resulted in 46,000 FTE jobs in 2018. Over the 2013-18 period, employment exhibited an annual average growth of 21.3% starting from 18,000 FTE jobs in 2013. Improvements in GDP and employment also

resulted in average annual productivity (GDP per employee) gains of 1.7% - from \$94,000 GDP per employee in 2013 to \$102,000 in 2018, as shown in Exhibit 11 below.

Exhibit 11: Cross-sector productivity (GDP per employee) enabled by wireless services 2013-2018



6. Conclusion

Canada's wireless industry is critical to enabling key sectors to shift to the digital economy. The telecommunications industry is at the cusp of 5G - a new generation of network technologies, which will enable the digital transformation of the Canadian economy. While the transformation process has already started based on existing networks, the launch of commercial 5G services will require substantial investments on the part of operators – on top of record levels of investment already made by wireless operators in 3G to 4G networks, in recent years.

The wireless industry has steadily increased its contribution to the Canadian GDP and will continue to be essential to the development of its economy as follows:

- Contributes to GDP and employment through economic activities generated by the Canadian **wireless ecosystem**;
- Enables **cross-sector productivity improvements** through advanced wireless network technologies and services leveraged by other sectors; and;
- Augments economic growth through **increased wireless service penetration** by improving the way people live and work.

Based on a comprehensive study conducted by Nordicity, it is estimated that the Canadian wireless industry contributed \$48.2 billion, or 2.5% to the Canadian GDP and generated 327,000 high-paying jobs in 2018.

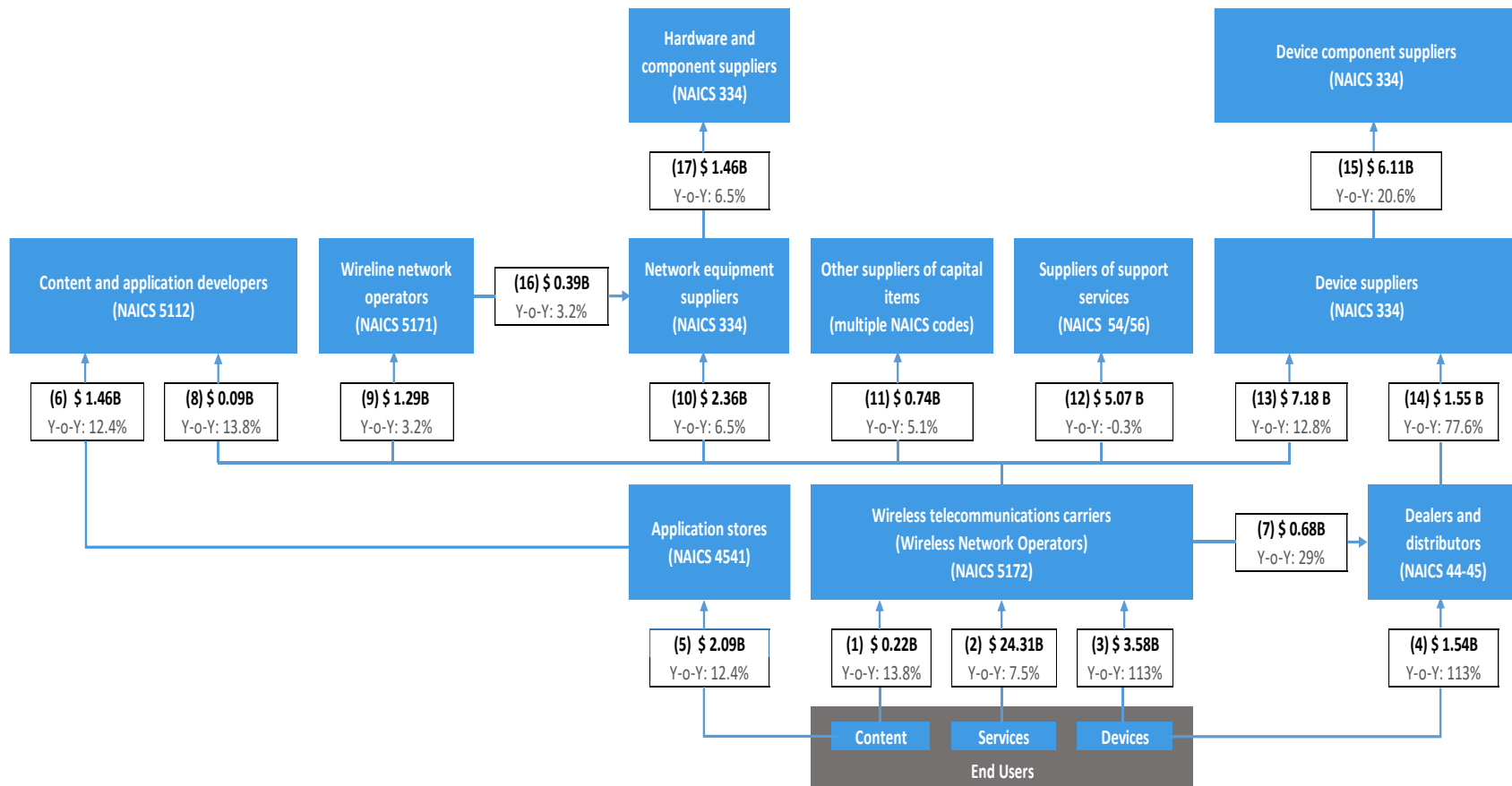
The wireless industry's **contribution to GDP** increased at an annual compound growth rate of 7.1% - *from \$34.3 billion (2013) to \$48.2 billion (2018)*. **Employment** also increased at an annual compound growth rate of 5.3% - *from 252,000 (2013) to 327,000 (2018)*. **Capital Investments** by the Canadian wireless network operators increased at an annual compound growth rate of 4.4% - *from \$2.5 billion (2013) to \$3.10 billion (2018)*. Overall, **Productivity** (GDP per employee) increased at an annual compound growth rate of 1.6% - *from \$136K (2013) to \$147K (2018)*.

Appendix A: Canadian Wireless Ecosystem Economic Activities Summary

From	Economic Activity	Revenues (\$ Billion)	
<p style="text-align: center;">End Users (Final Demand):</p>	(1): Content: Wireless telecommunications carriers	0.22	31.74
	(2): Services: Wireless telecommunications carriers	24.31	
	(3): Devices: Wireless telecommunications carriers	3.58	
	(4): Dealers and distributors	1.54	
	(5): Application stores	2.09	
<p style="text-align: center;">Service Providers</p>	(6): Content and application developers	1.46	20.42
	(7): Dealers and distributors	0.68	
	(8): Content and application developers	0.09	
	(9): Wireline network operators	1.29	
	(10): Network equipment suppliers	2.36	
	(11): Other suppliers of capital items	0.74	
	(12): Suppliers of support services	5.07	
	(13): Device suppliers	7.18	
<p style="text-align: center;">Suppliers (of equipment, devices, hardware, support services etc)</p>	(14): Device suppliers	1.55	7.96
	(15): Device component suppliers	6.11	
	(16): Network equipment suppliers	0.39	
<p style="text-align: center;">Total</p>	(17): Hardware and component suppliers	1.46	60.12
	Sum of all activities		

Source: Nordicity calculations based on data collected from different sources including wireless operators, Statistics Canada, CRTC, and calibrated using Nordicity's historical data archive.

Appendix B: Total Revenues Generated by the Canadian Wireless Ecosystem²¹



Source: Nordicity calculations based on data collected from different sources including wireless operators, Statistics Canada, CRTC, and calibrated using Nordicity's historical data archive.

End Notes

¹ The GDP numbers presented in this report are at current prices.

² Includes 2013-2018 annual reports (BCE, Rogers, TELUS, Quebecor, Sasktel, Shaw-Freedom), 2014-2018 CRTC *Communications Monitoring Reports*, Statistics Canada Symmetric Input-Output Tables 15-207-X (2015), CANSIM Table 14-10-0204-01, and reports by the Information and Communications Technology Council, such as its 2016 Annual Review and The Application of Everything (2014).

³ In cases where data from operators were not available, Nordicity developed estimates using industry and historical trends, as well as its data archive.

⁴ The wireless industry has traditionally been viewed in terms of a value chain, with separate and independent components. In recent years, the development of the sector suggests that it is probably best viewed as an ecosystem, with a high degree of interdependence among the constituent segments.

⁵ See Exhibits 1 and 2 for details.

⁶ For example, see **2019 CRTC Communications Monitoring Report** “Against a backdrop of higher data usage (the average mobile data subscriber used over 2 GB of data per month in 2017, a 30% increase from 2016) and significant smartphone penetration (87% in 2017), prices for mobile services have declined over the 2016-2018 period” (p. 61)

⁷ For example, see **2019 CRTC Communications Monitoring Report** “The increase in data demand and usage from 2014 to 2018 vastly outpaced the revenues derived from data service, which resulted in lower revenues per GB per month. The average revenue per 1GB of data usage per month has been declining since this metric was first reported in 2015” (p.264)

⁸ The GDP numbers presented in this report are at current prices.

⁹ For the purpose of this analysis, productivity is defined as GDP divided by the number of FTEs (jobs): **Productivity = GDP ÷ FTE.**

¹⁰ The definition of direct, indirect, induced and total economic impacts is provided as follows:

- **Direct impact:** Refers to GDP and employment generated by Canadian wireless network operators themselves, as well as other sub-industries in the wireless ecosystem geared towards the final consumer, such as dealers, distributors and application-content stores.
- **Indirect impact:** Refers to GDP and employment generated by the sub-industries that supply inputs to Canadian wireless network operators, dealers, distributors and application-content retailers (including online and “bricks and mortar” stores). The sub-industries include wireline network operators, network equipment, computer hardware, component suppliers, and device suppliers, support services providers and so forth. The purchase of goods and services from these suppliers increases income and employment, which, in turn, increases the demand for other upstream suppliers, i.e. suppliers’ suppliers.
- **Induced impact:** Refers to GDP and employment generated through the re-spending of income earned by the participants in the direct and indirect components of the ecosystem. That is, induced impact arises from re-spending that occurs in the economy at the household level, e.g. employees of wireless network operators using their income to purchase goods and services in the general economy.

- **Total economic impact:** The total economic impact is equal to the sum of the direct, indirect and induced economic impacts.

¹¹ A key challenge in calculating the 2018 economic contribution of the Canadian wireless industry to the Canadian economy was the determination of the relative portion retained in Canada versus the portion generated outside of Canada. This study focuses only on the contribution of companies in the wireless telecommunications ecosystem to the Canadian economy. For some sub-industries within the wireless ecosystem – such as wireless network operators – most (or all) of the value added occurs in Canada; for other sub-industries – such as device component suppliers – the value added occurs almost entirely outside Canada, specifically in countries where the components are designed or manufactured. To address this issue, after calculating the global GDP impact of the Canadian wireless industry, we estimated how much of the total GDP generated by companies in the Canadian wireless ecosystem is retained in Canada. Estimates of the share of economic activity retained in Canada by sub-industry were constructed based on secondary research.

¹² According to Statistics Canada CANSIM Table 14-10-0204-01 (formerly CANSIM 281-0027) average weekly earnings of employees in Canada were \$1001.18 (or an annual average of \$52,061.36) in 2018. As per Nordicity's estimates, average annual wages (earnings) in the Canadian wireless ecosystem were \$ 78,388 in 2017.

¹³ Statistics Canada Symmetric Input-Output Tables 15-207-X, 2015. (Previously used CANSIM Table 36-10-0415-01,, formerly CANSIM 381-0022 *Input-Output Structure of the Canadian Economy in Current Prices*; CANSIM stopped further updates to the series.

¹⁴ CANSIM Table 14-10-0204-01 -formerly CANSIM 281-0027 (Average weekly earnings by industry, annual).

¹⁵ **Productivity** is commonly defined as a ratio between the output (e.g. GDP) and inputs (unit of labour). That is, it measures how efficiently production inputs such as labour are being used in an economy to produce a given level of output. "There are different measures of productivity and the choice between them depends either on the purpose of the productivity measurement and/or data availability. One of the most widely used measures of productivity is Gross Domestic Product (GDP) per hour worked." <http://www.oecd.org/std/productivity-stats/40526851.pdf>. Since it was not possible to estimate total hours worked by employees in the Canadian wireless ecosystem, the number of FTEs has been used, which is consistent with standard practice.

¹⁶ The Supply and Use Tables (SUT) published by Statistics Canada, contain detailed statistics relating to production, intermediate use and final consumption of goods and services in the Canadian economy. Accessed 2016 SUT at <https://www150.statcan.gc.ca/n1/pub/15-602-x/15-602-x2017001-eng.htm>

¹⁷ To determine "contribution of labour to Gross Value Added" ratios for the 20 economic sectors, relevant Supply and Use Tables from Statistics Canada, providing estimates for the compensation of employees in the GDP for the identified sectors, were used. That is, compensation to gross value-added ratio was used to obtain wage income earned by employees employed in each sector. The number of full-time equivalent employees was then calculated using annual average earnings published by Statistics Canada CANSIM Table 14-10-0204-01 - formerly CANSIM 281-0027 (Average weekly earnings by industry, annual).

¹⁸ Harald Edquist, Peter Goodridge, Jonathan Haskel, Xuan Li, Edward Lindquist, "How important are mobile broadband networks for the global economic development?", *Information Economics and Policy*, Volume 45, 2018, Pages 16-29.

¹⁹ For this purpose, Nordicity used annual GDP (Constant 2012 dollar) for the period 2013-2018 published by Statistics Canada (Table 36-10-0401-01). Data on mobile subscriptions for the same period were obtained from Communications Monitoring Report and International Telecommunications Union (ITU).

²⁰ Study by Gruber et al (2011) entitled: “Mobile telecommunications and the impact on economic development” attempted to assess the economic contribution of mobile adoption at a macroeconomic level using several econometric specifications. The study was based on annual data from 192 countries for the 18-year period between 1990 and 2007 and concluded that countries in high penetration cluster (i.e. 30% and above) have higher growth impact (with mobile penetration levels’ coefficient of 0.048) while controlling for simultaneous effects (refer to 3 Stage Least Square specification estimates p. 406)

²¹ Devices revenues (which represent 2.5% of total “direct + indirect GDP”) of “service providers” and “dealers and distributors” exhibited a year over year increase of 113%. This extraordinary increase was mainly due to surge in sale of high value / premium devices as well as increase in device upgrades by existing subscribers. For example, see Rogers 2018 Annual Report [p. 34], and BCE Annual Report 2018 [p. 50]