



The Benefit to the Canadian Economy from the Wireless Telecommunications Industries: An Economic Impact Assessment

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A Report prepared for the Canadian Wireless Telecommunications Association

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1 Executive summary

This study assesses the impact of the wireless industry in Canada on the Canadian economy. We are grateful to the members of the CWTA for the data that they have provided.

The Canadian wireless communications services industry has continued to see growth during challenging economic times. Revenues from wireless services increased (in real terms) 2010, and capital expenditure was in line with the world-wide average within the industry.

The strength of the industry and a significant increase in the use of mobile broadband services mean that the wireless sector continues to provide economic value to the wider economy in Canada. The industry stimulates growth, generates wealth and creates value for the government through taxes and spectrum licence fees.

We have concluded that the total value that the wireless communications industry generates for the Canadian economy amounted to nearly \$43bn¹ in 2010. This derives from the direct GDP contribution, the output multiplier and the consumer surplus which compares to \$41bn in 2009.

This value is much more than the revenues earned by the operators, dealers and service providers resident in Canada. The direct economic impact of the Canadian wireless telecom services industry in 2010 included the following:

- the wireless communications services industry in Canada generated \$17.66bn in revenues in 2010 an increase of 4.5% from the previous year² and directly contributed \$18bn to Canadian gross domestic product (GDP)³. The greatest contribution to the national GDP from the wireless communications services industry came from the mobile operators and support service sectors.
- when this direct contribution to GDP is complemented by the Statistics Canada output multiplier⁴ of 0.87 we can see the total economic benefit from the supply of wireless communications services in 2010 to be \$33.66bn.
- \$2.5bn was invested in capital during 2010, which represents 14.16% of aggregate Canadian mobile operators' 2010 revenues. This level of capital intensity is greater than the average for North America which was 13.3% in 2010 (Ovum analysis). The operators are seeing increased use of their high speed mobile data access services which take advantage of their network and spectrum investments to provide additional mobile data capacity and

¹ Note: unless otherwise stated, all financial figures in this report are expressed in Canadian dollars.

² CRTC Communications Monitoring Report 2011, Ovum's estimate of 2010 Capex and previous report.

³ Statistics Canada states that the GDP of an industry represents the value added by labour and capital in transforming inputs purchased from other industries into output.

⁴ The 'output multiplier' is a statistical tool which enables the economic impact of demand on contributing suppliers in the supply chain to be assessed, based on the demand for end-user services. Statistics Canada provides a multiplier of 0.87 for the integrated telecommunications industry. This has been applied to the wireless sector in this study.

take advantage of their acquisition of AWS spectrum in 2008. Over the period 2005-2010 capital expenditure in the industry has grown at a CAGR of 15.6%.²

- the use and availability of wireless telecom services and products generated a consumer surplus of approximately \$9.311bn in 2010. This is the difference between what end-users are willing to pay for a service and what they actually pay and represents the direct benefit consumers receive from wireless communications services in Canada.
- the Canadian wireless telecommunications industry supported 261,000 jobs in 2010 – direct employees, support staff, and those indirectly employed.
- the wireless sector offers high value employment – it had an average salary level of \$64,732 in 2010, in the same year the average Canadian salary was just \$44,366.
- the \$18bn value of the Canadian wireless industry in 2010 compared favourably with the value generated by other major Canadian industries such as food manufacturing (\$19.49bn) and agricultural crop production (\$16.97bn). Within this total wireless industry value:
 - the use of mobile broadband and other data services experience rapid growth stimulated by widespread coverage of advanced 3G service capabilities, which in 2010 were available to 98% of the Canadian population, up from 96% the previous year⁵, and more demand from smartphone users wishing to get the most out of their phones, from applications such as video streaming and social networking. 3.5G services (HSPA+) are available to 97% of the population.
 - the mobile data/broadband sector generated \$4.42bn in revenues from data services in 2010, representing 25% of total revenues.
 - the mobile content sector generated around \$240m in 2010⁶, which compares to \$227m in 2009. This includes music, TV and gaming services. The majority of revenue is from the downloading of music and mobile gaming. Revenues from streaming music services and subscription TV / video services are very modest.

The wireless industry in Canada has made substantial investments over many years. Incumbent operators and new entrants continue to invest heavily, despite challenging economic conditions. They are doing so to meet the increasing demand for high performance services which are enabled by new technologies. This investment is in the form of additional network nodes, fibre and microwave backhaul and new core network infrastructure. In some rural areas, the wireless network is the only means of providing broadband services, which can place considerable strain on the radio access network capacity.

⁵ CRTC Communications Monitoring Report 2011

⁶ Based on operator survey and estimates of the proportion of revenue directly attributable to non-operator application stores

2 Introduction

2.1 Scope of the study

This study was commissioned by the Canadian Wireless Telecommunications Association (CWTA)⁷ as an update to the report published by the CWTA in May 2011 on the impact the Canadian wireless industry had in 2009. This report assesses the beneficial impact that the Canadian wireless industry had in 2010, and will likely continue to have, on the Canadian economy.

This independent report has been prepared to demonstrate that the mobile industry continues to provide significant economic value to the wider economy in Canada well beyond the revenues which flow to the network operators and service providers. The industry has established mobile broadband services to a vast majority of the Canadian population, a service area which is projected to see rapid growth over the coming years.

The focus of the report is to quantify the economic impact of the industry in terms of GDP, jobs and productivity gains for both the supply side and demand side of the economy.

The key objectives of the study are:

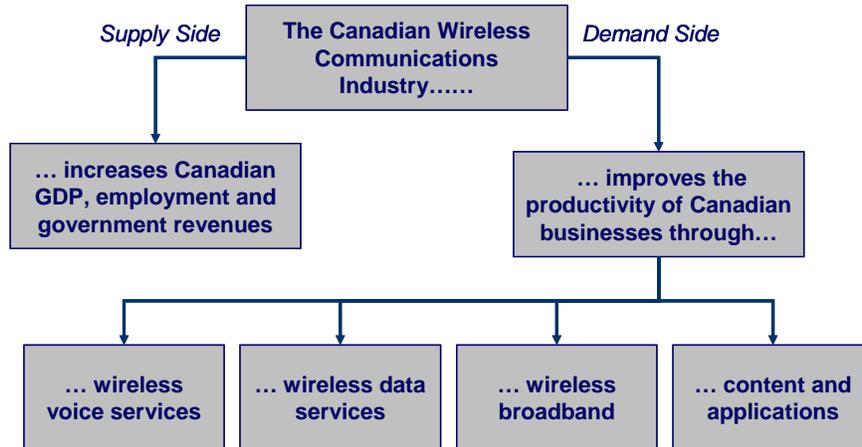
- to identify and demonstrate the supply side economic benefits of mobile services in Canada in terms of contribution to gross domestic product (GDP) and employment.
- to identify the productivity gains that accrue from wireless services.
- to assess the consumer surplus - the welfare and social benefits that mobile services provide for consumers, from a quantitative and qualitative perspective.

This report builds on the studies published by the CWTA in April 2010 and May 2011⁸, with minor adaptations to improve the methodology and provide a more detailed analysis of mobile broadband services. The May 2011 report was based on 2009 market data. This 2012 report is based on 2010 data.

⁷ CWTA is the authority on wireless issues, developments and trends in Canada. It represents cellular, PCS, messaging, mobile radio, fixed wireless and mobile satellite carriers as well as companies that develop and produce products and services for the industry.

⁸ The Benefit of the Wireless Telecommunications Industry to the Canadian Economy

Figure 1: Principal economic impacts of the Canadian wireless industry on the Canadian Economy



Source: Ovum

2.2 The structure of the report

The Canadian mobile services industry has been performing strongly. We consider in this report what economic benefits the supply and use of mobile services generated for the Canadian economy in 2010.

The report is structured as follows:

- Section 3 provides an overview of the Canadian wireless industry sector.
- Section 4 presents our estimates of the end user revenues generated by the mobile services industry in Canada in 2010, how these flow along the value chain and what value add was captured by which suppliers. It also estimates the GDP retained within Canada and the number of jobs in Canada which were dependent on the industry.
- Section 5 quantifies the consumer surplus generated by the industry to end users and describes the social benefits provided by the sector to the general economy.
- Section 6 provides some brief case studies which illustrate the value that mobile broadband services bring to industry and to the economy.
- finally, in Section 7 we present our conclusions.

3 Canadian wireless industry sector overview

3.1 Strong growth and investment during recession

The Canadian government recognises that the ICT industries have a major role to play in supporting economic growth and enhanced productivity. This is demonstrated by the 2011 speech by the Minister of Industry⁹. It is fortunate therefore that the Canadian wireless industry bucked the overall economic trend and that it remains heavily committed to improving the availability and performance of wireless broadband services.

The Canadian wireless market is characterised by:

- a need to serve a huge geographic area. With a population density of 3.4 people per sq km, Canada is much more sparsely populated than the US which has around 30 people per sq. km, and Europe, which has over 70 people per sq. km. and it is laudable that Canadian operators manage to cover 99% of the population with voice services, and achieve 3.5G coverage for 97% of the population¹⁰ – which require high levels of capital expenditure.
- as of Q4 2010, the geography of Canada was served by 56 licensed operators. This includes three national operators plus regional and local operators.
- high operating costs for network operators. This is explained by the low population density in many provinces, which involves higher network deployment costs, but also increased expenses resulting from the operation of new networks able to support high levels of data traffic.

Despite these characteristics, the wireless industry is still the driving force of the Canadian telecommunication industry.

In 2010, the Canadian wireless communications market generated revenues of \$17.66bn, an increase of 4.5% on 2009's \$16.9bn. This represents 42.3% of all Canadian telecommunication revenues, an increase of one percentage point from the previous year, as customers continue to substitute from wireline to wireless services.

Although the rate of growth of the wireless industry has eased slightly in 2010 it remains positive at 4.5%, unlike the wireline industry which saw revenues fall for the second successive year, down 1.25%, to \$23.7bn¹¹.

⁹ <http://www.ic.gc.ca/eic/site/ic1.nsf/eng/06786.html>

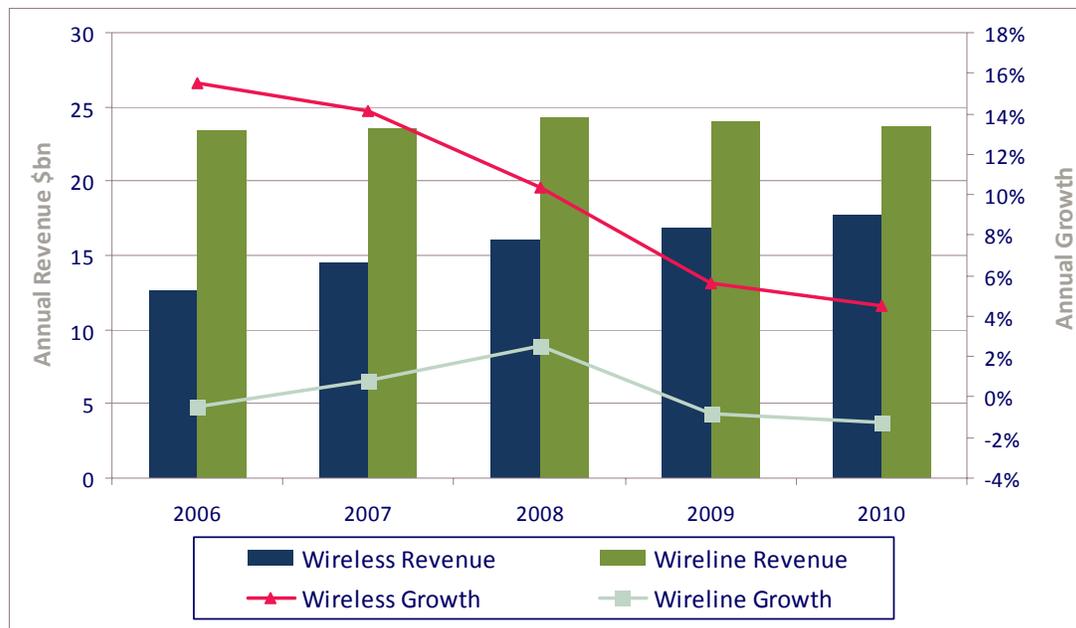
¹⁰ CRTC Communications Monitoring Report 2011, Section 5.5

¹¹ CRTC Communications Monitoring Report 2011

Wireless minutes of use fell year-on-year in 2010 by 0.75%, driving a slight drop in ARPU from \$58.81 to \$57.86 per month, a fall of 1.6%. Total wireless subscribers increased by 8.5% from 2009 to 2010, with total wireless connections standing at 25.8m by the end of 2010¹².

Analysis of the Canadian wireless communications industry has to be considered against the situation in the overall national economy. Industry Canada’s statistics of the Canadian Economy¹³ show that the economy grew by 3.3% in 2010, this is in sharp contrast to 2009 which saw a 2.8% contraction in the Canadian economy.

Figure 2: Canadian wireless revenues continue to grow – but more slowly than in 2009



Source: Ovum, CRTC Communications Monitoring Report 2011

Mobile data and broadband services

The mobile access market provides a range of services, including mobile telephony, mobile data, roaming, wireless Internet access and paging. As is the case in many other countries in the world, the importance of mobile data services is growing, particularly for accessing social networking, gaming services and music content. The OECD reports that there were 10.4m

¹² CRTC Communications Monitoring Report 2011

¹³ http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00013.html

active mobile broadband subscriptions in Canada in 2010¹⁴. Across the industry, operators reported that 25% of all revenues were attributable to wireless data services, a five percentage point increase over 2009.¹⁵

To ensure continuing world class service for Canadians, the operators have been evolving their wireless networks and Canadian national wireless carriers have made a major migration to HSPA+, bringing mobile broadband speeds of up to 21Mbit/s to consumers, albeit with higher operating costs to operators. As mentioned above, by the end of 2010, approximately 97% of Canadians had access to 3.5G or equivalent mobile broadband services with speeds of up to 21 Mbit/s on handheld mobile devices. Their next phase of infrastructure upgrade and migration has started, with operators deploying LTE networks¹⁶ which will allow mobile broadband services of 40 Mbps or more.

Due to the unceasing demand from Canadians for world class mobile technology and services the industry requires continual capital expenditure on new generation systems to address the evolving nature of technology. In 2010, based on the capex data provided by the operators for this report and subscriber data numbers¹⁷, the Canadian wireless industry average network capital expenditure was \$101.17 per subscriber. This is a decrease of 18.4% from 2009's \$123.91, which reflected significant investment in HSPA+ and the investments made to take advantage of the AWS spectrum acquired in 2008.¹⁸

The growth in mobile data, driven by mobile broadband is being seen in all advanced markets. Figure 3 shows the level of world-wide voice and data traffic, with the latter driven by mobile broadband, smartphones and laptop connectivity. Data traffic now well exceeds traffic from voice services.

Cisco prepares an annual report which monitors the development of mobile broadband and their report projects data traffic growth at a CAGR of 78% from 2011 to 2016¹⁹, as shown in Figure 4. The CAGR is down from the previous Cisco forecast, which was 92% from 2010 to 2015²⁰, a reflection that the rate of growth slows as the market becomes better established. This growth is fully expected by the operators and they recognise that continued investment will be needed to support this trend.

¹⁴ www.oecd.org/dataoecd/44/36/48241503.xls

¹⁵ Operator Annual Reports and CRTC Communications Report 2011

¹⁶ Rogers Press Release: Feb 06, 2012 - Rogers to launch Canada's fastest LTE devices and new price plan
Bell Press Release: Sep 13, 2011 - Bell to launch 4G LTE network in Toronto, Mississauga, Hamilton, Kitchener-Waterloo and Guelph tomorrow

Telus Press Release: Feb 9, 2012 - TELUS 4G LTE wireless service goes live in 14 metropolitan areas across Canada

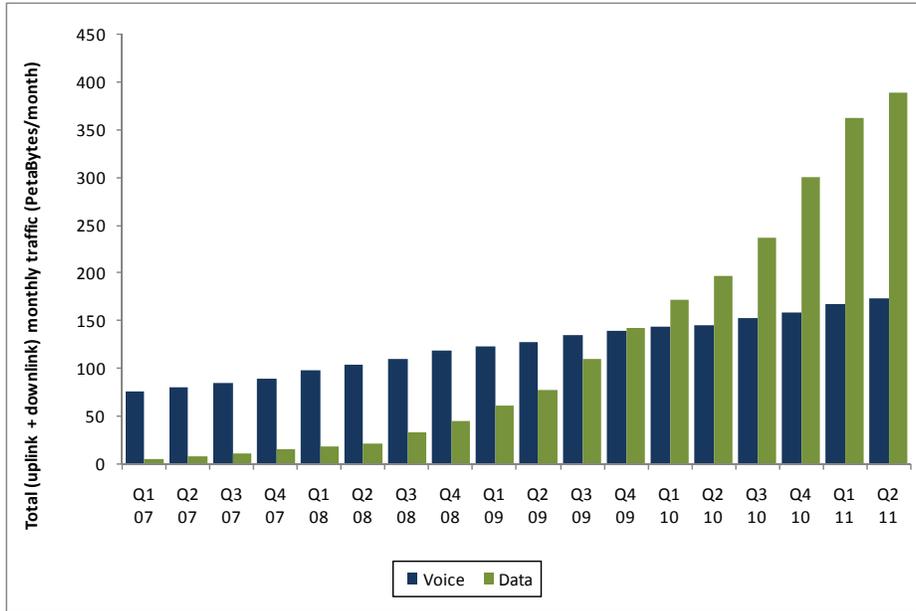
¹⁷ http://cwta.ca/wordpress/wp-content/uploads/2011/08/SubscribersStats_en_2010_Q4.pdf

¹⁸ Based on Ovum 2010 capex analysis and CRTC Communications Report 2011 subscriber data

¹⁹ Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011–2016

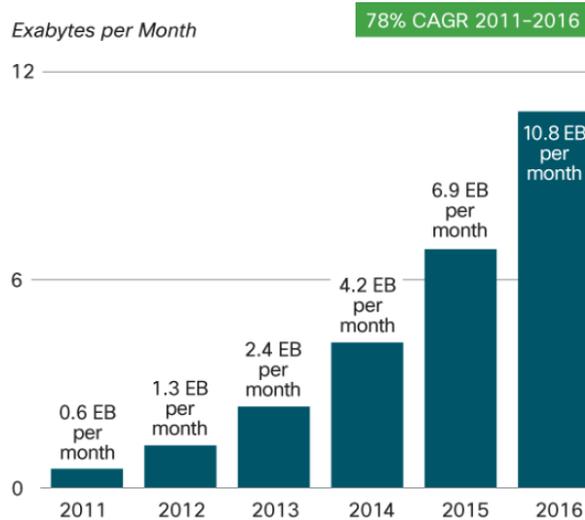
²⁰ Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010–2015

Figure 3: Worldwide monthly mobile traffic (Uplink and Downlink)



Source: Ericsson, Traffic and Market data report, Nov 2011.

Figure 4: Worldwide mobile data traffic forecast



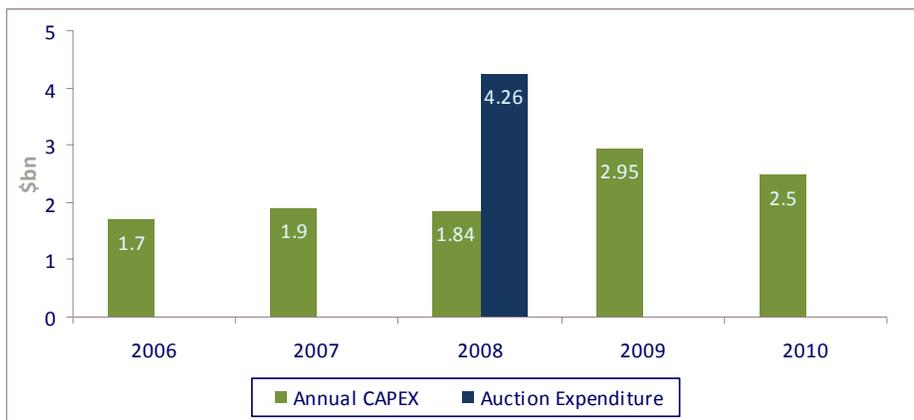
Source: Cisco VNI

Capital investment

There is clearly a continued need for operators to invest in new technology. Prudent business management requires that this investment is spread reasonably evenly from year to year and, from 1996 to 2007 the industry invested between \$1.1bn and \$1.9bn every year in capitalised equipment and services. In 2008, the amount of wireless capital expenditure increased dramatically, to \$6.1bn, due to the cost of AWS spectrum. In 2009, network capital expenditure increased significantly from 2008 (i.e. excluding spectrum costs). This was due to the continued investment by the established operators to increase their coverage and network performance, and investment by those new operators that bought spectrum rights in 2008 as they deployed their networks. In 2010 capex was at 14.16% of revenue, an investment of \$2.5bn. Ovum’s world-wide analysis of mobile operators’ capex indicates that the Canadian level is slightly less than the world average of 15.3%, and higher than the North American average of 13.3%.²¹

Figure 5 illustrates the most recent trends in wireless capital expenditure.

Figure 5: Canadian cellular network investment



Source: 2005-2008, CRTC Communications Monitoring Report 2010; 2009 and 2010, Ovum estimate based on operator survey, company reports and statements

In addition to these network investments are the significant on going costs and one-time costs of the spectrum licences required to operate these networks. Until 2010, the incumbent cellular/PCS operators paid \$130m annually for the spectrum that was not awarded by auction. Since 1998, Industry Canada has had a policy to award mobile spectrum licences via auction. In 2001, Canada’s wireless operators transferred \$1.482bn to the government for 10 year PCS licences. In 2008 the industry transferred \$4.26bn to the government for AWS spectrum.

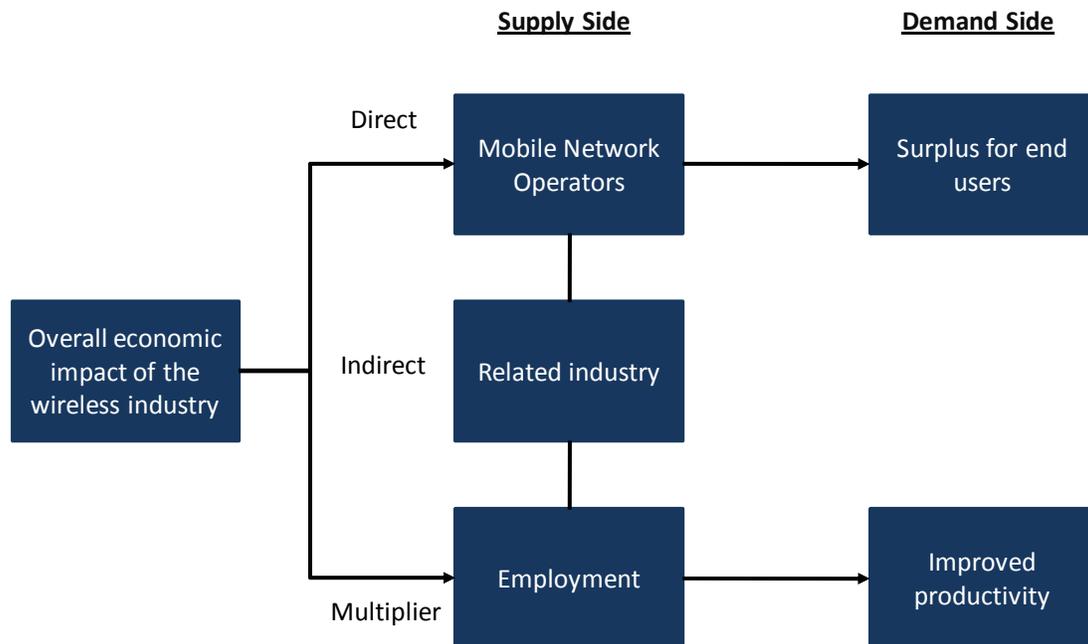
²¹ Ovum: 4Q11 Capex Spreadsheet: Global

Each licensing process results in intensified capital spending as new networks are deployed to make use of the spectrum. The AWS auction in July 2008 resulted in significant capital investment by operators across the sector in 2009 and the level in 2010 continues to exceed the systems-related capex of 2006-2008.

3.2 The economic contribution of wireless telecoms services

This report provides an independent assessment of economic impacts that the Canadian wireless telecom industry had on the Canadian economy in the year 2010 and considers how some of the metrics have changed from 2009. The conclusions reached in this study are based on Ovum’s economic model for the Canadian wireless telecoms services industry.

Figure 6: Principal economic impacts of the wireless industry on the Canadian economy



Source: Ovum

The model incorporates:

- financial and business data received under NDA from the operators.
- publicly available data concerning wireless carriers, wireless handset, equipment manufacturers and the overall wireless telecom industry.

- Ovum's own independent analysis, research and forecasts.

Our analysis indicates that in 2010 the wireless telecommunications industry in Canada contributed \$18bn to national GDP, this compares to \$17.22bn in 2009. Of this \$18bn GDP contribution, \$12.37bn was retained in the Canadian value chain and \$5.63bn was sourced outside Canada.

We estimate that the sector contributed directly and indirectly to employment of 261,000 in Canada. If an induced employment factor of 1.1 is taken into account, this rises to more than 277,000 employed.

4 Supply side impacts of the Canadian wireless industry

4.1 Supply side impacts: our methodological framework

In this section of the report we discuss the supply side – the provision of services by mobile network operators and service providers – and the supply side benefits that are generated. These are considered for the year 2010 and exclude any supply side benefits that come into the country which are generated by systems and device vendors exporting to other parts of the world.

The Canadian wireless communications industry includes both suppliers that were founded in Canada (e.g. RIM, Ericsson Canada (Nortel) and Sierra Wireless) as well as a number of other manufacturing companies such as Alcatel Lucent, Huawei, Motorola, Nokia, Nokia Siemens Networks and others. Most of these companies undertake R&D in the country (RIM, in particular, invests heavily in R&D which brings many positive externalities to the wireless industry) and increasingly the major vendors undertake operational support roles for their customers and provide network operations and management services.

In order to estimate the impact of the supply side, we adopt the following three step process:

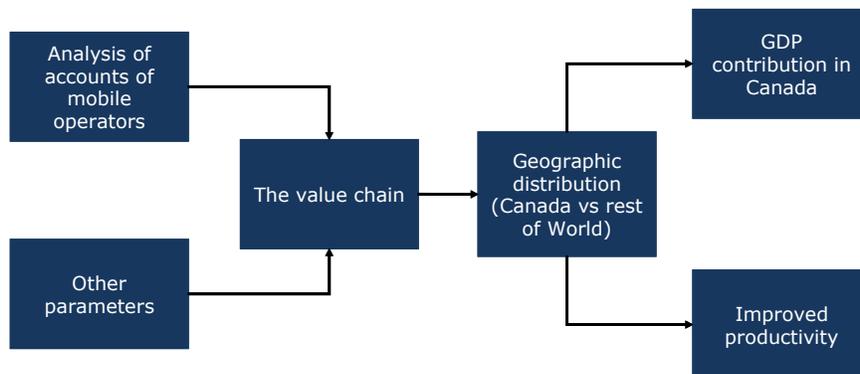
- Step 1: we start by quantifying the value chain for the industry - from the purchase of services and terminals by end users through to the creation of the components which go into making the network equipment used to supply these services.
- Step 2: we then consider how the value added at each step in the chain is distributed geographically. In this report we simply look at the division of the value add²² between the Canada and the rest of the world.
- Step 3: we then use our findings to estimate the GDP and employment generated by the wireless communications services industry in Canada.

It is important to note that:

- we estimate the supply side economic impacts of the Canadian wireless services industry alone. We do not estimate the supply side impacts of the rest of the world's wireless services industry on Canada.
- the estimates include the impact of inbound and outbound roaming revenues but assume that the flow of roaming revenues between Canada and the rest of the world is balanced.

²² We use the terms *value add* and *GDP contribution* interchangeably since they are both terms for labelling the contribution to overall national GDP which a firm makes. In our simplified model, GDP is considered to be the sum of the value of final products and services sold.

Figure 7: Ovum’s model for estimating supply side effects

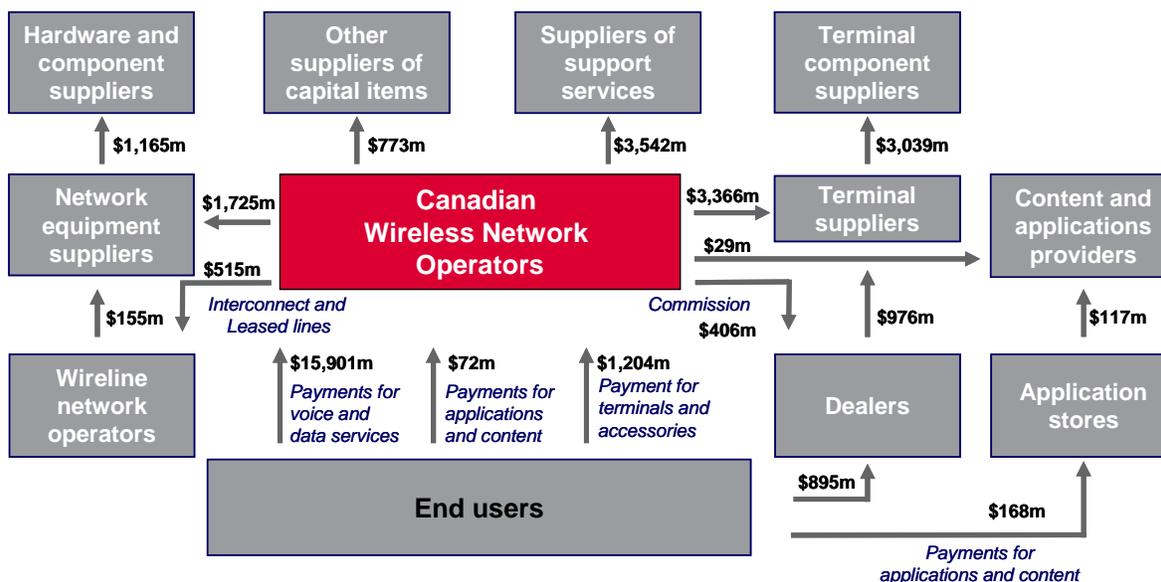


Source: Ovum

4.2 Canada’s wireless value chain

Ovum has developed a model to estimate the value added (GDP contribution) and the effects on employment generated by the wireless sector in Canada. The model is based on a simplified version of the Canadian wireless sector value chain, as shown in Figure 8.

Figure 8: The value chain for wireless services in Canada



Source: Ovum. Note: definitions of value chain categories are provided in Annex A

We use the model to estimate:

- 1 the GDP (or value add) generated by Canada's mobile services industry. Revenues are broken down in the model by industry sector (Figure 8), geographic region (Canada and the rest of the world), and the component of value add (wages, other operating costs and depreciation, and taxes, profit and interest).
- 2 the direct, support service, indirect and induced employment generated within Canada by the mobile sector.

The Ovum model is built up as follows:

- basic statistics on the total revenues generated by the industry sourced from Statistics Canada, and the operators. These are combined with the detailed accounting breakdowns which were provided to us by the operators and relevant account information derived from industry accounts. These enabled us to estimate and provide a relevant breakdown of the costs and revenues across the mobile services industry.
- these estimates are combined with other key input parameters to estimate the revenue flows along the value chain and the value added by each industry segment. The value added is then distributed by geography (Canada and rest of world) and component. It uses, among other sources, estimates of the geographic distribution of the value added by terminal supplier.
- the model then calculates the number of jobs generated by Canada's mobile services industry by dividing the relevant value add by the relevant average annual unit wage cost for the industry segment.
- finally, the model calculates the value add per employee in the mobile sector (within wireless operators and dealers) and compares it with the value add for the average worker in Canada.

Content and applications value chain

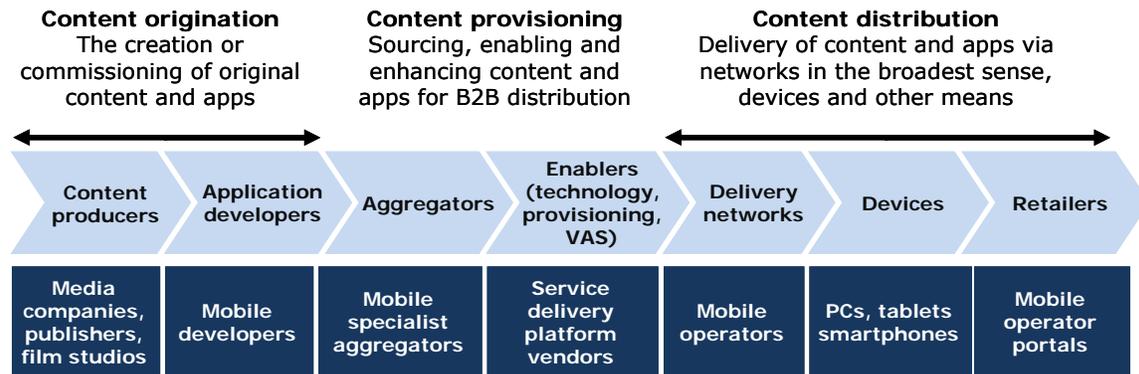
The use of mobile broadband and associated data services is growing rapidly. The market for applications and content is also developing, and consumers have several routes to acquire content:

- from their mobile service provider.
- from application stores such as Nokia's Ovi, Apple's iTunes stores, RIM's Blackberry App Store, Amazon and gaming stores.
- direct from application developers and vendors.

The products acquired may be chargeable or free to use, and includes personalised content, mobile games, music, mobile TV and other content (e.g. alert services, premium/branded news and information service subscriptions; betting and gambling).

Advertising services, which may be associated with search or media services also generate revenues and value.

Figure 9: Content value chain



Source: Ovum

These services and applications are an important and developing sector of the mobile industry, enabled by higher speed, lower priced mobile broadband and devices designed to exploit the content.

Ovum’s analysis shows a growing market for mobile value-added services, estimated at \$240m in total. The majority of this revenue, \$168m, goes directly to the application stores, with \$72m going to the operators. As the value flow show, as large proportion, \$146m is then passed on to the content and applications providers. Subscriptions for streaming music and video services are usually device-agnostic. As such, a proportion of Ovum’s overall market estimate of revenues for these services is attributed to the wireless sector.

Mobile video services

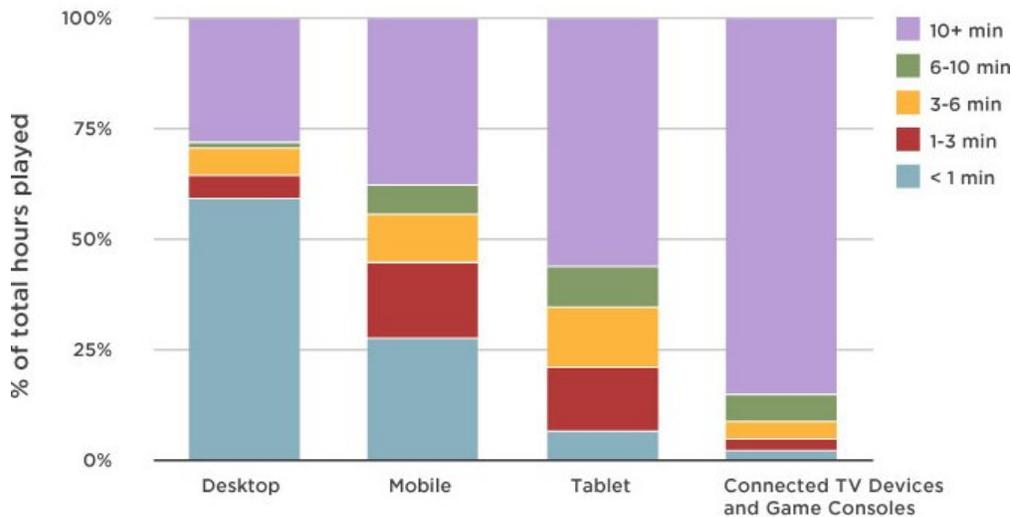
One high-value service area which is enabled by mobile broadband is the use of video services. The rapid adoption / usage rates indicate that consumers derive significant value, both from the content itself and from the ability to access video, when and where they want it. The services are in one of three main forms:

- free to air content: for example, YouTube and other services which may be funded through advertisements, and video clips on social networking sites. In general, these are referred to as short-form content, rather than long-form content.
- indirect broadcast services: which are made available either as part of a multi-screen subscription package (i.e. the content is made available to television, laptop, tablet or smartphone) to help a broadcaster’s customer acquisition and retention strategy or as additional revenue-generating services to new customers.
- premium content services: for example sports or other speciality channels which may also be offered as part of a bundle to help reduce churn.

The value to the service providers is generated in several ways: directly generated revenues from mobile broadband subscriptions and charges for the provision of content; through revenues which result from new customer acquisition or reduced churn; and through advertising associated with the services - which is typically in the range \$5-\$75 per 1,000 impressions (i.e. the number of times an advert is displayed on a device) depending on the associated content and its consumer demographic.

Whilst the trend is that more mobile subscribers are consuming video services, the amount of use varies considerably by age group. Usage statistics from Ovum’s research and other published sources vary depending on the research methodology and definition of usage. Ovum’s international consumer research indicates that short-form video services are consumed by 25% of mobile phone subscribers, on-demand TV and live TV by 3% each, and movies on-demand by 1% of mobile subscribers. Research in the US²³ indicates that around 11% of mobile subscribers (in the 13+ age group) watch video on a mobile phone, and that those mobile subscribers do so for an average of 4 hours 20 minutes per month (Q4, 2010).

Figure 10: TV: Content length and device type (Q3 2011)



VIDEOMIND Video Index



Source: Ooyala - The VideoMind Video Index report

Netflix, the US-based on-demand Internet streaming media service provider, launched its services in Canada in Sept 2010. The company’s services are available on smartphones and large screen mobile devices and it is the availability of services such as this, which were reported in October 2010 to generate more than 20% of US downstream traffic during peak

²³ Nielsen: The Cross-Platform Report

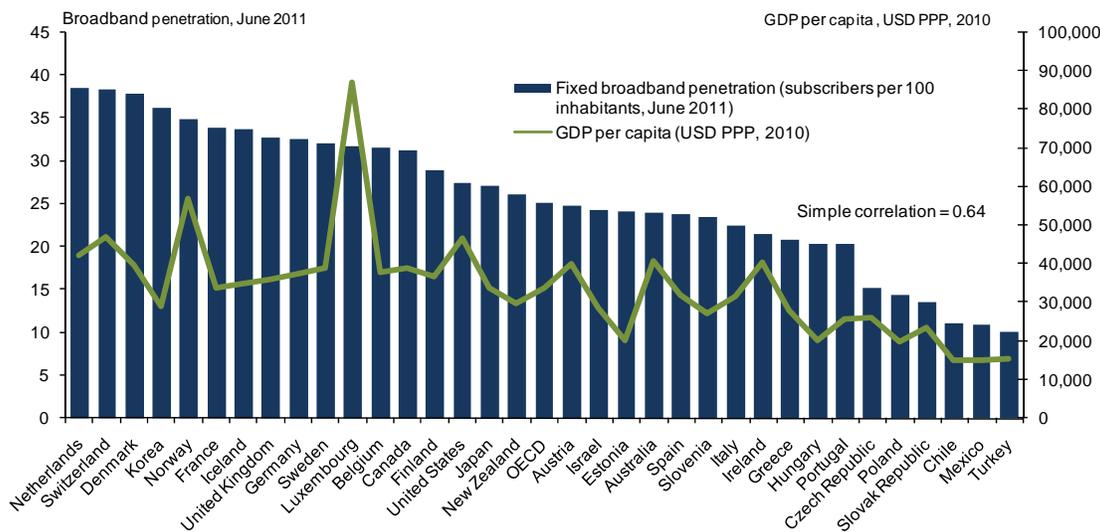
times²⁴ - albeit this is mainly to fixed network broadband connections. Recent analysis shown in Figure 10 indicates that video services on mobile and tablet devices, which are watched for more than 10 minutes per viewing, make up ~38% and ~56% of viewings respectively. This will include viewings with devices connected through non-mobile networks, but nonetheless, it indicates the viewing is for longer periods than typical desktop video consumption.

The video streaming revenues which can be attributed to the mobile sector in 2010 are very modest. However, as services become better established the revenues will improve.

Economic value-add of broadband

In Canada, approximately 98% of all households had access to 3G mobile broadband services in 2010, and 97% were able to access 3.5G, HSPA+ services.²⁵ In order to further improve these coverage rates, the Canadian government established a modest budget in 2009 of \$225m, specifically earmarked for broadband development and to improve broadband availability to underserved areas²⁶.

Figure 11: Broadband penetration rates and GDP per capita



Source: OECD

²⁴ http://www.sandvine.com/news/pr_detail.asp?ID=288

²⁵ CRTC Communications Monitoring Report July 2011.

²⁶ Contrast this amount to the wireless industry's single year investment of \$2.95 bn

While broadband penetration rates remain substantially below the availability percentages, particularly with regard to mobile broadband, the value that broadband services adds to an economy can be very significant and thus an important consideration.

In many countries it has been shown that improving broadband penetration creates significant economic value. Indeed, in a comparison across 31 countries, the OECD demonstrates a correlation between fixed broadband penetration rates and GDP per capita, as shown in Figure 11 (although correlation doesn't imply causation).

The value that broadband brings to an economy can be considered along two dimensions: first, an improvement in the country's GDP and, second, an enhancement of consumer surplus. In this section we examine each of these dimensions for the fixed broadband market before presenting a discussion on the potential value that mobile broadband might contribute to the Canadian economy.

Improvement in GDP

A number of studies have attempted to calculate the impact that broadband availability and broadband speed have on a country's GDP.

A study by Deloitte²⁷ found that the direct contribution of the internet to the Australian economy is worth approximately AUS\$50bn or 3.6% of Australia's Gross Domestic Product (GDP) in 2010. A similar direct contribution in Canada would be \$44.4bn.

A report²⁸ conducted in 33 OECD countries quantified the isolated impact of broadband speed. It showed that a doubling of the broadband speed for an economy increases GDP by 0.3%. In Canada this would be equivalent to \$3.7bn. The study also showed that additional doublings of speed can yield growth in excess of 0.3%. For example a quadrupling of speed equals 0.6% GDP growth stimulus. Other studies, have shown that a 10 percentage-point increase in broadband penetration raises annual per-capita growth by between 0.9-1.5 percentage points".^{29,30} Whilst studies may differ in their estimations and in the way in which they quantify broadband, they do provide a measure the economic benefit to GDP of mobile broadband. These and other studies enable us to estimate the broadband contribution to GDP in Canada in 2010 to be \$102bn.

We stress that this value is a rough estimation and simply serves to provide an indication of the likely magnitude of the broadband contribution to GDP in Canada. A much more rigorous analysis of the value of broadband would need to be conducted to obtain a more precise estimate and, even then, any estimation will struggle to account for the many indirect effects of broadband that might add economic value but are not directly measurable.

²⁷ The Connected Continent, August 2011

²⁸ New study quantifies the impact of broadband speed on GDP, Sept 2011, <http://www.ericsson.com/news/1550083>

²⁹ Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L. 2009. Broadband Infrastructure and Economic Growth. CESifo Working Paper No. 2861.

³⁰ Kim, Y., Kelly, T. and Raja, S. 2010. Building Broadband: Strategies and Policies for the Developing World. GICT Department, World Bank.

Enhancement of consumer surplus from broadband access

While the economic value of broadband can be assessed in terms of its contribution to GDP, another measure is the additional consumer surplus that is derived as a result of broadband connectivity.

A 2009 study showed that broadband connectivity in the US yielded US\$32bn of consumer surplus in 2008; this represents a 58% improvement in broadband consumer surplus from 2005 when the surplus was approximately US\$20bn.³¹ This value of US\$32bn appears reasonably consistent with values in other studies.^{32,33}

We have used the amount of US\$32bn in our estimation to determine a comparable value for the Canadian market. By combining population data for Canada and the United States with data on the number of broadband subscriptions in each country, we calculate broadband penetration rates for the two countries, and by assuming that the ratio of consumer surplus derived from broadband connectivity and broadband penetration for the United States is the same as the ratio for Canada, we calculate the consumer surplus derived from fixed network broadband connectivity in Canada to be \$4.52bn.

The economic impact of mobile broadband

The above analysis focuses exclusively on the fixed broadband market. As mobile broadband becomes more prevalent and penetration increases, assessing the economic impact of this type of broadband will become more and more important. The nature of mobile broadband, however, is such that attaining an accurate measure of individual usage is extremely difficult; this, in turn, means that valuing the economic impact of mobile broadband is challenging. Before considering the economic value, we will consider the substantial productivity gains which have already resulted from the growing deployment and use of wireless broadband services. At a personal level these benefits range from the simple, e.g. being able to access personal data, information and content which may be stored in cloud-based services, through to more advanced services, e.g. GPS-based resource location services linked to maps. These applications also benefit commercial users, for whom mobile broadband has become an essential component of business life. With many employees needing to travel within their business, mobile access to email and the internet are now a necessity. Productivity gains come from more specialised applications that support staff engaged in field service, healthcare, utility operations, sales, courier and delivery services - in fact just about every manufacturing and service sector. The benefits are available to large organisations and small, and the latter may benefit more as it is no longer necessary to have the backing of a large enterprise to be able to benefit from tailored services.

³¹ Dutz, Orszag and Willig. 2009. The Substantial Consumer Benefits of Broadband Connectivity for U.S. Households.

³² Rosston, G., Savage, S. and Waldman, D. 2010. Household demand for Broadband Internet Service. FCC.

³³ Horrigan, J. 2010. Broadband Adoption and Use in America. FCC.

The OECD reports a total of 10.8m mobile broadband subscribers in Canada (June 2011).³⁴ Ovum forecasts that this will increase to over 20m users by 2015.

The range of applications becoming available for mobile broadband users illustrates the considerable value that users must enjoy from the availability of the access service and the applications. It is not straightforward to estimate this value, but we have included an estimate in the assessment of the consumer surplus, discussed in Section 5 of the report.

4.3 Total value add generated by the Canadian wireless sector

We quantify the monetary flows between key players in the value chain. In 2010, we found that:

- the total end user spend on wireless services and devices in the Canadian economy was \$17.66bn, which was comprised of:
 - \$15.9bn directly from consumers to mobile network operators for communications services.
 - \$2.1bn spent by consumers on handset terminals and accessories. Of this \$1.204bn flows directly to wireless operators and \$895m to independent dealers. Operators pay terminal manufacturers \$3,376bn. The difference between their receipts and payments is due to handset subsidies by the operators and the 11% increase in spend reflects the growing market in smartphones.
- the wireless operators rewarded independent dealers for sales to end users in 2010, through commission payments of \$406m. This is significantly lower than the figure reported in our previous report, and is based on quite a wide spread of data-points received from the operators. The total revenue to dealers amounts to \$1.295bn. Of this total revenue, we estimate that approximately \$976m was paid to terminal suppliers.
- terminal suppliers receive the bulk of their revenue from wireless operators in Canada, with \$3,376bn flowing to them from this source. Of their total revenue of \$4,352bn, roughly \$3,046bn, or 70%, was paid for terminal components, to suppliers or internally, within the same corporate organisation.
- in addition to commission payments, wireless operators also had a number of other outgoing revenue flows:
 - Ovum estimates that wireless operators made significant payments to the sum of \$3.542bn to support service suppliers. These services cover those which have traditionally been handled by external agencies, such as advertising, professional services (lawyers and accountants) and IT, but which now also encompass customer support and outsourced network operations and maintenance services. These payments represent around 27% of wireless operators' total costs (excluding free cash flow).

³⁴ OECD Broadband Portal

- additionally, wireless operators undertook total capital expenditure of \$2.491bn, of which \$1.725bn flowed to network equipment suppliers. The continued investment in high performance mobile data access systems underpinned much of the increase in capex.
- finally, wireless operators made payments of \$515m to wireline operators, primarily for leased lines and interconnect services. This represents a 45% fall on a year before, highlighting the predominance of wireless services for voice calls in 2010.
- wireline operators also played a role in the total value added of the Canadian wireless sector. Roughly 30% of the revenue they received from wireless operators for leased line and other services in 2010 was paid to network equipment suppliers for the equipment used to provide these services and for network construction. This gave network equipment suppliers total revenue of \$1.875bn of which \$1.165bn flowed to suppliers of the network equipment component vendors.

Table 1 below summarises the contributory value added generated by each part of the value chain in 2010 as a result of these payment flows:

Table 1: Value added in Canada which is generated within the value chain

	Value Added (\$m)	Percentage of total value added
Dealers and app. stores	325	2%
Wireless operators	6,778	38%
Wireline operators	361	2%
Support service suppliers	3,542	20%
Network equipment suppliers	714	4%
Hardware and components	1,165	6%
Terminal suppliers	1,303	7%
Terminal component suppliers	3,039	17%
Other capex suppliers	773	4%
Total	18,000	100%

Source: Ovum. Note definitions of value chain categories are provided in Annex A

When assessing the value of industries to the Canadian economy, the Government statisticians use a modelling technique which is referred to as the 'output multiplier'. This is a statistical tool which enables the economic impact of demand on contributing suppliers in the supply chain to be assessed, based on the demand for end-user services. Statistics Canada provides a multiplier of 0.87 for the integrated telecommunications industry. We have applied it to the wireless sector in this study, which leads to a total economic benefit from the supply of services

of \$33.66bn (\$18bn * 1.87), an increase of 4.5% on 2009's figure, which was above Canada's average inflation in 2010 (of 1.68%³⁵), indicating that Canada's wireless telecommunication industry in 2010 contributed more to Canadian GDP in real terms, than it did in 2009.

4.4 Geographic distribution of value add

Of the total value add accruing from the wireless sector in Canada in 2010 (\$18bn), \$12.38bn (68.8%) of the total GDP generated by the wireless operators and the companies which provide support services, was retained in Canada. The main areas of value which not retained in Canada were generated by the terminal suppliers as the components that they source for device manufacture are typically manufactured in the US, Europe and Asia. While there are significant national developers of mobile equipment, devices and applications, our analysis includes only the value that this company derives from its sales of devices and the use of wireless services in Canada. We do not include the significant value that is generated in other regions of the world.

Table 2 below shows how the value add is distributed between Canada and the rest of the world for each player in the value chain in 2010.

Table 2: GDP impact of wireless services in Canada in 2010

	Value Added (\$ m)	Percentage of total value added	Value added, and retained in Canada (\$ m)	Percentage of retained total value added
Dealers and app. stores	325	2%	325	3%
Wireless operators	6,778	38%	6,407	52%
Wireline operators	361	2%	354	3%
Support service suppliers	3,542	20%	3,542	29%
Network equipment suppliers	714	4%	179	1%
Hardware and components	1,165	6%	291	2%
Terminal suppliers	1,303	7%	234	2%
Terminal component suppliers	3,039	17%	274	2%
Other capex suppliers	773	4%	773	6%
Total	18,000	100%	12,379	100%

Source: Ovum

³⁵ Statistics Canada (2012)

4.5 Wireless services compared with other sectors

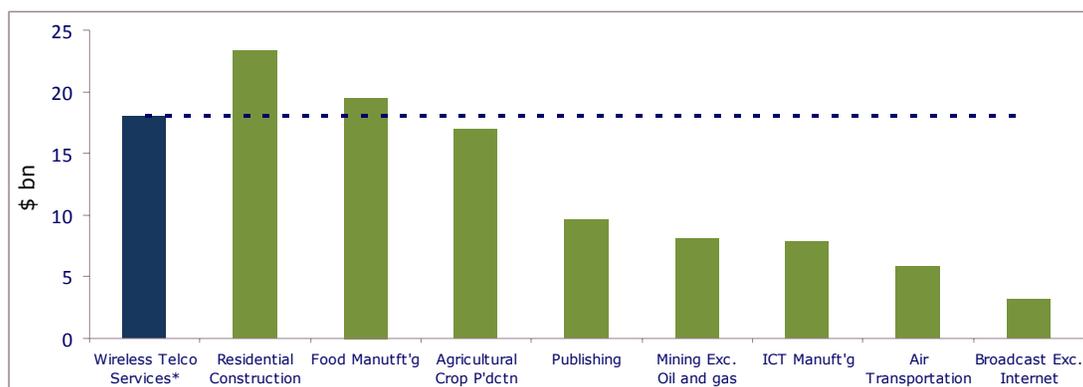
Industry Canada notes that the sectors of the Canadian economy can be regrouped to form five largely goods-producing industries and fifteen services-producing industries. The former are primarily associated with the production of goods:

- agriculture, forestry, fishing and hunting
- mining and oil and gas extraction
- utilities
- construction
- manufacturing.

The services sector is considered in fifteen wide-ranging sectors, which range from wholesale and retail trade, transportation and warehousing, finance and insurance, through to the public administration sector. Wireless communications services are included in the Information and Cultural Industries category.

The statistics for the major good-producing industries are well established and it is instructive to compare the contribution that the wireless telecommunications services sector makes to the Canadian economy against them. Figure 12 presents a selection of data points for other industry sectors which are recognised as major contributors to the economy. The wireless communications sector contributed \$18bn to GDP in 2010. Not only did this represent a significant contribution, comparable to other major economic sectors, but a comparison with industry data over the preceding year indicates that while recessionary times have led to most other industry sectors contributing lower amounts to GDP, the wireless sector has actually improved its contribution (from \$17.22bn in 2009), highlighting the resilience and necessity (in consumers' eyes) of this sector.

Figure 12: Comparison of contribution to GDP 2010 – selected sectors



Source: Statistics Canada; *Ovum

4.6 Employment effects

Ovum's model also provides an estimate of the total employment created in Canada as a result of the wireless sector. This has been achieved in the following manner.

We first disaggregate the employment effects into:

Direct employment – the number of workers employed directly by the various players in the value chain. We estimate this based on the total value add accruing from wages for each part of the value chain divided by average wage for that part.

Support employment – the number of workers employed by firms providing support services (e.g. professional services, IT, outsourced customer support and outsourced network operations and maintenance) to the various players in the value chain. We estimate this using the total value add accruing from other operating expenses for each part of the value chain divided by average wage for the Canadian economy.

Indirect employment – we assume that the tax, interest payments and profit component of value added also generates employment, as the spending by Government using tax revenues and the spending by financial institutions and shareholders using their income from Canada's mobile services industry will create new jobs. As with support employment, we divide by the average wage for the Canadian economy.

Induced employment – is due to the beneficial effect of the spending power of those employed directly in the industry or in support services. As consumers, these employees will spend some of their income on products and services which contribute further to employment and tax revenues to the government. Induced employment differs from the indirect employment effect, which is the beneficial effect derived from tax and interest to the Government and financial institutions.

The results of our analysis of the employment in Canada due to the wireless communications sector are summarised in Table 3. This shows Ovum's estimates of the employment created by each part of the Canadian wireless sector value chain. The estimate of the number of employees within the wireless network operators is based on full time equivalent staff numbers from major operators, pro-rated for the whole industry. Our methodology and the effect of induced employment are discussed below and in Annex C which discusses induced employment multipliers.

The calculation of employment in the network equipment supply sector, and in other sectors, is based on the value-added by the sector, divided by the estimated average wage within the sector. Two additional points should be noted with respect to the network equipment supply sector:

- this estimate is based only on those staff employed in the production of systems for use in the Canadian wireless service industry.
- staff in the network equipment supply industry, involved in network operations and support are included in the support service sector.

The network equipment suppliers play an important role in the Canadian wireless industry. Whilst the staff who are directly involved in equipment supply are fairly modest in number, a far greater number are involved in supplying support services to the network operators, e.g. systems installation, commissioning, network operations and management.

All industry / commercial sectors cause additional jobs to be created: in support; from induced revenues, and indirectly from revenues which go to the government in taxes or pass through to the finance sector. The wireless industries are evolving their operational models to strike a balance between the core-skills that they need to retain in-house (to maintain a competitive edge) and the use of specialist outsourced network support staff – who bring specialist skills in systems and operations. The total number of support service staff is just under 80,000, which is 4.5% lower than the 83,000 reported in our previous report, reflecting the peak of activity in 2009 stimulated by higher capex, which in turn was driven by the spectrum acquisitions in 2008. The total direct, support and indirect employment in Canada which results from the wireless telecommunications services industry was 261,000 in 2010, which is 2 times that of the employment generated by the wireless network operators (129,300 in total, of which 31,700 are directly employed). This increase of directly employed staff may be attributed to the growth and maturing of the newer operators' businesses. The size of the support services is a reflection of the interdependence of many industries. Not only are traditional support services (advertising, legal, accounting, etc.) included in this category, but so too are some of the network support functions as wireless network operators come to rely on outsourced services from vendors and managed services companies. The outsourcing of services can ensure that the operator can employ centre of excellence teams, and at the same time help achieve cost savings.

We have determined the employment figures in Table 3 by dividing the value added in each sector, by the associated estimated wage rates.

As noted in Annex C, the impact of induced employment can be determined by use of a multiplier within the range 1.1 to 1.7, as shown in Table 3. The final result is that we estimate that the number of jobs dependent on the Canadian wireless services industry is within the range 261,058 to 373,825. The indirect employment is that generated by the tax, interest payments and profit component of value added in the industry. This is not subject to the induced employment factor, as would be a third order factor.

Our analysis estimate for Canada is that the wireless communications services sector in Canada contributed around 1.43% to GDP in 2010, which excludes any induced contribution factor. This is based on the value added by the sector as a percentage of Canadian 2010 GDP.

Table 3: Canadian employment from mobile communications services

	Direct	Support	Indirect	Total
Dealers and app. stores	3,444	2,187	2,187	7,818
Wireless network operators	31,725	22,786	74,784	129,295
Support service suppliers (incl. n/w support)	11,908	51,601	15,877	79,387
Wireline network operators	2,229	3,234	1,455	6,918
Other capex suppliers	6,931	6,931	3,466	17,328
Terminal suppliers	1,979	2,365	526	4,870
Terminal component suppliers	2,309	2,759	613	5,682
Network equipment supply	1,508	1,801	400	3,709
N/w IT platforms and component suppliers	2,460	2,939	653	6,051
Total	64,493	96,603	99,961	261,058
Total with Induced Employment factor of 1.1	70,942	106,264	99,961	277,167
Total with Induced Employment factor of 1.7	109,638	164,226	99,961	373,825

Source: Ovum

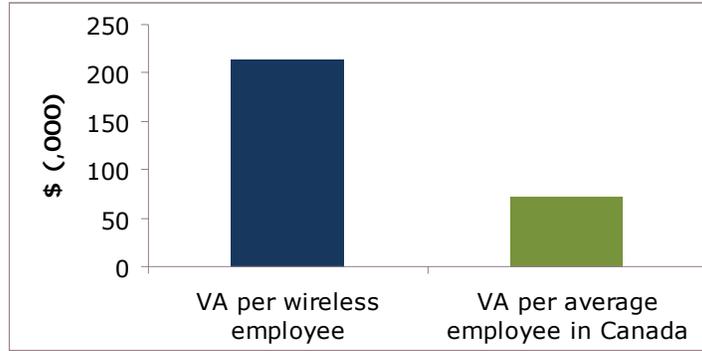
4.7 Employee value add

We can also use the information above to calculate the value added per employee in the wireless sector (including dealers and mobile operators), using the following formula:

- $\Sigma [\text{Value add (wage costs) + Value add (profit, interest, tax)}] \div \Sigma \text{ Employment.}$
- Our estimates suggest that the value added per employee in 2010 in Canada was considerably higher in the wireless sector, at \$213,600, than for the economy as a whole, in which there is an added value per employee of \$72,400³⁶. This figure for the wireless sector compares with \$166,000 in last year's report. The increased value-add is attributed to increased efficiencies achieved through the deployment of latest technology networks.

³⁶ Statistics Canada

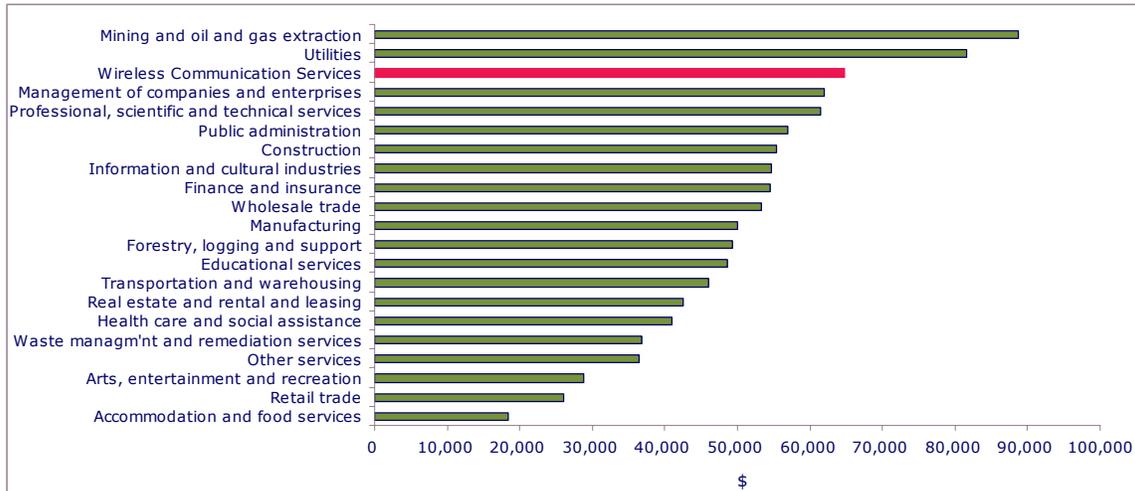
Figure 13: Value add - wireless services versus average Canadian employee in 2010



Source: Ovum

As can be seen from Figure 13, the value added in the wireless services sector compared very favourably against Canadian average value added per employee, indicating that the wireless communications services industry values its employees highly when compared with others industry sectors. This reflects the efficiency of the sector, the need for highly skilled staff to respond to demands for continual innovation and the value added in the sector.

Figure 14: Average annual earnings (\$) across Canadian industry sectors in 2010



Source: Statistics Canada – Average Weekly Earnings by Industry³⁷ and Ovum

³⁷ <http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labr73a-eng.htm>

5 The consumer surplus from wireless services

5.1 Summary

Consumer surplus refers to the monetary difference between what a consumer is willing to pay to obtain a good or service, and is actually paid; if a consumer would be willing to pay \$6 for an item, but can obtain it for only \$4, that consumer experiences \$2 of consumer surplus, conversely if the item was only offered for \$6, the consumer would receive zero consumer surplus.

Our estimates suggest that the consumer surplus accruing from the use of wireless services in Canada in 2010, was at least \$9.311bn. This is comprised of the aggregate surplus experienced by each wireless subscriber in Canada and includes the value derived from calls, messaging and data services.

\$9.311bn represents the lower bound figure as a measurement of consumer benefits from wireless telecoms, due to our model not taking into account a number of ancillary (intangible) benefits to consumers. Such benefits include the benefit from receiving calls, integrated handset functions such as phone cameras and music players, and more efficient emergency service contact (leading to insurmountable benefits to Canadian citizens' health and wellbeing) potentially saving lives.

This 2010 consumer surplus figure represents an increase from 2009 (\$9.044bn). This increase is partly due to the decrease in the average retail costs for wireless services (down to \$58 per month in 2010 from \$59 per month in 2009).

5.2 How consumer surplus measures economic welfare

Consumer surplus is a standard tool used to quantify the benefits that consumers receive. The concept was formally developed by Alfred Marshall in his *Principles of Economics*³⁸. It can be defined as the difference between what a consumer would have been willing to pay for a certain quantity of a good, and what that consumer actually has to pay. In Marshall's words:

“the price which a person pays for a thing can never exceed and seldom comes up to that which he would be willing to pay rather than go without it: so that the satisfaction which he gets from its purchase generally exceeds that which he gives up in paying its price: and he thus derives from the purchase a surplus satisfaction. The excess of the price which he

³⁸ *Principles of Economics*. 2009 ISBN: 978-1-60520-802-2 Alfred Marshall

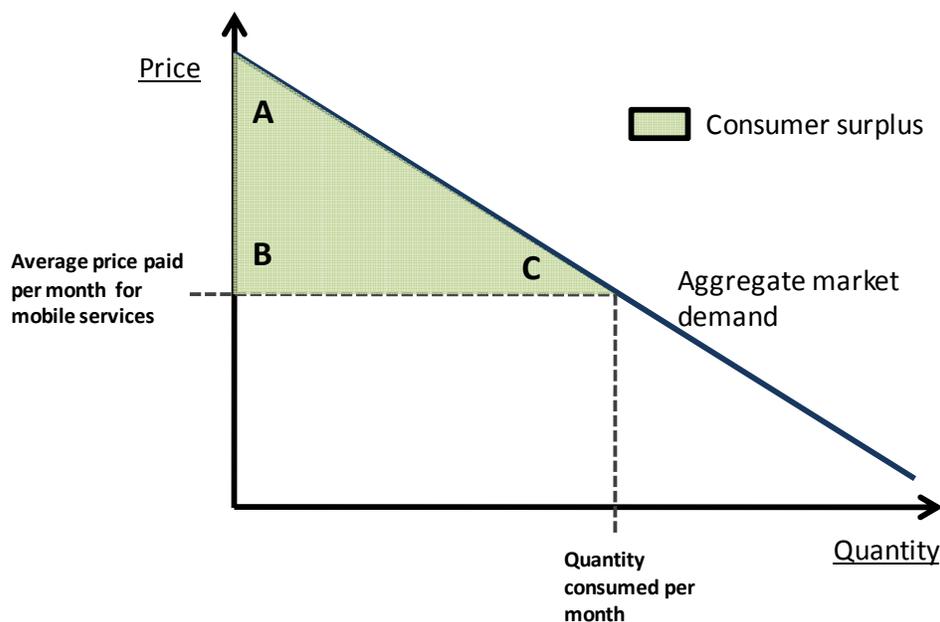
would be willing to pay rather than go without the thing, over that which actually does pay, is the economic measure of this surplus satisfaction."

In order to calculate the total consumer surplus within an industry, all individual consumer surpluses are summed together. The consumer surplus which Canadian consumers and businesses enjoy as a result of using wireless services therefore is a function of:

- 1 the price which users are prepared to pay, on average, for wireless service, less
- 2 the price which they actually pay, multiplied by
- 3 the number of subscribers.

Consumer surplus is depicted by the area encapsulated by the triangle 'ABC' shown in Figure 15.

Figure 15: A definition of consumer surplus



Source: Ovum

The aggregate demand curve represents all persons in the economy, and their associated maximum willingness to pay to obtain the good/service. For those with a high willingness to pay (consumers in the upper left portion of the demand curve), the consumer surplus they experience at the 'Average price' is significant, however as we move down and rightwards along the demand curve, consumers with a lower willingness to pay are encountered, and the surplus they experience at the average price is less. Aggregating all consumer surpluses gives us the total market consumer surplus represented by the shaded green triangle in Figure 15.

5.3 Estimate of the current consumer surplus

Consumers in the telecommunications industry derive satisfaction and convenience from making calls, receiving calls and from being able to access the telephone service wherever they are, which may be thought of as a less tangible benefit from holding a subscription.³⁹ Such factors are extremely difficult to quantify and, for this reason, consumer surplus calculation in the telecommunications industry typically focuses exclusively on the surplus arising from the calls/texts an individual makes and the services accessed. We duly stress that the consumer surplus we estimate here is a lower bound, due to the non-inclusion of all other factors associated with mobile telecommunications from which consumers derive benefit.

Determining the exact consumer surplus, would require a complex set of data, including the number of subscribers and detailed pricing information, including discounts, price changes, and the prices of service bundles. This detailed data for Canada was not available at the time of this study and we are not aware of any other studies or reports which have previously made estimates of the consumer surplus for the Canadian wireless sector. We have therefore followed a simplified modelling approach to estimate a lower bound for consumer surplus.

The approach uses the average spend on wireless phone services, along with an estimated demand curve for the Canadian economy, to produce a lower bound proxy for consumer surplus from wireless phone services.⁴⁰ The area between the demand curve and the average price (the area encapsulated by the triangle 'ABC' in Figure 15) provides a proxy for the lower bound of consumer surplus in the Canadian wireless market in 2010, which we estimate to equal \$9.311bn.

The consumer surplus for the Canadian wireless communications sector can be put into perspective with the operating revenues of the wireless service providers and the contribution to GDP. With the sector generating revenues of \$17.66bn in 2010 and contributing 1.46% to the country's GDP, our estimated consumer surplus of \$9.311bn is significant. The consumers benefit from the rapidly increasing breadth and depth of mobile communications services, which range from keeping in touch with family and friends, social networking – whether through voice or basic data / SMS services; business communications, improving efficiencies in the private and public sectors; personal security and social cohesion; entertainment; and more. It is the value of these personal, social and commercial benefits which contribute to the overall consumer surplus.

³⁹ Lee, D and Lee, D. 2006. Estimating consumer surplus in the mobile telecommunications market: The case of Korea. Telecommunications Policy 20, 605-621.

⁴⁰ A similar approach was recently adopted by the Australian Communications and Media Authority (ACMA). In their December 2009 report entitled "Consumer benefits resulting from Australia's telecommunications sector" they used "average revenue per call minute" as the price variable and "call minutes per subscriber" as the quantity variable when modelling changes in consumer surplus for mobile calls. Our approach, however, differs slightly from the ACMA study as we do not impose the restrictive assumption that the demand curve is linear.

6 Case Studies: Examples and benefits of mobile broadband

6.1 Machine to machine (M2M) solutions – with mobile support

The area of machine to machine communications is developing rapidly with many and various services and applications. These are mainly in the commercial and government sectors, and some applications are starting to be found in the home.

M2M solutions may rely on a range of communications networks - bespoke to the application, fixed network, corporate network or supported by mobile network infrastructure. The latter is highly attractive across all sectors, as the mobile networks have very high geographic coverage, high capacity and high availability. The interface is based on low-cost components, driven by very high volumes in standard mobile devices - as compared to lower-volume bespoke interfaces which may be needed for other wireless support networks.

Many commercial and public sector business areas are taking M2M solutions, often with sector-specific telematics and applications. Transport and utilities are the strongest sectors, with healthcare seen as a longer term opportunity and a long tail of other sectors:

- Transport and logistics: the business case is easy to make, with obvious, easy-to-calculate productivity gains:
 - fleet management – real-time awareness of fleet location, speed, rest periods.
 - vehicle monitoring – engine and vehicle performance, critical parameter monitoring, alarm reporting.
 - audit - for client reporting (e.g. delivery notifications, in case of fleet hire, subcontract)
 - security – vehicle tracking if stolen; reduced insurance premiums.
- Utility companies (electricity, water, gas): are using M2M for consumer metering and network telemetry and to enable new applications such as smart grid and smart metering. Mobile networks are also being used for supervisory control and data acquisition (SCADA), services which may also use dedicated spectrum.
- Healthcare: wireless networks provide the connection to allow the monitoring of patients outside a hospital setting, which is important for geographically large and remote regions. Remote patient care, healthcare administration and emergency response all benefit.
- Government: supply chain management, civil defence, disaster management and emergency services, public safety applications make use of wireless applications and networks.
- Industrial / manufacturing: asset tracking within the enterprise and process monitoring.
- Finance: insurance companies can monitor property and goods; ATM monitoring.

- Retail: a wide range of applications in this sector: point-of-sale, vending machine management, ticketing, mobile payment services and digital signage solutions.
- All verticals:
 - Voice and data communications: with sales, support and field staff, enabling and maintaining communications with their operational base.
 - Security: with the transformation of remote alarm monitoring solutions from fixed communications to wireless security.

6.2 Machine to machine (M2M) solutions in the home

The advent of smart homes – homes full of network-connected devices, from security systems to kitchen appliances – has been discussed for some years, but is yet to develop into maturity. Whilst sectors such as government, transportation, and retail have driven the growth of M2M technologies, the take-up in the home has been less rapid. However telecoms service providers are starting to see growth as the consumer market develops and consumer-focused devices increase.

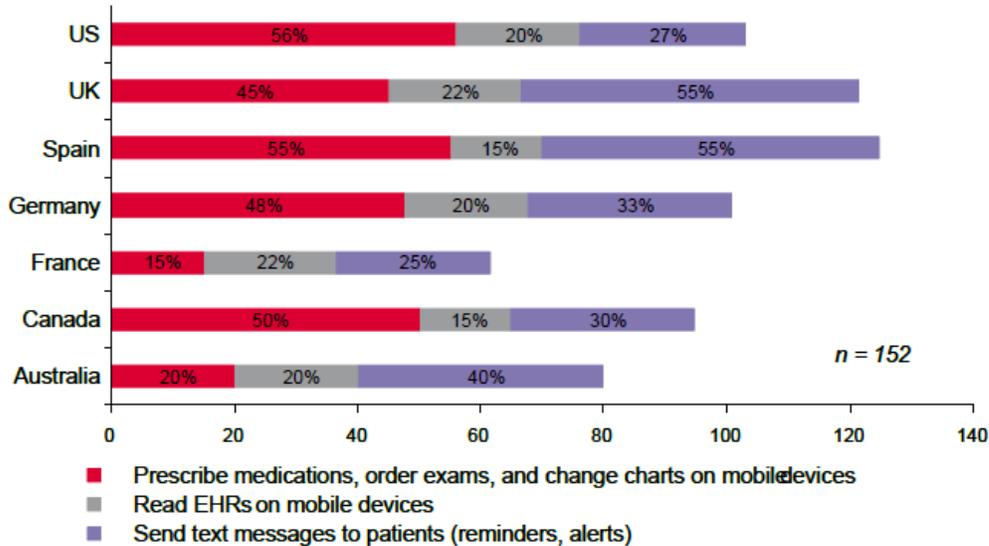
The existence of ubiquitous mobile networks and strong subscriber relationships put network operators and service providers in a good position to stimulate and encourage the market, and the explosion of smart, connected devices and applications brings with it an exponential increase in the value of broadband and mobile broadband infrastructure. Smart homes will enable consumers to access and control doors, thermostats, security systems, and appliances, and monitor home energy use. Ultimately, customers will be able to control these devices using smartphones, PCs, TVs, and tablets. The service providers are able to offer both 'domestic' services, as noted above, and also health (remote medical monitoring), security cameras, smart meters, appliance sensors, and remote monitoring that enables users to maximize energy efficiency.

Mobile health in the home

Mobile healthcare is becoming established and the increased adoption level of electronic health records (EHR) entails the need to read EHRs on mobile devices. The rising availability of tablets and increasingly capable smartphones is also increasing the use of EHR in the healthcare sector. Various m-health capabilities are developing to facilitate data access and exchange, especially for prescribing medication and ordering examinations. In addition to healthcare providers increasingly using mobile devices, consumers use mobile devices to download apps to help them stay healthy or monitor their fitness.

As m-health capabilities are becoming established, the type of applications used varies between geographies. The chart below indicates how Canada compares reasonably well against other major markets.

Figure 16: m-health: e-health applications on mobile devices



Source: Ovum, Healthcare Embraces Fast Telecoms Technology (April 2011)

The drive for m-health applications and services in Canada is being driven by the federal government funded agency Health Infoway, a not-for-profit organization, tasked to increase the adoption of health information systems. It is responsible for setting Healthcare IT (HIT) goals, assessing the proper allocation of monetary funds, and developing guidelines around adoption and implementation. For roughly the last decade, Canada has invested about \$2bn into HIT. An important goal has been to provide 50% of citizens with an EHR by 2010, which was met, and 100% by 2016. In 2010 alone, Infoway invested over \$200m in technologies such as telehealth, mobile health, and EHRs. In 2011 Infoway approved an allocation of \$45m to create what it calls "consumer health solutions" aimed at enabling patients to access health records through mobile devices. National government investment in HIT will continue through 2012. Canada Infoway's leadership views mobile health as an essential means of engaging the patient, and sees it as a major priority and worthy of significant investment in the near future.

6.3 Case studies: m-health solutions

Health professionals can take advantage of mobile broadband services to enable them to deliver their services more efficiently and more quickly. The range of monitoring and diagnostic services becoming available allows individuals to have real-time monitoring and notification of many health-related parameters.

Baby monitoring

An example in this field is a baby suit, developed by Exmove, which includes sensors that monitor a baby's condition (e.g. heart, temperature, moisture) and movement. Communications from the sensors are carried over wireless connections and allow the baby's

condition to be monitored day and night time. Information can then be conveyed to health professionals or parents by means of real-time text messages and/or email to a mobile phone, computer or other device. Services such as this can be beneficial in everyday circumstances, at times when the infant is ill or perhaps when the parents have left the child with a babysitter.

Diabetic monitoring

Machine to machine applications may be used to support applications such as remote glucose monitors and location monitoring, with mobile communications services able to provide an essential connection. The iGlucose solution from PositiveID Corporation enables a log of blood glucose levels to be maintained without the diabetic needing to remember to measure and record on a regular basis. The records and trends can be shared with the patient, family members or health professionals, as needed – by text message or email – to help ensure that effective treatment or therapies can be provided.

There are no geographic boundaries to the provision of these services, only the availability of the network services to aggregate the source data and distribute the results.

Brain disorder monitoring

NeuroDevNet and TELUS are working together to support Canadian research that uses new technologies to assist children with brain development disorders. Drawing on funding from the TELUS Toronto Community Board and the Network of Centres of Excellence program, NeuroDevNet will develop smart home technologies that help children with autism spectrum disorders learn to become more independent.

Benefits of e-health

The 2011 Infoway report *Telehealth Benefits and Adoption Connecting People and Providers across Canada*⁴¹ used an evaluation process which employed a combination of quantitative and qualitative assessment techniques to assess the benefits of the Infoway telehealth programmes. Whilst the assessment is not specific to the connectivity networks used, the increasing use of mobile devices will both increase the total value of the programmes and the value that is contributed by the mobile sector. Some of the main benefits identified by the report are:

- telehealth patients reported avoiding a round trip of between 200 and 712 kilometres per Telehealth event. The report assumes that this saving applies to 93,693 rural patient events for Canadians living in rural regions, leading to a saving of almost 45 million kilometres of personal travel avoided, 460,000 hours of driving time, producing close to 13 million kilograms of CO₂.
- telehealth patients reported avoiding between \$400 and \$1,000 per return trip, helping Canadians living in rural regions avoided approximately \$70 million of personal costs due to

⁴¹ https://www.infoway-inforoute.ca/index.php/resources/reports/benefits-evaluation/doc_download/340-telehealth-benefits-and-adoption-connecting-people-and-providers-full

the availability of Telehealth. This number underestimates the total costs to Canadians, since urban and suburban patients also saved on travel costs, though these savings are understandably less than for rural equivalents.

- there are approximately 2,500 patients with a variety of chronic diseases such as congestive heart failure, chronic obstructive pulmonary disease and diabetes treated in Canada each year through Telehomecare. Recent estimates indicate that Telehomecare was responsible for the reduction of one inpatient admission per patient – a 50% reduction. At a cost of \$8,000 per stay, this reduced health care costs by \$20 million across Canada. Emergency department visits were similarly reduced. Two-thirds of the average 3.96 visits were eliminated through the use of Telehomecare. Emergency department visits average \$138, saving an estimated \$915,000.

6.4 Case study: transport and freight

The transport company Canadian Freightways, operating across Western Canada, is seeing significant benefits from the two M2M solutions that it has deployed. These are typical of the benefits which are being achieved throughout the transport industry.

Pick-up and delivery

In the local pick-up and delivery fleet, handheld devices are used to record the pick-up, depot transfer and delivery of packages and cargo. The records and data gathered are transferred immediately over the wireless network to the company web portal and made accessible to customers who are able to check time of pick-up / delivery, order completeness and inspect the confirmation signature. Additionally, the technology removes the need for the company to print a receipt on collection, as that too is available via the portal, if the customer needs it.

The data collected enables Canadian Freightways to examine logistics records, e.g. drive time, pick-up / delivery / unloading times, waiting time - which enable much more accurate job costings to be prepared and hence more accurate pricing. This in turn helps customer satisfaction, the performance of the company and helps to avoid under-priced jobs. Furthermore, the availability of on-line data means that the number of customer phone queries are reduced, enabling cost savings in the customer service team.

Line haul

The company also operates line-haul units, carrying bulk loads between cities with single of double trailer units. These long distance units are able to monitor and report a significant level of information in real time. The company has deployed an in-cab solution with connection through the mobile / cellular network.

The driver activity logs (a legal safety requirement to monitor driving time and rest time) are now automatically monitored, reported and directly recorded. The system also enables a wide range of vehicle parameters to be constantly monitored and reported, for example:

- idling time (which can be quite long, especially in the winter to warm-up the unit and maintain during a pick-up / delivery transaction).
- information on speed, braking action, engine RPM, engine/ vehicle diagnostics, and tyre pressure all help to ensure safe driving and encourage efficient use of resources. This data can be combined with GPS data to assess driving behaviour, e.g. safe cornering.

Benefits

A review of information from a number of sources feed into our estimates of benefits to the transport industries.

Significant savings in operating expenses can be achieved in the industry from improved vehicle routing, reducing the route time and hence staff and fuel costs, and increasing vehicle utilisation. Research with industry experts indicates that cost savings are approximately 3% and up to 50 minutes in time per delivery can be saved from having increased awareness of the time spent.

Many vehicle parameters can be monitored and analysed to help develop driver awareness training and improve vehicle routing. The report Secrets of Better Fuel Economy⁴² indicates that within the trucking industries:

- incorrect gear usage can affect fuel consumption by 4%.
- use of the cooling fan when driving can decrease MPG by 3% - 5%.
- above 55mph, fuel consumption decreases by 1 mpg / 1 mph increase in speed.
- when idling a truck uses 0.5 gal/hour at 650 RPM and 1 gal/ hour at 1000 RPM. Reducing idle time from 50% to 25% can improve MPG by 2% to 4%.
- overall, driving behaviour (including acceleration and braking) can affect fuel consumption by up to 30%.

The Statistics Canada summary report⁴³ of the 2011 financial statistics data for the Canadian trucking industry indicates that the total operating expenses of the industry were \$38.4bn, of which:

- \$10.1bn (26.4% of total operating expense) was attributable to salaries, wages, benefits.
- \$7.9bn (20.1%) to vehicle fuel expenses.

If we assume that it is possible to achieve savings of 3% on both of these major expense areas, this will result in around \$300m saving in staff costs and \$240m in fuel costs across the national transportation industry sector.

As well as direct cost savings the ability of the industry to collect data leads to real, measurable benefits for the trucking companies, for the drivers and for the environment:

⁴² Secrets of Better Fuel Economy - Cummins Engines

⁴³ CANSIM Table 403-0005

- environmental benefits from reduced emissions as a result of lower and more efficient fuel consumption, fewer miles being driven and reduced idling time.
- reduced fuel consumption, with impact on oil imports and balance of trade.
- the awareness of driving patterns allows feedback and training of drivers leading to improved safety for the driver and other road users.
- driver well-being benefits from the use of the mobile communications services to allow improved use of non-working hours, especially when on long-haul journeys, e.g. download and watch videos, email access, video-conferencing calls to home.
- driver benefits, e.g. cash bonuses and/or air miles, as a reward for good driving techniques which can be assessed from the data collected.
- customer satisfaction from improved services and online access to records.
- reduced back-office costs for the transport sector resulting from information, bookings and queries being handled through the on-line portal.

Canadian Freightways estimates that their capital investment in in-cab technology was repaid within 18 months in fuel savings alone.

6.5 Enabling efficiencies in police forces and emergency services

Mobile broadband is being used as a medium to enable a broad range of emergency service staff to communicate with colleagues and have access to all the information that might be available in the office.

The ability to maintain a high level of access to network applications and maintain operational continuity, from virtually any location is a considerable benefit to many services:

- health and ambulance staff.
- emergency services – air, land or sea.
- civil emergency and civil defence.
- police and fire crews.

Public Safety Canada

Public Safety Canada has set up a mobile-specific web site⁴⁴ for the public to access emergency-related information. Minister Toews, Canada's Minister of Public Safety, recently stated⁴⁵: "The Government of Canada is working to reduce risks by ensuring all Canadians have access to information to keep them safe prior to and during emergencies." "Recent disasters have demonstrated the value of mobile technology in getting information to those in need."

⁴⁴ <http://www.getprepared.gc.ca/m/index.htm>

⁴⁵ <http://www.publicsafety.gc.ca/media/nr/2011/nr20111018-eng.aspx>

To complement the public mobile network, the Government has recently allocated 10 MHz of the 700 MHz bandwidth for the use of emergency responders including police, fire fighters and paramedics. The new network will be dedicated to the emergency services. "This lays the foundation for a national mobile broadband communications network that will help protect communities and save lives by improving emergency response across Canada."⁴⁶ The network, which uses spectrum that became available with the shift away from analogue broadcast television, will take effect over several years.

Police

In the USA, Sprint has reported that a city police department has significantly benefitted from mobile broadband services.

An inefficient system involving manual report writing and office-based data entry, which could only input summary data, has been replaced with a new records management system which allows the collection of comprehensive data about a crime incident as opposed to only summary information. Significantly, the new system enables officers to enter information at any time, wherever located. Data can be registered from the patrol car by use of a mobile broadband connection. The solution, which includes encryption, can seamlessly switch between Wi-Fi hot-spots and mobile network, allowing reporting and real-time access to a range of online resources.

The benefits are considerable increase in operational efficiency, coordination with online records (e.g. car details, driving licence, criminal records), and improved liaison with other services, e.g. fire department and ambulance.

⁴⁶ <http://www.publicsafety.gc.ca/media/nr/2012/nr20120503-eng.aspx>

7 Conclusions

We reach the following conclusions from this study.

The wireless communications industry continues to generate significant value for the Canadian economy. This value is much more than the revenues earned by the operators, dealers and service providers resident in Canada:

- in terms of direct contribution through the sale of goods and services to operators, the sector generates \$17.66bn, and a resulting contribution to GDP of \$18bn.
- using the Statistics Canada 'output multiplier' for the sector, it generates an additional \$15.66bn benefit due to the economic flow through to contributing suppliers in the supply chain.
- there is an additional consumer benefit, in that consumers are provided with services which they value by \$9.311bn more than they pay for the services.

The wireless industry continues to show growth and invest strongly well ahead of most other industry sectors and at a greater level than the national level of growth of 3.3%.

- revenues grew by 4.5% to \$17.66bn, with mobile data and broadband performing strongly.
- network capital expenditure in 2010 was sustained at 14.16% of revenues with investments of \$2.5bn. This is slightly less than the world average (15.3%) and higher than the North American average of 13.3%.

The wireless industry contributes to employment. We estimate that:

- over 31,700 staff are employed by the mobile network operators.
- a total of nearly 64,500 are employed directly as a result of the industry and 96,600 in services which support those directly employed.
- a further 99,900 are employed indirectly – as a result of spending by government of tax revenues and spending by financial institutions and shareholders.
- for all of these employees, there will be further induced employment, by virtue of the employees spending in the economy. Our total estimate is that over 261,000 people are employed in Canada as a result of the wireless industry.

The wireless communication industry is continually evolving and in need of investment to bring new services to a growing and demanding market. Operators have already established mobile broadband services to 98% of the population and demand for these services is generating new and strongly growing revenue streams. The applications that are enabled by mobile broadband now range from consumer-oriented content and applications for smartphones, notebooks and tablets, through to innovative services for enterprises, industry and government sectors.

Annex A: Value chain categories

Dealers and application stores

Retail outlets which are independent of the wireless network operator. The dealers may be shops, franchises or online stores selling handsets, devices, terminals and accessories. More recently, online application stores have become established, selling applications and content (music, videos) for smartphones.

Wireless network operators

The companies which operate wireless networks and provide retail mobile voice, data and broadband communications services.

Support service suppliers (incl. n/w support)

This is a broad category. It includes two broad groups of suppliers:

- professional service firms such as accountants, lawyers, advertising agencies and associated media, corporate IT services.
- outsourcing companies providing network and customer support services, such as call centres, network management, operations support services. It should be noted that some of the services in this category may be provided by the network equipment supply vendors.

Wireline network operators

The companies which operate wireline networks and provide retail and wholesale services. It is the wholesale services, such as leased lines, and, if applicable, interconnect charges which are relevant to this study.

Other capex suppliers

This is a broad category which includes office IT systems, vehicles and other non-network capital expenditure.

Terminal suppliers

The manufacturers and vendors of handsets, terminals, network cards/ dongles and smartphone devices.

Terminal component suppliers

The manufactures and vendors of components used in the terminals, such as displays, batteries, processors, chipsets, casings, keypads, operating systems and applications software.

Network equipment supply

The voice and data switching and routing systems used in the radio access network and core network, including ancillary equipment, such as frames, towers, power systems.

Network hardware and component suppliers

This is a broad category of systems and components which are supplied to the network equipment vendors. The category includes components used in the switching and routing systems, hardware platforms and base station equipment including towers, cables and power supplies.

Annex B: Mobile licensees

There are 56 licensed cellular operators in Canada⁴⁷.

Cellular 800 MHz / PCS 1900 MHz / AWS	
	Bell
	MTS Allstream Inc.
	Rogers Communications Inc.
	SaskTel
	TELUS COMMUNICATIONS
Cellular 800 MHz / PCS 1900 MHz	
	Amtelecom Limited Partnership
	BROOKE TELECOM CO-OP LTD
	EXECULINK TELECOM INC
	GOSFIELD NORTH COMMUNICATIONS
	HAY COMMUNICATIONS CO-OPERATIVE
	HURON TELECOMMUNICATIONS
	LANSDOWNE RURAL TELEPHONE CO
	MORNINGTON COMMUNICATIONS
	NEXICOM MOBILITY INC.
	NORTH FRONTENAC TELEPHONE CO
	NORTH RENFREW TELEPHONE CO LTD
	Peoples Tel Limited Partnership
	QUADRO COMMUNICATIONS CO-OPERATIVE
	ROXBOROUGH TELEPHONE CO LTD
	TBayTel
	TUCKERSMITH COMMUNICATIONS
	WIGHTMAN TELECOM LTD
	WTC COMMUNICATIONS

Cellular 800 MHz

⁴⁷ Source: <http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf09269.html>;

BRUCE TELECOM
CITY OF PRINCE RUPERT (SPEC LIC.)
Cochrane Telecom Services of the
COMPAGNIE DE TELEPHONE DE LAMBTON
COMPAGNIE DE TELEPHONE DE ST-VICTOR
COMPAGNIE DE TELEPHONE DE WARWICK
COMPAGNIE DE TELEPHONE UPTON INC
COOPTEL
FIRST NETWORKS OPERATIONS INC.
LA CIE DE TELEPHONE DE COURCELLES
Latitude Wireless Inc.
LE TELEPHONE DE ST-EPHREM INC
NorthernTel L.P. (Vendor: 20027589)
ONTEL INC. o/a ONTERA
SOGETEL MOBILITE INC
Telebec L.P. (Vendor: 0020027589)
TELEPHONE GUEVREMONT INC
TELEPHONE MILOT INC
The Corp. of the City of Dryden
PCS 1900 MHz
Blue Canada Wireless Inc.
ICE WIRELESS INC.
Lynx Mobility Inc.
Novus Wireless Inc.
Public Mobile Inc. (6934579 Canada Inc.)
Yamatech Group Incorporated
PCS 1900 MHz/AWS
Globalive Wireless Management Corp.
AWS
7140282 Canada Inc.
ALO Mobile Inc.
Bragg Communications Inc. (Eastlink)
Celluworld Inc.
Data & Audio-Visual Enterprise Wireless Inc. (Mobicity)
Shaw Communications
Vidéotron Ltée

Annex C: Induced employment

Induced employment is generated by the spending of those employed either directly in the communications sector or in the support services to the sector. A number of economic studies have made estimates of the induced employment effect, which is presented as a multiplier of the direct and support services employment. A summary of the results of these studies, which shows that the multiplier ranges from 1.1 and 1.7, is provided in Table 4.

Table 4: Multiplier benchmarks

Title of study	Multiplier
The contribution of mobile phones to the UK economy. O2 for ONS	1.13
Ovum studies on economic impact of mobile telephony in Bangladesh and USA, based on review of various other studies*	1.6
Association Française des Opérateurs Mobiles*	1.7
Economic impact of spectrum use in the UK. Europe economics, based on ONS	1.1
Sicrana, R., and de Bonis, R.: "The Multiplier Effects of Telecommunications Investments on Economic Growth and Restructuring" **	1.5
Radio authority, UK 1995, Economic impact of radio	1.4
Deloitte for GSMA, 2006, Economic Impact of mobile telephony in East Africa	1.2
Deloitte for GSMA, 2006, Economic Impact of mobile telephony in Pakistan	1.4
Atkinson et al (2009) in the US (modified by Katz and Suter (2009)) ¹	1.13
Strategic Networks Group, 2003	1.4
Range	1.1 - 1.7

Notes: * On employment, ** On GDP

Original Source: As given in table

¹ Atkinson, R., Castro, D. and Ezell, S. 2009. The digital road to recovery: A stimulus plan to create jobs, boost productivity and revitalise America. Katz, R. and Suter, S. 2009. Estimating the economic impact of the broadband stimulus plan

Source: Deloitte, 2008 and Ovum

The approach of considering induced employment is recognised in other studies. ComReg, the national telecommunications regulatory authority in Ireland, has made an assessment of the contribution that radio communications services have on the Irish economy. In 2006 ComReg estimated that mobile network services contributed nearly €3bn or 1.7% of Ireland's GDP and that nearly 31,000 direct jobs were supported by the use of radio spectrum.⁴⁸

⁴⁸ ComReg presentation 27 May 2009;
<http://www.comreg.ie/fileupload/publications/Irelandinnovationhub.pdf>

A report prepared for the GSMA 'European Mobile Observatory' found that in 2008, mobile communications services operators contributed approximately €138bn to the economy (1% of total EEA GDP); generated an estimated 3.5m jobs for Europeans, of which 610,000 were directly employed and induced employment of 2.9m more; contributed approx. €130bn to public funding, of which €44bn came from mobile operators and estimated that productivity gains of mobile broadband could increase GDP by 3 to 4% worldwide.

