CANADA'S MOBILE IMPERATIVE:

LEVERAGING MOBILE TECHNOLOGIES TO DRIVE GROWTH

MOBILE | TECHNOLOGIES | PRODUCTIVITY | CANADA

INFORMATION AND COMMUNICATIONS TECHNOLOGY COUNCIL (ICTC)

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Acknowledgement

We thank all of those involved directly or indirectly in contributing to our efforts, while acknowledging sole responsibility for errors of commission and omission. The data and information sources for this report include primary data collected through a cross-section of vehicles including key informant interviews, surveys, vacancy searches, and the social media. For benchmarking, the most up-to-date customized Labour Force Survey data published by Statistics Canada was used.

Special gratitude is expressed to all who took their time to discuss with us in great detail the various opportunities and challenges related to mobile technologies and its adoption in Canada. We also thank Mark Goldberg of Mark H. Goldberg & Associates Inc. for his helpful comments.

Thank you!

We hope the findings of this study will help them in their decision-making processes and also be used as departure point for future studies.

This report presents a timely review of the mobile technology landscape in Canada and showcases that these technologies will play a major role in the economic resurgence in the coming years. ICTC's sub-sector studies continue to demonstrate their value as a lens for critical and constructive thinking about some of the most fundamental opportunities and challenges in these spheres, and we are confident that these studies will remain as central as ever in key ICT discussions.

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Executive summary

The Information and Communications Technology Council (ICTC) is pleased to present this *Canada's Mobile Imperative: Leveraging Mobile Technologies to Drive Growth* report. It demonstrates the emergence and adoption of mobile technologies, and the opportunities those have created for incremental efficiency and productivity gains, cost reduction, and revenue generation in all sectors of the Canadian economy. We have adopted a broad definition of mobile technologies that includes devices, network infrastructure, and an ecosystem of applications and services that includes connectivity services, as well as middleware and apps such as social networking and more.

In this study, we explore the benefits and costs of mobile technologies adoption at the enterprise and macro-economic levels; adoption and use of mobile technologies by employees; challenges to greater enterprise mobility adoption; specific costs associated with adopting, maintaining and upgrading mobile technologies; and, recommendations for enterprises and policy-makers to capitalize on opportunities and minimize cost and risks.

Chief among our findings, we have calculated on the basis of new primary and secondary research that businesses that adopt mobile technologies enhance their productivity and establish sustainable competitive advantage. This is of particular importance as growth in Canadian workers' productivity levels has fallen by half between 2001 and 2011. An average Canadian worker today produces 23% less output than a worker in the U.S. and 45% less than a worker in Norway – the nation with highest labour productivity in the world.

An estimated 410,000 people are employed in Canada as a result of wide adoption of mobile technologies. 82,000 of these are induced jobs and 328,000 are direct and indirect employment in mobile technologies and related services. Of these, over 175,000 are involved in wireless and networking, over 45,000 in Canada's mobile applications (apps) economy, over 38,000 as a result of increase in social networking and related corporate utilization of digital platforms owing to wide business and consumer adoption of mobile technologies, approximately 20,000 each in the cloud services industry, mobile devices manufacturing industry, and in designing and developing mobile-enabled websites, and over 10,000 in providing location-based services. A conservative multiplier of four to one (e.g. every four jobs in mobile technologies generate one job in the rest of the economy) is used in this study to estimate the 82,000 induced jobs created by the mobile technology labour market.

In the mobile technology labour market, some occupations are invariably more crucial than others and demand for such jobs will continue to rise in the medium term. Nearly 12,000 new jobs will be created in five key occupations between now and 2017. When all the other relevant technical and non-technical occupations are taken into consideration, the total number of new jobs expected to be created by 2017 in mobile technologies and related services is approximately 40,000. Employment outlook for five of the most crucial occupations in mobile technologies are also detailed in the study.

The information gathering and analysis framework for this study includes: a literature review and key informant interviews; secondary data collection and analysis; primary data on mobile technologies adoption gathered by Harris Decima on behalf of ICTC between January and March of 2013 through one-on-one interviews with technology leaders (e.g. CTOs) from over 400 companies across a diverse array of economic sectors; and, econometric analysis to investigate the causal effects (as opposed to correlations) of the impact of mobile technologies adoption and wireless (e.g. cellular phones) subscription on economic growth. We consider that our analysis is a first contribution of its kind given a

relative dearth of publicly-available data with respect to adoption of mobile technologies in the enterprise. As statistical agencies worldwide begin to generate more of this data, there will be a future opportunity to create useful international comparisons. Thought leaders from across Canada were convened at a workshop to discuss opportunities and challenges related to mobile technologies and this discussion has also informed our analysis.

Sizable potential benefits are encouraging Canadian businesses to embrace mobile technologies. 51% of all Canadian businesses have adopted mobile technologies, as 100% of their employees use at least one form of mobile technology for work purposes. Employees of the other 49% of Canadian businesses surveyed have adopted mobile technologies to at least a certain extent in some business processes.

Businesses are adopting mobile technologies for a variety of purposes. Of the 400 companies surveyed, 91% of Canadian businesses use mobile technologies for anywhere connectivity (e.g. checking emails etc.), 69% to enable employees to work from remote locations, 66% to network with clients, 56% for business development, 55% to access documents off-site, 51% to modernize business processes, and 46% to input data for faster information flow.

Adoption and use of mobile technologies among workers across organizations and the provinces are not uniform. 55% of the workers in Quebec use mobile technologies for work purposes, while the corresponding ratio in Saskatchewan and Manitoba is 80%. Overall, 72% of all Canadian workers currently use at least one form of mobile technology for work purposes.

Nearly two out of three (64%) Canadian businesses report achieving increased efficiencies from mobile technologies adoption. One in two (50%) Canadian businesses report a reduction in operating costs achieved by using mobile technologies. Among these, 23% of businesses say they have reduced operating costs by up to 5%, 27% by between 5% and 10%, and 22% of businesses have reduced costs by over 20%.

One in three (37%) Canadian businesses say they have improved customer service and satisfaction as a result of mobile technologies adoption. One in five (22%) businesses enables their workers to access enterprise systems using mobile technologies. One in three (30%) Canadian businesses say they benefit from faster access to real-time business-critical information as a result of mobile technologies adoption.

One in four (28%) Canadian businesses report productivity gains as a result of adopting mobile technologies. Canadian workers and employers report an average productivity gain (time savings) of 1.2 hours each week per worker. For business entities, this productivity gain translates to a 3% reduction in salary expenses or increase in output. Since the average worker salary Canada-wide is $24 per hour per, 3% is a sizeable savings on the whole.

One in five (19%) Canadian businesses report improved resource utilization as a result of mobile technologies adoption. 30% of Canadian businesses report improved energy management as a result of mobile technologies adoption, while 7% experienced reduced safety hazards.

The smartphone penetration rate reached 62% in 2012, implying over 17 million Canadians use smartphones. Many more will swap their cell phones for smartphones in the near future. Nearly three out of four (73%) Canadian businesses employ mobile technologies and digital platforms for marketing purposes. It is also estimated that company revenues increase between 12% and 15% as a result of strategic marketing using mobile technologies.

Mobile technologies adoption is not accomplished without a significant allocation of resources. Increasingly, businesses are allocating budget for mobile technologies adoption while one in four (24%)

businesses is still wary of the costs of adoption and maintenance. 72% of businesses have dedicated budget for wireless connectivity, 61% businesses allocate budget for mobile devices, 34% businesses have dedicated budget for mobile-enabled websites, 25% businesses allocate budget for developing applications for the IOS platform, and 18% of surveyed businesses have dedicated budget for developing applications for the Android and Blackberry platforms. Funding allocated for developing apps depends on their features and is independent of the platform; we did not find any statistically significant differences among platform-specific budget allocation. When making resource-related decisions, Canadian businesses consider ease of use for employees and clients, available support and services, reliability and security.

Mobile technologies' capabilities and availability have achieved a relatively mature status since emergence nearly a decade ago and businesses are accelerating their adoption of mobile technologies. Among surveyed businesses, 71% state that increased adoption of mobile technologies in all aspects of their business processes and among all employees is a priority for their companies. Just 3% of the respondents remain unsure as to the utility of doing so; adoption is not a priority for 26% of businesses.

We consider that this is the first time such wide-ranging research on the impact of mobile technologies adoption has been conducted in a Canadian specific context. The benefits of mobile technologies adoption and use are clear as a result. Our report delves into the actions that might beneficially be taken by government, enterprises and educators. The implications of a failure to act are that Canada's standing with respect to productivity and prosperity on the world stage will decline. While we consider that this report offers much needed clarity with respect to this topic, further work remains to be done. We invite readers to engage with us with respect to concrete actions that might be taken by all stakeholders to achieve new opportunities. In addition, we consider that stakeholders would benefit from further research efforts to study the economic and labour market impact of mobile technologies adoption in sector and province specific contexts.

INTRODUCTION

Growth in Canadian workers' productivity levels has been declining for some time. Growth in labour productivity in Canada was 0.7% in 2011, half of the 1.4% seen in 2001 (OECD, 2013). On average, a Canadian worker contributes US$46 to the GDP for each hour of work. This is 23% lower than a worker in the U.S., and 45% lower than a worker in Norway – the nation with highest labour productivity in the world. Compared between workers that work full-time (e.g. 1,500 hours in a year), productivity gap reduces each Canadian worker's share of output by $35,000 per year compared to an American worker, and $92,000 per year compared to a Norwegian worker. Declining productivity reduces economic growth and sows the seeds of job losses and lower living standards for future generations.

This gap persists for Canadian businesses despite policies implemented in recent years that include low interest rates, tax incentives to invest in capital resources, deregulation in key industries, and low inflation. A central role for innovation in business strategies, not just policy measures, is clearly required to address persistent productivity challenges. The benefits of mobile technologies that allow workers and businesses to upgrade existing business models, workplaces and operational procedures, are a critical component of this. For the purposes of this study, we have adopted a broad definition of mobile technologies that includes devices, network infrastructure, and an ecosystem of applications and services that includes location-based services, as well as middleware and apps such as social networking and more. These technologies are increasingly sophisticated, enhanced by the cloud and residing on multiple interconnected devices that allow machine-to-machine (M2M) connectivity.

The last few years have seen tremendous growth in consumer and business adoption of mobile technologies but there is certainly even more significant evolution to come. Mobile technologies are creating immense opportunities in every sphere of economic activity. Canadian enterprises are adopting mobile technologies in response.

We have entered a new era of communications and information exchange. Further rapid uptake of these technologies is imminent. By 2020, it is estimated that 50 billion devices will be connected and we will be living in a networked society enabled by high-speed and next-generation wireless networks, and cloud architectures. Still, businesses in a number of sectors have been slow to react. They have yet to adopt newly-available technologies to improve operations and workflow. First responders, for example, still use 20-year-old technology. The time to exploit incredible new technologies is now to increase efficiency and productivity.

Every 1% increase in wireless subscription leads to an increase in the growth rate of GDP per capita by 0.06% in developed countries and by 0.08% in developing countries (Qiang and Rossotto with Kimura, 2009). This is comparable with earlier findings by Waverman, Meschi and Fuss (2005). A more recent study by Deloitte finds that a 1% increase in wireless subscription leads to an increase in GDP per capita growth of 0.065%. Czernich et al. (2009) estimates that impact to be between 0.09% and 0.15%. Mobile technologies encompass more than wireless devices and naturally have an even greater impact on productivity and economic growth, and the findings of this study emphasize as much.

Companies that lay solid foundations and comprehensively adopt mobile technologies will be in a strong position to enhance productivity and establish sustainable competitive advantage. A body of evidence to conclusively support this hypothesis was previously lacking. This paper bridges that gap. The lack of data with respect to mobile technologies adoption by enterprises – and the resulting lack of estimates of the economic impact of mobile technologies – make it difficult for policymakers to design responsive strategies. Due to a lack of understanding of the benefits derived from adoption, or an unwillingness to

incur the upfront costs associated with implantation of a mobile strategy, many Canadian businesses have yet to fully embrace mobile technologies. Although return on investment is not uniform across all economic sectors, there is no doubt that by investing in innovation and adopting innovative technologies, Canadian businesses across the industrial spectrum can improve low productivity that is currently holding Canada back from fully maximizing its potential on the world stage.

As the findings of this study indicate, Canadian businesses with the foresight to realize that the business environment and models will change even more drastically before the 2010s are out are making innovation central to their business strategies. They know that the investments they will make in adoption of mobile technologies will help secure their future success. Canada's future competitiveness will depend on a workforce and workplaces that are universally equipped to take advantage of emerging innovations.

Great opportunities often go hand-in-hand with significant challenges. The proliferation of M2M, a looming and acute shortage of spectrum capacity particularly in urban areas, the utilization of frequencies to maximize benefits for Canada, increased bandwidth demands resulting from LTE and other emerging technologies, white spaces (unused frequencies), affordability, lack of competition and security threats are issues that will have to be addressed to make the most of new opportunities.

Against this fast-moving backdrop, this paper begins in section 2 with a brief overview of the nature of mobile technologies, major players in the value chain, a discussion of the existing literature on the topic and the research agenda for this study. The study's approach and methodology are outlined in section 3. Section 4 explores the impact of mobile technologies on the Canadian workforce and how that results in benefits for Canadian businesses. Section 5 outlines various adoption-related issues and challenges of which Canadian businesses need to be aware. What the future holds for innovations in mobile technologies is discussed in section 6. In a final section of the paper, the findings of this study are summarized in the context of a discussion about strategies to stimulate the Canadian economy with increased adoption of mobile technologies.

BACKGROUND AND CONTEXT

Mobile technologies are increasingly providing us with greater mobility and connectivity, resulting in profound changes in the way we live our daily lives, do business, consume news and information, and even the way we are governed.

Stakeholders in every sector of the economy are embracing mobile technologies to offer services responsive to customer demand. For example, construction companies track equipment utilization, materials, and receipts in real-time, allowing them to quickly make adjustments and thus gain efficiency; educators deliver content to students, providing in-context learning and entering student grades through mobile technologies; healthcare providers provide mobile-health (m-health) assistance, emergency medical alerts, and health education; public administrators alert citizens of natural disasters, energy blackouts and other emergencies, and coordinate real-time location-based data for emergency responses.

Further examples abound: transportation authorities offer m-ticketing and disseminate flight or public transportation alerts via mobile; the retail sector provides real-time information on clearance sales, parking space availability, and respond to clients' needs and requests; the banking industry is facilitating mobile transactions with m-banking; employment agencies post job postings and provide job-matching services using mobile technologies; farmers access market prices, seeds, and fertilizers-related updates using mobile technologies; fishermen use real-time updates on hot spots, river flows, tides and hatches. Mobile technologies are transforming entire value chains. For instance, the distribution of content in digital form such as music, video, software, books or news has significantly altered those value chains.

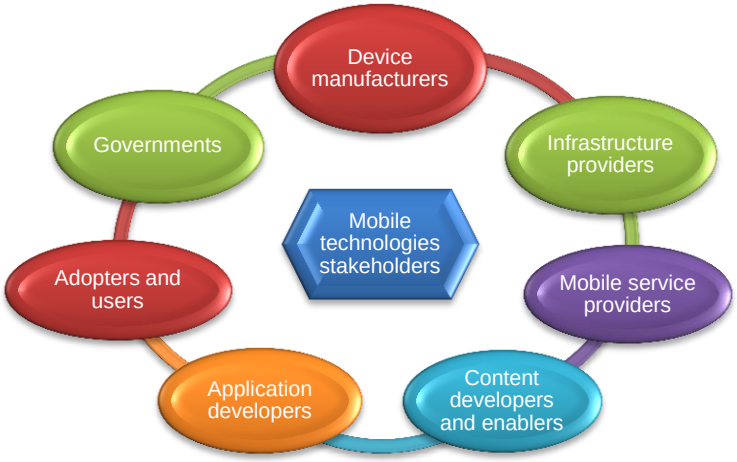
Mobile devices are an integral part of all the changes above and cellular subscriptions outnumber wired internet connections in both developed and growing economies. Mobile devices are the most rapidly adopted technology in history and the most popular and widespread personal technology in the world (ITU, 2009). For businesses, the restructuring of business models to take advantage of the wired internet use to drive efficiencies in the previous decade is reoccurring as mobile technologies drive a new cycle of innovation (Bertschek, Cerquera and Klein, 2011; Forman and van Zeebroeck, 2010; Spezia, 2011). The impact is discernible in the rapid growth of mobile applications and related businesses and jobs in Canada and worldwide (ICTC, 2012a).

Changes in business paradigms over the past several years have been overwhelming and, yet, we must brace ourselves for what is to come. Within three to five years, many existing limitations in spectrum capacity, frequencies, network, bandwidth, device memory, processor, video resolution, battery life and data input will be eliminated. This will be accompanied by the proliferation of M2M and a reduction in prices due to increased consumer demand, competition, and economies of scale. Newer form factors will emerge to respond to the varying needs of the market and accelerate making mobile technologies even more compelling. They will be critical to business sustainability (Hamerman, 2010; Kahua, 2012).

Canadian businesses are compelled – more so in today's ultra-competitive and uncertain economic environment than at other times – to achieve cost reduction through greater efficiencies without reducing services. They need to understand and maximize the power of mobile technologies and to provide options for and access channels to employees and clients. Other important factors that businesses need to be cognizant of include knowledge expansion and deployment for effective adoption of mobile technologies, how to make the potential benefits of adoption sustainable, how to foster innovation in terms of service delivery, how to utilize the service offerings of mobile technology service providers and how to remain flexible to meet future transformations in these technologies.

Mobile technologies stakeholders

Stakeholders are varied across the mobile technologies value chain and they all play a key role along it (Cable, 2011). Given the scope of this study and the way mobile technologies are defined here, key players in this value chain include:



Device manufacturers produce mobile devices that are the interface between users and networks.

Infrastructure providers sell the network equipment necessary for mobile users to access voice and data services, and enhance the process by increasing the functionality of the network, while lowering costs and increasing performance.

Mobile service providers sell network connectivity to send users, in addition to value added applications and services.

Application developers create the interface between the device and the network hardware. Developers' role is creating and releasing wireless applications and writing efficient programs that help users to conduct transactions from anywhere and at any time.

Content developers and enablers play a key role in compiling content into mobile-ready formats so applications can immediately extract desired information and package it according to users' requests.

End users are individuals and business entities that use mobile technologies and provide input for improvements. With increased connectivity, they take active part in designing solutions.

Governments not only develop policies and standards that frame marketplace competition, but also stimulate demand. They are also among the end users, employing mobile technologies to advance

responsive public service delivery, expand citizen engagement, increase operational efficiency and amplify accountability.

The research agenda

It is evident that mobile technologies enable mobility and connectivity, and yet the benefits or return on investment required for adoption is challenging to measure and largely unavailable to date. With that in mind, this study focuses on:

- The economics of mobile technologies: various avenues of benefits to be gained as a result of mobile technologies adoption and what that means for corporate end users and the Canadian economy.
- Resource allocation by Canadian businesses for adopting mobile technologies and how that compares with the expected return on this investment.
- Challenges and factors to consider related to adopting mobile technologies.
- Skills that employers will be looking for so that all employees can thrive in a connected workplace and who that may impact.
- How these technologies will evolve in the next several years and how that will affect the Canadian workforce and businesses.
- Strategies and incentive required to ensure that the adoption of mobile technologies in Canada flourishes and Canada consolidates its position on the global stage.

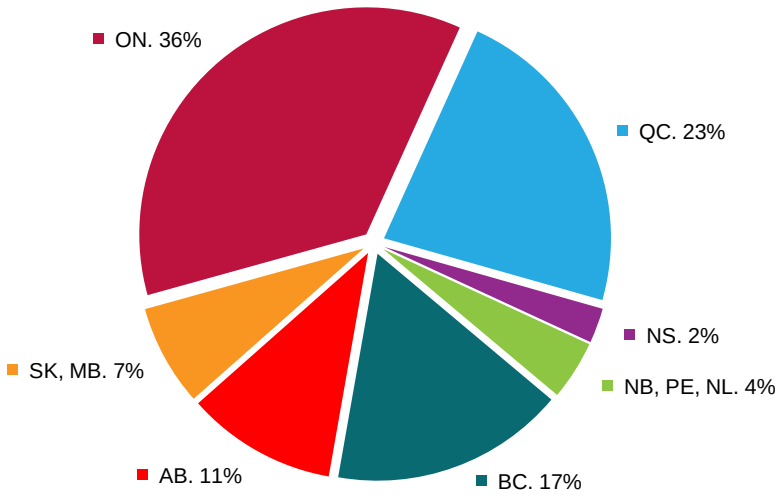
METHODOLOGY

This study began with conducting a **review of the existing literature** to establish definitions, research gaps and study scope. A best-efforts list of thought leaders engaged in the Canadian mobile technologies ecosystem was established from desktop research as well as from ICTC's network.

These thought leaders participated actively in **key informant interviews** and provided important insights that were used to finalize the survey tools and methodologies for primary data collection. These interviews included consultations with key national and provincial association stakeholders.

Primary data regarding the impact of mobile technologies was gathered through a **targeted survey** by Harris Decima conducted on behalf of ICTC between January and March of 2013 from a random sampling of 400 Canadian enterprises. For both the key informant interviews and targeted survey, one-on-one discussions were held with people in leadership positions such as CEOs, CIOs, CTOs, CFOs, heads of IT, directors of operations, executive directors, and presidents of companies in the following sectors: manufacturing; construction; transportation and warehousing; information and cultural; wholesale trade; retail trade; finance and insurance; real estate and renting and leasing and management of companies; professional, scientific and technical services; arts, entertainment and recreation; administrative and support; public administration; educational services; health care and social assistance; accommodation and food services; and other. The following graph exhibits the geographic composition of the survey participants:

Figure 1. Survey participants by province



Source: ICTC mobile technologies survey, 2013

The impact of mobile technologies adoption is estimated through aggregation of the survey findings with appropriate weight (business counts) applied and using an econometric model.

Econometric framework

Our econometric model is set up such a way that growth of GDP per capita is a function of inputs of interest such as mobile technologies adoption and wireless subscription. It also accounts for other factors that are known to influence economic growth. For instance, workers' education or the size of the labour force drives GDP growth as well as mobile technologies adoption or wireless subscription.

Thus it is important that these factors are included in the model, because in the absence of valid factors such as human capital, the estimate will attribute the effects of missing factors to mobile technologies adoption, for instance.

In this model:

$$Y = X'\beta + \varepsilon \quad (1)$$

where Y denotes annual growth rate of GDP per capita in a given year and is expressed as a function of X and the error term ε. Explanatory variables include mobile technologies adoption rate, wireless subscription, two lag terms of real GDP per capita and other determinants of economic growth, including total capital formation (investment), government expenditures, total trade, available labour and stock of human capital. All variables are expressed in logarithmic form. Data for these variables were collected from Statistics Canada, the World Bank, the Organization for Economic Co-operation and Development (OECD), and the Canadian Wireless Telecommunications Association (CWTA). Data is measured across a 5 year (2008-2012) period. How our estimates compare with the findings of other studies are discussed further in the results section.

Industry leaders from across Canada were gathered at a **thought leaders' workshop** to discuss opportunities and challenges related to mobile technologies and strategize for the future. These discussion points are included in the analysis of strategies for future directions related to mobile technologies adoption.

ICTC will continue to disseminate these findings among stakeholders through webinars and other relevant channels to ensure changing realities are reflected in planning for future developments.

THE IMPACT OF MOBILE TECHNOLOGIES

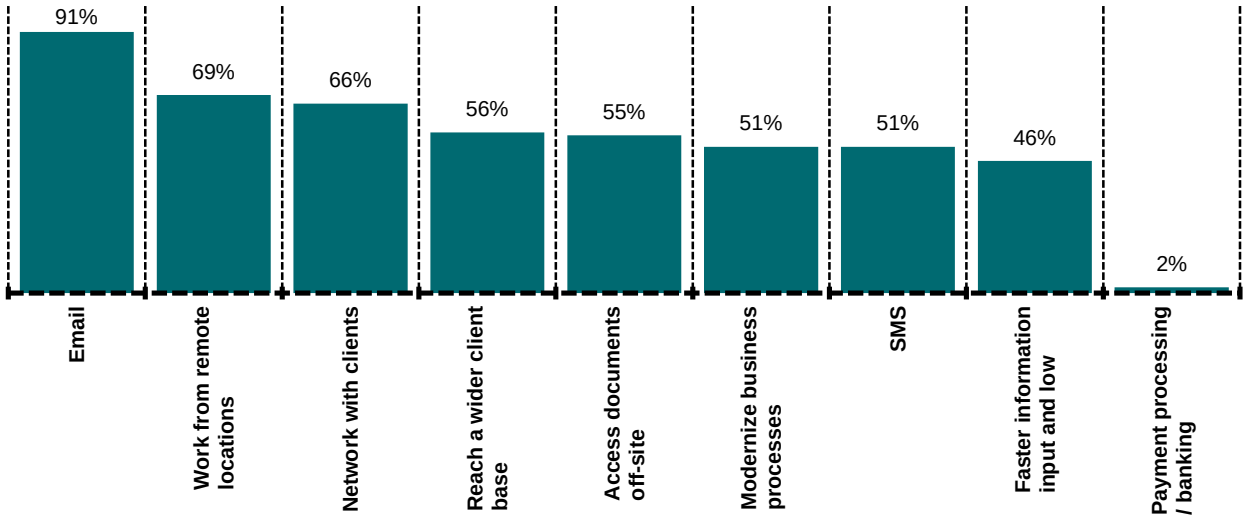
Mobile technologies are profoundly altering consumer behaviour. This trend is spilling over into business practices and the demand for access to information and applications through mobile technologies is surging. Businesses are driving for mobility and searching how to effectively position themselves to benefit from the trend. Simply having mobile access to e-mail is profoundly insufficient in today's business environment. The amalgamation of mobile devices with their various applications and software is making it simpler for businesses to communicate with staff, customers and vendors.

Mobility is allowing agility for Canadian enterprises, but few of them are utilizing mobile technologies to the fullest extent possible and as a result are not yet reaping all the benefits. ICTC's consultation with Canadian businesses shows that:

- 51% of all Canadian businesses have embraced and adopted mobile technologies, as 100% of their employees use at least one form of mobile technologies for work purposes. The other 49% have adopted mobile technologies to at least some extent in their businesses processes by some of their employees.

- Currently, 91% of Canadian businesses use mobile technologies to remain connected (e.g. checking emails etc.), 69% use these technologies to enable employees to work from remote locations, 66% to network with clients, 56% for business development, 55% to access documents off-site, 51% to modernize business processes, and 46% to input data for faster information flow.

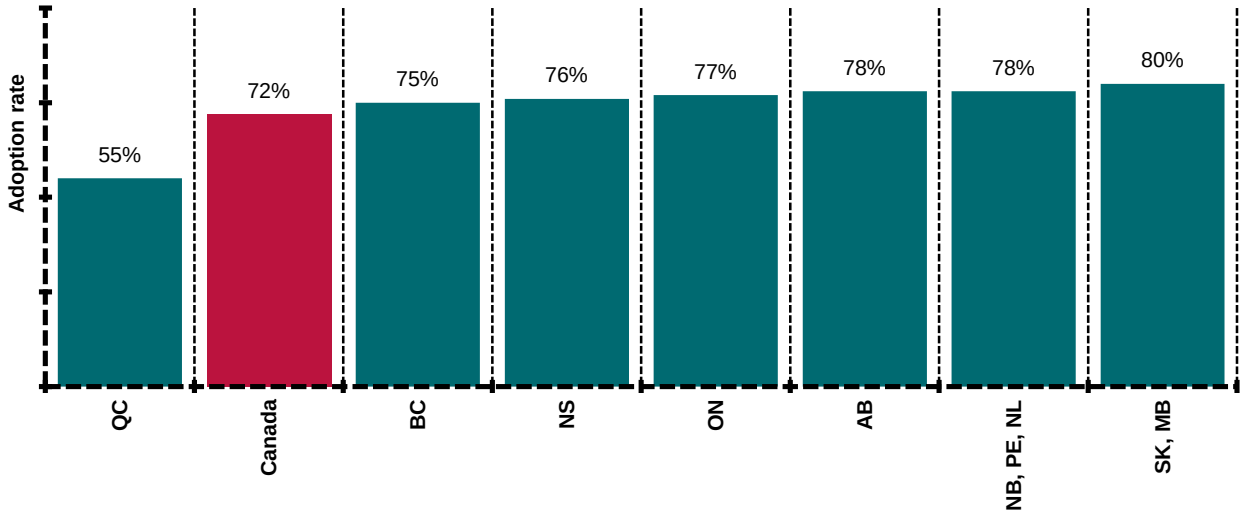
Figure 2: Usage purpose of mobile technologies in Canadian businesses



Source: ICTC mobile technologies survey, 2013

Nationwide, 72% of all Canadian workers currently use at least one form of mobile technologies for work purposes. Adoption of these technologies, however, is not uniform across provinces. 55% of workers in Quebec use mobile technologies for work purposes, while the corresponding ratio in Saskatchewan and Manitoba is 80%.

Figure 3. Mobile technologies adoption by province



Source: ICTC mobile technologies survey, 2013

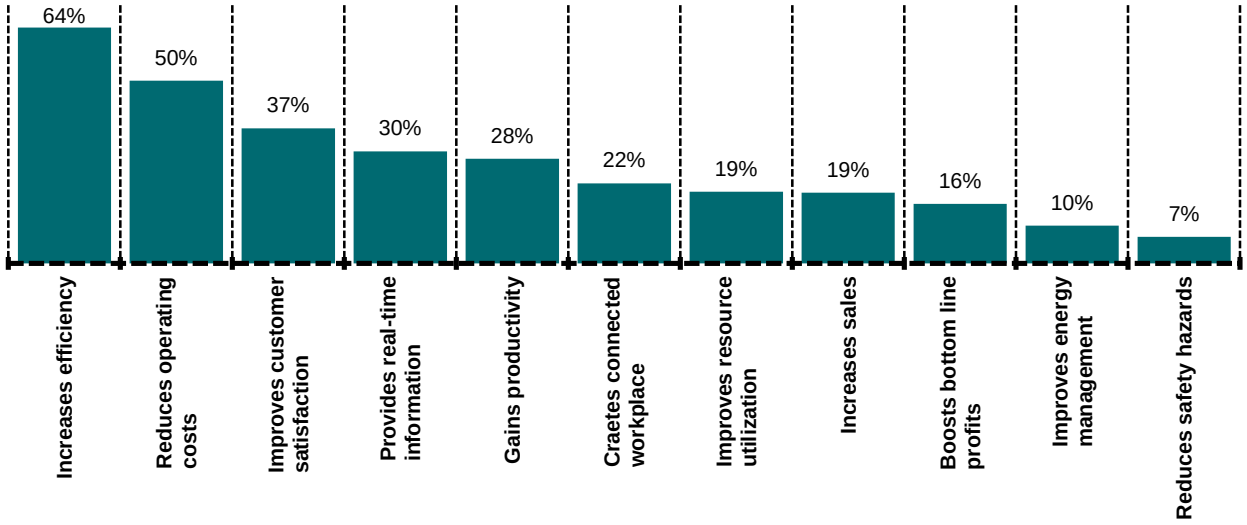
Adoption of mobile technologies by Canadian businesses is propelled by a number of factors, such as technological advances, societal trends, availability, costs, and economics. Businesses can take a strategic approach to increase adoption. If adoption facilitates increased revenue through clients accessing services through mobile technologies, there is no reason not to adopt.

Technological advances are allowing businesses to reduce costs and physical infrastructure requirements, to increase their productivity that leads to increased profitability. Mobile technologies are allowing enterprises, particularly small- and medium-sized ones, to remain connected with clients, stay competitive through cost-effectiveness and function smoothly.

Efficient business processes

Mobile technologies are changing the way companies do business. Real-time and location-based processes result in quick and easily accessible data and communications, information consistency, responsive case management and seamless information exchanges. Information and actions are being coordinated in any location and with business partners and clients, improving collaboration among stakeholders. In addition, human resources needs and situations are better managed as they occur. Real-time information improves responsiveness and knowledge-based decision making.

Figure 4. Benefits of mobile technologies adoption



Source: ICTC mobile technologies survey, 2013

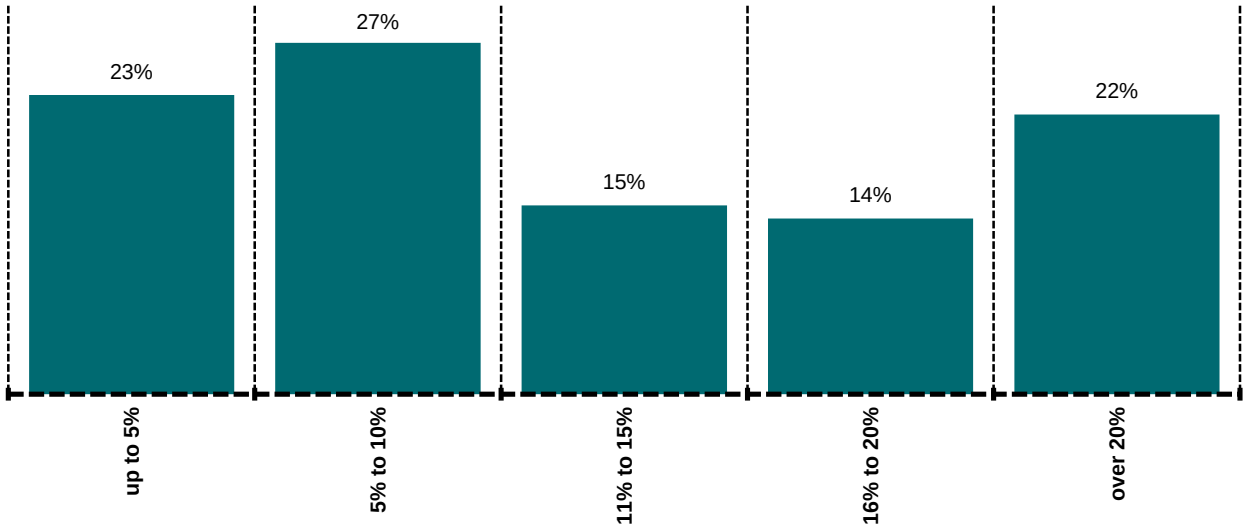
Mobile technologies enable enterprises become more efficient, more creative and, thus, more valuable to clients. These technologies are being used to support more efficient business processes through real-time communications, quick data access, notifications and business updates. Businesses are turning to mobile technologies for improved and responsive service delivery, operational efficiencies and active client engagement. Two out of three (64%) Canadian businesses report achieving increased efficiencies from mobile technologies adoption.

Cost-effectiveness

With improved processes and accuracy, businesses are able to lower costs, which is critical in an economically uncertain environment. Competing now and into the future means businesses must find ways to increase efficiencies. Streamlined processes, shared and coordinated data access, reduction in number of devices to manage, transactions resulting from adoption of mobile technologies are delivering cost-saving results for businesses. The empowerment of workers with mobile technologies is reducing requirements and costs for time, travel and staffing, as well as eliminating redundant data entry. Increasing effectiveness is allowing businesses to save on resources. Using mobile technologies allow companies to manage their businesses more proactively.

One in two (50%) Canadian businesses report achieving reduction in operating costs from mobile technologies adoption. Among them, 23% businesses report to have reduced operating costs by up to 5%, 27% businesses report to have reduced operating costs between 5% and 10%, 29% businesses have reduced operating costs between 11% and 20%, while 22% businesses have reduced costs by over 20%.

Figure 5. Margin of costs reduction



Source: ICTC mobile technologies survey, 2013

Improved customer relationships

Mobile technologies allow businesses to have an unprecedented level of connectivity between employees, vendors, and customers. These technologies are leading to products and services being offered to customers in new ways. They make enterprises more efficient, more creative and, thus, more valuable to clients. Mobile technologies enable access to customer relationship management systems using native or web-based applications from multiple locations to maintain real-time customer information. The modern consumer increasingly demands personalized services. They are empowered through mobile technologies to access inventory availability and pricing, establish new accounts, find quotations and place orders interactively, obtain account information, or make payments. This results in improved customer satisfaction levels and streamlines business processes, responsiveness and resource requirements. Businesses can stay current on client opinion and priorities. Extended outreach also expands corporate accountability and transparency to stakeholders and empowers greater client participation in strategic decision making. One in three (37%) Canadian businesses report to have improved customer service and satisfaction as a result of mobile technologies adoption, while the other respondents reported no change in this regard.

Real-time information

Mobile technologies enable a seamless pull of current data directly from the enterprise system, and most importantly, they are making these solutions easy to use. The growth of cloud computing has also impacted positively on the use of mobile devices, supporting more flexible working practices by providing services over the internet. These technologies are allowing workers to keep in touch, be productive and make use of company data, resources, forms and business processes – regardless of distance, time, place and diverse natural conditions – using wireless networks through their mobile and wireless devices. For example, these technologies are enabling direct data input (e.g. for construction workers or healthcare professionals) and it has reduced errors and inefficiencies and resulted in improved productivity. Workers no longer take notes on paper to transfer into the computer. They connect to the enterprise system via wireless connection. Mobile technologies offer welcome and productive relief from hours spent collecting and verifying information.

The number of workers accessing enterprise systems using mobile technologies surpassed 1 billion worldwide in 2010 and is estimated to reach 1.2 billion in 2013 (IDC, 2010). That represents more than one in three of the global workforce. The corresponding number for Canada is quite low in comparison, as ICTC's mobile technology survey shows that only 22% (one in five) of companies enable their workers access enterprise systems using mobile technologies. With the kind of benefits mobile technologies offer workers and enterprises in terms of improved productivity, efficiencies, coordination, real-time communications and performance management, it is only logical to equip all workers with the latest available mobile technologies. The ability to tackle work anywhere and at any time will bring greater efficiency and bottom-line results. One in three (30%) Canadian businesses report that they benefit from faster access to real-time business-critical information real-time information flow as a result of mobile technologies adoption.

Productivity gain

With improved processes and accuracy through mobile technologies adoption, businesses increase efficiency, lower production costs, and thus increase productivity to ultimately realize greater profitability. These technologies enable the Canadian workforce to work smarter and utilize time more efficiently. A majority of Canadian workers are already mobile – doing work related activities using mobile technologies. Mobile technologies play a major role in empowering employees to remain productive, regardless of their location.

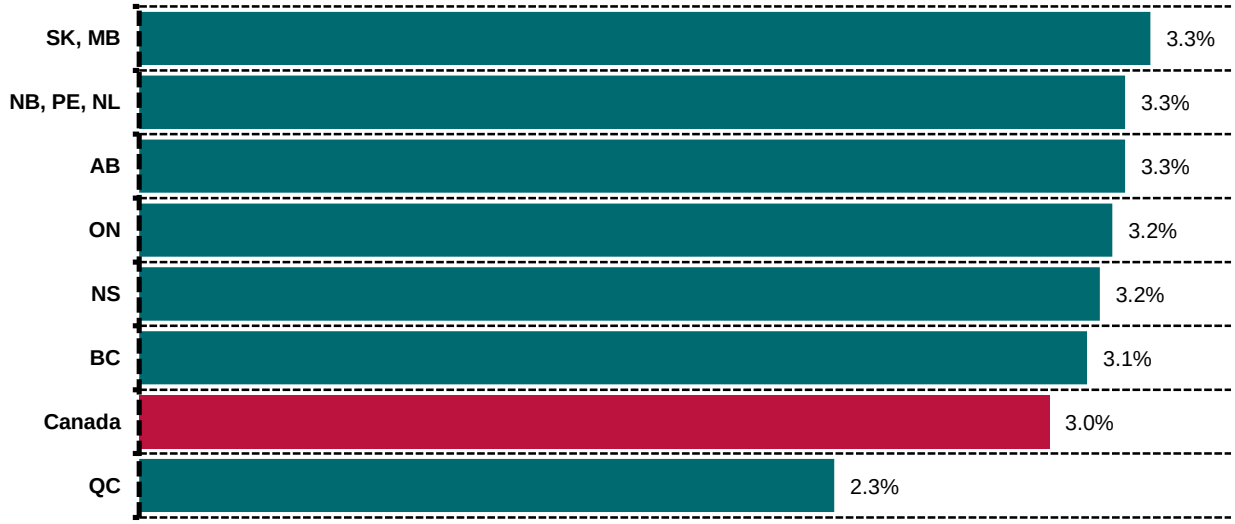
ICTC's in-depth consultation with Canadian employers gives a good basis to quantify the gain in workforce productivity. One in four (28%) Canadian businesses report productivity gains as a result of mobile technologies adoption. Canadian workers and their employers report a productivity gain (time savings) of 1.2 hours each week per worker. An example of the source of this savings is manual, paper-based processes that require workers and their supervisors to spend hours collecting and verifying information, while mobile technologies are streamlining this process. Mobile technologies enable workers to spend that much longer completing business-related activities, compared to workers that lack access to these technologies.

As technology advances and the Canadian employers put the necessary mechanisms in place for universal mobile technologies adoption, this benefit can be increased many times. Given that workers are doing work-related activities (e.g. business related correspondence) outside of business hours, much of

this significant contribution will remain unrecognized and unreported, but that does not diminish its size or significance.

For business entities, productivity gain (time savings) of 1.2 hours each week per worker translates to 3% reduction in salary expenses or increase in output. With the Canada-wide average salary of $24 per hour per worker, 3% is sizable.

Figure 6. Increase in worker output by province



Source: ICTC mobile technologies survey, 2013

Research and development

The productivity benefits of mobile technologies do not end there. They also include business expansion through more accurate product or service demand projections and customer outreach, streamlined and more accessible information flow, lower start-up and operating costs for entrepreneurs, and real-time, flexible communications and transactions with clients.

The interactive nature of mobile technologies is allowing businesses to share information and get immediate feedback from clients on products and services. This accessibility is reducing time required for market research and leading to faster research and development for companies, enabling them to stay competitive. Reduced time lag in multiple phases has led to product upgrades moving at a faster rate, not to mention clients becoming more satisfied and loyal with the more direct roles in a company's development.

Improved resource utilization and eco-friendly business practices

Mobile technologies play an active role in improving utilization of resources and incenting eco-friendly business practices. People connect virtually from remote locations rather than traveling, substituting transportation for mobility and reducing their carbon footprint. This also helps ensure business continuity, for instance amid severe weather conditions. One in five (19%) Canadian businesses report an improvement in their utilization of resources as a result of mobile technologies adoption.

Mobile devices reduce energy consumption. Current network optimization packages for mobile infrastructure can reduce energy consumption by 44%, while solar-based base stations have the potential to reduce carbon emission by 80% (World Economic Forum, 2009). These reductions result in businesses achieving greater cost optimization. On the other hand, mobile devices batteries are not very green and so the proliferation of these batteries will have an environmental cost. Enterprises need to ensure proper disposal and adopt greener solutions. This will also contribute toward achieving a 'green' corporate image.

30% of Canadian businesses report improved energy management as a result of mobile technologies adoption, while 7% experienced reduced safety hazards.

Strategic marketing

Mobile technologies have introduced a new dimension into advertising and marketing for Canadian as well as global businesses. Existing and potential clients get exposure to advertisements on mobile devices through a wide variety of mobile marketing technologies including SMS, mobile websites, mobile applications, banner ads, quick response (QR) codes, interactive voice response (IVR) messaging and more. Mobile technologies accommodate enhanced advertising features. These advertisements can be customized to individual taste and preference. This allows more effective marketing strategies and outcomes. For mobile application developers, advertising revenues – generated when a mobile device user purchases a product or service advertised in an app and the app developer receives a share of that revenue – grew from $12 million in 2008 to $52 million in 2010 to $150 million today in early 2013. Revenues from advertising constitute 22% of app developers' total revenues (ICTC, 2012a).

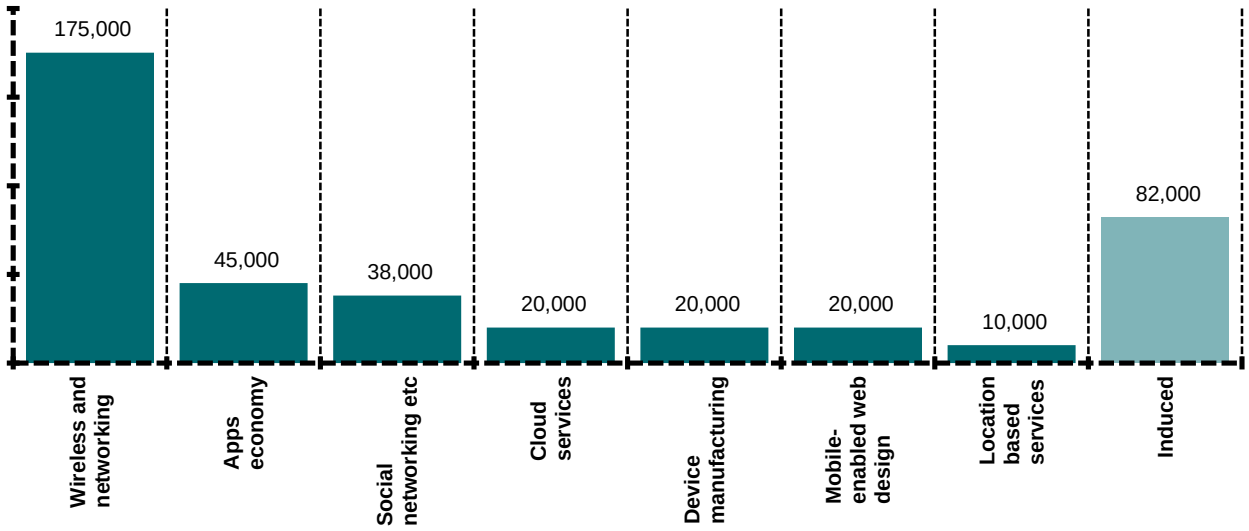
As the smartphone penetration rate reached 62% in early 2013 and more Canadians swap their cell phones for smartphones, application advertisement revenues will continue to experience spectacular growth. Three out of four (73%) Canadian businesses employ mobile technologies and digital platforms for marketing purposes. It is also estimated that company revenues increase between 12% and 15% as a result of strategic marketing using mobile technologies.

Mobile technologies labour market

Jobs in mobile technologies cover a wide range of opportunities and, as these jobs are gaining prominence, measuring the scope and contribution of these occupations in the Canadian economy is vital. The mobile technologies labour market includes positions in small start-up companies, in growing small and medium enterprises (SMEs), and in large corporations. Technical positions range from telecommunications services managers to software developers to mobile-enabled web designers.

An estimated 410,000 people are employed in Canada as a result of wide adoption of mobile technologies. 82,000 of these are induced jobs and 328,000 are direct and indirect employment in mobile technologies. Of these, over 175,000 are involved in wireless and networking, over 45,000 in Canada's mobile applications (apps) economy, over 38,000 as a result of increase in social networking and related corporate utilization of digital platforms owing to wide business and consumer adoption of mobile technologies, approximately 20,000 each in the cloud services industry, mobile devices manufacturing industry, and in designing and developing mobile-enabled websites, and over 10,000 in providing location-based services.

Figure 7. Employment in mobile technologies



Source: ICTC, 2013

In estimating the labour market, it is a standard practice to use a multiplier. This allows estimating the spillover effects of the labour market of interest by approximating the combination of the direct, indirect, and induced employment.

For clarity, beyond developing mobile technologies, this labour market also consists of incremental employment in other sectors for those who adopt and utilize these technologies and additional employment resulting from increased household spending resulting from rising incomes because of direct and indirect employments (induced employment effects).

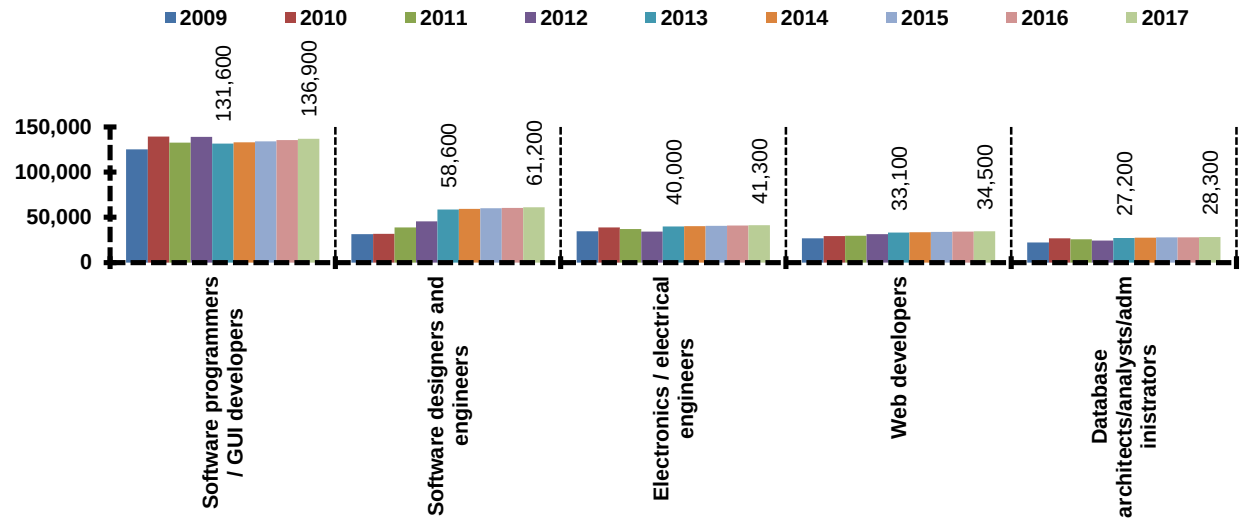
That is where a multiplier becomes useful. A multiplier of two implies that for every direct job, there are two indirect and induced ones. An example with respect to mobile technologies would be a technically savvy worker who works in a health care environment and whose job is to download and process the information received from clients who are using health related mobile technologies to seek consultation. Higher earnings from these direct and indirect employments will be spent in the marketplace where additional salespersons will be required. This is an example of induced employment.

There is no fixed multiplier that is used across studies. Multipliers from one economy should not be extrapolated to another, either. In most cases, it is left to the discretion of the researchers. For example, a study that examined the Facebook labour market used a range between 2.4 and 3.4 (Hann, Viswanathan and Koh, 2011). In contrast, a study that examined the apps economy labour market in the U.S. used 1.5 (Mendel, 2012). In some other labour market studies, Atkinson et al. (2009) used 3.6 for the US, Katz et al. (2009) used 3.4 for the US, Katz et al. (2008) used 1.38 for Switzerland, Crandall et al. (2003) used 2.17 for the US, and Strategic Networks Group (2003) used 3.4 for Canada.

A conservative multiplier of 1.25 is used in this study to estimate the breadth of the mobile technology labour market. This implies that every four jobs in mobile technologies generate one job in the rest of the economy. This is, perhaps, erring on the side of caution and may need to be revised as the adoption of mobile technologies becomes even more prevalent. 1.25 will, however, be used as the multiplier in this study.

In the mobile technology labour market, some occupations are invariably more crucial than others and demand for such jobs will continue to rise in the medium term. Nearly 12,000 new jobs will be created in five key occupations between now and 2017. When all the other relevant technical and non-technical occupations are taken into consideration, the total number of new jobs expected to be created by 2017 in mobile technologies and related services is approximately 40,000. Employment outlook for five of the most crucial occupations in mobile technologies are outlined below:

Figure 8. Employment forecast for select mobile technology occupations



Source: ICTC, 2013

Note that the historic and projected levels outlined above are employment in the overall Canadian economy and not restricted to mobile technologies. As roles, responsibilities, work areas, and sectors get more intertwined, all employment in these occupations are expected to be directly or indirectly linked with mobile technologies.

Impact on GDP

Our findings indicate that the adoption of mobile technologies has a discernible impact on the economy. The evidence of this impact is positive, though only at a relatively low level of confidence mainly due to a small sample size, as data is measured across a 5 year (2008-2012) period.

There are two ways increased mobile technologies adoption boosts GDP:

1. GDP grows by .08% for every 1% increase in mobile technologies adoption because of benefits like increased productivity;

2. GDP grows another .069% for every 1% increase in wireless subscriptions because of the generation of subscription revenues

These are incremental to each other. So, for every 1% increase in mobile adoption, GDP grows by 0.149% due to the combined benefits.

Canada's GDP is $1,680,000,000,000 ($48,000[1] per person x 35 million people).

We've said that a 1% increase in mobile technologies adoption would result in 0.149% growth in Canada's GDP.

So, GDP grows by $2,503,200,000 for every 1% increase in mobile adoption ($1,680,000,000,000 x 0.00149).

Because this study is the first of its kind to estimate the impact of mobile technologies adoption on economic growth, future studies will be able to benchmark their findings against this study. On the other hand, our estimate of the impact of wireless subscription is consistent with recent literature. Many of the recent studies that explored this impact find that a 1% increase in wireless subscription leads to an increase in the growth rate of GDP per capita between 0.06% and 0.08%.

[1] In current dollar

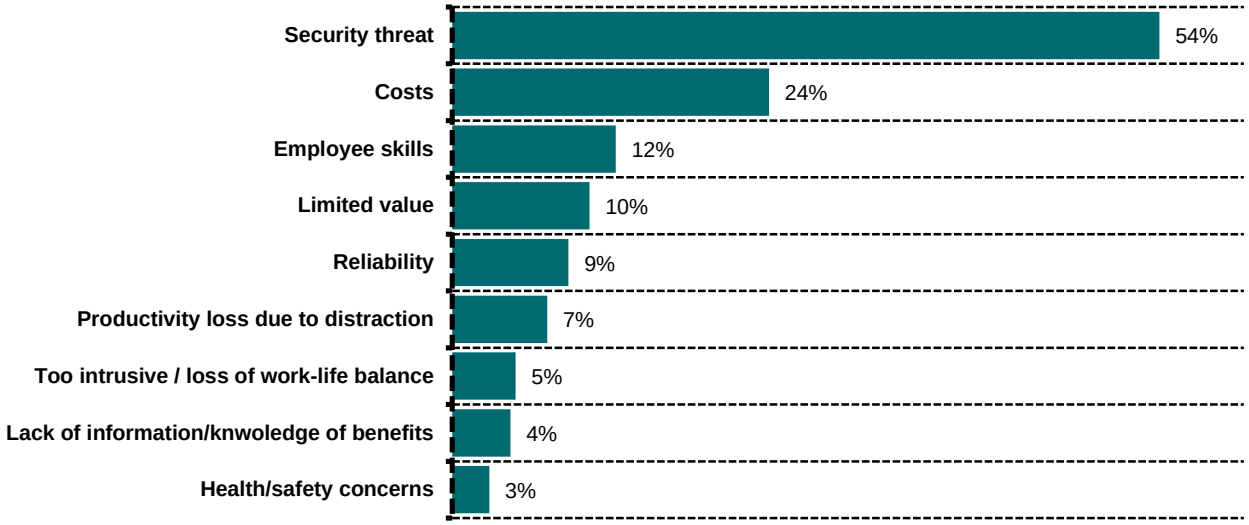
ISSUES AND CHALLENGES OF ADOPTION

Although adoption of mobile technologies results in multiple benefits to businesses, these technologies are not without their challenges.

Security threat

When enterprise systems are available on mobile devices, platforms and applications, security is a valid concern and must be addressed throughout the implementation lifecycle. Of the respondents to ICTC mobile technologies survey that raised various concerns related to mobile technologies adoption, more than one in two (54%) conveyed data and network security to be their biggest challenge in managing mobile technologies.

Figure 9. Concerns among business in adoption



Source: ICTC mobile technologies survey, 2013

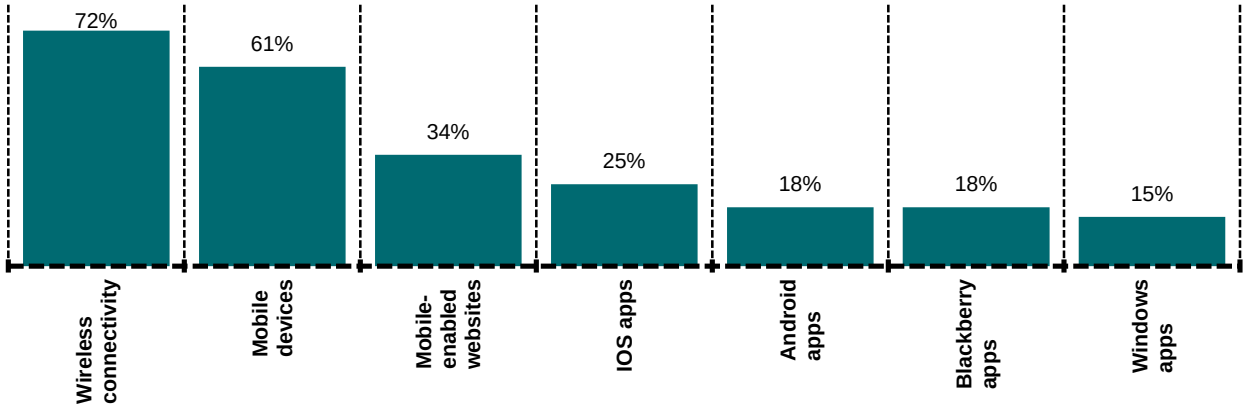
Costs and allocation of budget

Investments in mobile technologies are driven by a need to enable better business practices, as businesses can achieve a quick return on investment (ROI) if they offer mobility-enabled solutions. Increasingly, Canadian businesses offer their products and services via mobile technologies. Most products and services are available through mobile websites, and businesses are developing apps for

major smartphone platforms. Resources need to be allocated for this purpose and one in four (24%) businesses is still wary of the costs of adoption and maintenance. To maximize the benefits and minimize the costs of adoption, businesses first need to evaluate adoption and deployment options. A clear and accurate knowledge of the businesses processes and the technologies needed to enable and support those processes is a vital starting point. That knowledge is a critical foundation for subsequent informed decision-making.

Increasingly, businesses are allocating budget for mobile technologies adoption. 72% of businesses have dedicated budget for wireless connectivity, 61% businesses allocate budget for mobile devices, 34% businesses have dedicated budget for mobile-enabled websites, 25% businesses allocate budget for developing applications for the IOS platform, 18% businesses have dedicated budget for developing applications for the Android and Blackberry platforms, and 15% businesses allocate budget for developing applications for the Windows platform.

Figure 10. Share of businesses with dedicated budget



Source: ICTC mobile technologies survey, 2013

The level of funds allocated for developing apps depends on the functionality and is independent of the platform, as we did not find any statistically significant differences among platform-specific budget allocation. When making resource-related decisions, Canadian businesses consider ease of use for employees and clients, available support and services, reliability and security.

Skills shortage and mismatch

The adoption of mobile technologies is increasing demand for highly skilled workers. Nevertheless, the ease use of mobile technologies is an important consideration. Workers will be more productive and efficiently complete tasks if they can avoid long and complex authentication procedures for accessing enterprise networks and data. A majority of respondents report ease of use to be an important factor in the adoption of mobile technologies.

The evolving and expanding nature of mobile technologies dictates that a large range of skills are needed for service providers to provide efficient, user-friendly services and for adopters to use these technologies effectively. As a result, service providers and adopters alike will seek employees with leading-edge skills, of which there is currently a worrying mismatch in Canada. Canada needs strategies and approaches to maintain its position ahead of the curve, as the growth of the economy will be constrained if we do not meet the continuing strong demand for skills.

ICTC's extensive consultation with mobile technologies stakeholders reveals that skills requirements for providing and adopting mobile technologies changes on a continuing basis, mainly as a result of the emergence of new technologies, platforms, devices, and user preferences. Ensuring a steady supply of competent workers is critical as skills become substantially specialized. It is, thus, vital that stakeholders take all necessary actions to provide the workforce with the required tools and support.

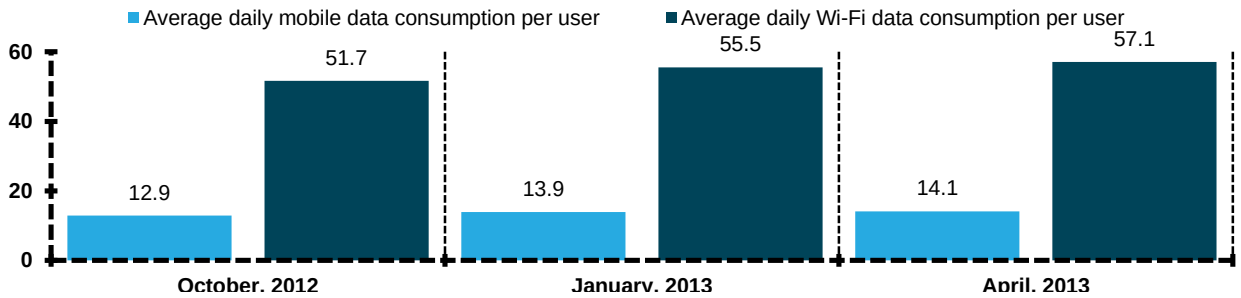
Investing in skills to increase efficiency and productivity is the order of the day to innovate high-value-added technologies and related services. Strong Canadian skills strategies will help Canada realize its aspiration to lead the global mobile technologies economy.

Spectrum capacity

In the not-too-distant future, spectrum capacity will be a severe challenge as there will not be enough of it to meet demand, particularly in urban areas. Auctioning the spectrum freed up in the 700 MHz band as a result of the digital television transition has still not been accomplished. Auctions have already taken place in the U.S. and policy-makers are looking for ways to get even more spectrum into the hands of the wireless providers in response to industry demand. Reverse auctions will soon be underway so that broadcasters release spectrum they do not need.

Beyond even these reverse auctions, though, the Federal Communications Commission (FCC) has identified that there is likely going to remain a need for more spectrum. Ultimately, there will be a fundamental discussion as to whether spectrum should continue in the hands of broadcasters who use it for just one purpose (e.g. television), or whether there is a larger public interest purpose for which it could be used.

Figure 11. Average daily Wi-Fi and mobile data consumption (megabytes)



Source. Cisco Data Meter

Cisco collects and releases data on Wi-Fi and cellular network data consumption. The global average for daily data consumption over Wi-Fi is four times that of cellular. Much of that data is used to access digital content through digital platforms such as YouTube, Hulu, and Netflix and this stream accounts for the highest share of data consumption. Such applications as Google Maps or Weather Network to gather real-time information also account for a large share of data consumption. Web browsing, social networking, and audio streaming are other important drivers of data usage. Consumers and businesses alike generally choose to use Wi-Fi to stay within the limits of their cellular data plans. Wi-Fi traffic will continue to grow strongly and this trend has strong implications for mobile technologies service providers for their product, service, pricing, and network planning.

As data consumption increases pressure on the capacity and speed of Wi-Fi, the availability of more spectrum will provide support on both counts. The development of new Wi-Fi standards has increased its speed and spectral efficiency. Sufficient spectrum to meet demand is needed to deliver the full potential and peak performance. To this end, Industry Canada is currently auctioning for Mobile Broadband Services (MBS) — 700 MHz Band to enable sustained competition in the wireless telecommunications services market, to promote robust investment and innovation by wireless telecommunications carriers, to make these benefits available to Canadians across the country, including those in rural areas, and to harmonize with the U.S. band plan to promote economies of scale, cross-border roaming, and simpler cross-border frequency arrangements and coordination procedures. Further details on Industry Canada's spectrum roadmap plan are available here.

White spaces (unused frequencies)

White spaces refer to unused frequencies allocated to a broadcasting service. These white spaces commonly exist between used channels, since assigning nearby transmissions to immediately adjacent channels may create interference to both. In addition, there is also unused radio spectrum which has either never been used, or is becoming free as a result of technical changes. In particular, the switchover to digital television frees up large areas between 50 MHz and 700 MHz.

Wi-Fi ultra may enable transmitting digital broadband signal over a long distance and through barriers such as concrete walls and forests. White spaces can allow reaching a very large community with broadband Internet, which can have huge development impacts in disadvantaged, rural, and remote communities.

White spaces are not part of the 700 MHz auction but may offer enhanced wireless broadband. Many observers argue that the white space is a potential game-changer in the battle over the future of internet connectivity in Canada. American research shows that there is significant white space spectrum potentially available. Combined with innovative business models, the possibility exists to create a new internet access infrastructure that is high-speed, mobile, open-access and has a relatively low capital cost structure in terms of expanding availability in underserved areas at high speeds and low prices. In key ways it would represent a fundamental alternative to existing business models, to the benefit of consumer choice.

Manufacturers and vendors are considering designing network and devices that can handle the white space which is at lower frequencies. Large players such as Google have initiated a push to open up the white space in the digital TV spectrum for web access.

M2M and bandwidth demands

The evolution of mobile devices and their widespread adoption among consumers prompt them to seek products and services using mobile-enabled applications. This results in a higher concentration of traffic and can affect the service provided by the network. 11% of respondents to ICTC's mobile technologies survey report ensuring network reliability to be a major challenge in managing mobile technologies.

Wireless devices will have access to connectivity at 150Mbs (and above) by 2016 as a result of the advent of LTE technology, driving further innovation. Networking between machines or sensors is leading a proliferation of M2M to facilitate previously manually completed functions in areas such as security, utilities metering, maintenance, automotive, healthcare, and consumer electronics. A wide range of industrial sectors are utilizing M2M technologies and this will only increase in the future. As was discussed by many of the thought leaders and survey respondents, real-time information monitoring is becoming critical for businesses to monitor progress in operations. It will be particularly critical for businesses in the healthcare, automotive, mining, and oil & gas sectors. Globally, M2M traffic will grow by 24 times between 2012 and 2017, when 9% of global M2M connections will be connected via 4G, nearly 59% by 3G and 32% by 2G, changing from 1%, 35%, and 64% respectively (Cisco Data Meter). As M2M becomes more prevalent and migrates from 2G onward to 4G technologies, the requirement for additional bandwidth will intensify.

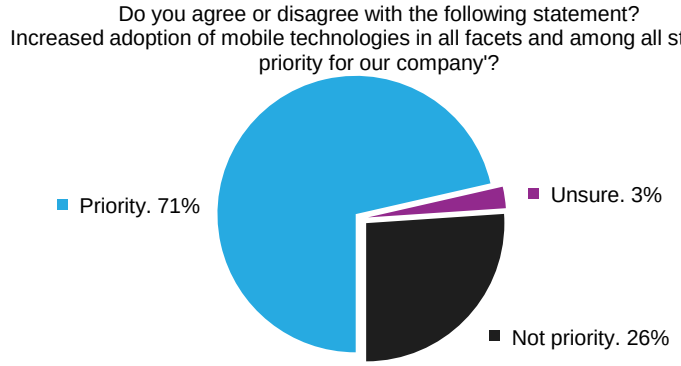
Unfinished development

Many vital business processes and systems (e.g. project management, enterprise resource planning (ERP)) still do not offer integrated mobile capabilities. This limits a company's ability to maximize the benefits of mobile technologies and many are taking the route of developing their own mobile applications. As a result, companies now need to manage all the various mobile devices, platforms and applications operated from different locations, a complex endeavour. 10% of respondents find mobile technologies in the current state to be of limited value.

WHAT THE FUTURE HOLDS

Now that the capability and availability of mobile technologies has reached a relatively mature status, technology services providers are able to help willing Canadian businesses adopt mobile technologies. The benefits of such adoption are undeniable. As a result, businesses are accelerating their adoption of mobile technologies. Among surveyed businesses, 71% state that increased adoption of mobile technologies in all facets of their business processes and among all employees is a priority for their companies. While only 3% of the respondents remain unsure, adoption is not a priority for 26% of businesses.

Figure 12. Mobile technologies adoption - Opinion poll



Source: ICTC mobile technologies survey, 2013

It is becoming evident that mobile devices and applications are revolutionizing business practices and thus impacting the entire economy in numerous ways. This is paving the way to generate revenue from content.

Increasingly, mobile devices will be equipped with high definition (HD) video display and recording capabilities. Consumer demand and subsequent economies of scale will reduce the cost of standardizing this component. Some manufacturers are developing three dimensional (3D) video and still photos capabilities by mounting two cameras on the devices to replicate the distance between the eyes. Other manufacturers are equipping devices with projectors to overcome the problem of relatively small screen size inherent in mobile devices.

Devices are becoming equipped with multiple core processors, enabling these devices to divide different applications between the processors, improving processing speed and battery life. As components become more sophisticated and miniature, new form factors will emerge to respond to the varying needs of the targeted consumer segments (e.g. iPad mini).

By 2020, it is estimated that 50 billion devices will be connected. The proliferation of M2M will necessitate further creativity and most of the innovations such as automobile to automobile, telemetry, remote sensing and diagnostics for patients etc. will take place in this area.

CONCLUSIONS AND THE WAY FORWARD

Combining rigorous analysis and consultation with Canadian businesses, this report is intended to share widely employed practices and provide reference and guidance to help all Canadian businesses address the opportunities and challenges associated with adopting mobile technologies. By connecting devices with applications through networks and cloud services, mobile technologies are enabling real-time access to integrated data, empowering employees and clients to access services from any place at any time, and thus improve operations and efficiency. These technologies have a positive and significant impact on overall economic growth by transforming existing and delivering new products and services.

In addition to providing a solid understanding of the context shaping mobile technologies adoption, ICTC seeks to help organizations take action. The strategies outlined are the result of our analysis and insights shared by thought leaders about the trends and challenges they face in trying to achieve a balanced level of mobile technologies adoption costs and benefits. Which strategies any given business will adopt and implement will be specific to their business scope.

Mobile technologies adoption is important for all sectors: All companies are looking for mobile, agile and smart solutions. No vertical sector can ignore adoption, as mobile technologies present compelling benefits that are nearly universal. Technological infrastructure is reaching a point where improved services can be delivered using mobile technologies. Business entities are enjoying many of the benefits of adopting these technologies and want to integrate them to additional business areas. This creates additional market and sub-market opportunities for service providers. It is important that mobile technologies service providers increase ties with all vertical sectors and sub-sectors to maximize reach and benefit from synergies. Industry-specific trade fairs will be beneficial where mobile technologies service providers come to present their offerings for respective industry verticals.

Continue with traditional service delivery: Service providers need to realize and be cognizant of the fact that regardless of 100% wireless or smartphone penetration or high demand for mobile-enable products and services, there will remain a clientele base that will not have the resources or understanding to utilize mobile technologies and will thus require traditional methods for service delivery.

Raising awareness of benefits is critical: There is a strong need to create awareness of the benefits and advantages of adopting mobile technologies among Canadian business entities. Networking is vital to spread the word. To address the diverse needs of various verticals, establishing standardized information for sector-specific users about how to utilize mobile technologies will encourage many to adopt and thus create growth opportunities for service providers.

Costs are a major constraint: Resource allocation is a foundational constraint for adoption of mobile technologies. Returns on investment for mobile technologies adoption is quite high and introducing measures that are conducive to such adoption would be beneficial to Canadian businesses. If corporate tax holidays or credits are tied to mobile technologies adoption, businesses will have the incentives and means to adopt quickly. Businesses need to be aware and optimize the use of technological innovations that will make it easier and less expensive to adopt mobile technologies to deploy services. Policy-makers could benefit enterprises by promoting adoption among businesses and providing marketing support to service providers. Government's role as a significant procurer cannot be over-emphasized. In addition, ensuring mobile technologies service providers, particularly SMEs and start-ups, can adequately fund their activities is important. Procurement policies that create demand, favourable tax incentives, and generally competitive corporate tax rates would be potentially beneficial. There should be some protection aimed at startups but regional funds to generate activities in a particular geographic location have a checkered history. This should be taken into consideration when formulating new policies. Policy-makers

should use the findings of this report as a baseline and raise awareness of the need to invest in the adoption of mobile technologies. ICTC's considerable expertise in this area can be made use of to explore additional research areas, as necessary.

Ease of use is vital: In today's work environment, workers require skills both to interact with mobile technologies (e.g. field workers) and to analyze the real-time data received using these technologies (e.g. data analytics). Mobile technologies service providers need to understand the needs of both these groups and make their offerings suitable for both groups.

Enhanced security and privacy policies are important: As the use of mobile-enabled services increase, privacy and access to information will be an important challenge and additional security and privacy is required and should be provided. Clients should be provided with clear guidance on privacy and security related issues. Businesses' responsiveness to clients' expectations in terms of accountability, transparency, and improved delivery of services is going to be critical.

Labour shortages will hold Canada back: Strengthening all employees' capacities to function in a connected and mobility-enhanced workplace is crucial. Not all employees may embrace mobile technologies adoption due to lack of understanding or skills. Some may see new technologies, enterprise solutions, or business processes as a threat to their jobs. Sensitizing employees in this regard and providing them with the right tools to be successful in this new environment is very important for business success. As adoption rate increases and new genres of mobile technologies emerge, availability of talent and right blend of skills among Canada's ICT workforce is going to be more vital than ever before, as Canada's competitiveness will depend on that. Meeting the continuing strong demand for appropriately-skilled workers is a big challenge. The combination of skills that is in highest demand consists of subject-matter expertise combined with technical knowledge and prowess, business acumen, and interpersonal abilities. Workers with right technical skills are rare; workers with the right combination of multidisciplinary skills are rarer still. This can only be achieved through a collaborative process that involves all stakeholder groups including educators, employers, employees, policymakers, technology advisors, and researchers. In addition, programs are needed that target youth at a younger age when they are still making decisions about their courses and career options, when they are being influenced by peers, teachers and parents away from STEM in some cases due to misinformation about the opportunities. Furthermore, foreign talent needs to be recognized and welcomed to address the skills shortage. They also have a detailed understanding of the global market, thus facilitating Canadian service providers to establish a strong foothold in a highly competitive, borderless environment.

Skills mismatch looms as a critical challenge: There is a distinct disconnect between what industry looks for in terms of skills and what our post-secondary system is currently producing. This is partly the result of the long lead time required to create new academic programs. The gap cannot be addressed by either industry or the post-secondary system acting in isolation. Many universities and colleges have introduced programs that combine ICT with other fields. Educators need to ensure that their programs are reflective of the changing industry demands and their graduates are fully equipped and prepared to fill these needs. Post-secondary institutions require the assistance of a real-time tool to forecast future skills needs at the national and regional levels so that they can modify their curricula to address employers' needs and offer integrated, hybrid programs in timely fashion.

Up-skilling of the workforce has to be a collaborative effort: If corporate tax credits are tied to labour market practices to encourage focused (e.g. youth, women, immigrants) hiring, service providers will have both incentives and means to provide training opportunities to staff so they may upgrade their skills — a once common practice that has regressed since the onset of the recession. Women are 50% of the population, yet greatly underrepresented in the ICT workforce. The ICT sector faces significant image and perception problems, including the view that is singularly computer-focused, male-dominated, lacking in

social relevance and predominantly anti-social. A gender-bias in STEM education and employment is widely known and thus there are few visible role models for young women. Concerted, cooperative promotion and outreach efforts are needed to counter the perceptions that there are fewer opportunities in STEM and ICT and that the careers are not stimulating.

International exposure broadens horizon of our workers: Canadian employees are becoming more aware of the need to broaden their horizons and are actively looking to get international assignments to learn and grow. Employers should actively help in this endeavour, as the end result is more rounded employees and that would be beneficial to their companies too. Workers can learn about local issues from local client and providers' perspectives and bring that learning back to Canada and improve the offerings of Canadian service providers with additional relevant factors taken into consideration.

New partnership models are necessary: Taking advantage of the compelling global opportunities will require scaling up, but in a mobile technologies environment, partnership is required and critical to scale in a way it might not have been previously. It is important for a mobile technologies service provider to have big reach, but that reach is likely to be achieved through partnerships. Small companies' offerings may be embedded into larger integrated offerings, and large partners can assist in opening export doors. Companies, particularly large and established ones, have a corporate social responsibility to help nascent SMEs. Larger companies have established 'comfort zone' partners and it is often difficult for 'outsiders' to break through and create partnerships. Less well-known SMEs can face challenges opening door at large multi-nationals.

A clearing house of resources can help: An intermediary resource centre for SMEs is needed to act as a clearing house and provide SMEs with 'one-stop' support. Industry collaborators such as ICTC, NRC / IRAP, or the Ontario Centres of Excellence can facilitate that. There is a need to share information with SMEs, facilitate them, providing them with the right network, contact, support structure and platform as relevant. Highlighting best practices, challenges, lessons-learned and strategies to combat those challenges are critical information for start-ups. Mentoring SMEs and their key personnel and informing them of various available industry support programs and how to access such programs can play a vital role in a company's development and growth. Established companies should play an active role in this regard.

Significant global opportunities: Most mobile technologies service providers are domestically-focused. But, an excellent blend of advanced technological, research and corporate infrastructure means that Canada offers unique opportunities and brand Canada needs to be built and promoted around this theme. Concerted effort is needed from all stakeholders. Canadian mobile technologies service providers can be proactive and direct in promoting their work. Industry and policymakers need to devise a strategy and take active part showcasing their products and services internationally. Promotional activities need to go beyond highlighting available technology and promote the amazing skills and talent available in Canada. Local knowledge is just as important as domain knowledge to be able to deliver a cutting edge mobile solution, particularly in the global market. Immigrants, diasporas and international students need to be utilized appropriately to help with this by bringing their existing contacts and relationships to a company – if those are leveraged effectively by their employers.

Policy support is vital: The federal government has excellent programs in place to support SME innovation, R&D and export. Programs such as IRAP and SRED are doing an excellent job in this regard. There are government bodies such as CMF and OMDC that assist mobile technologies and digital content service providers. More effort, however, is needed to raise awareness of these programs and simplify the processes for SMEs to access them. Policymakers need to play a facilitator's role and assist SMEs with export, organizing international trade shows, networking with potential international client and showcasing Canadian offerings in the international arena. Mobile technologies service providers face low

barriers to entry and supporting these SMEs, particularly start-ups, is crucial. In comparison with capital-intensive subsectors, potential for growth in jobs and revenues is strong and public authorities can put this subsector on a sustainable growth path with relatively low investments. Policy-makers in competing jurisdictions provide notable support and protection to their entrepreneurs. For example, South Korea has a friendly domestic market that allows Korean companies to perfect their products in a friendly domestic market before going global. Strategies need to facilitate service providers to deploy the latest mobile technologies and help businesses adopt these technologies for efficiency and productivity gain. Providing incentives for enterprises to utilize and leverage mobile technologies could be useful. Policy-makers can provide encouragement for more advanced data connectivity and encourage the rollout of competitive, advanced telecommunications networks, as adoption of advanced connectivity increases with decreasing costs. Policy-makers' knowledge and understanding of the industry is not ideal. Regular conversations with the industry need to take place on an ongoing basis and an independent body such as ICTC can facilitate that.

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