

Growth Of Broadband And ICT Adoption By SMEs In Atlantic Canada

Author: Gregory J. FLEET, University of New Brunswick, Saint John, Canada, fleet@unbsj.ca

Since 2005, we have conducted three Atlantic Canada-wide surveys of SME businesses benchmarking levels of ICT adoption, change in adoption, as well as the role of marketing and export on ICT usage in helping to create growing and sustainable business opportunities. Despite Atlantic Canada's low population base and distance to major population centres, SMEs in the region show strong levels of adoption of various ICT products and services. Broadband access, website adoption and online purchasing is now over 90%. Even newer social networking services, such as web analytics, search engine optimization, and the use of Twitter are being adopted by as many of 44% of the SMEs. These adoption rates will be compared with our previous studies to document the historical growth within Atlantic Canada, as well as compare these baseline measures to other regions within Canada, as well as studies of comparable regions worldwide.

Keywords: SME, ICT, Adoption, Broadband, Canada, Rural

Introduction

Positive growth of the Atlantic Canadian economy is next to impossible without growth at the small and medium enterprise (SME) level, where, like many regions of the world, these smaller companies make up over

90% of all businesses [1]. As a result, researchers worldwide have been tracking the performance of these organizations looking for ways to encourage their growth and thereby stimulate local economies. Much of the recent focus of this research has been on the adoption of Information and Communication Technologies (ICT) for SMEs (e.g., [2], [3], [4], [5], [6], [7]). This is due in large part to the early work of Porter [8], who showed that the Internet and advanced ICT can improve operations and enhance market reach. Many of these studies focus their research on rural and less-developed regions, where ICT is perceived to help level the playing field for competition against larger enterprises as well as against global businesses ([9], [10], [11], [12]).

The realization of these potential improvements for many SMEs are known to be constrained by basic resource issues of time, money, and knowledgeable personnel [13], [14]. In fact, some have found that SMEs are generally slower at adopting ICT than their larger counterparts [15]. This has led to the combined effort, over the past decade, by governments, universities, and regional development agencies to seek opportunities to research and train these SMEs to incorporate more ICT into their operations.

Within Atlantic Canada, the Electronic Commerce Research and Training Centre (ECC) at the University of New Brunswick has been working with local, provincial and national government organizations to understand and enhance SMEs use of ICT. This research and training agenda began over 10 years ago. In 2004, the Centre began the first of a number of SME studies on the adoption and use of ICT by Atlantic Canadian businesses. With the latest completed in early 2010, there are now *three* region-wide studies of ICT adoption by SMEs over a six-year period.

Adoption levels and growth: In this paper, we will summarize the adoption of ICT by Atlantic Canadian SMEs, and the change in adoption over a 5.5-year period. Atlantic Canada is a sparsely populated, largely rural region made up of four of the smallest provinces within Canada. The total population is just over 2.3 million with population densities that range from as little as 2.2 people/km² in Newfoundland, to a maximum of 10.9 people/km² in Nova Scotia [16]. Despite its size, this region of Canada (in particular, the provinces of New Brunswick and Nova Scotia) has been known for pioneering efforts in advanced telecommunications and Internet use ([17], [18], [19], [20]). The question, then, is what impact this effort by government and business has had on elevating levels of adoption, especially when compared to other regions of Canada or worldwide.

It would make sense to compare our data with those regions within Canada and worldwide where business and population demographics are comparable to those of Atlantic Canada. While ideal, this is quite difficult for a number of reasons. First of all, the number of studies that quantify ICT adoption levels (especially of SMEs) is rather limited (and often published by national government or international bodies) Second, comparisons across studies can be difficult when different questions, objectives, motives and contexts can all directly influence the specific interpretation by both participants (in answering the questions) and researchers (when analyzing the data). Still, we can see some general patterns that are relevant for this study.

Businesses in the western world (US, Canada, and areas of Europe, in particular) have demonstrated high levels of adoption [21]. On the other hand, studies from developing economies have struggled to explain lower adoption levels of ICT. It is also common to see that adoption levels are directly related to the size of the business; that is, larger organizations typically have higher adoption levels [22]. Similarly, rural regions can display lower levels of adoption when compared with their urban counterparts ([23], [24]).

Therefore, it wouldn't be unexpected to find that Atlantic Canada SMEs demonstrate these trends with relatively high levels of adoption compared to other regions worldwide, though lower, in general, than the rest of Canada. Yet, Davis & Vladica [25] looked at adoption within one Atlantic Canada province in late 2004, and found fairly high levels of adoption compared with the rest of Canada. At that time, the provincial government for New Brunswick had been working with the local telecommunications companies to bring broadband to all communities, both urban and rural. (In fact, this effort culminated with the announcement by the government in 2008 that their goals were realized [26]). The elevated levels of adoption by Davis & Vladica [25] might also find explanation in the general culture of innovation in Atlantic Canada, especially in New Brunswick where New Brunswick Telephone (NBTEL) became a test-bed for new telecom and Internet services [27].

In this study, the results from three baseline studies taken over a five and a half year period will chronicle the adoption rates within Atlantic Canada. This is quite unprecedented. Similar historic views of SME behaviour have often relied on cross-study comparisons from different researchers and different institutions. Therefore, following paper will provide a unique snapshot of adoption within Canada focusing specifically on the growth in broadband and other ICT services, as well as plans for future ICT adoption.

Methods

Given the geographical size and dispersion of the population, reaching businesses across this region would be difficult without the use of the Internet and web surveys. Therefore, our studies employed email for initial contact, and web-based surveys to conduct our research.

When the Electronic Commerce Research and Training Centre (ECC) started, the funding was tied to providing training and education to SMEs across this region. Therefore, the main goal of these surveys was to provide a benchmark of technology adoption to help understand the business population and to frame a series of subsequent training initiatives particularly suited to their needs. As such, the questions surveyed a range of issues mostly using nominal and ordinal rating scales and response types to better focus the topic and depth of material for the training sessions.

In this quantitative baseline survey, participants were asked to choose from a variety of closed-ended responses as well as rating statements using 3-, 5- and 7-point Likert scales. In some cases, they were also invited to provide an explanation of their answers to some specific open-ended questions.

Each of the three Atlantic Canada studies was conducted using a secure, password-controlled web-based survey. Unique email invitations were sent to thousands of SMEs across the region inviting their participation by completing the 40-plus item questionnaire. The email addresses were culled from a range of local and federal government and business sources. The most recent 2010 study, for example, created an email database of over 11,000 businesses.

The surveys were available for completion for a period of 4 to 5 months. Regular reminders were sent to those businesses that had yet to participate. Early participation prizes were used as incentives, as were small denomination gift cards and larger technology offerings in a final prize draw (e.g., iPod touch, Netbooks).

The questions in the survey requested feedback on four areas: specific Internet use (current and planned), perceived enablers and barriers to ICT adoption, the role of ICT in marketing and export efforts, and general business details.

In order to ensure comparability between studies, the large majority of questions remained unchanged in the second and third studies. Some small changes did occur; for example, additional questions were added to

explore the role of ICT in marketing and export, and most recently (in the 2010 study) questions were asked about the use or planned use of social media. To accommodate these additional questions, some questions from the original surveys were removed in order to keep the completion duration similar to past surveys and feasible for busy participants.

Results

Participants: Participation varied from study to study. The initial survey garnered the highest response rates with 776 SMEs across the four provinces completing the survey. The subsequent surveys resulted in smaller yet respectable response rates of 400 and 432 SMEs, respectively. (Given the large number of email invitations, overall response rates, as a percentage, ranged between 4 and 10%).

For our purposes, SMEs were defined as businesses with fewer than 300 employees. We further classified these SMEs into four groups: micro-enterprises (less than 4 employees, which included owner-owned SMEs), very small (5 to 19 employees), small (20 to 49 employees) and medium (50 to 300 employees).

It is important to note two key elements of these participants. First of all, the sample was a non-random, self-selected group of Internet users. As such, we cannot directly assume representativeness for all Atlantic Canadian SMEs without quantitative (statistical) or qualitative (comparison of the socio-demographics of the participants with the characteristics of the regional population) analysis. Second, given that the participants needed an email account to receive the invitation and needed access to a web-based terminal to complete the survey, we can be sure that our sample has underestimated those businesses currently without Internet services. This last issue was considered low risk from the point of view of training, since the goal of the SME education was to reach and better the operations of those SMEs already using the Internet. But it will most definitely elevate our numbers by oversampling online SMEs.

Representativeness of sample: The representativeness of our samples was assessed by comparing a number of socio-demographic properties. Of the four Atlantic Canadian provinces, the home province of the research university was slightly (and consistently across the three surveys) over represented proportionally, while the other three provinces were typically slightly underestimated in participation. This is not surprising given that

the survey invites and web pages were clearly branded with the ECC and the New Brunswick University, and the strong local pride in this part of Canada. Industry sector participation was both broad and varied, with representation from all 20 sectors (using the North American Industry Classification System—NAICS) that “distinguish the structure of the Canadian economy” [28]. In particular, the top six sectors were retail, consulting, professional services, IT services/products, light manufacturing and tourism comprising 50% of our sample.

Probably the most marked difference between our data sample and the population was with respect to the size of the SME. Statistics Canada [29] indicates that nearly 80% of all SMEs in Canada have 4 employees or less. Our samples, on the other hand, had between 40 and 50% of micro-enterprise representation. As would be expected, the larger-sized SMEs were similarly over-represented. Despite these differences, there are two important facts to consider. First, these differences can be considered when summarizing the results, and appropriate weights be assigned to better reflect to the population from our sample. Second, the data gathered in each of the three surveys were exceptionally consistent one to the next, suggesting that inter-test reliability was very high, and that with careful weighting, our results could truly minimize these demographic biases in the sample.

Adoption of ICT and e-commerce: Looking at the adoption numbers across the three surveys shows there has been considerable growth in ICT across a number of technologies. One of the more dramatic results from the past 6 years of research on SMEs in Atlantic Canada is the adoption of broadband Internet. Given the way this question was structured in our survey, we will examine broadband adoption by looking at the drop in numbers of those connecting to the Internet using traditional narrowband dial-up service. In 2005, this number was nearly one-third (31%). In 2007, adoption dropped to 14%, while in 2010 the numbers were as low as 5% of the sample. Therefore, 95% of our 2010 sample were using some form of broadband to connect to the Internet.

Less substantial, though nonetheless interesting, are other increases in ICT adoption. Website adoption has risen from 71% in 2005, to 80% in 2007 and 84% in 2010. If we isolate only those businesses that export products or services (approximately 30% of our sample), then we find that 90% of exporting SMEs have websites (in 2010). Similarly, if we look only at micro SMEs (4 employees or less), and weight our sample to match that of the population proportions,

a full 94% of the sample have websites. In other words, given the under-representation of micro-enterprises in our sample, our latest measurement of 84% adoption of websites clearly underestimates the broader pattern in the region.

In each survey we asked businesses what technologies and services they currently use. Table 1 shows how 17 technologies and services ranked year over year. This table reveals that SMEs have ubiquitously adopted basic technology and Internet behaviour (PC workstations, Web site and email use). The other 14 services saw a full range of adoption rates from 1% to 94% and, with the exception of two technologies (i.e., biometrics and RFID), adoption across the three surveys grew between 11% to 24% for these 12 remaining services, from one survey to the next.

A common measurement of adoption is the use of websites and email for conducting good-and-service transactions. Table 1 shows a steady growth: from 46% in 2005 to 53% in 2007 and, most recently, to 61% in 2010.

Exporters: The first study in 2005 identified export as a key characteristic of those SMEs shown to be higher adopters of ICT. Therefore, in 2007 we added some additional questions about export behaviours. A comparison of these last two surveys shows there was no growth in the number of SMEs who export good and/or services in Atlantic Canada (or that any growth that occurred since 2007 was offset by a drop in those no longer exporting). Yet at the same time, our results showed a dramatic change in perception by SMEs. We asked participants a series of questions about where they see their market growing in the coming years (e.g., domestic versus international). The data revealed a huge increase in the number of SMEs indicating they see the global market as realistic for their businesses, and many more see the North American and global markets as the context for their eBusiness offerings. For example, 82% of SMEs said they see the Internet as key to reaching beyond local markets, a number that was only 40% in 2007.

This finding was supported by other data in our surveys. When participants were asked to choose from a variety of factors that played a role in their export business, the Internet was consistently rated as high as 30%, the highest rank of all factors.

Table 1. The percentage of Atlantic Canadian SMEs that currently use a variety of technologies and services for their business (from studies in 2005, 2007 and 2010).

Use of technologies	2005	2007	2010	Use of technologies	2005	2007	2010
Personal computer, workstations	91%	>99%	>99%	Secure consumers transactions	31%	34%	46%
E-mail (electronic mail)	91%	>99%	>99%	Intranet	21%	32%	45%
Internet (e.g. visiting websites)	91%	>99%	>99%	Remote data storage	21%	29%	43%
Network/information security	78%	90%	94%	Hosted software solutions	18%	27%	41%
Functional software packages	74%	88%	88%	Network conferencing (video)	16%	25%	39%
Wireless internet (WiFi)	59%	64%	76%	Extranet	9%	19%	20%
Shared file folders	51%	67%	70%	Remote help desk assistance	16%	14%	20%
Secure business transactions	42%	55%	62%	Biometrics (e.g. finger-print scans)	1%	5%	5%
				Radio Frequency ID (RFID)	4%	3%	5%

Future Technology Adoption: Finally, we also found considerable changes in opinion about what technologies and services SMEs *plan to use* in the future. Table 2 compares the latest survey results with the previous two surveys summarizing the percentage of SMEs that said they plan to adoption specific technologies. Here one can note that interest in many of these 14 services has doubled since the 2007 survey. For example, while interest in reworking the design of the company's website grew 6% between 2005 and 2007, that percentage jumped to 12% between 2007 and 2010. In fact, three services (website development, promotional/Internet marketing services, and customer support) grew by 14% and 15% after showing only a 3% to 5% interest previously. This growth in *optimism* is mirrored elsewhere in the survey. In addition to stating their future interest in the 14 ICT services, respondents were also given the option to indicate 'I have no plans in this regard'. In 2005 over 1/3 of the sample failed to see these technologies as part of their companies near-term plans; but by 2010, only 13% voted this way.

Table 2. The percentage of Atlantic Canadian SMEs that indicated they plan, in the near future, to use a variety of technologies and services for their business (from studies in 2005, 2007 and 2010).

Planning to use in near future	2005	2007	2010	Planning to use in near future	2005	2007	2010
Website design	27%	33%	45%	Technical consulting	8%	16%	26%
Website content development	28%	30%	44%	Delivery fulfillment and order tracking	12%	15%	19%
Promotional/Internet marketing services	24%	28%	43%	Security/Access management	9%	13%	16%
Internet marketing Strategy	-	-	42%	Business process integration	7%	8%	14%
Payment services	21%	29%	39%	Catalogue management	9%	14%	13%
Customer support	18%	23%	37%	I have no plans in this regard	34%	28%	13%
Hosting	8%	19%	28%	Other	3%	3%	4%
Shopping cart	11%	18%	26%				

Discussion

This study is quite unique, providing a view of ICT adoption by SMEs across Atlantic Canada over a 5-year period. The re-use of the survey each year, and the high degree of inter-test reliability provide a unique look at the changing landscape of this part of (mainly rural) Eastern Canada.

One of the most dramatic findings in our study is the adoption of broadband Internet, as reflected by the drop in use of dial-up service. In 2005, more than 3 of 10 in our sample were still using dial-up Internet access. Less than 5 years later our Atlantic Canadian sample indicated that number was now only 1 in 20. In eastern Canada, the provincial governments have placed a priority here, with a goal ensuring 100% broadband penetration for all residents of this region (e.g., Business New Brunswick [30]). The data from sample mirrors this level of growth.

There are a number of studies that can be used for comparison, both for these broadband numbers and subsequent adoption levels. Within Canada, Industry Canada and Statistics Canada has been making similar measurements. In their reports, we can see similar trends in *broadband* adoption and reduction in use of *dial-up* [31], though this national study summarizes for all Canadian enterprises, not just SMEs. From 2000 to 2006, *broadband* adoption had risen from 35% to 85% while *dial-up* use dropped from 60% to 10% over the same period. The last two years (2005 to 2006 – where their study

overlaps with our data) showed slower growth, as reflected in dial-up access dropping from 14% to 10%. Again, these numbers are for all enterprises, and it is generally understood that adoption rates in larger businesses outpace that of smaller enterprises. Still, *broadband* adoption by SMEs in Atlantic Canada, while potentially behind the rest of Canada early in the decade, seems to have quickly caught up by 2010.

The United Nations report on the information economy [21] provides global numbers for enterprise adoption of various technologies from 2003 to 2005 where, for example, 63% of businesses in the EU had *broadband* Internet in 2005. When looking at specific countries, the adoption levels do show a wide range: the lowest in Poland (43%) and the highest in Sweden (83%).

Therefore, midway through the decade, *broadband* adoption in Atlantic Canada is behind the rest of Canada, and comparable to findings in Western Europe.

When comparing the adoption of other technologies within Atlantic Canada to the rest of the world reinforces the finding that this region in Canada has demonstrated both dramatic and high comparative levels of ICT use (as seen by the measurements summarized in Table 1). Neogi & Brocca [31] summarized private enterprises across Canada from 2000 to 2006 and found that *Internet use* was mostly stalled at 83% in 2006, *website adoption* growth had reached 40%, *online purchasing* was at 45%, while *online selling* was at a mere 8%. The United Nations report [21] shows similar numbers in western regions: 91% of enterprises (with more than 10 employees) having *Internet access* (with Scandinavian countries at 96% or higher). Their summary of adoption in developing countries shows a wide range from 20% of enterprises having Internet access in Chile to 70% in Costa Rica. *Website adoption*, like in the Canadian numbers, was often found in only half of those SMEs with Internet access. Finally, in EU enterprises *selling online* ranged between 10% and 20% with wide differences among countries.

Like our study, there is other research looking at SME adoption of ICT within a specific regions, showing findings roughly corresponding to those from the UN study. In Wales, Holvey [32] reported that only 20% of SMEs were found with *websites* in 2003. In Nigeria, less than 50% of SMEs had *Internet* in 2007, while 57% used email [33]. Finally, in South Africa, looking only at tourism SMEs in 2005, Migiro & Ocholla [34] found Internet access as high as 88%, *broadband* adoption at 72%, and *website adoption* at 74%.

Our data also demonstrates some other areas of considerable growth

in adoption: use of business websites, wireless Internet (WiFi), secure online customer transactions, as well as a number of operational areas (intranets, remote data storage, hosted software, video conferencing), each showing from 12% to 14% growth in the past two years (Table 1).

And in looking to the future, patterns around those technologies and services SMEs *plan to adopt* reveal areas of notable interest: the focus on more website development and design, on Internet marketing services and customer support; that growth in interest being 12% to 15% since 2007 (Table 2).

Conclusion

Comparison with Canadian and international data show that despite differences in definitions of firm size, our data often present a more positive or optimistic view of ICT adoption, with Atlantic Canadian companies in our sample indicating higher use and higher employment of technologies and services than our Canadian or European counterparts. While analysis is still ongoing, these differences are likely the result of three factors: (i) sampling, methodology and analysis differences between the studies, (ii) real regional differences that may have been masked in the larger Canadian study, and/or (iii) the effect of over-estimating by our sample (given that our sample participants were mostly Internet users). Unfortunately for Canada, the SECT (Survey of Electronic Commerce and Technology) survey, which is the basis for the Neogi & Brocca [31] article, has not been conducted since 2007, so our comparison with national data is lacking up-to-date numbers and comparisons.

The value of these findings is equally exciting. In a mostly rural part of Canada, growth in adoption as we have seen above has many implications. The ECC has been using these results to help better focus education and training opportunities for SMEs. We have also been sharing the results of these studies through our Centre's website, to help SMEs better understand their competitive environment. Our funding partners have traditionally included various levels of government, and these results continue to be used for planning by policy makers. Finally, an understanding of which technologies and services are growing quickly and which are growing slowly helps better understand models of adoption including isolating specific enablers and barriers for SMEs.

There are, as well, recognized limitations in this work. The mainly nominal data limit the range of analytical tools available for analysis, and the focus on understanding baseline behaviour for determining training materials

has influenced the choice of questions and areas of focus. Future work will likely continue to assess the more applied dimensions of SME behaviour, but we are looking to explore some potential hypotheses in future studies.

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