

## ADOPTION AND USE OF INTERNET TECHNOLOGIES AND E-BUSINESS SOLUTIONS BY CANADIAN MICRO-ENTERPRISES

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### INTRODUCTION

Micro-enterprises make up the majority of firms in most countries.<sup>1</sup> In New Brunswick, micro-enterprises represent around 73% of all firms (Bourgeois and Dulipovici, 2003). Canada has about one-half million micro-enterprises, representing around 77% of all Canadian firms (Industry Canada, 2001). The proportion of micro-enterprises within the population of firms is even larger when owner-operated firms with no employees are factored in.

At first glance, micro-enterprises seem to represent a huge economic development potential. Promotion of micro-entrepreneurship is frequently advocated as a component of strategy for poverty reduction, regional adjustment, or economic regeneration. However, in reality, micro-enterprises face numerous obstacles to growth, including (in many cases) lack of growth ambitions. The literature provides several reasons to believe that many micro-enterprise owners do not seek to significantly modify their business practices.

Furthermore, Internet technologies and e-business solutions would seem to provide major growth and development opportunities to micro-enterprises. The business case for adoption of these technologies seems to be compelling. Yet the uptake of ICTs among SMEs, especially among micro-enterprises, is occurring much more slowly than anticipated.

Most research on e-commerce adoption among SMEs has focused on SMEs in general. However, it is not obvious how much in common a micro-enterprise with a couple of employees and a medium-sized firm with five hundred employees have from an e-business point of view. Very little research has been published specifically about the behavior of micro-enterprises with respect to the Internet and e-business. In the present article we contribute to knowledge of micro-businesses' involvement in e-commerce by presenting some results of a survey of adoption and use of Internet technologies and e-business solutions among micro-enterprises in New Brunswick, Canada. We describe the business characteristics of respondents, patterns of adoption and use of e-commerce technologies, perceived barriers to business growth and facilitators of e-business adoption, and perceived impacts of use. In each

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<sup>1</sup> In Canada, micro-enterprises are defined as firms with fewer than five employees.

case we compare the responses of micro-enterprises with those of larger SMEs (firms with 5-500 employees). We show that although micro-enterprises share several characteristics of e-business adoption and use with larger SMEs, they are more cautious adopters of Internet technologies and e-business solutions than these larger firms, and in general they seem to have greater difficulty than larger firms in realizing business value from involvement in e-business. Our research has implications for understanding processes of e-business enablement among the smallest enterprises, and for developing strategies, services, and incentives for the modernization and expansion of the micro-enterprise sector.

## **THE CANADIAN MICRO-ENTERPRISE SECTOR**

Recently-published results of surveys of the Canadian micro-enterprise sector provide an excellent overview of this group of firms. Knowledge of these characteristics is helpful in interpreting the behavior of New Brunswick micro-enterprises with respect to Internet technologies and e-business solutions.

- Canadian micro-enterprises belong mainly to mature males. More than three-quarters of micro-enterprise owners are males, and over 80% of owners are 40 years of age or older (Industry Canada, 2001; Papadaki & Chami, 2002).
- Most micro-enterprises provide crucial household income. In about three-quarters of Canadian micro-enterprises, the firm is the sole or most important source of income for its owner (*ibid.*). Nearly half of micro-enterprises are located in homes.
- Canadian micro-enterprises are not growth oriented. Two-thirds of micro-enterprises have no expansion plans, and willingness to take risks to obtain growth is relatively low. Rate of graduation to the next size category of SMEs is therefore very low: about one percent over ten years (Industry Canada, 2001). Firm longevity is impressive – 83% of micro-enterprises are over seven years old (Industry Canada, 2001).
- The vast majority of Canadian micro-enterprises focus on the local market. The owner-manager performs most of the business operations.

In the aggregate, micro-enterprise owners are not aggressive entrepreneurs, and by a strict definition may not be entrepreneurs at all. Most do not seek to grow their firm beyond its current size. However, micro-enterprises provide important sources of personal income and employment, and their orientation toward their local market indicates that they are often embedded in networks characterized by geographic and social proximity to their customers. Papadaki and Chami's (2002) multivariate analysis of survey data identifies the following characteristics of micro-enterprises or their owners that relate positively to firm growth: higher education, entrepreneurial intensity, informal networking with customers and suppliers, business partnering, product innovation, adoption of e-business technologies, managerial delegation, focus on local market, age, and size (younger, smaller firms grow faster).

No typology of micro-enterprises has been published, but several types have been described in the literature. Among the micro-enterprises described by Industry Canada and Papadaki and Chami, around two-thirds appear to be uninterested in growth. The remaining micro-enterprises, or a portion of them, are presumably interested in some degree of growth. Among these are high-growth ventures, micro-enterprises established by entrepreneurs with growth as a primary objective. High-growth micro-enterprise ventures are distinguishable by entrepreneurial intent (i.e. growth objectives) as well by characteristics of the entrepreneurs and their business plans (Friar & Meyer, 2003). A fourth type of micro-enterprise consists of firms established in distressed environments as vehicles to escape from poverty. A large literature exists regarding the delivery of services, especially micro-credit, technical support, and training, to these firms (e.g. Johnson, 1998; Platt & Wilson, 1999).

We conducted a survey of use of Internet technologies and e-business solutions among SMEs in New Brunswick, Canada in March and April, 2004 under the auspices of the Electronic Commerce Centre (for complete results see Davis & Vladica, 2004). Responses were elicited regarding technology use, the economic and social characteristics of the firm, perceived constraints to and facilitators of adoption of Internet technologies and e-business solutions, desired support services, and perceived impacts or benefits of adoption of these technologies. Participation was solicited via local economic development agencies. Response rate was around 12% - around double the reported average response rate for web-based surveys. Because the survey was conducted online, only firms with online capabilities participated. Of the 280 respondents, 181 were micro-enterprises. Micro-enterprises represent about two-thirds of the population of respondent firms, but only 11% of employees and 14% of sales of the respondent population. This is comparable to the distribution and economic and employment size of micro-enterprises in the New Brunswick economy. It is not possible to estimate the sectoral representativeness of the sample of participating firms. Around two-thirds of the participating micro-enterprises are in the following industries: tourism, consulting services, professional services, IT services, other services, arts and crafts, construction, retail, and education.

Although they share the characteristic of small size, the four types of micro-enterprises described above differ in their technological behavior and service and support needs. The New Brunswick firms that participated in our survey probably qualify neither as survival nor as high-growth venture micro-enterprises. However, since they report annual revenue growth of nearly 20% during the past three years, they are unlike the typical Canadian micro-enterprises described by Papadaki and Chami. Most are oriented toward the domestic market. A minority of micro-enterprises, described in Davis & Vladica (2005), use the Internet for export sales. Among all micro-enterprises, these firms report the high levels of business value generated from use of Internet technologies and e-business solutions.

## **SIZE, MARKET ORIENTATION AND TECHNOLOGICAL BEHAVIOR**

Are technology adoption and value creation processes in micro-enterprises similar to processes in larger firms, except on a smaller scale? Some research has been published comparing e-commerce behavior of SMEs with larger firms, (Daniel and Grimshaw, 2002), but little research has been published on IT or e-commerce adoption and use by micro-enterprises in the industrial North (see however de Berranger, 2002; Fillis et al., 2004a; Pierson, 2003). The approach used in existing research is primarily qualitative and the emphasis frequently is on the social embeddedness of the firm that is said to influence or even determine the firm's business logic. Fillis et al. (2004b) propose a conceptual framework regarding e-commerce adoption by smaller firms. They emphasize the competencies and orientation of the micro-enterprise owner-manager, the perception of opportunity and value, and the implications of risk aversion.

The literature contains an impressive array of models of IT adoption and value creation by firms. Stage or 'ladder' models, which are popular in scholarly and policy literature on e-commerce adoption by SMEs, refer to steps of engagement in increasing technological complexity or process integration (e.g. Daniel, 2003; Rao et al., 2003). Because they introduce concepts of evolution, technological trajectories, and technology packages (bundles of interrelated technologies), stage models provide a potentially valuable framework for understanding the dynamics of technological change. Unfortunately, while the stage model makes conceptual sense, it does not accurately describe SMEs' technological behavior (Zheng et al. 2004, Levy & Powell, 2003). Empirical research suggests instead patterns of adoption in specific functional areas of the firm often in response to perceived opportunities or threats represented by customers, suppliers, or competitors (Levy & Powell, 2003). Models referring to stages of technological complexity do not appear promising at present as conceptual frameworks for understanding the technological behavior of micro-enterprises. Process models referring to steps in Rogerian innovation diffusion (e.g. Kendall et al., 2001) may be a more fruitful avenue to explore, although this approach has not been applied to technological adoption by micro-enterprises.

The connection between growth strategies, IT adoption, and market orientation of micro-enterprises requires further research. Among SMEs, export activity increases with size. Medium-sized firms are more than twice as likely to export as micro-enterprises (OECD, 2004). Considering that most micro-enterprises are oriented toward the local market, the potential of Internet technologies and e-business solutions to facilitate internationalization is not likely to be of great interest to them. However, some micro-enterprises that do seek to develop export activities, such as the small craft firms analyzed by Fillis (2002), are natural candidates for adoption of e-commerce solutions. New technology-based micro-enterprises have a much greater propensity to export than less innovative micro-enterprises (Delapierre et al., 1998). The New Brunswick micro-enterprises in our survey population are not noticeably export-oriented, although they place high value on the market and customer development capabilities afforded by the Internet and e-commerce. However, those micro-enterprises that report the greatest business value from Internet technologies and e-business

solutions are the ones that traffic in digital products or services or seek to develop customers outside the local market (Davis & Vladica, 2005).

## **BUSINESS CHARACTERISTICS OF MICRO-ENTERPRISES**

Table 1 shows information about certain business characteristics of micro-enterprises and provides a comparison with larger New Brunswick SMEs (i.e. 99 respondent firms between 5 and 500 employees). It shows that even though micro-enterprises are significantly younger than larger SMEs in the survey population, and are by definition smaller in terms of numbers of employees, their productivity in terms of average revenue per employee (around CAD \$116K) is not significantly different from that of larger SMEs. Also, the average annual growth rates reported by micro-enterprises (around 20%) do not significantly differ from those reported by larger SMEs.

Moreover, the population of New Brunswick micro-enterprises and that of larger SMEs display substantially similar patterns of market orientation. Each firm population earns roughly 55%-60% of its revenue in the Province of New Brunswick, another 10% in the Atlantic Region, and around 10% in Canada, the United States, and internationally, respectively.

Reported intensity of local competition and aggregate competition is significantly lower for micro-enterprises than it is for larger SMEs. This suggests that New Brunswick micro-enterprises have found unique niches in the local market that provide a certain amount of shelter, while permitting rates of growth and revenue per employee comparable to those enjoyed by larger SMEs. Intensities of competition in the Canadian and international markets reported by micro-enterprises are similar to those reported by larger New Brunswick SMEs.

In summary, New Brunswick micro-enterprises earn as much per employee and grow as fast as larger New Brunswick SMEs. They earn more than half their revenues in the local market, in which significantly lower competitive pressure is exerted on micro-enterprises than on larger SMEs.

## **ADOPTION OF INTERNET TECHNOLOGIES AND E-BUSINESS SOLUTIONS**

Table 2 shows the percentage of New Brunswick SMEs that have adopted various Internet technologies and e-business solutions and compares rates of adoption of Internet technologies and e-business solutions between these micro-enterprises and larger New Brunswick SMEs. Practically all SMEs use PCs and e-mail and have access to the Internet. Practically every e-business technology and website functionality is adopted significantly more slowly by micro-enterprises than by larger SMEs. Micro-enterprises use dial-up connections to the Internet significantly more frequently than larger firms, and their rates of adoption of wireless, high

speed, or very high speed connections are significantly lower. The interesting exceptions to technological lags among micro-enterprises have to do with the significantly greater use of the Internet for selling and exporting among micro-enterprises. Micro-enterprises are as capable as larger SMEs of conducting secure transactions with consumers, and significantly more capable of conducting secure B2B or B2G transactions. They rely significantly more on network and information security technologies than larger SMEs do.

We now turn to factors that affect business success among micro-enterprises, factors that facilitate e-business adoption, and outcomes or effects of adoption of Internet technologies and e-business solutions (Tables 3, 4, and 5 respectively). Items are measured on five-point Likert scales ranging from 5 (very high) to 1 (no impact). Each Table shows average scores of New Brunswick micro-enterprises (N=180) and larger SMEs (N=99). Results of tests of equality of means are included. Micro-enterprises' average scores on each item are usually lower than the corresponding SMEs' average score, even though the rank order may be similar. It is as if micro-enterprises experience more difficulty than larger SMEs in distinguishing among barriers, facilitators, and outcomes of business decisions.

Table 3 (perceived barriers to business success) shows that micro-enterprises consider the major impediments to be fulfillment (deliver of products or services to customers), domestic market development, quality control, and differentiation. Among larger SMEs, overhead cost control and staff management issues are also major perceived barriers. It is of interest that export development is regarded as a minor impediment to business success by micro-enterprises and larger SMEs alike.

Table 4 (facilitators of e-business adoption) shows that for micro-enterprises, the main facilitators of adoption of e-business are the attraction of new markets, entrepreneurship, the nature of the goods or services that the firm buys or sells, technological change management, strategy, and focus. For larger SMEs, demanding customers and suppliers, management effectiveness, and employee skillfulness are important facilitators.

Table 5 shows the perceived effects of adoption and use of Internet technologies and e-business solutions. SMEs attribute larger absolute effects to adoption than micro-enterprises do. Improved relationships with customers, increased adaptability, improved image, and increased speed of delivery are the top business outcomes for micro-enterprises. Larger SMEs emphasize successful rivalry with competitors, improved productivity, improved customer service as well as brand image improvement and improved relationships with customers.

Table 6 shows how barriers, facilitators, and business outcomes are bundled together in the lives of micro-enterprises. We factor analyzed the scores for barriers, facilitators, and busi-

ness outcomes and extracted 10 factors accounting for 72% of the variance. Results are summarized in Table 6. Impacts, facilitators, and barriers are listed according to the factor on which each loads primarily (loading weights and secondary loadings are not shown). It can be seen that all impacts load on Factor 1. Impacts are highly correlated with each other, suggesting that micro-enterprises experience outcomes of e-business adoption as unidimensional and very highly inter-related with each other (Davis & Vladica, 2005). Facilitators, too, load mainly on one factor. However, barriers represent eight separate factors having to do with quality improvement and market differentiation, managing IT and information, managing staff, marketing and market development, overhead costs, export development, responding to competition, and purchasing. It is worth noting that the e-business development challenges that are usually believed to be of concern to SMEs (cost-effective purchasing, responding to competition, and export development) seem to be minor issues for micro-enterprises. Quality, differentiation, fulfillment, and IT and information management are more important development challenges. Of course, these challenges are relevant only in the context of firms' business goals and objectives, which are not obviously related to growth and export development.

## CONCLUSIONS

Most e-enabled micro-enterprises in New Brunswick are approaching e-business cautiously and incrementally. They are primarily interested in the use of Internet technologies and e-business solutions for purposes of quality improvement, customer relationship improvement, and differentiation in the local market. In other words, they are using Internet technologies and e-business solutions to support and extend existing business models. Many micro-enterprises have found small profitable niches in the local market that are unlikely to attract the attention of larger firms. It seems unlikely that most micro-enterprises will increase their engagement in e-business unless competition obliges them to become more aggressive and, especially, seek business outside the local market. Competitive threats are not currently a major driver of e-business enablement among micro-enterprises. Also, use of Internet technologies and e-business solutions for export of products and services is low on the list of most New Brunswick micro-enterprises' interests. Not surprisingly, larger SMEs use Internet technologies and e-business solutions for a broader range of business purposes, especially including internal coordination and purchasing.

Our findings have significance for economic development strategies that seek to increase the engagement of SMEs in e-business. First, firms can use Internet technologies and e-business solutions for a variety of different purposes and generate business value from them. Incremental e-business enablement produces modest but positive results for firms. Second, e-business enablement among micro-enterprises is not driven primarily by rivalrous competition but instead by the search for differentiation and quality within the domestic market. Third, only larger SMEs seek e-business solutions that increase efficiencies in internal and external business operations. Fourth, public policies that seek to induce e-enablement of

SMEs in order to promote exports must not cast their nets too widely, because e-enablement in itself does not trigger export behavior. Instead, policies should focus on those firms that have already made a commitment to learn to export, whether they have e-business capabilities or not.

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**Table 1: business characteristics of micro-enterprises compared to larger SMEs**

	<b>micro- enter- prises mean</b>	<b>SMEs mean</b>	<b>sig. (2- tailed)</b>
estimated % annual growth, past three years	19.94	23.30	0.379
year established	1992.3	1985.9	<b>0.000</b>
revenue per employee (\$000)	116.6	110.6	0.833
% revenue from New Brunswick	60.67	55.37	0.300
% revenue from Atlantic Canada (excl. NB)	9.56	10.38	0.690
% revenue from Canada (excl. AC)	10.43	13.71	0.245
% revenue from US	9.09	12.07	0.315
% revenue from international (excl. US)	15.12	10.25	0.564
<b>intensity of competition</b>			
locally	2.04	2.31	<b>0.007</b>
in Canada	2.24	2.39	0.155
internationally	2.20	2.21	0.927
aggregate	2.15	2.30	<b>0.073</b>

Intensity of competition scale: 1 = low, 2 = medium, 3 = high. 2-tailed t-tests of equality of means do not assume equal variances. Probabilities <.1 in bold.

**Table 2: use of Internet technologies and e-business solutions: comparison between micro-enterprises and larger SMEs**

	<b>micro- enter- prises mean</b>	<b>SMEs mean</b>	<b>sig. (2- tailed)</b>
<b>connectivity</b>			
regular dial-up phone with modem	65.75%	52.53%	<b>0.033</b>
high speed (ISDN/DSL)	38.67%	60.61%	<b>0.000</b>
cable modem	7.73%	13.13%	0.174
wireless	6.08%	17.17%	<b>0.009</b>
T1 or greater	2.76%	11.11%	<b>0.015</b>
<b>e-business use</b>			
personal computer	97.2%	99.0%	0.270
e-mail	98.3%	100.0%	<b>0.083</b>
Internet	97.8%	99.0%	0.421
functional software	67.2%	91.9%	<b>0.000</b>
external website	52.5%	80.6%	<b>0.000</b>
wireless	45.7%	65.7%	<b>0.001</b>
shared file folders	34.5%	79.8%	<b>0.000</b>
remote data storage	17.7%	37.9%	<b>0.001</b>
Network/information security technology (e.g. firewall, anti-virus software, access control)	17.4%	3.0%	<b>0.000</b>
hosted solutions	12.0%	38.1%	<b>0.000</b>
intranet	11.4%	43.4%	<b>0.000</b>
extranet	9.8%	24.5%	<b>0.004</b>
remote help desk	7.4%	26.0%	<b>0.000</b>
net meetings	6.3%	22.4%	<b>0.001</b>
<b>transactions</b>			
Conducting secure transactions with consumers	50.6%	43.4%	0.257
Conducting secure business transactions with other businesses or government.	42.3%	26.5%	<b>0.008</b>
use Internet to purchase goods or services	70.2%	87.8%	<b>0.000</b>
use Internet to sell goods or services	42.0%	46.5%	0.474
percent of gross sales conducted over the Internet	27.3	18.4	<b>0.025</b>
percent of Internet sales to customers outside Canada	26.2	17.4	<b>0.046</b>
<b>website functionality</b>			
information about the business	47.5%	77.8%	<b>0.000</b>
information about products	45.3%	75.8%	<b>0.000</b>
asynchronous two-way communication	21.5%	39.4%	<b>0.002</b>
online payment	7.2%	10.1%	0.419
digital products or services	7.2%	15.2%	<b>0.054</b>
secure website	7.2%	27.3%	<b>0.000</b>
privacy policy statement	6.6%	15.2%	<b>0.038</b>
synchronous two-way communication	3.3%	4.0%	0.762
wireless access	1.1%	8.1%	<b>0.016</b>

2-tailed t-tests of equality of means do not assume equal variances. Probabilities <.1 are in bold.

**Table 3: barriers to business success: comparison between micro-enterprises and larger SMEs**

Perceived barriers to business success	micro	SME	p
Delivery of products/services to customers	4.39	4.62	<b>0.021</b>
Attracting new domestic customers	4.38	4.34	0.720
Improving the quality of the products/services	4.37	4.63	<b>0.004</b>
Developing niche, specialized markets	4.26	4.21	0.692
Getting marketing message out	4.18	4.28	0.411
Keeping overhead costs down (i.e. office space, consumable)	4.09	4.30	<b>0.098</b>
Managing customer information	3.95	4.07	0.278
Equipment costs	3.86	4.03	0.165
Implementing new information and communication technologies	3.85	3.99	0.244
Managing and reporting financial and tax information	3.82	3.95	0.265
Managing office information technology	3.79	3.95	0.205
Attracting and retaining key staff	3.59	4.59	<b>0.000</b>
Increase staff productivity	3.53	4.43	<b>0.000</b>
Geographical distance from clients and suppliers	3.49	3.50	0.938
Finding customers abroad	3.16	3.32	0.360
Purchasing supplies and raw materials	3.10	3.63	<b>0.005</b>
Managing and communicating with mobile staff	2.65	3.49	<b>0.000</b>

Scores are from five-point Likert scales ranging from 1 (no impact) to 5 (very high impact). 2-tailed t-tests of equality of means do not assume equal variances. Probabilities <.1 are in bold.

**Table 4: facilitators of e-business adoption: comparison between micro-enterprises and larger SMEs**

Facilitators of e-business adoption	micro	SME	p
Possibility to access new markets	3.78	4.07	<b>0.042</b>
Entrepreneurship	3.54	3.76	0.116
Nature of the goods or services bought or sold	3.47	3.73	<b>0.075</b>
Capability to manage technological change	3.46	3.79	<b>0.019</b>
Strategic objectives	3.38	3.59	0.142
Focus	3.38	3.67	<b>0.044</b>
Demanding customers or suppliers	3.37	3.91	<b>0.000</b>
Access to specialized suppliers	3.36	3.64	<b>0.047</b>
Management effectiveness	3.32	3.86	<b>0.000</b>
Access to financial resources	3.29	3.49	0.186
Business processes in place that facilitate learning	3.27	3.56	<b>0.036</b>
Competitive threats	3.22	3.76	<b>0.000</b>
Leadership quality	3.19	3.59	<b>0.004</b>
Management commitment	3.16	3.69	<b>0.000</b>
Skillful and resourceful employees	3.08	3.89	<b>0.000</b>
Attitude towards risk	3.07	3.39	<b>0.022</b>
Internal business culture	3.02	3.55	<b>0.000</b>
Favourable regulatory environment	2.96	3.38	<b>0.004</b>

Scores are from five-point Likert scales ranging from 1 (no impact) to 5 (very high impact). 2-tailed t-tests of equality of means do not assume equal variances. Probabilities <.1 are in bold.

**Table 5: impacts of using Internet technologies and e-business solutions**

<b>impacts of EB use</b>	<b>micro</b>	<b>SME</b>	<b>p</b>
Improved relationships with existing customers	3.31	3.77	<b>0.002</b>
Increased adaptability	3.27	3.56	<b>0.073</b>
Improved brand and image	3.24	3.81	<b>0.000</b>
Increased speed of delivery	3.18	3.38	0.251
Increased productivity	3.16	3.59	<b>0.006</b>
kept up with competitors	3.14	3.85	<b>0.000</b>
Increased customer service	3.05	3.65	<b>0.000</b>
Increased profitability	2.95	3.30	<b>0.021</b>
Improved quality of goods or services	2.90	3.09	0.279
Improved co-ordination with partners or suppliers	2.88	3.56	<b>0.000</b>
Developed unique expertise or market	2.81	3.02	0.255
Improved rate of new product development	2.67	3.08	<b>0.020</b>
Increased domestic market share	2.58	2.99	<b>0.012</b>
Decreased cost of production	2.47	2.65	0.300
Increased international market share	2.14	2.50	<b>0.035</b>

Scores are from five-point Likert scales ranging from 1 (no impact) to 5 (very high impact). 2-tailed t-tests of equality of means do not assume equal variances. Probabilities <.1 are in bold.



Purchasing supplies and raw materials	barrier									X	
		1	2	3	4	5	6	7	8	9	10
% variance explained		34.6	11.5	5.6	4.2	3.4	3.3	2.7	2.5	2.3	2.0