MICRO-ENTERPRISES’ USE OF INTERNET TECHNOLOGIES AND E-BUSINESS SOLUTIONS: A STRUCTURAL MODEL OF SOURCES OF BUSINESS VALUE

Charles H. Davis, Faculty of Communication and Design, Ryerson University, Toronto, Canada (c5davis@ryerson.ca) and Florin Vladica, Electronic Commerce Centre, University of New Brunswick, Saint John, Canada (vladica@unbsj.ca).

INTRODUCTION

In most countries, micro-enterprises make up the majority of firms.¹ Canada has more than 500,000 employer micro-enterprises, representing 77% of all firms (Industry Canada, 2001); if we include owner-operated firms with no employees, the number and proportion of micro-enterprises would be much larger. Although the development potential of this group of firms would seem to be huge, micro-enterprises face numerous obstacles to growth. And, although information and communication technologies (ICTs) would seem to provide major advantages to micro-enterprises, the uptake of ICTs among SMEs, including micro-enterprises, is occurring much less vigorously than anticipated. Furthermore, most research on e-commerce adoption among SMEs has focused on SMEs in general. Very little has been published specifically about the technological behavior of micro-enterprises. Moreover, much of the research on SMEs’ use of e-commerce focuses on adoption patterns and barriers to adoption, rather than on business outcomes.

In the present article we depart from prevailing lines of research, and attempt to identify sources of business value in micro-enterprises resulting from adoption and use of e-commerce, which we also refer to as Internet technologies and e-business solutions. Micro-enterprise owners express more interest in knowing about sources of IT-based business value than about barriers to adoption. This attitude on the part of micro-enterprise owner-operators is consistent with their orientation toward growth and risk, as we discuss below. Based on data obtained from a survey of SME e-commerce adopters in New Brunswick, Canada, we present a structural model that identifies effects of e-commerce use on production of various kinds of business value. In our model, effects may be direct or moderated by various internal or external facilitating or constraining factors. We investigate the direct and indirect effects of connectivity, website functionality, use of e-business solutions, and online transaction capability, and we identify the kinds of business value that micro-enterprises claim to derive from use of these technologies and solutions. 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 of the micro-enterprise sector.

¹ In Canada, micro-enterprises are defined as firms with fewer than five employees.
CHARACTERISTICS AND DEVELOPMENT CHALLENGES OF MICRO-ENTERPRISES

The Canadian micro-enterprise sector has recently been surveyed, and its contours and characteristics described (Industry Canada, 2001; Papadaki and Chami, 2002). More than three-quarters of micro-enterprise owners are males, and over 80% of owners are 40 years of age or older. In about three-quarters of the cases, the firm is the sole or most important source of income for its owner. 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 about one percent over ten years (Industry Canada, 2001). In other words, micro-enterprise owners are not aggressive entrepreneurs, and by a strict definition most are not entrepreneurs at all. However, 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. Nearly half of micro-enterprises are located in homes. 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).

Knowledge of these characteristics is helpful in interpreting the behavior of New Brunswick micro-enterprises with respect to Internet technologies and e-business solutions. Micro-enterprises, in the aggregate, are not aggressive businesses or noticeably entrepreneurial or risk-oriented. Most do not seem to seek to grow beyond their current size. However, they 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.

We know of no typology of micro-enterprises. Among the micro-enterprises described by Industry Canada and Papadaki and Chami, around two-thirds are typical in that they appear to be unwilling to incur some risk in order to grow. At least two other configurations of micro-enterprises exist: firms established in distressed environments as vehicles to escape from poverty, and high growth ventures – firms established by entrepreneurs with high growth in mind. A large literature exists regarding the delivery of services, especially micro-credit, technical support, and training, to micro-enterprises in distressed or impoverished communities (e.g. Johnson, 1998; Platt and Wilson, 1999). 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 and Meyer, 2003). Despite sharing the characteristic of small size, these three types of micro-enterprises are substantially different, and their technological behavior and service and support needs undoubtedly differ as well. The firms that participated in our survey probably qualify neither as survival nor as high-growth venture micro-enterprises. However, some are relatively ambitious. Those that realize the greatest
business value from Internet technologies and e-business solutions are ones that traffic in digital products or services or seek to develop customers outside the local market.

Among SMEs, export activity increases with size: medium-sized firms are more than twice as like to export as micro-enterprises (OECD, 2004). Considering the orientation of most micro-enterprises 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. The connection between growth strategies and internationalization of micro-enterprises requires further research. New technology-based micro-enterprises have a much greater propensity to export than less innovative micro-enterprises (Delapiere 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.

E-COMMERCE ADOPTION AND USE: MODELS AND SOURCES OF BUSINESS VALUE

Are technology adoption and value creation processes in micro-enterprises similar to processes in larger firms, except on a smaller scale? Perhaps so with respect to processes linking the firm to the market, but probably not with respect to internal business processes or supply chain processes. 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 interconnected 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’ behavior (Zheng et al. 2004, Levy and Powell, 2003). Empirical research suggests instead patterns of adoption in specific functional areas of the firm (Levy and Powell, 2003), often in response to perceived opportunities or threats represented by customers, suppliers, or competitors. Furthermore, because of their size, micro-enterprises are unlikely candidates for intensive internal process integration. In summary, stage 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 widely applied to technological adoption by micro-enterprises.

Little research has been published on IT or e-commerce adoption and use by micro-enterprises in the industrial North (de Berranger, 2002; Fillis et al., 2004a; Pierson, 2003). The approach is primarily qualitative and the recurring emphasis 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.

Below we present a quantitative portrait of use of Internet technologies and e-business solutions among Canadian micro-enterprises, along with a structural model of sources of business value from use of these technologies. 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 and Vladica, 2004). Responses were solicited 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. Firms reported a broad range of benefits from use of Internet technologies and e-business solutions.

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. Except for the most widely diffused Internet technologies and e-business solutions, which are used by practically all SMEs (e-mail, PCs, access to the Internet), micro-enterprises lag behind larger SMEs in the adoption of nearly all other technologies (see Figure 1). Other important differences (not described here) are found between micro-enterprises and larger SMEs regarding expectations, resources, risk tolerance, declared needs and desired capabilities, and strategic behavior (see also Daniel and Grimshaw, 2002). However, in New Brunswick, micro-enterprises are quicker than larger SMEs to identify and exploit opportunities for online export: micro-enterprises have the highest rate of Internet-based export sales (on average 26% of the firms’ Internet sales are to international customers).

MEASUREMENT MODEL

Much e-commerce and IT adoption research conceptualizes adoption and its outcomes in terms of technological, organizational, and environmental variables (useful reviews of this literature are provided by Premkumar, 2003, and Windrum and de Berranger, 2002). Although these models go by a variety of names, we will call them TOE (Technology-Organization-Environment) models after Zhu et al. (2002). In this research, the dependent variable can be adoption, business performance, or business value, and many combinations of independent variables have been used (Van der Deen, 2004). We employ a version of the TOE class of explanatory frameworks, testing a range of internal and external enabling and constraining
factors as exogenous variables that respondents rated in importance on a five-point Likert scale. The other set of exogenous variables in our model has to do with use of various Internet technologies and e-business solutions.

Regarding the dependent variable, business value, value creation from IT assets is an unsettled area in IS/IT research, characterized by considerable conceptual and methodological diversity (Cronk & Fitzgerald, 2002; Kwon et al., 2002; Pflughoeft et al., 2003). We employed an inductive approach, assembling a composite list of possible e-commerce business outcomes from the scholarly literature and from statistical agency surveys, and we streamlined the list to avoid overlap and respondent fatigue. Most of the variables measure perceived business value on a five-point Likert scale, but we have included several objective measures having to do with rate of growth and geographical composition of revenue.

We modeled the data using the technique of Partial Least Squares (PLS). All of the measurement relationships between indicators and constructs in our model are specified as formative. In other words, the latent constructs are conceived as being formed by the indicators that measure them, rather than the reverse. Constructs created with formative indicators are linear composites of the indicators, and are conventionally called composite variables or indices. Reflective indicators must be unidimensional and correlated, while formative indicators need not be (Chin, 1998; Gefen, Straub, and Boudreau, 2000). The literature does not contain tested constructs or validated scales that are suitable for use as reflective indicators for measuring adoption of Internet technologies and e-business solutions. Therefore, although the use of formative indicators is less elegant than a model based on reflective indicators, the current state of theory obliges us to use formative indicators and so we make do with composite variables.

The significance levels of variables were measured using PLS’s bootstrap re-sampling procedures. Exogenous variables with significant negative weights were eliminated from the model in several iterations, but variables with non significant weights were not removed from the model.

The model contains seven composite variables. Indicators measuring the use of Internet technologies and e-business solutions are grouped into four composite variables: connectivity, website functionality, e-business use, and transactions. Indicators measuring internal and external enabling and constraining factors are grouped into two composite variables: internal and external factors. The composite dependent variable, business value, is comprised of a number of outcome indicators as described above.

---

2 We used PLS Graph 03.00 build 1126.
STRUCTURAL MODEL

The structural model is shown in Figure 2. Since the purpose of this research is to identify sources of business value, Internet technologies and e-business solutions are exogenous variables in our model (we do not seek to explain the conditions that led to their adoption). The composite variables External Factors and Internal Factors are hypothesized to moderate the effects of the Internet technologies and e-business solutions on firm performance. We also hypothesized that these e-commerce technologies have direct effects on firm performance.

RESULTS AND DISCUSSION

As seen in Figure 2, the R-squareds of two of the dependent variables are .28 and .257, and the R-squared of the composite variable for business value is .524. All are significant at p<.001. and the strength of the business value composite variable is good. Significant exogenous variables in the model are shown in Table 1, along with their path weights and level of significance.

For micro-enterprises, production of business value from e-business appears to be a lumpy experience. Increased profitability, increased productivity, increased adaptability, increased market share – improvements in one area seem to bring improvements in other areas. This suggests that for micro-enterprises, the business value construct might be developed as a scale rather than as a composite index.

Table 2 shows levels of significance of hypothesized pathways and Figure 2 shows path coefficients. We summarize the results as follows:

- Connectivity (speed, mode, or combination of connections to the Internet) has no direct or indirect effects on business value.
- Website functionality has a strong indirect effect on business value via external factors (defined by variables measuring market development) if the firm has an external website.
- E-business use (defined especially be the exogenous variables measuring use of shared file folders and remote data storage) has a strong direct effect on business value.
- Transactions (defined by variables measuring presence and intensity of online commercial activity) have strong direct effects on business value as well as strong indirect effects via internal and external factors.

Micro-enterprises report greatest business value from market development, information sharing with customers, and undertaking transactions. Connectivity, website functionality, or interactivity per se are not important sources of business value for microenterprises. Market development and location of distant customers are significant external moderating factors, while ICT implementation and choice of products and services that lend themselves to Internet commerce are significant internal moderating factors.
CONCLUSIONS

The model that we have described portrays a micro-enterprise that grows by adopting web-based commerce and developing new markets for products and services, especially products and services that lend themselves to Internet commerce. The firm thereby produces a complex experience of business value that includes top line and bottom line benefits. This business model does not obviously characterize the average member of the community of New Brunswick micro-enterprises. It seems, instead, to characterize micro-enterprises that have actively exploited Internet technologies and e-business solutions for purposes of business development and growth. The fact that this business model emerges clearly from the survey data suggests that evolutionary pressures and learning processes are at work on more than a few members of the micro-enterprise community, inducing them to use Internet technologies and e-business solutions to undertake business activities that produce value in new ways.

ACKNOWLEDGEMENT

Research reported here was supported by a contract to the Electronic Commerce Centre of the University of New Brunswick from the Atlantic Canada Opportunities Agency (ACOA) to develop e-commerce training and awareness services for SMEs in New Brunswick. This support is gratefully acknowledged. Data analysis was supported through a project funded by the Social Sciences and Humanities Research Council (SSHRC) for research in Atlantic Canada on Innovation Systems and Economic Development: the Role of Local and Regional Clusters in Canada. This support is gratefully acknowledged also. Finally, many thanks to Dr. Barbara Marcolin for her assistance with PLS. Errors are our own.

REFERENCES


Figure 1: SME adoption of various Internet technologies and e-business solutions by size category of firm, New Brunswick, Canada, 2004

Need to describe the figure here.

Scale: percent of firms using technology or solution. N = 280 firms.


Source: Davis and Vladica (2004).
Figure 2: structural model of sources of business value among micro-enterprise users of Internet technologies and e-business solutions.

**** p<.001; *** p<.01; ** p<.05; * p<.1. Non significant pathways and variables are not shown.
Table 1: significant indicators in the model

<table>
<thead>
<tr>
<th>construct</th>
<th>code</th>
<th>explanation</th>
<th>Metric weight</th>
<th>sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>connectivity</td>
<td>Q35</td>
<td>T1 line or greater</td>
<td>0.461</td>
<td>**</td>
</tr>
<tr>
<td>e-Business</td>
<td>Q40</td>
<td>shared file folders</td>
<td>0.515</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>Q47</td>
<td>remote data storage</td>
<td>0.46</td>
<td>**</td>
</tr>
<tr>
<td>website</td>
<td>Q42</td>
<td>external website</td>
<td>0.67</td>
<td>***</td>
</tr>
<tr>
<td>transaction</td>
<td>Q56</td>
<td>goods or services sold via Internet</td>
<td>0.842</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q57i</td>
<td>percent of gross sales conducted on the Internet</td>
<td>0.505</td>
<td>***</td>
</tr>
<tr>
<td>external factors</td>
<td>Q26r</td>
<td>find customers abroad</td>
<td>0.326</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Q76r</td>
<td>possibility to access new markets</td>
<td>0.445</td>
<td>***</td>
</tr>
<tr>
<td>internal factors</td>
<td>Q32r</td>
<td>implementing new ICTs</td>
<td>0.261</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Q75r</td>
<td>nature of goods or services sold</td>
<td>0.586</td>
<td>***</td>
</tr>
<tr>
<td>business value</td>
<td>Q59r</td>
<td>increased productivity</td>
<td>0.086</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q60r</td>
<td>increased profitability</td>
<td>0.084</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q61r</td>
<td>increased speed of delivery</td>
<td>0.081</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q62r</td>
<td>increased adaptability</td>
<td>0.088</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q63r</td>
<td>increased domestic market share</td>
<td>0.09</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q64r</td>
<td>increased international market share</td>
<td>0.091</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q65r</td>
<td>increased customer service</td>
<td>0.086</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q66r</td>
<td>improved relationships with existing customers</td>
<td>0.086</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q67r</td>
<td>kept up with competitors</td>
<td>0.092</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q68r</td>
<td>decreased cost of production</td>
<td>0.076</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q69r</td>
<td>increased quality of goods and services</td>
<td>0.084</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q70r</td>
<td>improved coordination with partners or suppliers</td>
<td>0.075</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q71r</td>
<td>improved rate of new product development</td>
<td>0.084</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q72r</td>
<td>developed unique expertise or market</td>
<td>0.088</td>
<td>****</td>
</tr>
<tr>
<td></td>
<td>Q73r</td>
<td>improved brand image</td>
<td>0.1</td>
<td>****</td>
</tr>
<tr>
<td>growth</td>
<td></td>
<td>average annual rate of growth, past three years</td>
<td>0.042</td>
<td>****</td>
</tr>
</tbody>
</table>

**** p<.001; *** p<.01; ** p<.05; * p<.1. Non significant pathways and variables are not shown.
<table>
<thead>
<tr>
<th></th>
<th>external factors</th>
<th>internal factors</th>
<th>connectivity</th>
<th>transactions</th>
<th>e-business use</th>
<th>website functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>external factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>internal factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>business value</td>
<td>***</td>
<td>*****</td>
<td>*****</td>
<td>*****</td>
<td>****</td>
<td>***</td>
</tr>
</tbody>
</table>

**** p<.001; *** p<.01; ** p<.05; * p<.1