Use of Internet Technologies and e-Business Solutions: a Structural Model of Sources of Business Value among Canadian Micro-enterprises

Charles H. Davis, Ryerson University, Toronto, Canada
Florin Vladica, University of New Brunswick - Saint John, Canada

Abstract

This paper presents a structural model of sources of use value of Internet technologies and e-business solutions among micro-enterprises. The model postulates direct effects of connectivity, website functionality, transaction capability, and e-business use on perceived business value, and indirect effects of these capabilities on value creation via internal and external factors. The model is estimated with PLS with data from 181 micro-enterprises in Eastern Canada. It shows that perceived business value is predictable among micro-enterprises that use specific Internet technologies and e-business solutions to sell goods or services online and that seek to expand their market reach. This finding helps to explain the relatively slower uptake of e-business among micro-enterprises, many of which operate in face-to-face service industries and are embedded in local markets.

1. Introduction

Micro-enterprises make up the majority of firms in most countries. In Canada, micro-enterprises are defined as firms with fewer than five employees.

Few comprehensive empirically-based typologies of micro-enterprises have been published, but several types of micro-enterprise have been described in the literature. Among the micro-enterprises described by [15, 19], around one-third are growth oriented. 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 [13]. Non growth-oriented micro-enterprises are lifestyle firms, firms with low capabilities, unregistered owner-operator firms, or firms established in distressed environments as vehicles to escape from poverty.

Surveys of Canadian employer micro-enterprises show that more than three-quarters are owned by males, and over 80% of micro-enterprise owners are

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¹ In Canada, micro-enterprises are defined as firms with fewer than five employees.
in the aggregate, Canadian employer micro-enterprises are not noticeably entrepreneurial or risk-oriented. Two-thirds have no expansion plans. Rate of graduation to the next size category of SMEs is about one percent over ten years [15]. However, firm longevity is impressive – 83% of micro-enterprises are over seven years old (Ibid.). The owner-manager performs most of the business operations.

Canadian micro-enterprises provide important sources of personal income and employment. In about three-quarters of cases, the micro-enterprise is the sole or most important source of income for its owner. Nearly half of micro-enterprises are located in homes [19].

The following characteristics of Canadian micro-enterprises or their owners are related 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) [19; 20].

3. E-commerce adoption and use: models of sources of business value

Only a limited amount of research has been published on IT or e-commerce adoption and use by micro-enterprises in wealthy Northern countries (see especially [8, 11, 22]). The approach is primarily qualitative and the recurring emphasis is on the social embeddedness of the firm that is believed to influence or even determine the firm’s business behavior. [9] 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.

How should the use of IT to create business value be conceptualized? The literature contains an impressive array of models of IT adoption and value creation by firms. Stage or ‘ladder’ models, which are popular in policy and some scholarly literature on e-commerce adoption by SMEs, refer to steps of engagement in increasing technological complexity or process integration (e.g. [5]). 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 seems not to accurately describe SMEs’ behavior ([17, 26].

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 [17]. Furthermore, because of their size, micro-enterprises are unlikely candidates for intensive internal process integration. Finally, the vast majority of Canadian micro-enterprises are oriented toward the local market. Therefore, 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 described in [12] are natural candidates for adoption of e-commerce solutions. 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.

Much e-commerce and IT adoption research conceptualizes adoption and its outcomes in terms of technological, organizational, and environmental variables (for a review of this literature see [25]). Although these models go by a variety of names, we will call them TOE (Technology-Organization-Environment) models after [27]. In TOE models, the dependent variable can be adoption, business performance, or business value, and many combinations of independent variables have been used [24]. Our structural model, described below, is based on TOE models of technology adoption, and our measurement model uses an index of perceived business outcomes as the dependent variable. Value creation from IT assets is an unsettled area in IS/IT research and is characterized by considerable conceptual and methodological diversity [3, 16, 21]. We assembled a composite list of possible outcomes of use of Internet technologies and e-business solutions from the scholarly literature and from statistical agency survey questionnaires, and we used a streamlined version of this list of variables to construct the composite dependent variable.

Our survey of use of Internet technologies and e-business solutions among SMEs in New Brunswick, Canada was conducted in March and April, 2004 (for complete results see [7]). 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 about 12%, much higher than reported average response rates for web-based surveys.

The main drawback of online surveys is that they exclude possible respondents who do not have online capabilities [9]. Since our research focuses only on current e-business users, exclusion of non users is not an issue. In other words, our research refers only to current users of Internet technologies and e-business solutions. It does not refer to non-users or potential users.

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. Around half the firms were in tourism, arts and crafts, consulting and professional services, IT services, and other services.

Are processes of technology adoption and value creation in micro-enterprises similar to processes in larger firms, except on a smaller scale? 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 are found between micro-enterprises and larger SMEs regarding exposure to competition, facilitators of e-business adoption, perceived barriers, declared needs and desired capabilities, and strategic behavior [7]. However, although they adopt Internet technologies and e-business solutions more slowly than larger SMEs, online micro-enterprises are quicker than larger SMEs to identify and exploit opportunities for Internet-based export: micro-enterprises have the highest rate of Internet-based export sales of SME size classes (on average 26% of micro-enterprises’ Internet sales are to international customers).

4. Measurement and structural models

In this paper 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. 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). Most of the business value variables measure the respondent’s perception of impact of IT on business on a five-point Likert scale. (It would obviously be of interest to compare the micro-enterprise owner-manager’s perception of IT impacts with objective measures of impacts. The accuracy of micro-enterprise owner-managers’ attributions of changes in business performance to use of technology is a topic requiring research). We have also included several objective measures among the business value variables having to do with rate of growth and geographical composition of revenue.

The model contains seven composite variables (described in Table 3). 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 distinction between internal and external factors that constrain or enable firm performance is commonly accepted in competitiveness research; see for example [18]).

Significant indicators for each composite variable are shown in Table 1. The composite dependent variable, business value, is comprised of a number of outcome indicators as described in Table 3.

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 [2, 14]. 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 structural model is shown in Figure 2. The composite variables External Factors and Internal

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1 We used PLS Graph 03.00 build 1126.
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.

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.

5. Results and discussion

Significant exogenous variables in the model are shown in Table 1, along with their path weights and level of significance. Table 2 shows levels of significance of hypothesized pathways and Figure 2 shows path coefficients. As seen in Figure 2, the model has modest predictive power for two of the dependent variables (external factors and internal factors), and good predictive power for the composite variable for business value ($R^2 = .524$). All dependent variable $R^2$’s are significant at $p<.001$.

The meaning of the model can be summarized as follows:

• Micro-enterprises report greatest business value from market development, information sharing with customers, and undertaking online transactions.

• Market development and recruitment of distant customers are significant external moderating factors, while ICT implementation capabilities and strategic choice of products and services that lend themselves to Internet commerce are significant internal moderating factors.

• Website functionality has a strong indirect effect on business value via external factors (defined by exogenous variables measuring market development) if the firm has an external website.

• E-business use (defined by the exogenous variables measuring use of shared file folders and remote data storage) has a strong direct effect on business value.

• Transactions (defined by exogenous variables measuring online 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.

• Connectivity (speed, mode, or combination of connections to the Internet) has no measurable direct or indirect effects on business value. Moreover, connectivity, website functionality, or interactivity per se are not important sources of business value for micro-enterprises.

• In micro-enterprises, the production of value from e-business appears to be lumpy. 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.

6. Conclusions

The model that we have described portrays micro-enterprises that grow by adopting web-based commerce and developing new markets for products and services, especially products and services that lend themselves to Internet commerce. The firms create business value that includes top line and bottom line benefits. This business model does not characterize the average member of the community of New Brunswick micro-enterprises. It seems, instead, to characterize micro-enterprises that are actively exploiting Internet technologies and e-business solutions for purposes of business development and export growth. The fact that this business model emerges clearly from the survey data suggests that evolutionary pressures and learning processes are at work on some 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. However, many of the micro-enterprises in our survey are in segments of the service industry, and with the exception of tourism the market for these services is primarily local. Enablement of global reach is of little interest to these firms, but affordable and reliable Internet technologies and e-business solutions that provide local visibility, security, interactivity, data sharing, and mobility should be of interest.

7. Acknowledgements

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Barbara Marcolin for her assistance with PLS, and to anonymous reviewers. Errors are our own.

8. References


[21] Pfplughoeft, K., Ramamurthy, A.K., Soofi, E.S., Yasai-Ardekani, M., and Zahedi, F., “Multiple Con-


Figure 1: SME adoption of various Internet technologies and e-business solutions by size category of firm, New Brunswick, Canada, 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 are in dotted lines. Non significant 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>don’t use/plan to use/use now</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>don’t use/plan to use/use now</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>
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<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>
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<tr>
<td></td>
<td>Q64r</td>
<td>increased international market share</td>
<td>0.091</td>
<td>****</td>
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<tr>
<td></td>
<td>Q65r</td>
<td>increased customer service</td>
<td>0.086</td>
<td>****</td>
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<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>
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<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 variables are not shown.
Table 2: significance of pathways in the model

<table>
<thead>
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<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>n.s.</td>
<td>***</td>
<td>****</td>
<td>n.s.</td>
</tr>
<tr>
<td>internal factors</td>
<td></td>
<td></td>
<td></td>
<td>n.s.</td>
<td>****</td>
<td>*</td>
</tr>
<tr>
<td>business value</td>
<td>***</td>
<td>*****</td>
<td>n.s.</td>
<td>****</td>
<td>****</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

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

Table 3: variables originally in the model

**Business value:** increased productivity, increased profitability, decreased cost of production, increased quality of goods and services, improved rate of new product development, developed unique expertise or market, increased speed of delivery, increased adaptability, increased domestic market share, increased international market share, increased customer service, improved relationships with existing customers, kept up with competitors, improved coordination with partners or suppliers, improved brand or image. **Internal factors:** nature of goods or services sold, skillful employees, business processes that support learning, capability of managing technological change, management effectiveness, management commitment, leadership quality, strategic objectives, internal business culture, attitude toward risk, entrepreneurship, focus, keeping overhead costs down, improving the quality of products and services, improving staff productivity, attracting and retaining staff, managing customer information, managing and communicating with mobile staff, managing office information technology, implementing new information and communication technologies, managing and reporting financial and tax information. **External factors:** purchasing supplies and raw materials, costs of equipment, developing niche or specialized markets, delivery of product and services to customers, attracting new domestic customers, find customers abroad, getting marketing message out, geographical distance from customers and suppliers, possibility to access new markets, competitive threats, demanding customers or suppliers, access to specialized suppliers, access to financial resources, favorable regulatory environment, intensity of competition. **Index of connectivity:** use of dialup, cable modem, high speed, T1 or greater, wireless. **Index of e-business use:** items in Figure 1. **Index of transactions:** use of Internet to buy, to sell; percent of gross sales conducted over the Internet. Index of website functionality: organization has a website, online payment, asynchronous two-way communication, synchronous two-way communication, digital products or services delivered via the website, secure website, privacy policy statement, wireless access, information about products, information about the business.