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Patterns of B2B e-commerce usage in SMEs

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Abstract

Purpose – The purpose of this paper is to identify the B2B e-commerce (B2BEC) usage patterns of North American small- and medium-sized enterprises (SMEs) in their supply chains, the contextual factors that influence usage patterns, and the subsequent effects of these patterns on firm performance.

Design/methodology/approach – The authors conducted an online survey of North American SMEs and obtained 229 responses. They utilized several statistical methods, including cluster analysis and profile analysis, to test five hypotheses.

Findings – The TOE framework, supplemented with interorganizational factors, provides a valid theoretical guideline to study firms' B2BEC usage patterns. Three distinct types of B2BEC usage patterns – E-Limiteds, E-Leaders, and E-Laggards – emerged. Different sets of contextual factors contribute to the formation of these three patterns of B2BEC adoption. Higher levels of B2BEC usage result in stronger firm performance.

Research limitations/implications – Future clustering variables could be more specific. The effects of other potential contextual factors should also be explored by future studies. This study can be replicated in other countries to determine whether the findings can be generalized.

Practical implications – In light of the potential performance improvements that B2BEC adoption offers, managers should assess the risks associated with maintaining their current speed of e-business deployment versus the risks associated with escalating it. Organizations that have been more reactive should consider how well or ill their sluggish approach prepares them for navigating the inevitability of increasing sophistication in supply chain management.

Originality/value – Limited empirical research exists on the B2BEC usage patterns of North American SMEs, the contextual factors that motivate them to adopt different B2BEC technologies in their supply chains, and how each of these usage patterns affects their performance. The current study contributes to the literature by shedding light on these issues.

Keywords Internet, Supply chain management, B2B electronic commerce, E-business, Contextual factors, Information technology, Small to medium-sized enterprises, Survey, Electronic commerce, United States of America

Paper type Research paper

Introduction

There are approximately 27 million SMEs in the USA, which account for 99.9 percent of all US firms and generate almost half the gross domestic product (GDP) of the country[1]. In Canada, there are about 1.4 million SMEs (Riding and Orser, 2007). Small businesses (those that have fewer than 100 employees) constitute 98 percent of all business in Canada and generate over 30 percent of Canada's GDP[2]. Overall, Canadian SMEs account for

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60 percent of Canada's economic output and 80 percent of national employment and 85 percent of new jobs. Although these SMEs have a big potential to achieve productivity gains from adopting sophisticated e-commerce applications, their adoption rates are below those of their American counterparts. This is partly due to their skepticism about the benefits of these technologies in terms of their return on investment[3]. Researchers have also suggested that SMEs are generally slow to incorporate e-commerce applications into their existing business models (Simpson and Docherty, 2004).

Literature review

The IT literature includes a number of studies that explored the factors affecting the adoption of IT (Premkumar *et al.*, 1994; Chwelos *et al.*, 2001). Innovation diffusion theory is probably one of the most often used IT adoption theories, among other theories such as information richness theory, theory of communicative action, and structuation theory (Lewis *et al.*, 2004). For example, many researchers used innovation diffusion theory as a framework to examine electronic data interchange (EDI) adoption (Premkumar *et al.*, 1994). Innovation diffusion theory is made up of several technological factors such as relative advantage, complexity, compatibility, observability, and triability that may affect firms' decision to adopt IT. Earlier works that utilized innovation diffusion theory focused on technological factors. However, EDI researchers also examined organizational and interorganizational factors in addition to technological factors (Chwelos *et al.*, 2001). These organizational factors were derived from research on organizational innovativeness conducted by such authors as Damanpour (1991) and Premkumar and Ramamurthy (1995).

The resource-based view is another widely used theory in the innovation adoption and IT adoption literature. This theory suggests that firms have valuable, rare, imperfectly imitable, and non-substitutable resources that help them gain competitive advantage and long-term performance benefits (Barney, 1991).

Teo *et al.* (2003) argued that institutional factors also play a significant role in IT adoption. Using institutional theory, they found that institutional factors strongly influence financial EDI adoption. According to institutional theory, firms are faced with pressure from their institutional environments to adopt practices and polices considered to be legitimate. If they do not, they may be devoid of the resources and social support required to be competitive. The institutional factors are based on three types of isomorphic pressures, including coercive, mimetic, and normative pressures (DiMaggio and Powell, 1983).

Another theory that has been frequently used in technology adoption research is the technology-organization-environment (TOE) framework (Tornatzky and Fleischer, 1990). The framework includes the technological context, the organizational context, and the environmental context. Some studies such as Gibbs and Kraemer (2004) and Soares-Aguiar and Palma-Dos-Reis (2008) utilized the TOE framework and institutional theory simultaneously, since institutional factors supplement the environmental context of the TOE framework.

One of the legitimate reasons for using the TOE framework is that it is consistent with Rogers' (1983) innovation diffusion theory (Zhu *et al.*, 2003). This is because the innovation diffusion theory utilizes three other categories of innovation adoption factors in addition to technological factors. These factors include leader characteristics, internal characteristics of the organization, and external characteristics of the organization (Zhu *et al.*, 2003).

Despite the fact that a wide variety of IT adoption factors have been analyzed by researchers, there are still many inconsistent findings across studies due, in part, to the existence of contextual factors. Given that contextual factors can be key to the development of successful knowledge management systems (Raisinghani and Meade, 2005) and that they are often omitted by many studies in this area (Zhang *et al.*, 2011; Bakker *et al.*, 2008), it is important that they be accounted for in IT and B2B EC adoption models. This is exactly what we attempt to do in this study: we identify the B2B EC usage patterns of North American SMEs in their supply chains, the contextual factors that influence these usage patterns, as well as the subsequent effects of these patterns on firm performance. In particular, only a few studies in this area have integrated these objectives into one study, especially within a North American context. In the current study, we use the term B2B EC to refer to internet-enabled B2B technologies or applications used by firms to buy and sell products and share information with their supply chain partners.

Study model and hypotheses

In this study, we decided to use the TOE framework, since it is not only a well-established framework but also encompasses various contexts with which B2B EC adoption can be assessed. However, Gibbs and Kraemer (2004) argued that the TOE framework does not contain interorganizational factors such as trust (e.g. used by Hart and Saunders, 1997) and trading partner readiness (e.g. used by Chwelos *et al.*, 2001) put forth by some interorganizational systems researchers. Therefore, we added trust to the model, along with other interorganizational factors, including pressure from trading partners (Hadaya and Pellerin, 2010) and pressure from competitors (Zhu and Kraemer, 2005). Figure 1 shows the general conceptual framework proposed for this study.

Presence of various B2B EC usage patterns in SMEs

Grewal *et al.* (2001) propose a model, which posits that the nature of firms' participation in electronic markets depends on organizational motivation and ability. This participation takes place in the form of exploration state, expert state, or passive state. Firms in the exploration state allocate various resources to learn the requirements of doing business in the online environment. On the other hand, firms in the expert state have successfully reengineered their processes to do business online. Firms in the passive state are not eager to commit their resources to actively participate in electronic markets but may experiment with these markets with the notion that they may utilize them in the future to supplement their traditional operations.

Frohlich and Westbrook (2002) proposed and tested four web-based integration strategies for supply chain partners. Firms in the first group included those that pursued little or no web-based integration. Firms in the other two groups only integrated their operations with either customers or suppliers, and those in the last group had the highest level of web-based integration that involved both customers and suppliers.

Cagliano *et al.* (2003) identified four distinct groups of firms with different uses of internet-based technologies in their supply chains. These included traditionals, e-sellers, e-purchasers, and e-integrators, which were similar to the four groups classified by Frohlich and Westbrook (2002). Lefebvre *et al.* (2005) used two categories of e-commerce adoption: nonadopters and adopters. Those firms in the nonadopters category pass through two stages, where they have no interest in e-commerce after which they start

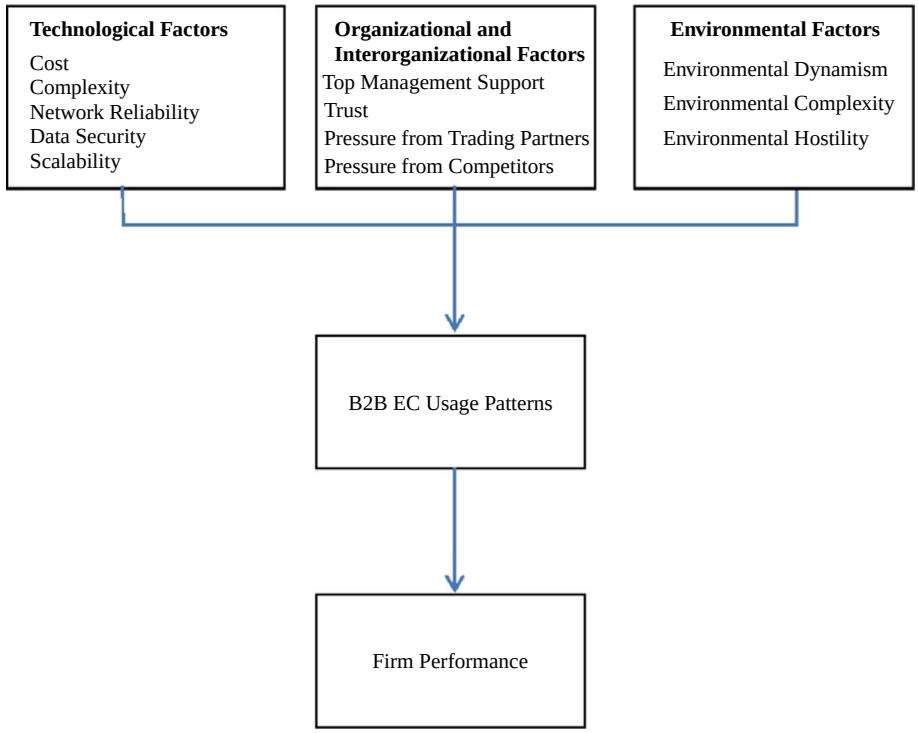

Figure 1.
Conceptual framework

planning on taking e-commerce initiatives. The adopters category consist of four stages where the level of complexity of e-commerce use moves from electronic information search and content creation to electronic transactions, complex electronic transactions, and electronic collaboration. Elia *et al.*'s (2007) findings also suggest that similar stages of e-commerce integration exist in manufacturing SMEs.

More recently, Papastathopoulou and Avlonitis (2009) found five clusters of World Wide Web (WWW) adopters: e-merchants, information seekers, e-purchasers, e-transaction adopters, and WWW experimentalists. On the other hand, Caniato *et al.* (2009) identified three clusters of e-business adoption in European firms. Firms in the low adopters cluster had very low rates of e-commerce and e-procurement adoption. Firms in the partial adopters cluster had intermediate levels of adoption, whereas those in the high adopters cluster had very high levels of e-business adoption with customers and suppliers. Thus, we posit that:

H1. B2B EC is implemented by SMEs to integrate different processes along the supply chain, so different B2B EC usage patterns are expected to emerge.

The effects of various factors on the formation of different B2B EC usage patterns in SMEs

There are various technological, organizational, interorganizational, and environmental factors that may play a role in the emergence of different B2B EC usage patterns. These factors can either encourage or discourage the adoption of these technologies. Some of the

technological factors include costs related to the implementation of B2B EC technologies (Ghobakhloo *et al.*, 2011), the complexity of these technologies (Tan *et al.*, 2009), the reliability of the networks over which transactions are conducted (Soliman and Janz, 2004), the extent to which these technologies ensure data security (Tan *et al.*, 2009), and the degree of scalability (i.e. economies of scale and scope) (Lee, 2003) that the technology provides.

Some of the organizational and interorganizational factors include the support provided by top management for adoption (e.g. through its vision and allocation of resources) (Premkumar and Ramamurthy, 1995), the level of trust between trading partners than can either help or hinder adoption (Nadler and Kros, 2010), and external pressure exerted by trading partners and competitors to adopt B2B EC technologies (Gil-Saura *et al.*, 2009; Johnson, 2010; Ghobakhloo *et al.*, 2011).

Environmental factors such as dynamism, complexity, and hostility can also play a role in firms' information technology adoption decisions.

Environmental dynamism. Since change happens gradually in stable business environments and quickly in turbulent business environments (Modarres *et al.*, 2003), firms operating in the latter are more likely to be innovative to keep abreast of market and competitive forces (Myers and Marquis, 1969). To come up with new product, service, and managerial innovations, these firms depend on information processing capability, which makes them more reliant on IT (Kearns and Lederer, 2004). Firms operating in turbulent environments can use supply chain integration as a means to minimise transaction costs and are therefore more likely to adopt B2B EC at a higher level (Stonebraker and Liao, 2004).

Environmental complexity. Environmental complexity can be defined as the extent to which an industry or firm's activities are heterogeneous in terms of inputs and outputs needed for its operations and the mix of suppliers, customers, and competitors it has. Firms operating in highly complex environments require reliable and efficient IT resources to manage the abundant information they exchange with their supply chain partners (Wade and Hulland, 2004). Firms that operate in diverse markets are also susceptible to various ideas from competitors and customers and are more likely to adopt innovations (Miller and Friesen, 1983).

Environmental hostility. Environmental hostility is concerned with the extent of threat that firms face from competition in terms of price, product, technology, and distribution (Ozsomer *et al.*, 1997). Some previous studies (Chwelos *et al.*, 2001) reported that firms in competitive environments are more likely to adopt EDI. Thus:

H2. Technological, organizational, interorganizational, and environmental factors play a significant role in determining the types of B2B EC usage patterns SMEs adopt.

The effects of B2B EC usage patterns on firm performance in SMEs

There is ample evidence in the literature regarding the relationship between IT and firm performance. However, within the context of B2B EC, there is little empirical research on the relationship between B2B EC usage patterns and firm performance, particularly as it relates to SMEs (Raymond and Bergeron, 2008). In line with the literature, we maintain that the greater the B2B EC usage, the stronger the effect on firm performance. Therefore, we would expect firms with more integrated B2B EC systems in place to have better performance results. The following literature generally provides evidence for the argument that the intensity of IT and B2B EC usage is

positively related to firm performance: Melville *et al.* (2004) argue that improvements in organizational performance can be achieved when IT resources are implemented within the appropriate business processes and improvements in these processes are realized. Dehning *et al.*'s (2007) findings show that, in manufacturing firms, IT-based supply chain management systems lead to improvements in financial performance through improvements in business processes.

Stratopoulos and Dehning (2000) find that firms that utilized their IT resources more efficiently had more successful financial results. However, the performance of effective IT users was superior to that of the less effective users for only three or four years after which the gap was closed as other competitors implemented the same technologies. Devaraj and Kohli (2003) also report that the extent to which IT is used is directly related to financial and quality performance.

Empirical studies such as Barua *et al.* (2004), Ranganathan *et al.* (2004) and Sila (2010) focused on the adoption and performance effects of B2B EC. For example, Barua *et al.* (2004) posited that the abilities of firms to coordinate and utilize their resources (including processes, IT, and readiness of customers and suppliers) created online informational capabilities, which led to customer and supplier-side digitization. They also contended that this digitization improved financial performance. The study found that firms' supplier-side digitization had a positive effect on customer-side digitization, which, in turn, contributed to financial performance. On the other hand, Ranganathan *et al.* (2004) found that organizational environment and external environment had a positive direct effect on the internal assimilation and external diffusion of web technologies in firms' supply chains, respectively, which then led to improved performance. Thus:

H3. The higher the level of B2B EC usage patterns of firms, the stronger the relationship between B2B EC and performance.

Methodology

We measured the nine technological, organizational, and interorganizational factors by 23 items (Soliman and Janz, 2004). We adopted the three environmental factors from Miller and Friesen (1983), where environmental dynamism and environmental hostility were measured by three items each, and environmental complexity was measured by one item. We used three types of firm performance measures based on a review of the IT business value literature (Barua *et al.*, 1995; Melville *et al.*, 2004; Wade and Hulland, 2004). These measures included business process performance (which assessed the efficiency of specific business processes), operational performance (which evaluated overall operational performance of the firm), and financial performance. Business process performance was operationalized by five items, and the other two measures had three items each. We asked responding firms to rate their level of performance in these three areas since their adoption of B2B EC technologies as compared to that of their major competitors. All the items were measured using a 1-7 Likert scale.

We conducted an online survey of 3,000 firms selected from the mailing list of the Council of Supply Chain Management Professionals and Industry Canada's web site[4]. After sending two reminders over a two-week period, we obtained 420 responses. Since our focus in this part of a larger-scale survey study is on SMEs, we eliminated responses from large firms and those with missing data. In this study, we define SMEs as those firms having less than 500 employees. We also decided to omit service firms, since the use of B2B EC technologies we examined is not as prevalent in these firms. This yielded a total

of 229 responses for our analysis. Table I illustrates the profile of the responding firms. We tested for non-response bias by comparing the mean responses of early and late respondents to ten randomly selected survey questions with *t*-tests (Armstrong and Overton, 1977) and found no evidence of non-response bias.

Analysis and results

After a series of validity and reliability tests of the variables, we conducted the following analyses to test the three hypotheses.

Cluster analysis

A primary objective of this study was to discern if there are distinct patterns of B2B EC adoption and usage by SMEs regarding internet-enabled supply chain applications. For this purpose, cluster analysis was used. Cluster analysis is a procedure that combines objects or cases into groups based on their shared similarities. The classify procedure in SPSS for Windows was used to conduct the cluster analysis.

The variables used as the basis for forming clusters were the seven strategic supply chain decision areas identified by Lancioni *et al.* (2003): purchasing/procurement, inventory management, transportation, ordering processing, customer service, production scheduling, and relations with vendors. Respondents were asked to indicate on a 7-point Likert-type scale the extent to which their organizations have adopted internet-based applications in each of these substantive areas.

Table II contains the set of final centroids and the results of univariate ANOVAs used to assess if they differed among the three cluster types. As the number of observations and variances were unequal across cluster types, the more powerful Welch statistic was used rather than the standard ANOVA *F*-statistic. Table II also reports the results of the Tamhane test for paired comparisons, a *post hoc* option that caters to unequal variances. These analyses indicate that each of the three clusters was statistically different from each of the others on several clustering criteria, thereby providing evidence of their distinctiveness. As discussed below, the clusters were also compared on a number of contextual and outcome measures to provide external validation.

	Frequency	Percent
(a) Business type		
Manufacturer	150	65.5
Retailer	20	8.7
Wholesaler	14	6.1
Distributor	32	14.0
3PL/4PL	10	4.4
Other	3	1.3
(b) Years in business		
0-5	43	18.8
6-10	25	10.9
11-15	22	9.6
More than 15	139	60.7
(c) Number of employees		
0-20	133	58.1
21-100	27	11.8
101-500	69	30.1

Table I. Profile of the responding firms

	Cluster 1 (e-limiteds) ($n = 109$)	Cluster 2 (e-leaders) ($n = 83$)	Cluster 3 (e-laggards) ($n = 37$)	Welch F-statistic	Significant ($p < 0.05$) Tamhane paired comparisons
Purchasing/ procurement	4.98	6.37	4.11	54.79*	1-2, 1-3, 2-3
Inventory management	3.74	5.59	1.68	156.93*	1-2, 1-3, 2-3
Transportation	4.94	6.29	3.14	81.33*	1-2, 1-3, 2-3
Order processing	4.47	6.11	2.24	132.69*	1-2, 1-3, 2-3
Customer service	4.67	6.07	2.86	74.70*	1-2, 1-3, 2-3
Vendor relations	4.52	6.06	2.19	131.21*	1-2, 1-3, 2-3
Production scheduling	3.87	5.47	1.78	128.43*	1-2, 1-3, 2-3

Notes: Significant at: *$p < 0.05$; feasible range from 1 to 7

Table II.
Cluster centers for the B2B EC technologies

Interpretations of the cluster types

The cluster analysis produced three distinct types of B2B EC adopters, characterized by differences in the extent to which they use B2B EC technologies to manage their supply chain activities. The clusters are named: e-limiteds, e-leaders, and e-laggards. Each of these clusters is described in more detail below, using the results presented in Table II and displayed visually in Figure 2. These results show that there are systemic differences in the patterns of B2B EC adoption across organizations, thus confirming *H1*.

Type 1 – the e-limiteds. Accounting for the largest portion of the sample at 47.6 percent, the clear distinctiveness of the e-limiteds cluster is in its conservative approach to internet-based supply chain management. While this group demonstrates some appetite for technological sophistication, the transition is incomplete as levels of utilization are intermediate only. All tools do appear to have relevance to the e-limiteds, however, consistent with the "partial adopter" cluster of Caniato *et al.* (2009). That is, the adoption of e-business is prevalent along the supply chain, albeit in a cautious way and at a limited rate.

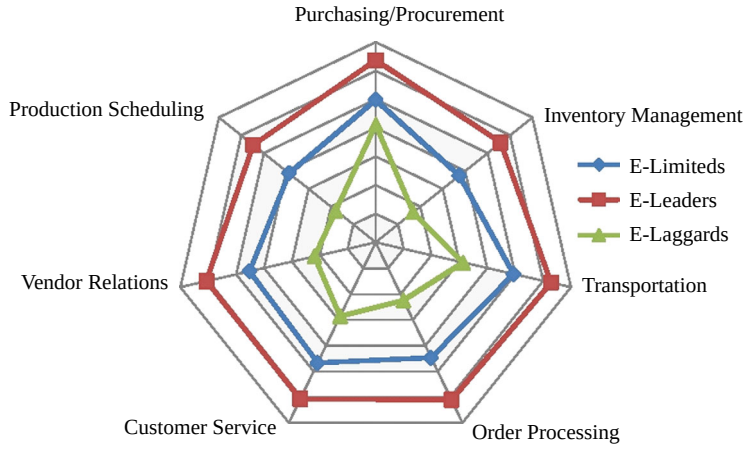

Figure 2.
Visual depiction of cluster centers

Type 2 – the e-leaders. This cluster illustrates the highest level of B2B EC usage and integration. It includes 36.2 percent of sample members, and reports significantly higher adoption ratings than the other clusters on all internet applications. Having embraced these applications in both upstream and downstream processes, the supply chain strategy appears integrative from point of origin to point of consumption and most closely resembles the textbook prescription for e-business implementation.

It may be noteworthy that the lowest level of usage for e-leaders has to do with operational processes (i.e. production scheduling and inventory management applications). With adoption levels in these areas significantly higher than the other clusters but lagging when compared to the cluster's other practices, a focus on internal operations may represent the final frontier for full e-business coherence and efficiency.

Type 3 – the e-laggards. The e-laggards constitute 16.2 percent of the sample and are labelled as such because of their apparent reluctance to adopt internet-based supply chain technologies. This cluster's scores on each of the seven internet applications substantially undercut all other cluster types, indicating relatively little or marginal pursuit of e-business.

This description is consistent with the "traditionals" identified by Cagliano *et al.* (2003) and the "low adopters" cluster identified by Caniato *et al.* (2009). Interestingly, this cluster represents the smallest group in the sample, a reversal of early research findings and a possible indication of the growing diffusion of the e-business mindset.

To the extent this group has made any movement toward adopting internet-based supply chain applications, it is in the purchasing and procurement decision area. This reflects the findings of previous research that show this to be the typical first point of entry into the B2B internet realm (Lancioni *et al.*, 2003).

Contextual and performance correlates of the cluster types

This phase of the research was conducted to examine two issues. The first was to provide insight into the contextual factors that are associated with the emergence of different B2B EC usage patterns, and the second to assess the relationship between these usage patterns and firm performance.

As discussed in the literature review and crystallized in *H2*, there are compelling reasons to expect that the patterns of B2B EC adoption can be affected by various technological, organizational, interorganizational, and environmental factors. Profile analysis was used to examine this relationship statistically. Profile analysis is a variation of multivariate analysis of variance, used where a series of dependent variables are measured on commensurate scales. It assesses whether the scores on this collection of variables differs across groups, both in terms of parallelism (whether the groups exhibit the same patterns of highs and lows) and levels (whether any groups, on average, score higher on the set of measures than others) (Tabachnick and Fidell, 1998).

Using cluster type as the grouping variable, a profile analysis was performed on the 12 factors that were hypothesized to shape the types of B2B EC that firms choose: pressure from trading partners, pressure from competition, costs, network reliability, data security, scalability, complexity, top management support, trading partner trust, environmental dynamism, environmental complexity, and environmental hostility. The profiles (the mean scores of each cluster on each of these factors) are shown in Figure 3.

The profile analysis was conducted using SPSS MANOVA. Based on Wilks' criterion ($F(22, 430) = 1.791$, $p = 0.016$) the profiles were found to deviate significantly from parallelism. For the levels test, statistically significant differences were

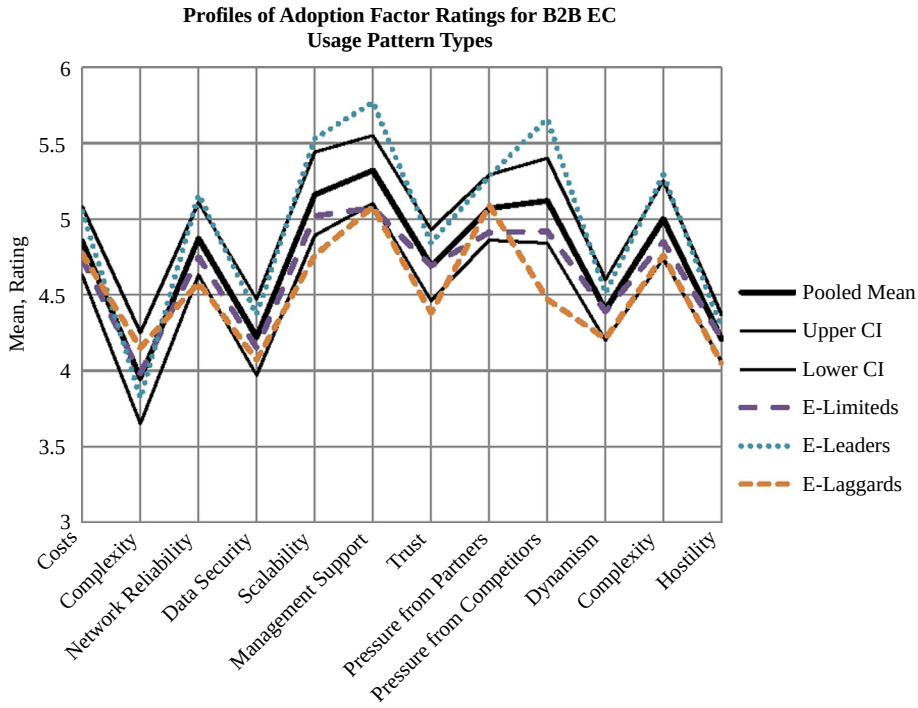

Figure 3.
Profiles of adoption factor ratings by cluster type

indicated among the means of the clusters combined over the 12 contextual factors ($F(2, 226 = 10.136, p = 0.000)$.

To evaluate and interpret these results, a contrast procedure was needed to identify the specific sources of variability. For this purpose a confidence interval procedure recommended by Tabachnick and Fidell (1989) was used: confidence limits were calculated around the profile of the three clusters combined (Table III), and individual clusters were evaluated in terms of whether they fell outside them.

This contrast procedure revealed that for seven of the contextual factors one or more of the clusters had means that fell outside the limits. The e-leaders had a reliably higher mean than that of the pooled groups on five factors:

(1) pressure from competition;

(2) network reliability;

(3) scalability;

(4) top management support; and

(5) environmental complexity.

In sharp contrast, the e-laggards had reliably lower scores than that of the pooled groups on six factors:

(1) pressure from competition;

(2) network reliability;

	Cluster 1 (e-limiteds) ($n = 109$)	Cluster 2 (e-leaders) ($n = 83$)	Cluster 3 (e-laggards) ($n = 37$)	Pooled mean (SD)	99.86% confidence interval around pooled mean
Technological factors					
Costs	4.74	5.05	4.77	4.86 (1.06)	4.63-5.08
Complexity	3.98	3.82	4.15	3.95 (1.44)	3.65-4.25
Network reliability	4.75	5.16*	4.58*	4.87 (1.14)	4.63-5.11
Data security	4.15	4.37	4.07	4.22 (1.19)	3.97-4.47
Scalability	5.02	5.53*	4.76*	5.16 (1.32)	4.89-5.44
Organizational and interorganizational factors					
Top management support	5.07*	5.77*	5.08*	5.32 (1.07)	5.10-5.55
Firm-trading partner trust	4.69	4.84	4.38*	4.69 (1.11)	4.46-4.93
Trading partner pressure	4.91	5.28	5.09	5.07 (1.02)	4.86-5.29
Pressure from competition	4.92	5.66*	4.47*	5.12 (1.32)	4.84-5.40
Environmental factors					
Dynamism	4.39	4.51	4.12	4.40 (0.963)	4.20-4.60
Complexity	4.85	5.29*	4.76	5.00 (1.12)	4.74-5.25
Hostility	4.21	4.28	4.05*	4.21 (0.741)	4.06-4.37

Notes: Significant deviation from profile at: $^{*}p = 0.05$; feasible range from 1 to 7

Table III. Factors affecting adoption of B2B EC technologies

(3) scalability;

(4) top management support;

(5) trading partner trust; and

(6) environmental hostility.

The e-limiteds had a reliably lower mean than that of the pooled groups on one factor only, that being top management support. These results provide support for *H2*.

A one-way ANOVA was then conducted to test for differences in firm performance among the three cluster types. As the assumption of homogeneity of variance was met, the standard *F*-statistic was used. The results of this analysis are presented in Table IV, indicating a significant difference in group means on the overall performance measure ($F(2, 226) = 26.553$, $p = 0.000$) and the individual performance measures. A graphical representation of Table IV is shown in Figure 4. Comparisons using the Scheffé test, an appropriate *post hoc* test for unequal group sizes, indicated that the mean performance scores for the e-leaders ($M = 5.17, SD = 0.93$), the e-limiteds ($M = 4.49, SD = 0.85$), and the

	Cluster 1 (e-limiteds) ($n = 109$)	Cluster 2 (e-leaders) ($n = 83$)	Cluster 3 (e-laggards) ($n = 37$)	*F*-statistic	Significant ($p < 0.05$) Scheffé paired comparisons
Overall performance	4.49	5.17	3.94	26.553*	1-2, 1-3, 2-3
Performance components					
Business process performance	4.48	5.18	3.90	26.764*	1-2, 1-3, 2-3
Operational performance	4.49	5.12	3.99	19.125*	1-2, 1-3, 2-3
Financial performance	4.50	5.22	3.96	20.104*	1-2, 1-3, 2-3

Notes: Significant at: $^{*}p < 0.05$; feasible range from 1 to 7

Table IV. Performance by cluster type

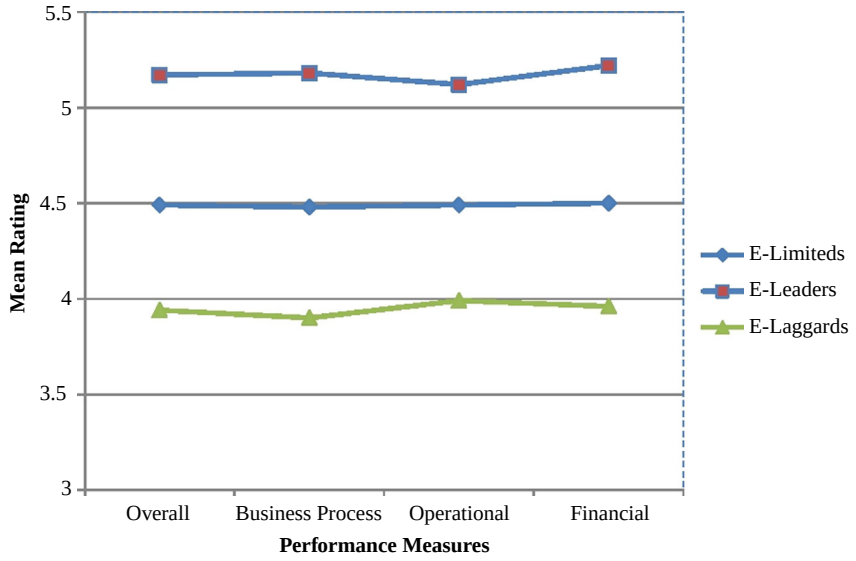

Figure 4.
Performance scores for B2B EC usage pattern types

e-laggards (M = 3.94, SD = 1.05) all differed mathematically and significantly from each other. We also obtained similar results when we compared the mean scores on the three components of performance across the three clusters. Thus, as posited in *H3*, firms that utilized higher levels of B2B EC technologies had stronger business performance.

Discussion and implications

The taxonomy generated in this study confirmed the findings of previous research, that of Caniato *et al.* (2009) in particular, where B2B EC usage patterns were characterized by different degrees of adoption balanced between upstream and downstream processes rather than by mono-directional strategies. The results also indicated the relevance of an organization's e-business usage patterns to outcomes, with the level of B2B EC integration demonstrating a strong positive relationship with overall firm performance. This positive relationship was also evident when we looked at the individual components of firm performance, including business process performance, operational performance, and financial performance.

As managers contemplate where their organizations fall on the B2B EC adoption continuum and the gap between their existing and potential practices, they should also ask themselves the following questions: are the risks associated with maintaining our current speed of e-business deployment greater or less than the risks associated with escalating it? Are these risks outweighed by the potential improvements in firm performance or not?

Obviously different external environments pose different operational contingencies for organizations. E-leaders reported a significantly more complex environment and more pressure from competition than average, and this may account at least in part for their more proactive B2B EC adoption strategy. Conversely, e-laggards reported a lower level of environmental hostility and competitive pressure than average, perhaps supporting their relative complacency concerning e-business uptake. Organizations that have been more reactive should consider whether their sluggish

approach has benefited or subverted their competitive posture, and how well or ill it prepares them for the inevitability of increasing sophistication in supply chain management. While we appreciate that not all organizations can be at the head of the technology parade, we do caution against them being too far back in the queue, which can result in learning and positioning curves that are just too steep.

Top management support figured prominently in the results, as the only contextual factor on which all cluster types deviated significantly from the pooled profile. Managers must embrace their roles as active orchestrators of innovation in the organization, and assess whether and how they are adding value to the innovation process. This requires them to fully understand the barriers and facilitators affecting their rate of e-business adoption, including an honest self-reflection on their own leadership in this regard. Are their attitudes and actions encouraging and supporting an evolutionary approach to managing the organization's supply chains, or are they signaling an unwelcoming and unyielding view of change?

There are other contextual factors that differentiated high adopters from low adopters. It appears that e-laggards did not see as good of a fit as e-leaders between the reliability and scalability of B2B EC and their organizational or product characteristics or perhaps their business strategies. In addition, e-laggards had less trust in their trading partners. More research is needed to identify the specific issues related to these factors that deterred e-laggards from actively engaging in B2B EC. Multiple case studies are particularly useful for this purpose.

Conclusion and further research

There are limitations in this study. First, the B2B EC applications used as clustering criteria were broad-based and general. Future clustering variables could be more specific. For example, inventory management applications could be measured by specific applications used for JIT delivery programs and communicating stock-outs.

A second limitation has to do with the nature of cluster analysis. While it is an established and commonly used classification tool, its outcomes depend on clustering techniques and decision rules selected by the researcher, and the interpretation of cluster solutions involves substantial researcher judgment. These concerns were however abated in this research by the validation procedures used, the clarity of the final cluster solution, and its similarities to other reported taxonomies.

Another limitation arose from the fact we obtained self-reported data from only one respondent for each firm that was surveyed. Fourth, we used cross-sectional data, which limited our ability to draw conclusions about causal relationships between variables. Future studies can overcome this limitation by using longitudinal data.

We also utilized a limited set of potential contextual factors to test our hypotheses, a limitation common to most research in this area. The effects of other potential contextual factors such as firm characteristics (e.g. industry type, country of origin, product or service characteristics, etc.), organizational culture, firm capabilities and resources, and firms' strategic orientation should be explored by future studies. Despite this limitation, we found that the TOE framework provides a valid theoretical guideline to study firms' B2B EC usage patterns. Future studies could use other organizational theories in tandem with the TOE framework to explore extensions of the hypotheses tested in this study. Finally, this study can be replicated in other countries to determine whether our findings can be generalized to other markets.

Notes

1. www.usitc.gov/publications/332/pub4125.pdf (accessed 11 January 2012).
2. www.ic.gc.ca/eic/site/sbrp-rppe.nsf/vwapj/KSBS-PSRPE_July-Juillet2011_eng.pdf/$FILE/KSBS-PSRPE_July-Juillet2011_eng.pdf (accessed 11 January 2012).
3. www.ic.gc.ca/eic/site/ecic-ceac.nsf/eng/gv00454.html (accessed 11 January 2012).
4. http://strategis.gc.ca (accessed 11 January 2012).

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