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## **Timeline of Initial Perceptions and Adoption of e-Business Among Quebec Forestry Sector SMEs**

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### **ABSTRACT**

*The present business environment is demanding and has forced companies to use information technology (IT) to remain competitive. E-business capabilities are currently one of the most salient factors that offer competitive advantage for most firms. This paper examines the evolution of the adoption of e-business practices between 2002 and 2009 from perception to actual adoption by small and medium size enterprises (SMEs) in the forestry sector in Quebec, Canada. A binary logistic regression analysis of survey data demonstrated the low rate of adoption of these technologies in this group. This research found that while firm size is the most influential factor for e-business solution adopters, location is also a vital factor. Firms in metropolitan areas adopt e-business solutions faster and in higher volume than firms do in rural areas. Thus, this paper highlights those factors that can influence the adoption of e-business practices in Quebec forestry-sector SMEs.*

**Keywords:** E-business adoption, e-commerce, website, SMEs, forestry sector, Quebec.

### **INTRODUCTION**

Globalization has played a significant role in influencing present markets. Companies must find new strategies to remain competitive in the global economy and accelerated competition has forced companies to use information technology (IT) based strategies to this end. In particular, e-business has become a reality that companies cannot ignore in the current business environment. Hence, this study presents the evolution of e-business practices, taking into account the perceptions expressed regarding the adoption of e-business during an investigation by Karuranga, Frayet, and D'Amour (2002). The purpose of this research is to study empirically the effect of these perceptions expressed in 2002 and adopted in 2009 regarding e-business practices of SMEs in the forest industry in Quebec, Canada.

E-business can be defined as a business model that enables buyers and sellers to exchange information and services using a range of electronic technologies (Davies & Garcia-Sierra,

1999). It allows businesses to adjust to novel markets and trade opportunities by increasing their sales through multiple channels, reducing their cost of transactions (Tan, Chong, Lin, & Eze, 2010), and increasing flexibility in communicating with business partners (Heung, 2003; Tan et al., 2010). In general, the major benefits reported in the extant literature are increased sales (Dubelaar, Sohal, & Savic, 2005; Scupola, 2009), improved distribution channels (Scupola, 2009; Tan et al., 2010), and improved customer service (Osmonbekov, 2010; Scupola, 2009; Tan et al., 2010). These benefits are, however, likely to be influenced by firms' capability to adopt the new technologies. The resource-based view (Grant, 1991) posits that organizational capability is strongly associated with business size. Recognizing this, some researchers have examined the benefit to firms associated with e-business technology adoption in recent years (e.g., Quayle, 2002; Scupola, 2009; Tan et al., 2010). Despite the proven benefits to firms, some barriers still exist to the adoption of e-business technologies due to incompatibility between existing and e-business technologies. The major barriers are lack of time (Scupola, 2009), high level of complexity (Kaynak, Tatoglu, & Kula, 2005), and high implementation cost (Gunasekaran & Ngai, 2007; Li & McQueen, 2008; Tan et al., 2010).

This article comprises three main sections. The first section is a literature review on e-business regarding the determinants of adoption and its presence in the forestry sector in Quebec, the second presents our data analysis methodologies, and section three presents and discusses the results obtained from our empirical study. Our conclusions and implications for researchers and practitioners are summarized in the final section.

## **E-BUSINESS ADOPTION PRACTICES IN THE FOREST INDUSTRY**

Rogers' Innovation Diffusion Theory (IDT) (1962) explains how technological innovation is changing the stage of creativeness to expanded use. Moore and Benbasat (1991) adapted the characteristics of innovation proposed by Rogers and outlined a set of constructs that can be used to study the adoption of technology by the individual: perceived relative advantage, perceived ease of use, perceived image, perceived compatibility, visibility, and result demonstrability. Whether positively or negatively taken into consideration for e-business adoption practices, these theories focus on the feelings and perceptions of individuals before using the technology in question.

Developed by Fishbein and Ajzen (1975), the Theory of Reasoned Action (TRA) defines the relationship between individuals' beliefs, attitudes, norms, intentions, and behavior. According to this theory, people's behavior is determined by their intention to implement the technology in question. This intention is itself determined by the person's attitude and subjective norms toward the behavior. Ajzen's Theory of Planned Behavior (1985, 1991) is an extension of the TRA: the author added a new model and built in the perception of behavioral control, which he defines as "the perceived ease or difficulty to perform the behavior" (Ajzen, 1991, p. 188). Taylor and Todd (1995) applied the Theory of Planned Action in the specific context of information systems. Their results show that the factors that determine the attitude are perceived usefulness, perceived ease of use, and compatibility.

Davis' (1989) Technology Acceptance Model highlights the factors that influence an individual's acceptance of IT. The adoption of the technology in question is studied in terms of ease of use and perceived usefulness. The Levels of Preparation Technology (NPT), more recently developed, refers to an individual's propensity to embrace and use new technologies for the fulfillment of life goals at home and at work (Parasuraman, 2000). Many previous studies (Acilar & Karamasa, 2011; Kenneth, Rebecca, & Eunice, 2012; Senarathna & Wickramasuriya, 2011) have explored e-commerce (EC) adoption factors among SMEs in various contexts and countries. Ratnasingam (2001), for example, presents the findings of research related to EC adoption in Australia and New Zealand. Respondents in their study reported the perceived lack of security as one of the main barriers to EC adoption. Other barriers included customer readiness, organizational inertia, and lack of knowledge.

Lee and Runge (2001) explored three antecedent factors in IT adoption among small retailers: (i) the owner's perception of the relative advantages of using IT, (ii) the social expectations of IT use, and (iii) the owner's innovativeness in business management. Their study found that the firm's innovativeness was the strongest determinant of adopting traditional information systems. However, the owner's positive perception of the relative advantages of using technology played the most critical role in the adoption of Internet-related technologies. Mehrtens, Cragg and Mills (2001) conducted case-study research to identify significant influences on Internet adoption among SMEs in New Zealand. Their study concluded that three factors significantly affected Internet adoption by small firms: perceived benefits, organizational readiness, and external pressure. Researchers also identified several other factors that influence the adoption of IT in SMEs, including the cost of technology (Alam, 2009; Chong, 2006), external pressure (Fink & Kazakoff, 1997; Hart & Saunders, 1998), owner-manager's characteristics (van Akkeren & Cavaye, 1999), information sharing (Salazar, Wang, & Oswald, 2011), context (Shemi & Procter, 2013), and security (Kendall, Tung, Chua, Ng, & Tan, 2001; Limthongchai & Speece, 2003). Kendall et al. (2001) focused on the receptivity of Singaporean SMEs to the adoption of e-commerce. This study adapted Roger's model of innovation diffusion as the framework and treated EC as a form of new innovation; however, their findings supported only relative advantage, compatibility, and trialability as factors affecting the adoption of e-commerce by SMEs. The compatibility issue is important because it addresses the perception of the importance of EC to business, now and in the future. Finally, trialability is related to compatibility, that is, the ability to engage in EC without incurring high start-up costs.

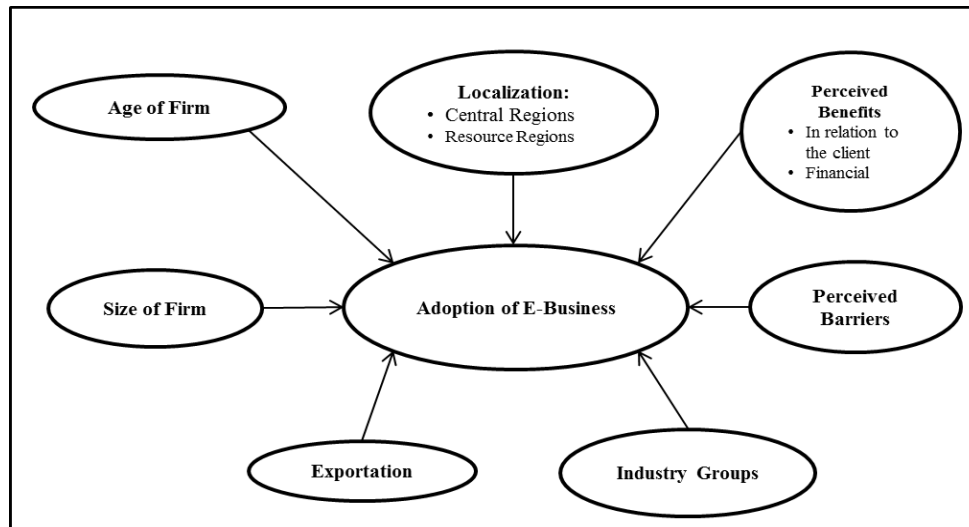
Riemenschneider and McKinney (2001) used the Theory of Planned Behavior in their analysis of differences in small business executives' beliefs of regarding the adoption of web-based EC. They found that EC adopters were influenced more by their social referent group than were non-adopters. In contrast, Lee and Runge (2001) found that social expectation only exhibits indirect influence on perceived relative advantage; therefore, it may not be an important factor in EC adoption decisions. Several authors used the Technology, Organization, and Environment framework (TOE) (Tornatzky & Fleischer, 1990) to understand different IT adoption practices. The most cited adoption practices are electronic data interchange (EDI) (Kuan & Chau, 2001), open systems (Chau & Tam, 1997), website (Oliveira & Martins, 2008), e-commerce (Martins & Oliveira, 2009; Oliveira & Martins, 2009), enterprise resource planning (ERP) (Pan & Jang, 2008), business-to-business (B2B) e-commerce (Teo Ranganathan, & Dhaliwal, 2006), e-business (Hong & Zhu, 2006; Lin & Lin, 2008; Oliveira & Martins, 2010a), and knowledge

management systems (KMS) (Lee, Wang, Lim, & Peng, 2009). Past studies indicated that factors influencing e-commerce adoption are diverse and inconclusive.

The forestry sector has not adapted well to e-business technology (Shook, Zhang, Braden, & Baldrige, 2002). In the United States, the failure of virtual forest enterprises was mainly due to an inappropriate business model (i.e., the concept of replacing humans with machines) and because the industry has traditionally been considered somewhat unprepared to adopt the technology in large scale (Stennes, Stonestreet, Wilson, & Wang, 2006). Although the Internet service was adopted by 80% of US wood products exporters in 1999 (Pitis & Vlosky, 2000), this technology is considered to be at a low standard in e-business, according to Xu, Rohatgi, and Duan (2007). However, the use of the Internet as an e-business technology is at the basic level in the present business environment. The situation of lower-level information technology use in the forestry sector is reinforced in the research of Shook et al. (2002) and Arano and Spong (2012). The authors in this study describe the forest industry as conservative in terms of adopting Internet technologies, especially in the Pacific Northwest region of the United States.

### **CONCEPTUAL FRAMEWORK AND HYPOTHESES**

The adoption of e-business (i.e., a set of Internet technologies) depends on several factors, including the perception that users can work with these technologies and other features related to the business and industry type (AbuGhazaleh, Qasim, & Roberts, 2012; Jeon, Han, & Lee, 2006; Oliveira & Martins, 2010b; Ramamurthy, Sen, & Sinha, 2007). The relationship between these factors and the adoption of e-business technology is represented in Figure 1, developed from the extant literature review. Internet technologies used in e-business bring many benefits to the adopting companies. In fact, they improve the flow of information between business partners by enabling the instant delivery of information at reduced costs (Sanders, 2007), to enormous effect. Internet e-business technologies enable a better understanding of the market, and wider geographical coverage allow for quick and accurate decisions, improve services to customers, reduce administrative costs, and optimize collaboration and communication between business partners (Zhuang & Lederer, 2004). Many authors emphasize the technological aspects in their definitions of e-business. Croom (2005) defines e-business as “the use of systems and open communication channels for information exchange, business transactions and exchange of knowledge between organizations.” Stone (2003) and Al-Azad, Mohiuddin, and Rashid (2010) assert that technology exists to improve profitability. Fillis, Johannson, and Wagner (2004) and Taylor and Owusu (2012) define e-business as an organization that uses electronic technology in their business operations (Xu et al., 2007). In the current research, we define the adoption of e-business as having a business website.



**Figure 1: Conceptual Framework.**

### **Independent Variables**

*The size of the firm.* Empirical research has shown a positive relationship between firm size and the adoption of information technology (Giunta & Trivieri, 2007; Lal, 1999; Ramamurthy et al., 2007). Dupuy and Vlosky (2000) examined the adoption of electronic data interchange (EDI) technology by the forest industry in Canada and the United States and concluded that the size of the company is the best determinant for adopting this type of technology. Thus, we can posit the following hypothesis:

**H1:** Firm size has a positive impact on the probability of a firm to have a website (1) or not (0).

*The age of the business.* The age of the business can serve as an approximation of its accumulated experience in general, but also of the reduction in perceived risk of investment in IT (Giunta & Trivieri, 2007; Ramamurthy et al., 2007). Thus, we can put forth the following hypothesis:

**H2:** The age of the firm has a positive impact on the probability of a firm to have a website (1) or not (0).

*Exportation.* Export activities are very rich in information; therefore, they benefit directly from the use of new information technologies such as websites (Giunta & Trivieri, 2007; Lal, 2002). A website should facilitate an export company's activities with their business partners, attracting new customers and streamlining transactions with suppliers; hence, the following hypothesis is proposed.

**H3:** Export activity has a positive impact on the probability of a firm to have a website (1) or not (0).

*Localization.* Geographical area is controlled to determine whether there are different levels of IT adoption across various jurisdictions (Fabiani, Schivardi, & Trento, 2005; Giunta & Trivieri, 2007). Through this process, the location will be operationalized as a categorical variable according to Doloreux, Amara, and Landry (2008), who classified the regions of Quebec by size and proximity to metropolitan areas. Hence, the following hypotheses are proposed:

**H4:** Location in the central regions as compared to location in a medium or large metropolitan area affects the probability of a firm to have a website (1) or not (0).

**H5:** Being in one of rural/resource area compared to being in a medium or large metropolitan area has an effect on the probability of a firm to have a website (1) or not (0).

*Industry groups.* Membership in a particular sector or industry group has been found to affect technology adoption (Giunta & Trivieri, 2007; Hong & Zhu, 2006). The forest product sector is subject to a first, second, or third transformation. Hence, the following hypothesis is proposed:

**H6:** Industry group affects the probability of a firm to have a website (1) or not (0).

*Perceptions.* Through this research, perceptions are captured by three index variables: perceived financial benefits, benefits received in connection with the client, and perceived barriers. The goal is to distinguish between perceptions that could encourage the adoption of the technology and those that may prevent it. Thus, the following hypotheses are proposed:

**H7:** Perceived benefits in connection with the customer have a positive impact on the probability of a firm to have a website (1) or not (0).

In this research, the variable profits relating to the customer are operationalized by an index that combines the perceptions expressed by a Likert scale (1=*strongly disagree* to 5=*strongly agree*) on several benefits that can be the adoption of e-business technologies on customers.

**H8:** Financial benefits received by the firm have a positive impact on the probability of a company to have a website (1) or not (0).

In this research, the perceived financial benefits variable is operationalized by an index that combines the perceptions (expressed on a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*)) of several benefits that can be adopted in e-business technologies to the firm's finances.

**H9:** Perceived barriers have a negative impact on the probability of a company to have a website (1) or not (0).

In this research, the perceived barriers variable is operationalized by an index that combines the perceptions (expressed on a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*)) of several disadvantages perceived in the adoption of e-business technologies.

## METHODOLOGY

### Data Collection and Descriptive Statistics

This research is intended to be complementary to that proposed by Karuranga et al. (2002), allowing a study of the state of e-business adoption in Quebec's forest sector. Indeed, it will study the sub-sample that was not adopted in e-business in 2002. The proposed research will take into account these companies' perceptions of e-business and will assess the current state of adoption. Thus, the data used in this research comes in part from the results of a telephone survey of 695 companies operating in the forest sector in Quebec conducted by Karuranga et al. in 2002. Responses were received from 312 firms. The target population for the current research was composed of 113 companies in Quebec's forest industry sector who reported that they had not adopted the technology of the e-business website as of Karuranga et al.'s 2002 survey.

To evaluate the evolution of website adoption, the other data were obtained from a new survey conducted in 2009 with the same group of companies. More specifically, the data for the dependent variable comes from the observation in 2009 of the corporate websites in question; information on other independent variables were obtained from the database of the Centre de Recherche Industrielle du Quebec (CRIQ). Data were available for only 70 of the 113 companies surveyed.

The survey's descriptive results (Table 1) show that in 2009, only 25.7% of companies surveyed had a website. These companies, which reported not having a website in 2002, are located mainly in the Central (37.1%) and resource regions (25.7%). A large proportion (65.7%) worked in sawmills, planning, and shingle mills, which corresponds to the primary group. The remaining 70 companies surveyed (34.3%) work in industry groups included in the secondary and tertiary processing of wood. Despite the relatively small size (average of 74.042 employees per firm, with a standard deviation of 135.10 employees) of the sample firms, more than half export some of their production to foreign markets (54.3%).

Continuous Variables	Variable Type	Min.	Max.	Avg.	Std. Dev.	Cronbach's $\alpha$
Firm Size (Size)	Continuous: number	4	875	74.042	135.10	—
Age of Firm (AGE)	Continuous: number	1.43	80.05	25.258	17.311	—
Benefits received in relation to the client (BENCLIENT)	Index: 4 items	4	19	13.73	3.04	.774
Financial Benefits Received (BENFI)	Index: 6 items	10	26	16.60	3.816	.825
Perceived Barriers (BARR)	Index: 3 items	2	13	8.17	2.60	.852
<b>Dichotomous Variables</b>		<b>Percentage</b>				
Percentage of companies adopting e-business		25.7				
Central Regions (CENTRAL)		37.1 (YES)				
Resource Regions (RESOURCE)		25.7 (YES)				
Exportation (EXPORTATION)		54.3 (YES)				
Industrial Groups (GROUPEINDUS)		65.7 (1)				
		34.3 (2)				

**Table 1: Descriptive Statistics.**



## **ECONOMETRIC MODEL AND MEASUREMENT OF VARIABLES**

In order to explain the adoption of e-business approaches operationalized by the adoption of a website as noted above, our model incorporates a set of relevant variables highlighted in the literature. These variables are firm size, age, industry group, location (central, regional, or resource), exportation, and financial benefits; these are commensurate with the customer and perceived barriers to the adoption of e-business. As this adoption is measured by a dichotomous variable, we used a binary logistic model type whose generic formulation is as follows.

$$\begin{aligned}\text{Log} (P_i/1-P_i) = & \beta_0 + \beta_1 \text{LNSIZE} + \beta_2 \text{SRAGE} + \beta_5 \text{CENTRAL} + \beta_6 \text{RESOURCE} \\ & + \beta_3 \text{EXPORTATION} + \beta_4 \text{GROUPINDUS} + \beta_7 \text{BENCLIENT} + \beta_8 \text{BENFI} \\ & + \beta_9 \text{BAR}\end{aligned}$$

Where,

- $\beta_i$  ( $i = 0 \dots 10$ ) are the coefficients
- $\text{Log} (P_i/1-P_i)$  is the logit of the variable ADOPTION, which is the logarithm of the ratio of the probability that a firm adopts the website compared to the probability that the same firm does not adopt.
- Independent variables:
  - LNSIZE: Company size measured by the logarithm of the number of employees
  - SRAGE: Age of the firm measured in years by the square root of the result obtained by subtracting the date of incorporation of the current date (i.e., 01/01/2009)
  - CENTRAL: Geographic location; takes the value 1 if the company is located in a central zone, and 0 otherwise
  - RESOURCES: Geographic location; takes the value 1 if the firm is located in resource regions, and 0 otherwise
  - EXPORT: Exportation measured using a binary variable taking the value 1 if company exports part of its production outside Canada, and 0 if it does not export
  - GROUPEINDUS: Industrial group membership; takes the value 1 if the firm belongs to an industrial group involved in primary processing and 2 if the industry group is included in the secondary or tertiary processing of forest products
  - BENCLIENT: Benefits received in connection with the client, measured by 4 items
  - BENFER: Perceived financial benefits, measured by 6 items
  - BARR: Perceived barriers, measured by 3 items

To avoid potential problems of multicollinearity, correlation coefficients between the independent variables were checked to ensure that they posed no threat to the validity of the model and/or the empirical results. In addition, coefficients of tolerance of each variable were checked. As no value was below 0.2, this test confirmed the absence of correlation between independent variables. To ensure the normality of the distribution of the continuous variables SIZE and AGE, changes in the logarithm and square root were made. Note that each multi-item index was subject to exploratory factor analysis in principal component with varimax rotation in order to eliminate weak correlation with the items measured, and manufactured to ensure its unidimensionality. Each factor analysis was evaluated by testing the factor solution adequacy of Kaiser-Meyer-Olkin (KMO) and by Bartlett's test of sphericity. Furthermore, internal

consistency of measures was assessed using Cronbach's alpha. Results (shown in Table 2) attest to the internal consistency and uni-dimensionality of the indices used to measure the constructs.

Variable Indices	No. of Items	Eigenvalue	Var. Captured	Cronbach's $\alpha$
Benefits received in relation to the client	4	2.408	60.203%	0.774
Financial benefits received	6	3.248	54.137%	0.825
Perceived barriers	3	2.332	77.744%	0.852

**Table 2: Constructed Explanatory Factor Analysis.**

### **Regression Results**

Results of the estimation of the explanatory model of the propensity to adopt e-business (the decision to adopt or not adopt a website) are presented below. What emerges is that the model is globally significant and has good performance as it correctly classified 83.7% of firms as adopters and non-adopters of e-business. Further, the Nagelkerke (1991) pseudo R<sup>2</sup> rose to .623. The null hypothesis means that all model parameters (except the constant) equal to zero are strongly rejected.

Dependent Variable: Propensity to Innovate [INNOVE]	
Independent Variables	Coefficients ( $\beta_i$ ) <sup>a, b</sup> Exponential $\square\square\square$
Constant	-8.505 .000
➤ Size of Firm [LNSIZE]	2.367 (.010)**
➤ Age of Firm [SRAGE]	-.253 (.243)
➤ Central Regions (YES = 1) [CENTRAL]	-3.319 (.038)**
➤ Resource Regions (YES = 1) [RESOURCE]	-4.936 (.010)**
➤ Exportation (YES = 1) [EXPORTATION]	.830 (.278)
➤ Industrial Group [GROUPEINDUS]	-.376 (.382)
➤ Benefits received in relation to the client [BENCLIENT]	.363 (.071)*
➤ Financial benefits received [BENFI]	.048 (.384)
➤ Perceived barriers [BARR]	-.426 (.058)*
Number of cases	70
Chi-square (df)	$\chi^2$ calculated = 23.650; $\chi^2$ theoretical (9)
Nagelkerke R <sup>2</sup> (Pseudo R <sup>2</sup> )	.623
Percentage of correct predictions	83.7 %
<sup>a</sup> Figures in parentheses represent p-values	
<sup>b</sup> * and ** indicate that the variable is significant at 10% and 5%, respectively	

**Table 3: Logistic Regression Model.**

Among the independent variables in the model, only the coefficients for variables SRAGS, GROUPINDUS, EXPORT, and BENEFI are not statistically significant. This indicates that, based on the observations of this sample, the age of the company, industry group, export status, and perceived financial benefits of e-business adoption have no effect on the probability that a firm adopts e-business practices.

Examination of the estimated parameters of the model reveals that the probability that a firm adopts e-business increases with firm size and the perceived benefit to the client. However, this probability decreases with the barriers that may be rise against the adoption of e-business. Company location in a central or resource region rather than in a metropolitan area has a negative impact on the probability that a firm will adopt e-business. This presentation of regression results explaining the propensity to adopt e-business is based solely on the signs and significance of coefficients of explanatory variables. To reflect the relative impact of different variables on the likelihood of adopting e-business, we rely on the elasticity coefficients of continuous variables and the marginal impact of dichotomous variables (Table 4). The partial elasticities reflect the average of the elasticity coefficients calculated for each of the 70 observations included in the analysis.

Continuous Variables	Partial Elasticity <sup>a, b</sup>
↘ Size of Firm [ <i>LNSIZE</i> ]	7.24
↘ Benefits received in relation to the client [ <i>BENCLIENT</i> ]	4.57
↘ Perceived barriers [ <i>BARR</i> ]	-3.17
Binary Variables	Marginal Impact <sup>c</sup>
↘ Central Regions (YES = 1) [ <i>CENTRAL</i> ]	-0.226
↘ Resource Regions (YES = 1) [ <i>RESOURCE</i> ]	-0.35

<sup>a, c</sup> The partial elasticities and marginal impact have been calculated using the software I.

<sup>b</sup> Elasticities are reported for an increase of 1% of the corresponding variable.

**Table 4: Elasticity Coefficients of Continuous Variables and the Marginal Impact for Dichotomous Variables.**

A summary of the hypotheses results is presented below in Table 5.

Independent Variables	Propensity to Adopt e-Business	
	Hypothesis	Result
↘ Size of firm	+	+
↘ Age of firm	+	NS
↘ Central regions	NA	-
↘ Resource regions	NA	-
↘ Exportation	+	NS
↘ Industry group	NA	NS
↘ Benefits received in relation to the client	+	+
↘ Financial benefits received	+	NS
↘ Perceived barriers	-	-
(+) indicates a positive association; (-) indicates a negative association NS=non-significant association; NA=not applicable		

**Table 5: Testing the Hypotheses.**

As shown in Table 4, the coefficient of elasticity for the variable measuring firm size is the highest. Taking a value of 4.15, this coefficient indicates that a positive relative change of 1% in firm size increases the probability that a firm will adopt a website to 7.24%, which is quite important. Regarding the impact of initial perceptions, an increase of 1% in profits earned (by customer report) increases the probability of a firm to adopt a website by 4.57%, and an increase of 1% decreases the perceived barriers probability of website adoption to 3.17%. Furthermore, the marginal impact of the variable location of CENTRAL is -0.226, meaning that if all firms in metropolitan areas relocate to one of the central regions, the probability of adopting e-business falls by 0.226%. Similarly, if all firms in metropolitan areas relocated to one of the resource regions, the probability of adopting e-business decreases by 0.35%.

## **DISCUSSION AND CONCLUSION**

This research was an econometric analysis of the impact of perceptions on the adoption of e-business approaches. The various e-business technologies have revolutionized the way companies do business. Known for their many benefits (Damanpour & Damanpour, 2001; Sanders, 2007; Zhuang & Lederer, 2004), these technologies should be adopted by any business, particularly SMEs that wish to succeed in the current competitive business environment. Karuranga et al. (2002) studied perceptions of Internet technology use by forestry-sector SMEs in Quebec. Like much other research (Kozak, 2002; Pitis & Vlosky, 2000; Shook et al., 2002; Stennes et al., 2006), this study demonstrated the low adoption rate of these technologies within forestry-sector SMEs in Quebec. The current research focused on changes in the adoption rate of e-business (company websites) practices by those companies who did not have a website when Karuranga et al. undertook their 2002 study. Among the 70 firms who replied to our survey, only 25.7% had a website as of January 1, 2009. Despite the popularity of this technology and its many benefits, the adoption rate of e-business tools is low.

Firm size is one factor that can affect the adoption decision. This is attributable to the fact that the larger the company, the more likely it is to be aware of the importance of having a web presence and of the many related benefits. It is interesting that, according to our sample, firm size is the most influential factor in the decision on whether to adopt e-business practices. Therefore, governments should focus more on raising awareness within SMEs of the benefits of e-business, subsidizing the purchase of necessary equipment and/or the training of personnel. Our findings are in line with those of Cusumano and Elenkov (1994) and Chen (1995), who argue that governmental policies are the pivotal factor in technology adoption patterns and that government incentives can promote a higher rate of adoption of e-business practices by SMEs. Human capital (Salazar et al., 2011) can also play an important role in technology adoption process; pro-active government policies can also make a difference. Company location in the central or resource regions also did not support decisions to adopt e-business. Thus, a company located in a metropolitan area is more likely to establish a website, that is, an e-business. This is a possible concern for service providers, who would then target their offerings to businesses in metropolitan areas. Among the perceived benefits, those related to the client affect the adoption decision. This shows that the forestry companies in Quebec are aware of the importance of the benefits to their customers. This fits into the objectives of CRM (customer relationship

management) and aims to strengthen communication between the company and its customers by using technological solutions.

As predicted by our hypotheses and by the model, perceived barriers decreased the likelihood that a company would adopt e-business practices. To reduce the impact of these negative perceptions, service providers should pay more attention to users' positive and negative reactions to their products and determine appropriate solutions.

The limitations of this study should be considered when interpreting its results. The small number of companies in our sample does not allow us to generalize the conclusions drawn, and the specialized nature of the forestry sector does not allow us to extrapolate these results to other sectors. Further, having strictly operationalized the adoption of e-business as the adoption of a website reduces the definition of our dependent variable. Thus, this research can serve as a bridge to others interested in the Quebec forestry sector, which should expand the operationalization of e-business approaches and other Internet technologies.

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## Appendix 1

### Operational Definitions of Dependent and Independent Variables

Variable	Definition	Measure
ADOPTION	Propensity to adopt e-business through the adoption of a website	Binary variable takes the value 1 if the company has a website and the value 0 if not
LNSIZE	Size of firm	Continuous variable reflecting the logarithm of the number of employees of the company
SRAGE	Age of firm	Continuous variable reflecting the square root of the age of the company, obtained by subtracting the date of incorporation of the company to date 01/01/2009
EXPORTATION	Exportation	Binary variable that takes the value 1 if the company is geographically in the central regions and 0 otherwise
GROUP INDUS	Industrial group	Binary variable takes the value 1 if the firm belongs to an industrial group involved in primary processing and value 2 if the industry group is included in the second or third processing of forest products
CENTRAL	Central regions	Geographical location that takes the value 1 if the firm is in a central zone, and 0 otherwise
RESOURCES	Resource regions	Geographical location that takes the value 1 if the firm is in a resource regions, and 0 otherwise
BENCLIENT	Benefits received in relation to the client	Index combining the perceptions expressed on a Likert scale (1= <i>strongly disagree</i> to 5= <i>strongly agree</i> ) of several benefits to customers that may result from the adoption of e-business technologies
BENFI	Financial benefits received	Index combining the perceptions expressed on a Likert scale (1= <i>strongly disagree</i> to 5= <i>strongly agree</i> ) of several benefits to company finances that may result from the adoption of e-business technologies
BARR	Perceived barriers	Index that combines the perceptions expressed on a Likert scale (1= <i>strongly disagree</i> to 5= <i>strongly agree</i> ) of several disadvantages perceived in the adoption of e-business technologies

## Appendix 2

### Correlation Matrix

	LNSIZE	SRAGE	CENTRAL	RESOURCES	EXPLORATION	GROUPINDUS	BENCLIENT	BENFI	BARR
LNSIZE	1								
SRAGE	.201	1							
CENTRAL	.038	.271	1						
RESOURCES	.222	-.191	-.536	1					
EXPLORATION	.546	.149	.129	.032	1				
GROUPINDUS	.097	-.157	-.238	-.020	-.014	1			
BENCLIENT	-.023	.148	-.153	.229	.097	.181	1		
BENFI	-.116	-.005	-.009	.096	.204	.014	.448	1	
BARR	-.151	-.014	.011	-.198	.134	-.180	.136	.207	1