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Empirical evidence from Luxembourg data**

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The determinants of e-business strategies: Empirical evidence from Luxembourg data¹

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Abstract

This article aims at analysing the factors than can explain the motivations of firms for investing in a website and for the degree of use of this site in an informative and/or in a commercial way. We also study the importance of reorganisations of the firm in the success of e-commerce. Firstly, we seek to find in the theoretical and the empirical literature the factors underlined as influencing the creation of a website, the choice of the richness in terms of contents, and the use of the site as a new business channel. Secondly, it permits us to formulate different hypothesis we test using a Luxembourg database. The results show that there are large differences between factors influencing creation behaviours and degree of involvement in the general use of the website. But, concerning the two uses the firm can make with its site, there are many similarities in the determinants of intensity of website uses both as an informational tool and as an e-commerce one. Regarding the links between reorganisations thanks to management ICTs and the setting up of an e-commerce website, our study displays a significant complementarity.

Key words: Internet strategies, e-commerce, firm reorganisation

JEL Classification: L14, L21, L86

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1. Introduction

From March 2000 and the Lisbon European Council, the European Union has set the ambitious objective of modernising the European economy² harnessing the benefits of the opportunities given notably by Information and Communication Technologies (ICTs). The long term strategy defined by this Council and included in the policy agenda of the Union is well-known as the “Lisbon Strategy”.

The first stage of this strategy was the endorsement of the eEurope 2002 Action Plan at the Feira European Council in June 2000. This plan aimed at co-ordinating regional, national and European actions to increase the number of individuals and enterprises connected to the Internet and to stimulate their uses. Because Small and Medium-sized Enterprises (SMEs³) are the backbone of the European economy⁴, they received the highest priority and the plan included a specific action to help such enterprises to use Internet in order to find new business opportunities. The GoDigital initiative was implemented by the Commission in order to: *“encourage SMEs to ‘Go Digital’ through co-ordinated networking activities for the exchange of knowledge on best practices”* (Commission of the European Communities, 2001, p.4).

The second stage was the eEurope 2005 Action Plan adopted at the Sevilla European Council in June 2002. Since 2000, the use of basic ICTs and access to the Internet had grown and in 2002 was closed to saturation levels. In fact, in Europe-15, 92% of SMEs⁵ and 99% of large firms used computers. Concerning Internet, in the same time and area, 79% of SMEs and 97% of large enterprises had an access to the Web. Because eEurope 2002 permitted to connect a large part of SMEs, the new priority was given to the development of e-business⁶ and viable business models *“with the aim of enhancing*

² *“The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion”* (Lisbon European Council, 2000, p.2).

³ According to the European Union definition (Commission of the European Communities, 2003b), SMEs are private enterprises with less than 250 employees. More precisely, are considered as “small”, enterprises with a number of employees between 10 and 49 and as “medium-sized”, enterprises with a number of employees between 50 and 249.

⁴ In 2003, there were 18.7 million private enterprises in Europe-15. More than 99% of these firms employed less than 250 persons (Commission of the European Communities, 2004). Moreover *“SMEs generate a substantial share of GDP and are a key source of new jobs as well as a breeding ground for entrepreneurship and new business ideas”* (Commission of the European Communities, 2001, p.5).

⁵ The data come from the Community enterprise survey on ICT usage conducted in 2002 (quoted by Commission of the European Communities, 2003a, p.25).

⁶ *“The term ‘e-business’ covers both e-commerce (buying and selling online) and the restructuring of business processes to make the best use of digital technologies”* (Commission of the European Communities, 2002, p.13).

the competitiveness of European enterprises and raising productivity and growth through investment in ICT" (Commission of the European Communities, 2003a, p.3). The Commission conscious of the opportunities given by e-commerce and of SMEs' difficulties to set up an e-commerce website and also to restructure their production and distribution processes to make best use of Internet technologies decided to establish an European e-Business Support Network⁷. The aim of this network is to co-ordinate and strengthen actions in support of firms to do e-business in a favourable environment⁸. It was also conceived for firms to share practical experience and information on funding support concerning ICTs adoption and uses. Because the end of the eEurope 2005 is impending, a new initiative, the i2010 programme, is going to perpetuate the actions carried on up to now. Moreover, it is time to draw up an assessment of the progresses in terms of websites and e-commerce practice diffusion made during the eEurope 2005 Action Plan. Thus, since 2002 in Europe-15, there has been in average an increase in the number of enterprises present on the Web with a single page or a real website, but since 2003 there has been, especially in Luxembourg, a stagnation or even a decrease in the diffusion rate of firms' sites. According to Eurostat⁹ in 2002 the EU-15 average rate¹⁰ of website ownership was around 55% of firms employing 10 persons and more, 62% in 2004 and 67% in 2005. If a focus is made on Luxembourg, we can notice that there has been a fast growth between 2002 and 2003 (with a rate of 61% of firms employing 10 persons and more in 2003 compared to 51% one year before), and then a stagnation with a rate around 62% in 2004 and 2005.

In spite of this stagnation, Luxembourg exhibits a very higher diffusion rate of websites than countries with the smallest ones, i.e. Portugal and France with rates around 30%. But this country has an important possibility in terms of growth, knowing that first, Nordic countries reached rates around 80%, and secondly that the development of online commerce is important in European households¹¹ and especially in Luxembourg, which

⁷ Further information is provided on the portal of this network: www.e-bsn.org.

⁸ The improvement of firms environment was an important objective in eEurope 2005. Regional and national actions were encouraged by the Commission with a particular emphasis on trust and confidence of consumers in order to help the development of e-commerce.

⁹ Source: Eurostat, Information society statistics, available on: <http://epp.europa.cec.eu.int/> for European data and STATEC/CEPS-Instead for Luxembourg data.

¹⁰ The average was calculated on a limited number of sectors (manufacturing, trade, hotels and restaurants, transport and communication, renting and business activities, and personal service activities) in order to have a comparability for all countries.

¹¹ In EU-15, in the second term of 2004, 21% of the population have bought or ordered online against 15% in the first term of 2003, that is to say 37% of Internet users in 2004 and 31% in 2003.

is on the top of the EU-15 in terms of household online commerce, with 32% of the population (half of the Internet users living in Luxembourg) which have used Internet to buy or order online in the second term of 2004, against 18% of the population (34% of Internet users) in the first term of 2003.

Are the factors that contribute to website creation behaviours different from those that influence the degree of involvement in the site use? As the site may be considered as a two sides tool which permits both to inform customers and to create a business channel, do the explanatory factors influence differently the intensity of website used as an information tool or as an e-commerce one? Do reorganisations undertaken by firms thanks notably to adoption of management ICTs (allowing to accelerate production and distribution processes) involve a higher setting up of e-commerce website?

That are the questions we seek to provide pieces of response in the remainder of the article. We successively analyse the determinants of website creation and of the degree of involvement in the website. Furthermore, we distinguish between the uses of the website and study the differences and similarities in factors influencing use behaviours. Generally, because of a lack of information concerning reorganisations in surveys, there exists few studies which study the e-business phenomenon. We try to offset this shortage thanks to the richness of items available in our database. Moreover this richness allow us to insert in our various investigations a large number of explanatory variables we can find in existing empirical studies.

On the one hand, we find that there are large differences between factors influencing creation behaviours and those influencing the degree of involvement in the general use of the website. On the other hand, concerning the two uses the firm can make with its website, there are many similarities in the determinants of intensity of website uses both as an informational tool and as an e-commerce one. Regarding the links between reorganisations thanks to management ICTs and the setting up of an e-commerce website, our study displays a significant complementarity. Thus, management technologies that improve the distribution process of the firm (such as ICTs linked with the logistic system or with customers systems) have a positive influence on e-commerce practice.

The remainder of this article is organised as follows. In the next section we present both theoretical and empirical literatures concerning the different factors influencing website creation and intensity of involvement in the site they highlight. After a detailed description of the database, we present both the dependent and explanatory variables introduced in our econometric analyses. Then we present the results and discuss the main empirical findings.

2. Factors influencing website setting up and use

The aim of this paper is to analyse the behaviours of firms facing the choice of investing in a particular use of Internet: the website. The website meets different needs for the firms: it is both a tool to inform and present the activities of the firm, and a tool to build a new business channel. Therefore, to ascertain the motivations of the firms towards its website, we will analyse the factors influencing the setting up of the website and the use of this website especially in an informative way or in an e-commerce perspective, and the relative importance of each factors in the different levels of the firm involvement.

In order to address this task, we begin with a review of both the theoretical literature and the empirical studies concerning the adoption of ICTs and in particular the setting up of a website and the use of this site. Generally agreed opinion on technologies diffusion is that the diffusion is better understood as a series of stages (Rogers, 1962; Gillepsie, Richardson & Cornford, 1995). That's why we can distinguish three subjects of study, in the empirical literature, that cover three stages of the website creation and use.

First, we find the website creation, that is generally modelled as a binary choice, i.e. to have a website or not (Sadowski, Maitland & Van Dogen¹², 2002; Dholakia & Kshetri¹³, 2004 and Martin & Pénard¹⁴, 2005). Secondly, some articles study the nature of the site (Lucchetti & Sterlacchini¹⁵, 2004; Martin & Pénard, 2005). The focus is made on the understanding of the richness of the site in terms of contents. This richness can be grasped in different ways. As in Lucchetti & Sterlacchini (2004), a composite indicator

¹² This study concerns 264 enterprises located in the Netherlands and employing between 1 and 499 persons (definition of SMEs by the OECD) interviewed during June and July 1998.

¹³ This analysis uses 45 SMEs (OECD definition) located in New England region (U.S.A.) asked before October 2002.

¹⁴ This study concerns 850 legal unit of firms located in Brittany (France) interviewed in early 2004.

¹⁵ The sample is composed of 168 SMEs (EU definition) located in Central Italy and questioned in the end of 2000.

can be constructed from the functions provided by the site, or as in Martin & Pénard (2005), a distinction can be made between elaborate websites and others according to the functions offered¹⁶. Thirdly, the last stage studied concerning the use of a website is the practice of e-commerce (Chappell & Feindt¹⁷, 2000; Dholakia & Kshetri, 2004 and Martin & Pénard, 2005).

In each of these stages, the factors displayed by the literatures can be classified into two types: internal factors and external ones (Dholakia & Kshetri, 2004).

2.1. Internal factors

The literature on ICTs adoption has highlighted different internal factors we choose to classify into three groups: resources, business characteristics and past experiences with ICTs.

2.1.1. Firm resources

From a theoretical point of view, the enterprises' resources are essential to diversify firms' activities. First, in the resource-based theory, the firm as a collection of resources and competencies seeks to exploit its resources with the aim of finding new opportunities of diversification and growth in order to reinforce its position on the market (Penrose, 1959; Barney, 1991). By the means of a website, the firm can reach this objective. Actually, firms can develop rent-yielding activities such as improvement of trade relations with customers and a greater ability to distribute their products thanks to the possibility of selling on-line. It seems reasonable to assume that largest firms with a lot of resources (notably financial and human) would be in the best position to exploit the business opportunities created by Internet technologies. Secondly, we can consider models of technology diffusion such as epidemic models, information cascade models and probit models (Geroski, 2000). In epidemic models and information cascade models, it is supposed that the decision of adopting a new technology is influenced by the diffusion of information concerning this technology given by primary-adopter, the

¹⁶ The functions included in these two studies are somewhat different. In the first one, the functions included are: catalogue of products, detailed product description, on-line ordering facility, feedback forms other than e-mail address, on-line job offer, multilingual site and site referenced on common Internet engines. In the second one, in addition to the presence of the catalogue of products, on-line ordering facility, on-line job offer, multilingual site, we find firm presentation, intranet, collection of customer information, after sales support, traceability of products, order processing, on-line payment security and a regular updating.

¹⁷ Chappell & Feindt (2000) realised a best practice analysis of e-commerce for 89 SMEs located in 17 countries and studied in July 1999.

“more able”¹⁸ firms. Because the adoption implies large sunk costs in terms of investment in the technology and in the organisational changes induced, the firms need to be adventurous and less risk adverse to adopt a technology with hypothetical benefit. But these models give no more information concerning the characteristics of those “more able” firms. The probit models or rank effects models (Karshenas & Stoneman, 1993) enhance these approaches and stress on the importance of individual characteristics in the adoption process, particularly resources measured generally by the size of the firm. Such models conjecture that firms have different gross returns from the use of new technologies. Consequently, firms with large resources are in a better position to adopt and are less affected by the uncertainty induced by ICTs adoptions and the reorganisations implied. Thus, such enterprises are less risk adverse and don’t need much information on the technology to adopt. This approach also permits to understand the inertia observed when we looking at the diffusion of ICTs and called usually the “wait-and-see” attitude. Many firms wait to adopt a new technology until profitability is demonstrated. Limited capital is generally used as one of the best explanation to the relative lack of investment in ICTs by small firms (La Rovere, 1998; Sadowski *et al.*, 2002).

In empirical studies, the size of the firm has been held as a measure of its resources, but other variables introduced below can be considered as alternative proxies for this characteristic. Concerning the size, the effect on the website setting up, the site content and e-commerce practice is not well-defined. All the studies we are aware of introduced the size of the firm as an explaining variable but the results don’t display the same results. Effectively, concerning the ownership of a website, while the analysis conducted by Sadowski *et al.* (2002) finds no significant effect, others find a positive influence of the size (Dholakia & Kshetri, 2004; Martin & Pénard, 2005). Concerning both the choice of the functions the site provides and the e-commerce practice, none of the analyses find a significant effect of the size. But a best practice analysis of e-commerce by Chappell & Feindt (2000) highlights a possible negative impact of the size. The explanation proposed is that small firms have greater flexibility and ability to adjust to

¹⁸ “The total population of potential users is composed of ‘more able’ and ‘less able’ firms, and the former start earlier and diffuse information faster” (Geroski, 2000, p.608).

changes in the market and are this way more efficient in setting up a new business channel.

Other variables like the affiliation to a group, human resources, the age of the firm, and communication requirements (i.e. the need to communicate with different units of the firms, partners, and potential customers) are found in empirical studies and can also be proxies for the financial and human resources.

Regarding the effect of belonging to a group, it seems to be ambiguous. According to Lucchetti et Sterlacchini (2004), *“independent firms decide more quickly whether to adopt a new technology or not, but (...) firms affiliated with a group experience less financial constraints and thus tend to be less risk-averse in the adoption decision”* (p.166). In empirical studies, the setting up of a website seems to be positively correlated with the membership of a group (Martin & Pénard, 2005). In the investment in an advanced website, some studies highlight a negative influence of the group (Lucchetti et Sterlacchini, 2004) while others stress on a significant and positive influence of this characteristic (Martin & Pénard, 2005). Concerning the study of e-commerce practice, few studies carry on an analysis, and when it is the case no effect of the group is displayed (Martin & Pénard, 2005).

It seems reasonable to think that human qualifications are associated with faster adoption of ICTs, thanks to an easier adaptation of qualified employees to technological progress. Lucchetti et Sterlacchini (2004) insert this factor in their study of factors influencing the richness of the site and find a positive impact. According to Chappell & Feindt (2000), the qualification of managers seems to be important, because they need to be able to cope with growing opportunities associated with e-commerce.

Concerning the age of the firm, the effect is ambiguous: on the one hand, old firms have a priori more resources than young ones, but on the other hand, as the age of the firm is an indication of its date of creation, young firms may have been created to exploit the opportunities of Internet. Martin & Pénard (2005) shed light on this ambiguity: relatively old firms (compared with enterprises less than 10 years old) have a great probability to create a site, but the age of the firm seems to be a handicap both in the choice of creating an advanced website and in the choice of developing e-commerce.

Finally, the need to communicate with different units of the firms (Martin & Pénard, 2005), or with potential customers (Sadowski *et al.*, 2002), only introduced up to now in the first stage of the analysis of websites, seems to have a positive impact. It appears

that multi-unit organisations have a huge potential to networking and have consequently a higher probability of ICTs adoption.

Hypothesis 1. *As the resources owned by the firm decrease the uncertainty concerning investment returns, they should have a positive influence on the website setting up and use.*

2.1.2. Business characteristics

The creation and use of the website seem not only affected by the resources a firm possesses, but also by the characteristics of its business. As the business influence depends on the ICT studied, there is no theoretical work on the subject we focus on. According to Sadowski *et al.* (2002) or Chappell & Feindt (2000), some sectors like services and technology-intensive sectors (notably computing) are on the forefront of adopting and using Internet technologies compared to traditional sectors such as retailing. Thus, firms belonging to services and technology-intensive sectors have higher probabilities to create a website. Moreover, as the OECD highlights, “[t]he products of services like tourism, which are intangible in nature and have a high information content, are well-suited for purchase over the Internet” (OECD, 2004, p.34). For Santarelli & D’Altri (2003) digitised or delivered on-line products facilitate e-commerce. According to Chappell & Feindt (2000), products that fit with lifestyles, aspirations of users have, at least for Business to Consumer, a high probability to be purchased on-line. As the characteristics of the product have an influence on the creation of a new business channel, it also influences the first stage, i.e. the creation of a site.

In empirical studies, the sectors are rarely introduced. When they are, no significance is most often displayed¹⁹, as in Sadowski *et al.* (2002) for the creation of the site or in Lucchetti & Sterlacchini (2004) for the study of website content. To characterise the business of the firm, empirical studies sometimes introduce the presence of the firm on foreign market and the dependence with one customer. Lucchetti & Sterlacchini (2004) find, in their analysis of website content, that being an exporter and having commercial branches abroad influence both significantly and positively the richness of the site. In

¹⁹ Except in Martin & Pénard (2005), where the membership to industrial sectors compared to agro-food sector has a positive influence on website setting up, whereas retailing, transportation and professional services have non significant coefficient.

order to know whether or not preferential partnership with a customer is a brake on website and e-commerce deployment, Martin & Pénard (2005) test the influence of this dependence on the two last stages of website use. The regressions display no significant influence of such a dependency.

Hypothesis 2. *Selling products that fit lifestyles of users on the territory and abroad should influence positively the probability of setting up a website and of using this site in an informative and/or a commercial way.*

2.1.3. Attitudes and past experiences with ICTs

The cost of adopting a new technology has to include the costs associated with developing the new competencies needed to use correctly and to exploit for the best the new technology. These costs can be reduced if the firm has already some ICT competencies. Firms possessing specific competencies thanks to prior technologies use are more able to adopt new technologies. Moreover, thanks to different skills and experiences accumulated by the firm with prior ICTs adoption, it permits the firm to have an ICT culture and also a better perception of technologies benefits. Consequently, the firm is less risk adverse to new investment in ICTs. Finally, it develops an in-house expertise, which avoids the firm to have to hand over responsibility for website creation, maintenance and updates to another firm. Thus, if the firm chooses to externalise, it resigns control over its website notably for updates, which can be a failure factor which contributes to website closes (Chappell & Feindt, 2000). Beyond the development of an ICT culture, the website setting up, and even more a commercial use of the site, needs to be associated with a business reorganisation to improve the performance of the firm. Thus the website need to be implemented as a part of a global strategy concerning the future development of the firm to ensure the success of the investment. In order to strengthen reactivity to customers' demands, the firm should have to adopt a flexible workplace organisation. While Milgrom & Roberts (1995) only consider two organisations of a firm, i.e. "mass production" and "modern manufacturing", Teece (1996) suggests that partial adoption of ICTs and new organisational practice is possible. So Bocquet and Brossard (2003) conclude that "[t]he diffusion of a technology can be a result of the diffusion of some new organizational practices and conversely" (Bocquet & Brossard, 2003, p.3).

The empirical literature provides few tests of the impact of past ICTs use and of the introduction of tools that make more flexible the production and distribution processes. Dholakia & Kshetri (2004) find a positive impact of a composite indicator of prior technologies use²⁰ on both the stage of website setting up and the one of e-commerce practice. Martin & Pénard (2005) introduce some ICTs in the analysis of website creation and find that prior adoption of ICTs²¹ has a positive influence on this stage. Furthermore, the probability of investing in an elaborate website increases with the quality of the Internet connection (Digital Subscriber Line (DSL) connection or leased lines), but the quality of the Web access has no influence on the investment in an e-commerce channel. Moreover, Martin & Pénard (2005) introduce in the two last stages some ICTs that can be interpreted as tools that make more flexible the organisation of the firm, such as Electronic Data Interchange (EDI) and Enterprise Resource Planning (ERP). The results stress on the positive impact of the existence of a technology that optimises the production and distribution processes such as EDI on the investment in an elaborate website. Furthermore, in the study of the factors that influence the setting up of a commercial website, the ERP, a technology that increases organisational flexibility and reactivity, has a positive influence.

Hypothesis 3. *The ownership of specific competencies thanks to prior ICTs use, and of technologies that make the production and distribution processes more flexible should influence positively the adoption of a website and the commercial use of the site.*

2.2. External factors

The literature on ICTs adoption has underlined different external factors we classify into four groups.

2.2.1. Competition

According to Markides & Geroski (2004), the website opportunities in terms of commercial applications take the form of a “strategic investment”. Actually, on the one

²⁰ This composite indicator is composed of phone line, computer, fax machine, email account and toll free number.

²¹ The ICTs introduced are local area network, pocket digital agenda, Internet access and mobile phones.

hand, it implies a depreciation of existing advantages of established firms because it creates an alternative retailing channel that notably permits entry of “pure players” (like Amazon). But on the other hand, Internet has a minor effect on consumer habits, because it appears as a complementary channel for purchasing products (Martin & Pénard, 2005). The threat of entry encourages existing firms to adopt new technologies in order to keep their market power, to pre-empt as many rivals as possible thanks to the creation of an artificial entry barrier. So we can compare such a strategy to the “Top Dog”²² of Fudenberg & Tirole (1984). In spite of a positive effect of competition on technology diffusion, it is possible that too much competition slows the diffusion process because it limits the possibility of extracting profits and high returns as the density dependence model conjectures (Geroski, 2000; Bocquet & Brossard, 2003).

In this connection, a market in which the competitive pressure is low (and so are the risks of being excluded from the market) the new technology has a high probability of being adopted and used. That’s why, a niche market can be a good place to experiment with new technology and new business model (Chappell & Feindt, 2000).

In empirical studies as well as in the theoretical literature, it seems to be difficult to grasp the threshold that makes a distinction between the encouraging competition and the “too much” competition. As measures of competition like concentration ratio (i.e. the sum of the market share for the four biggest firms) are global measures of the intensity of competition, they don’t capture this distinction (Martin & Pénard, 2005). It appears that the investment in an elaborated website or in a new business channel is negatively influenced by a high competition. This result implies that too much competition has a negative influence on the investment in the website. Finally, as far as we know, no empirical study has been conducted on the impact of evolving on a niche market on the probability of creating a website and using it.

²² This strategy implies an investment in order to eliminate existing or potential competitors.

Hypothesis 4. *Threat of entry should influence positively the investment in a website but too much competition should have a negative impact.*

2.2.2. Local incentives

Before the decision of setting up a website and the choice of the degree of involvement, the firm needs information about the efficient website investment and the returns implied. Such information can be directly transmitted from current users who experienced the technology. This diffusion process by current users can perhaps be involuntary. Actually, information given by the success or failure of rivals adoption might influence potential users. Information cascades models show that it can be optimal for a firm, having observed the actions of others, to follow the behaviour of the preceding firms without regard to its own information on the efficiency of the technology (Geroski, 2000; Bocquet & Brossard, 2003).

In empirical studies, some papers seek to analyse the impact of the competitors' behaviours on two of the three stages we shed light on. Concerning the decision of a website creation, Sadowski *et al.* (2002) introduce the actions of competitors but don't find a significant impact. Dholakia & Kshetri (2004) also analyse the actions of competitors as a pressure on the firms adoption motivations: they consider the perceptions a firm have about the uses of the Internet by competitors and they distinguish three uses concerning customer service, environmental monitoring and market research. The results display that the uses of Internet by rivals to improve customer services and for the supervision of the environment have a positive influence on the website creation. Dholakia & Kshetri (2004) introduce the same variables in their study of e-commerce setting up and find that a use of Internet to improve customer services by competitors has a positive influence. The characteristics of the territory where the firm is located can be introduced as a proxy for the intensity of communication between firms: for example, a location in a urban area can perhaps have a positive impact on website creation and use. This variable has been introduced in Martin & Pénard (2005), but the results show non significant effect of a urban location on the three stages of website setting up and investment.

Hypothesis 5. *ICTs adoption and use by rivals should be positively associated with the firm adoption of website and use.*

2.2.3. Market power

Thanks to the Internet, firms have opportunities to reach a higher number of potential customers but the website investment still remain risky because the returns are not guaranteed. These risks associated with this investment are a priori less important for well-known firms. According to OECD (2004), *“on-line clients view recognition of a brand or company name as an indicator of a firm’s credibility just as they do off-line”* (p.26). Thus, the brand image permits to avoid price competition or to maintain a value-for-money image²³ when the firm chooses to sell on-line (Brynjolfsson & Smith, 2000). As many customers still don’t choose the lowest price and stay stick with a particular brand, well-known firms don’t support a lot of risks. Studies on price competition on the web, such as Shankar, Rangaswamy & Pusateri (1998), show that the brand decreases consumer price sensitivity, which confirms the incitement for well-known firms to invest in a website and in an e-commerce channel.

As far as we know, no empirical study has introduced a measure of brand and renown of the firm to analyse their impact on the website setting up and the involvement in the use of the site.

Hypothesis 6. *The ownership of a brand should have a positive influence on website creation and use.*

2.2.4. External support

Before the adoption of a new technology, the firm needs information on the efficiency of the technology and on potential returns. These information can be fostered, for example, by business partners or by government support programs. Particularly, governmental policies can encourage the diffusion of website use and e-business practice thanks to the creation of *“a favourable business environment with fair and predictable rules”* (OECD, 2004, p.35). These actions undertaken by authorities can stand for the “central source” described in epidemic models (Geroski, 2000). This central source transmits

²³ *“Contrary to the common view that the Web is populated with volatile customers, the Web is actually a very ‘sticky’ space”* (Feindt, Jeffcoate & Chappell, 2002, p.58).

information to potential adopters. These information reduce the search costs of the firm and, as a result, can induce a faster adoption of websites and beyond encourage the use of this Internet technology.

Sadowski *et al.* (2002) assume that a support from partners can influence website setting up, but their empirical investigations don't highlight a significative impact. Martin & Pénard (2005) test the influence of a preferential partnership with a supplier on elaborated website and e-commerce deployment. The regressions display a negative influence of a dependence with a supplier in the analysis of the investment in an elaborated website. Poussing (2005) analyses the impact of the awareness of governmental initiatives undertaken in Luxembourg on the setting up of an e-commerce website. The empirical study introduces different initiatives like some actions instigated by European directives (i.e. the knowledge of electronic signatures, the code of electronic commerce, the "electronic commerce" committee, the Luxembourg office of accreditation that supervises the quality policy instigated by the code of electronic commerce, *cf. infra*) and the most famous Luxembourg label that promotes e-commerce by developing customers trust and assuring the security of on-line transactions. The results display that only the quality label has a positive influence on the investment in an e-commerce website. This result confirms that confidence in an on-line retailer is essential to conclude transactions.

Hypothesis 7. *External supports like government programs should influence positively the diffusion process of websites and e-commerce.*

We want to test those hypotheses using data from firms located in Luxembourg. The next section describes the database.

3. Data

In the framework of eEurope action plans, EU countries, supervised by Eurostat, have conducted on an annual basis a survey on enterprises' access to ICTs and their use, and on e-commerce, since 2001. The aim of the project "ICT usage by enterprises" is to have comparable EU-level data to analyse the development of the Information Society.

The data used in this study²⁴ relates to enterprises located in the Grand Duchy of Luxembourg. They were collected by the CEPS/INSTEAD²⁵ in collaboration with the Statec²⁶ and received financial support from the Community. The survey was sent by post, in the first half of the year 2005, to all enterprises employing 10 persons and more, and exercising its activities in all the sectors of the economy except the financial one²⁷. Therefore, 2472 enterprises were surveyed and 1161 answered (which entails a 47% response rate). The questionnaire takes over the Community one and inserts new items to analyse particularly the contents of firms' websites and the impact of government initiatives to promote ICTs adoption and e-commerce. The data gives some information about the characteristics of the firm surveyed and covers computers and communication technologies use, Internet access and use, e-security and sales, purchases via the Internet or other computer networks. As the questions concern the adoption and use of ICTs, the firms which are not equipped with computers (that is to say 29 firms) didn't need to respond these questions and consequently are excluded from the following of our study.

While for computerised firms located in Luxembourg the adoption of Internet reaches a rate of 95% in 2005 (96% in the EU-15), the rate of websites creation by firms employing 10 persons and more is smaller in the EU countries with a penetration rate of 67% in 2005 and in particular in the Grand Duchy where the rate is about 62%²⁸ (i.e. 698 of the respondents in our sample). Beyond the Internet presence of firms, the aim of our analyse is to focus on the nature of firms' websites. The data we use provide information on the content of websites. The survey gives details on most functionalities a website can offer to customers and suppliers.

²⁴ Appendix 1 offers a full description of the survey data.

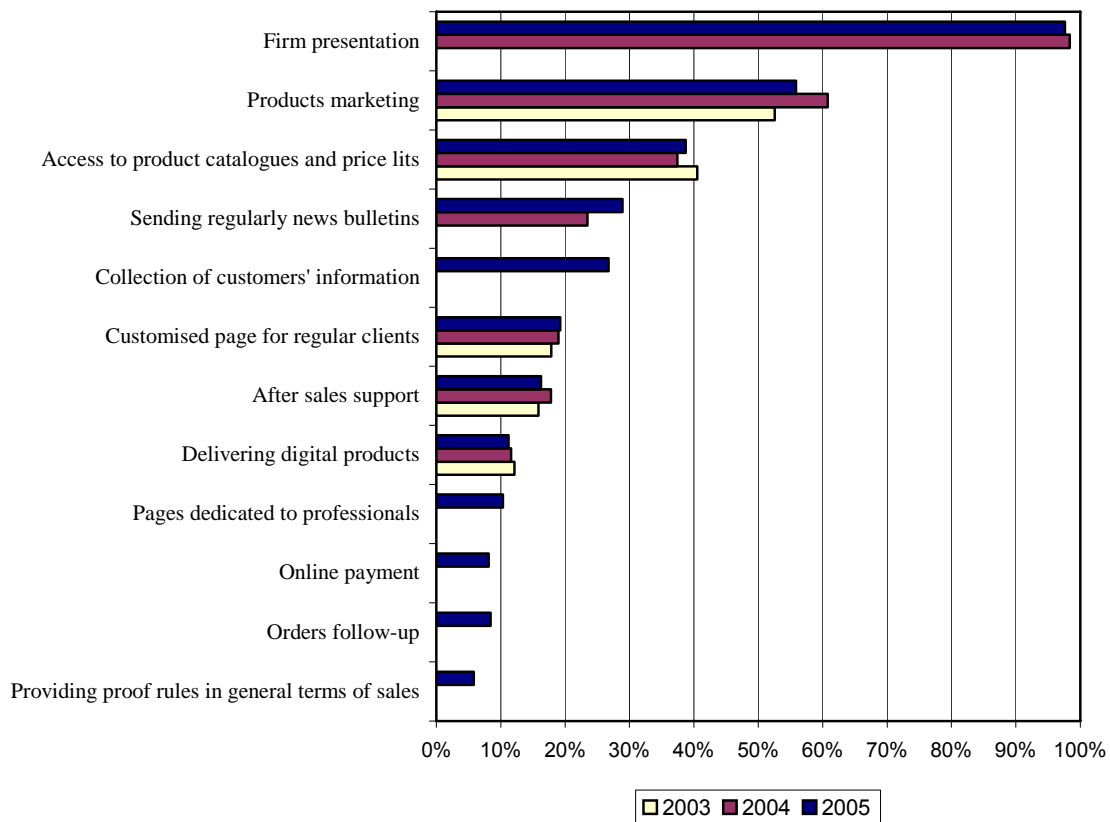
²⁵ CEPS/INSTEAD: Centre d'Etudes de Populations, de Pauvreté et de Politiques Socio-Economiques / International Networks for Studies in Technology, Environment, Alternatives, Development.

²⁶ The National Statistical Office of Luxembourg.

²⁷ Since enterprises from the financial sector received a specific questionnaire different from other economic sectors, they were excluded from the data.

²⁸ Even though the Luxembourg is behind the EU-15 average in 2005, this phenomenon is recent. Effectively, in 2004, the Web presence of enterprises was around 62% both in the Grand Duchy and in EU-15.

Figure 1. Websites functionalities



Note: firm presentation is provided in near 98% of the sites sampled.

As Figure 1 shows²⁹, the presentation of the firm is naturally the most provided function and is available in almost the whole sites. The website not only can offer the possibility of setting up a new retailing channel but can also be a way to canvass at a low cost new customers for the physical retailing channel. If we study in detail the second most frequent function (firms' products marketing), we notice that, for the 56% of firms which offer this function, about 73% received at least one order via Internet in 2004³⁰. For the remaining percentage, the site represents a way to prospect customers, and to dynamise sales made in traditional stores. The availability of the product catalogue is also one of the most provided function since the introduction of the description of sites in the Luxemburger project "ICT usage by enterprises", but it appears more as a function

²⁹ When prior questionnaires introduced the same functions, as the 2005 wave, in order to describe the nature of the site we provide information on the evolution of the content.

³⁰ Because the survey is conducted in the beginning of the year, the data on Internet sales and purchases concerns the year before.

to inform customers than a commercial one. Even if these functions show an interest for firms concerning e-commerce, on-line payments, after-sale support and a process of following-up orders are not well-developed while they are important for the success of e-commerce.

Because the development of e-commerce is one of the most important priority and challenge for nationals and European authorities, we are going to look into on-line commerce in the Union and particularly in Luxembourg. The Grand Duchy is a country in which the on-line purchasing is important both for enterprises and individuals. Effectively, 41% of enterprises declared to order on-line products or services during 2004 and 34% in 2003 against a EU-15 average near 30% in 2003 and 2004. Concerning individuals, according to the Statec (2005), 32 % of the population used Internet to buy or order on-line in 2004 (18% one year earlier), which put the Luxembourg on top of the Union in terms of household on-line trade. Indeed, at the EU-15 level, we can notice that 21% of the population bought or ordered on-line in 2004 and 15% in 2003.

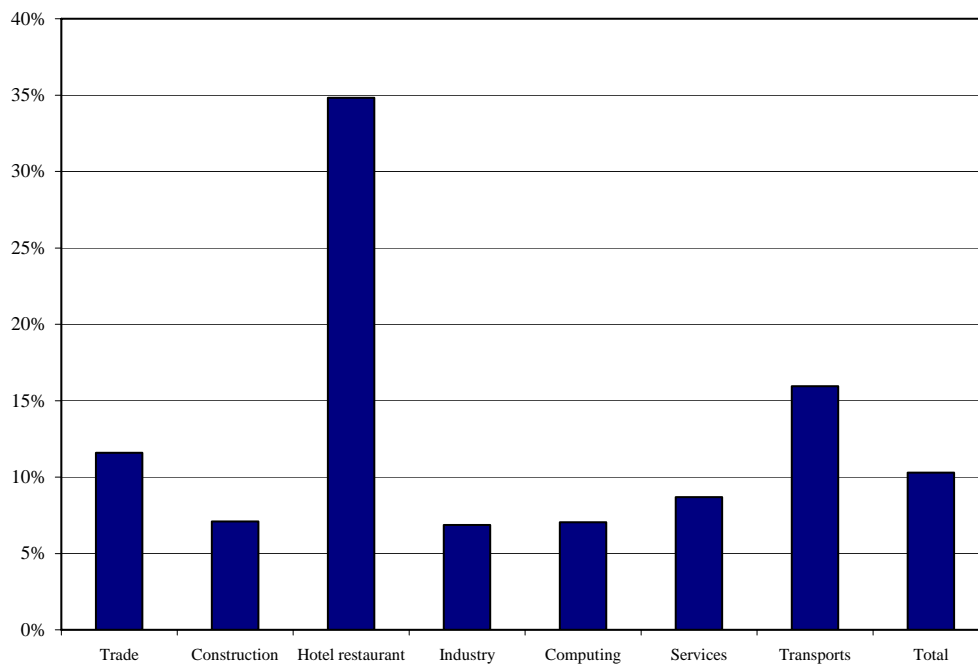
So, there is a real interest for on-line commerce in Luxembourg, but it does not result in a great development of direct on-line sales by enterprises. The Grand Duchy is still a very opened country concerning trade, and an important part of the purchases made on-line by enterprises and households are made abroad. Consequently, only 10.3% of firms received orders via Internet in 2004 and 11% in 2003, against 13% in the EU-15 in 2004 and 15% in 2003³¹. If we examine in details e-commerce, it exists sector-based differences, but because of a lack of data availability concerning purchases made by firms, we can only provide information on Business to Consumer (B to C) on-line trade. According to the Statec (2005) the products which are the most purchased on-line are books and magazines for which 59.2% of Internet users³² declared at least a purchase in the first term of 2004. Trips come after with 47.7% and entertainment tickets with 33.5%. Pieces of clothing are purchased by 21% of Internet users. Then, CDs and DVDs of music and films are bought by 30.8% of Netsurfers. Software and electronic

³¹ If we limit the analysis of on-line sales to firms owning a website with the function of marketing the products, the percentage of firms which received on-line orders was about 23 in 2003 and 24.30 in 2004, but there was no comparison data available at the EU-15 level.

³² The interest population is Internet users between 16 and 74 years.

equipment are both bought by a little more than 20% of Internet users, and hardware equipment by 10.5%. Therefore, it seems that, at least concerning B to C, the sectors of commerce, spare time (like hotels and restaurants) and computing can exploit easily the dynamism of e-commerce. On the one hand, the sector of hotels and restaurants already exploits the opportunities given by e-commerce. Effectively, we can observe in our sample that nearly 35% of the firms exercising its activities on this sector received on-line orders during 2004. On the other hand, concerning firms exercising on the sectors of trade and computing, few of them received orders via Internet as Figure 2 displays, while the e-commerce seems to be important in these sectors.

Figure 2. On-line order receipts by sectors

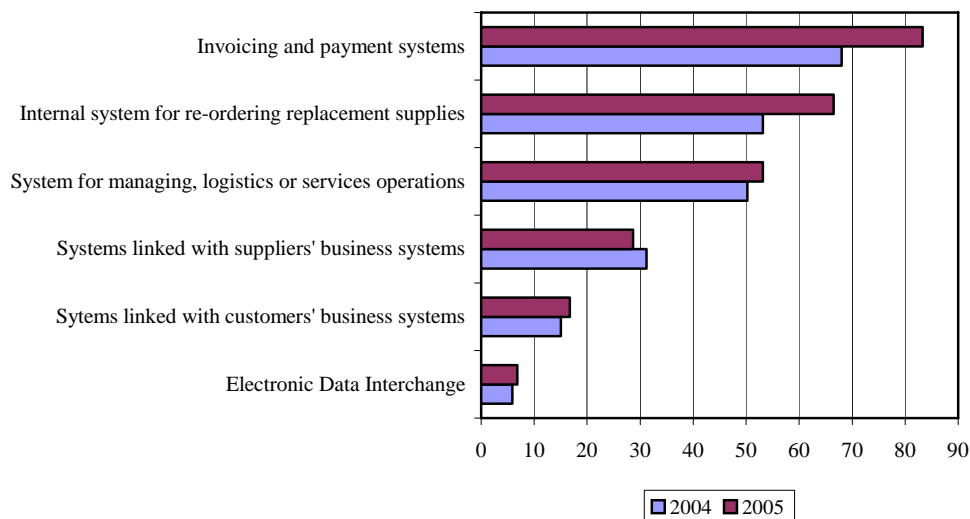


Note: on average, 10.3% of the firms sampled received at least an order via Internet in 2004.

Another priority for the Commission concerning e-commerce is the integration of this new distribution channel in the global strategy of firms, which implies the reorganisation of firms thanks notably to the adoption of management ICTs. The adoption of these ICTs effectively increases: 47.9% of firms in our sample have introduced management ICTs in 2005, against 43.4% one year before. As Figure 3 shows, these technologies are above all linked with the invoice system, the restocking one and logistic one. Associated

with the website, such ICTs can enable the firm to reduce retailing costs. Moreover, because they permit to react rapidly to customers requirements, the firm can accelerate its distribution process in order to come up to customers' expectations and, consequently, can increase its markets shares and revenues.

Figure 3. Management ICTs (% of firms adopting system to manage orders)

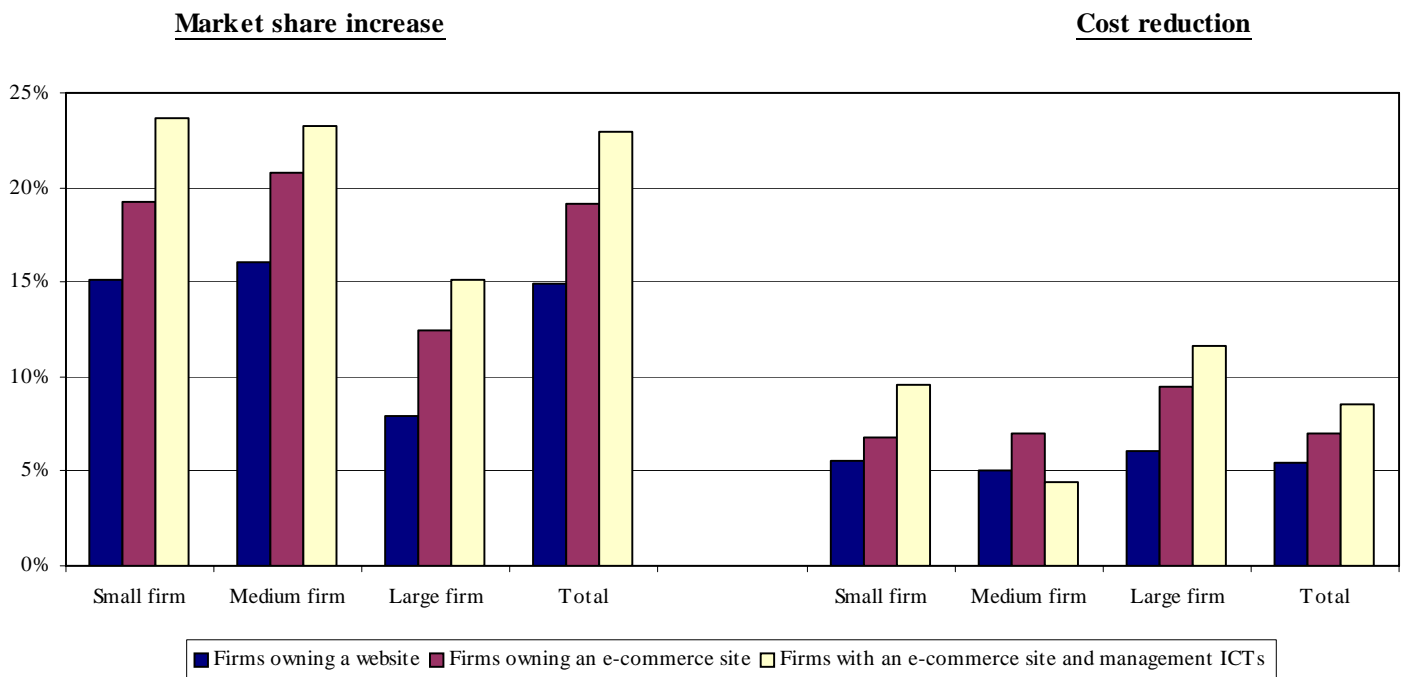


Note: in 2005, 83% of firms which introduced management ICTs chose to link these to invoicing and payment systems.

Items in the survey enable us to give some information concerning both market share increase and production and/or distribution costs reduction for firms with a website. For these firms, the advantages given by the website seem to locate more in the side of market opportunities than in the side of costs reduction. Effectively, for 15% of these firms the website permits to increase market share, while for only 5.5% it allows to decrease production and/or distribution costs. In order to analyse the importance of these two contributions of the website according to the implication of the firm both in e-commerce and in reorganisation, Figure 4 makes the link between integration of the website in the strategy of the firm and the consequences on market shares and costs reduction. Figure 4 shows this way that, more the firm gets involved in e-commerce and in the integration of this new distribution channel in its strategy via a reorganisation process, more the firm seems to benefit from the progress introduced by Internet. Moreover, concerning the increase of market share, it seems that both small and

medium-sized firms take more advantages than large ones, and it seems to be the opposite in the side of costs reduction.

Figure 4. The contributions of the website in the day-to-day life of firms



Note: 19% of firms owning an e-commerce website consider that their site contributes to increase market shares and near 7% consider that it permits to reduce costs.

4. Introduced variables

4.1. Dependent variables

Our first study is devoted to the analysis of the main determinants of the decision to invest in the creation of a website. Therefore, the dependent variable is a binary one taking the value 1 if the firm possesses a website and 0 otherwise. As said before, 698 firms in our sample own a website, that is to say 62% of the firms sampled.

In our second analysis, we focus on firms owning a website and study the characteristics of these firms depending on the use they make. Effectively, the website gives the firm possibilities to attain two main targets: inform customers and create a new

business channel. Firms which use Internet to diffuse information on their activities do not have necessarily the same characteristics as the ones which create a new means to distribute their products via Internet. We distinguish the different functionalities the site provides between those used to inform customers and those introduced to create a on-line business channel, and we create three ordered variables capturing the intensity of the involvement in the use of a website.

The first one (information score) covers the uses of informing customers, i.e. six functions available on the site: a presentation of the firm, an access to product catalogues, customised page for regular clients, pages dedicated to professionals, the possibility of sending regularly bulletins on the current affairs of the firm, and finally the capacity of collecting information on Netsurfers visiting the site. Always in the perspective of understanding the involvement of the firm in the use of the website, we integrate the frequency of the update. The firm gets one point each time its website provides one function and we add no point if the update is made less than once a month, 1 if the update is made at least once a month and 2 if the update is made more than once a week.

The second variable (e-commerce score) groups together the uses linked to the creation of an e-commerce distribution channel. This score encompasses six functions: the marketing of the products, the delivering of digital products, the possibility of paying on-line, the diffusion of proof rules in general terms of sales, the access to the after sales support service department, and the possibility of following-up orders. We introduce the update in this variable in the same way than in the information score.

The last variable (total score) is created for a comparison with the others scores and makes no distinction between the needs met by the different functions provided in the site. So this variable makes the addition of the twelve functions a firm can provide on the website and introduces the frequency of the update.

In conclusion, the variables are constructed like this:

$y_i=0$ if no function available on the site and the update is made less than once a month;

$y_i=1$ if only one of the functions is provided on the site and the update is made less than once a month;

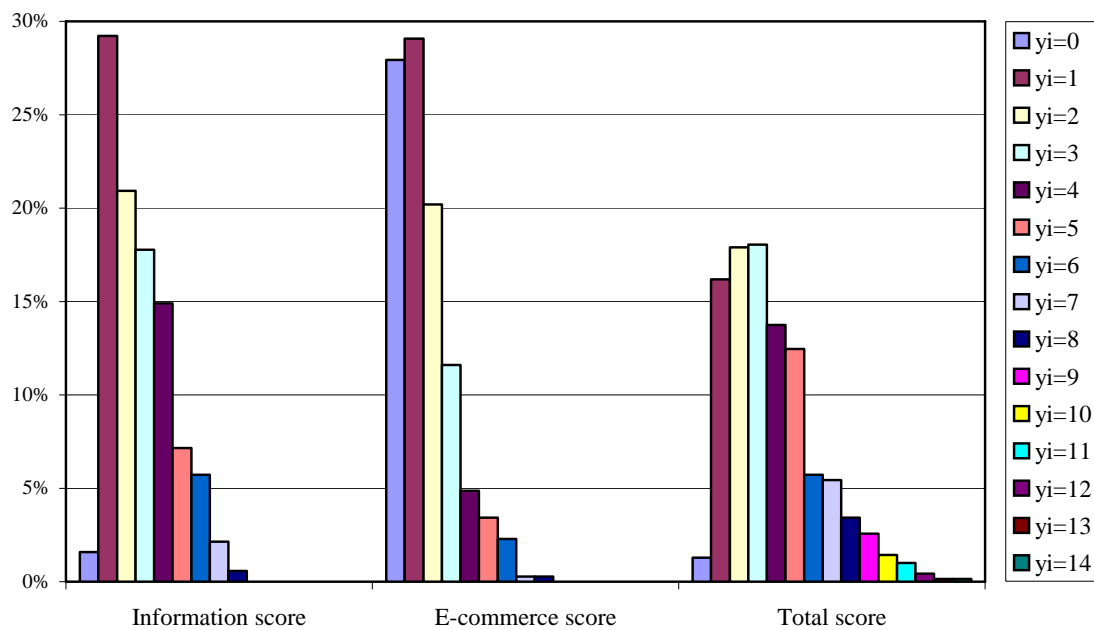
$y_i=\dots$;

$y_i=m$ if all the functions are provided and the update is made more than once a week.

$m=8$ for the information score and the e-commerce score and $m=14$ for the total score.

Figure 5 displays the distribution of these scores in the sample. As Figure 5 shows, there are a limited percentage of firms with $y_i=0$ in the information score and the total score compared with the e-commerce score, where more than 25% of firms owning a website do not propose at least one e-commerce function. The total score is on average 3.81. The information score is on average 2.74 while the e-commerce score is on average 1.59.

Figure 5. Description of the scores



Note: 29% of firms owning a website obtain 1 point for both their information score and their e-commerce one. 16% obtain 1 point for their total score.

In a third analysis, we concentrate on an important concern for European authorities: the need of reorganisation for a firm which wants to succeed in e-commerce. So we analyse the link between the creation of an e-commerce website and the setting up of ICTs which allow the firm to accelerate its production and/or distribution processes. On the one hand, we define an e-commerce website as a site providing transactional functionalities, i.e. a site with at least one of the functions introduced in the e-commerce

score³³. On the other hand, as a proxy for the reorganisation a firm can engage, we use both the adoption of at least one of management ICTs³⁴ introduced in the survey and those ICTs taking one-by-one.

4.2. Explanatory variables

In order to determine which factors influence the website creation behaviours, involvement in the use of the site, and the decision to reorganise the firm via the adoption of management ICTs, we introduce different variables. As described previously, explanatory variables are split into two groups: internal factors and external ones.

4.2.1 Internal factors

First, we want to analyse the influence of the resources possessed by the firm. So we introduce variables capturing the size of the firm, its organisational structure and a proxy for human resources capabilities³⁵. In order to pick up the effect of size, we use the classification of the European Union concerning small, medium-sized and large firms. Therefore, we create three dichotomous variables concerning the number of employees (10-49, 50-249, 250+). To measure the influence of the organisational structure, we introduce two variables, the first taking the value 1 if the firm has more than one legal unit in its organisation, and the second taking the value 1 if the firm is a subsidiary of a group. Because we don't have information on the qualifications of managers and of the workforce, we introduce a proxy for human capabilities to use ICTs. This proxy is, in fact, a measure of the possibility for employees to attend ICTs training. These courses are notably devoted to a better use of operating systems, software, Internet, etc.

Secondly, we insert variables to characterise the business in which the firm operates: we introduce either sector of activities established across Luxembourg³⁶ or the nature of customers (the dichotomous variable takes the value 1 if customers are predominantly

³³ For the record, transactional functions are: products marketing, digital products delivering, on-line payment, the diffusion of proof rules in general terms of sales, after sales support and/or order monitoring.

³⁴ For the record, management ICTs are: invoicing and payment systems, internal system for re-ordering replacement supplies, system for managing, logistics or services operations, systems linked with suppliers' business systems, systems linked with customers' business systems and electronic data interchange.

³⁵ As we have no information concerning the date of the setting up of the firm, the age of the firm is not introduced in our analysis.

³⁶ The different sectors are: industry; construction; trade; hotels, restaurants and cafés; transports; computing and services. As said before, the financial sector is excluded from the "ICT usage by enterprises" project.

households), depending on the specification. Then, we introduce a variable to analyse the influence of being an exporter. Because of the country size and so of a high probability of making trade with foreign customers, we create a variable taking a value between 0 and 100 in accordance with the percentage of the firm's sales realised abroad. Finally, to test the effect of a dependence with a customer, another dummy variable indicates whether the firm concludes over 30% of its sales with a single customer.

Thirdly, we introduce variables for the level of adoption and use of two types of technologies: common communicant ICTs such as local computer network, Intranet, etc., and management ICTs presented above. Depending on the specification, we insert these ICTs one-to-one or as a composite variable. We use two composite indicators, one for common ICTs and one for management ICTs. The indicator takes the value 0 if the firm has no ICT proposed in the survey, and 1 or more depending on the number of technologies owned.

Another variable is introduced in the regressions concerning the sample of firms owning a website. This variable characterise the age of the site. More precisely, it is a category variable which is dependent on the date of the setting up of the website.

4.2.2. External factors

First, we insert two groups of variables characterising the competition on the market. On the one hand, to capture the perception of the firm concerning the intensity of competition on its market, we create three dichotomous variables dependent of the intensity perceived: limited, intense and very intense. On the other hand, to have information on the importance of firm's position on a market, we insert four dichotomous variables (niche, follower, challenger and leader). Particularly, the variable "niche" takes the value 1 if the firm develops a niche on the market, i.e. if it exercises its activities on a good place to experiment with a new technology and a new business model.

Secondly, we introduce a variable to define the local incentives. As Luxembourg is a little country (the most distant town and the capital city are 70 kilometres away from each other) we don't think appropriate to introduce a variable characterising a location in a urban area. That's why, we insert a dichotomous variable capturing the setting up of an e-commerce website by main competitors. Thanks to this variable, we want to measure the influence of behavioural imitation.

Thirdly, in order to grasp the impact of the renown of the firm on creation and investment decisions, we create three binary variables (local, national and international), in accordance with the perception the firm declared concerning its brand and trade name. Finally, we want to study the impact of external support the firm can have when it has to choose between investing or not in a website and in the use. So we introduce a dummy variable that takes the value 1 if the firm transacts over 30% of its purchases with a single supplier, and 0 otherwise. After, we include different European and Luxembourg initiatives designed to encourage firms to adopt and use ICTs and e-commerce and implemented within the scope of eEurope action plans. An item in the survey lists the main public authorities actions present in the Grand Duchy. As for the analyse of prior ICTs use, we insert these initiatives one-to-one or as a composite variable depending on the specification. Eight public actions are included in the composite indicator which measures the intensity of knowledge concerning the different initiatives. These actions have different goals. Some public actions seek to promote use of ICTs thanks to the creation of communication platforms like "Handwriek-online" provided by the guild chamber or the portal "entreprises.lu"³⁷ provided by the government. These platforms aim to share out information, knowledge on best practise between firms, administrations, guild chamber and chamber of commerce, in order for firms to save time, money and efforts when they choose to adopt new technologies. There is another portal developped by the Ministry of Economy and Foreign Trade, focusing on information security. This portal named CASES³⁸ (Cyberworld Awareness Security Enhancement Structure) allows firms to get used to the theoretical side of network security and practical applications. Concerning the development of e-commerce there are many initiatives

³⁷ For more information on the platform "Handwriek online", see: <http://www.chambre-des-metiers.lu> and on the portal "entreprises.lu", see: <http://www.entreprises.public.lu>.

³⁸ <http://www.cases.public.lu>

taken by the Luxembourg. Some actions are stimulated by the transposition of European directives. We find first the law related to Public Key Infrastructure (PKI) or electronic signatures adopted on September 8th 2000 and derived from an European directive³⁹. This law was set up to assure security for trade, electronic administration and confidential data transfer. From this point of view, the government created in June 2001 the “electronic commerce” committee linked with the Ministry of Economy and Foreign Trade in order to verify the use of electronic signatures. Secondly, we find the code of electronic commerce. This code recovers both national and European legislation concerning e-commerce. Thanks to the law adopted on July 5th 2004, the Grand Duchy is in accordance with the European plan relating to electronic commerce. It allows notably to clarify protective rules concerning customers and to add a point to authentication organisms that allocate quality labels. The Luxembourg Office of Accreditation⁴⁰ (OLAS) was created to supervise the quality policy established by the code of electronic commerce. OLAS accredits notably the organisms that manage and deliver quality certificates and labels. The most important label concerning quality and security of e-commerce website is called “Luxembourg e-commerce certified”. The attribution of this label is subordinated to an audit carried out by an organism accredited by OLAS. This label promotes e-commerce by developing customers trust and confidence, and assuring the security of on-line transactions. Moreover, it offers guarantees concerning storage and treatment of information collected on customers.

³⁹ 1999/93/EC (Official Journal of the European Communities, 2000).

⁴⁰ <http://www.olas.public.lu>

5. Econometric results

5.1. The determinants of a website setting up

Our first analysis is dedicated to the study of a website creation decision by a firm thanks to a binary Probit model presented in Box 1.

Box 1. Methodology of the binary Probit model

The binary Probit model is used to study the factors that influence the decision of creating a website. The dependent variable (y_i) is dichotomous: it is ascribed the value 1 if the firm has a website and 0 otherwise. The estimate needs the definition of a latent variable in order to model the realisation of this event. This unobserved latent variable (y_i^*) corresponds to the net profit (or economic rent) obtained by the firm ($i=1, \dots, n$) when creating a website.

The latent variable is given by: $y_i^* = \beta x_i' + \mu_i$

with x_i the vector containing the explanatory variables, β the vector of parameters relating to the variables x_i , and μ_i the random error term.

$$\text{Prob}(y_i=1) = P(y_i^* > 0) = P\left(\frac{\beta x_i'}{\sigma_\mu} + \frac{\mu_i}{\sigma_\mu} > 0\right) = P\left(\frac{\mu_i}{\sigma_\mu} > \frac{-\beta x_i'}{\sigma_\mu}\right) = 1 - F\left(\frac{-\beta x_i'}{\sigma_\mu}\right)$$

$$\text{Prob}(y_i=0) = P(y_i^* \leq 0) = P\left(\frac{\mu_i}{\sigma_\mu} \leq \frac{-\beta x_i'}{\sigma_\mu}\right) = F\left(\frac{\beta x_i'}{\sigma_\mu}\right)$$

where F represents the cumulative distribution function.

$$F = \int_{-\infty}^{\frac{-\beta x_i'}{\sigma_\mu}} \frac{1}{\sigma_\mu \sqrt{2\pi}} \cdot \exp\left[-\frac{1}{2} \cdot \left(\frac{\varepsilon_i}{\sigma_\mu}\right)^2\right] \cdot d\varepsilon_i$$

In order to estimate the parameters β associated with σ_μ , the solution usually retained consists in the normalisation of the standard error σ_μ to 1.

To obtain the estimated parameters, we maximise the log-likelihood function presuming that the error term is distributed normally with a mean equal to 0 and a variance equal to 1.

This log-likelihood function can then be written as:

$$\text{LogL} = \sum_{i=1}^n [(y_i \log(1 - F(-\beta x_i')) + (1 - y_i) \log F(-\beta x_i'))]$$

Results from the analysis of the creation of a website are presented in Table 1.

5.1.1. Internal factors

Looking at the significance of the different variables concerning the firm resources, we find that financial resources have a positive influence on the decision of creating a website. Thus, small organisations (10-49 employees) have a lower probability of

creation compared to mid-sized and large firms. Small firms seem to adopt a “wait-and-see” attitude. As expected, an organisation characterised by a high potential of networking, of knowledge sharing (i.e. a multi-unit organisation) has, *ceteris paribus*, a probability of possessing a website increased by more than 8% compared with organisations with only one unit. The results about our proxy for human competencies display a positive influence. So, when a firm enables its employees to attend ICTs training, the probability of owning a website is raised by about 8.5% whatever the estimated model (Model 1 or Model 2). Finally, being a part of a group (that can provide both financial and human resources) don't seem to have an impact in the choice of creating or not a website. Therefore, the results substantiate for the most part the hypothesis 1 formulated above.

Firms in the transport, computing, services and hotels/restaurants sectors have a probability of creating a website greater than firms in the industry, construction and trade sectors. Thus, technology-intensive sectors (computing) and sectors selling products that fit the lifestyle of consumers (tourism i.e. hotels/restaurants in our study) are different from others in term of their effect on the probability of possession. So the probability of having a website is increased by 28.6% when the firm evolves on the computing or tourism sectors and only 10-12% when the firm evolves on transports or services sectors. The fact of exporting products, the quality of the customers (i.e. household or firms), and a dependence with one customer reveal insignificant in all models. Thus, the results concerning the business characteristics don't really support the hypothesis 2.

Concerning attitudes and past experiences with ICTs, the results show the expected sign for the common communicant ICTs. The more a firm has adopted ICTs, the higher its probability of website creation is. Having a DSL connection to Internet, whatever the quality, has a positive influence. If we study in details individual impacts of ICTs introduced in the ICTs score (*cf.* Appendix 2, Table 4), we notice that the ICTs that have the greatest influence on website creation decision are the Local Area Network, the electronic forum, the presence of an electronic working group calendar and the use of an Intranet. About the adoption of management ICTs set up in order to make the organisation of the firm more flexible, the results show no significant parameters for both

the score and the individual technologies (*cf.* Appendix 2, Table 4). Therefore, the regression results go in the direction of the hypothesis 3 only for common ICTs.

5.1.2. External factors

On the one hand, the intensity of competition on the market do not have an influence on the decision of creating or not a website. On the other hand, being the leader on the market has a positive impact on the setting up: the probability of having a site is increased by more than 11%, all else equal. In Model 2, in which we introduce the quality of the customers instead of the sectors in which the firm operates, it emerges that firms which develop a niche have a probability of creation raised by 7% *ceteris paribus*. As the intensity of competition has no significant coefficient, the hypothesis 4 is not substantiated in our study.

The possession of e-commerce websites by rivals has a positive influence on the website creation decision for an individual firm. This shows that following the behaviours of other firms is an important determinant for firms in establishing a presence on the Web. This results support the hypothesis 5 formulated above.

A firm that holds a brand or a trade name with a national renown has a probability of website creation increased by 10% compared with a firm with a local renown, *ceteris paribus*. An international renown has no influence on website creation. As at least one level of the renown is significant, the results support the hypothesis 6.

Neither a support given by a favoured partner (like a supplier) nor the fact for the firm to know government initiatives have a significant influence on the creation decision. If we watch in detail the regressions that introduce the different Luxembourg and European programs, it emerges that only the platforms developed by the guild chamber (“Guild chamber”) and by the government (“Entreprises.lu”) have a significant influence. But the coefficient of the guild chamber’s platform “Hanwriek-online” (known by about 20% of the firms of the sample) is negative. The information available on this platform seems to reinforce the fear of failure and the fear concerning the investment returns associated with the creation of a website. Therefore, the results don’t support the hypothesis 7.

Table 1. Factors influencing the creation of a website

	Model 1		Model 2	
	Coef/Std.Err.	Marg. eff.	Coef/Std.Err.	Marg. eff.
Constant	-0.6952** (0.3393)		-0.5248* (0.3175)	
Internal factors				
<i>Firm resources</i>				
Small	-0.6287** (0.2833)	-0.2156	-0.5649** (0.2796)	-0.1972
Mid	ns		ns	
Large	Ref.		Ref.	
Multi-unit organisation	0.2501* (0.1414)	0.0890	0.2417* (0.1396)	0.0868
Group	ns		ns	
ICTs training	0.2286** (0.0960)	0.0837	0.2366** (0.0945)	0.0871
<i>Business characteristics</i>				
Industry	Ref.		-	
Construction	ns		-	
Trade	ns		-	
Horesca	1.0638*** (0.2789)	0.2860	-	
Transports	0.2879* (0.1734)	0.1015	-	
Computing	1.0545*** (0.3147)	0.2860	-	
Services	0.3643** (0.1641)	0.1277	-	
Household	-		ns	
Exports	ns		ns	
Dependence with a customer	ns		ns	
<i>Attitudes and past experiences with ICTs</i>				
ICTs score	0.1761*** (0.0345)	0.0654	0.1885*** (0.0329)	0.0704
Low connection	Ref.		Ref.	
Low DSL connection	0.4191*** (0.1024)	0.1503	0.4102*** (0.1012)	0.1483
High speed DSL	0.4341*** (0.1059)	0.1551	0.4564*** (0.1050)	0.1638
Management ICTs score	ns		ns	
External factors				
<i>Competition</i>				
Limited competition	ns		ns	
Intense competition	Ref.		Ref.	
Very intense competition	ns		ns	
Leader	0.3335** (0.1361)	0.1183	0.3134** (0.1332)	0.1124
Challenger	ns		ns	
Follower	Ref.		Ref.	
Niche	ns		0.1990*	0.0725

			(0.1177)	
	Local incentives			
Rivals have an e-commerce website	0.3132*** (0.0939)	0.1132	0.3494*** (0.0922)	0.1267
	Market power			
Local renown	Ref.		Ref.	
National renown	0.2896** (0.1210)	0.1072	0.2693** (0.1206)	0.1003
International renown	ns		ns	
	External support			
Supplier support	ns		ns	
Governmental initiatives score	ns		ns	
LL	-621.4835		-635.0176	
Pseudo R²	0.1753		0.1573	
Correctly classified	72.26%		70.85%	

*, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. Standard errors are shown in brackets; ns: not significant; Ref.: reference group.

Note: in Model 1, the variable “multi-unit organisation” is significant at the 10% level. When a firm integrates different establishments, its probability of possessing a website is increased by 8.9%.

5.2. The determinants of the involvement in the use of a website

Our second analysis is dedicated to the study of the involvement of the firm in the use of its website in an informative way or in a commercial way, using count data models presented in Box 2.

Box 2. Methodology of count data models⁴¹

Models of count data (Poisson and Negative Binomial models) are used to determine the total obtained for the different scores we calculate, i.e. the number of functions and the quality of the update we can find on the site of a firm. The dependent variable is a count data which can take on the values: $0, 1, 2, \dots, m$ with $m=8$ for the variables information score and e-commerce score, and $m=14$ for the variable total score.

The Poisson regression model specifies that each y_i is drawn from a Poisson distribution with parameter λ_i which is related to the variables x_i .

$$\text{Prob}(Y_i=y_i / x_i) = \frac{e^{-\lambda_i} \cdot \lambda_i^{y_i}}{y_i!}$$

The most common formulation for λ_i is the log-linear model : $\ln \lambda_i = \beta' x_i$.

The expected score is given by: $E[Y_i / x_i] = \text{Var}[Y_i / x_i] = \lambda_i = e^{\beta' x_i}$ with $Y_i = e^{\beta' x_i} + u_i$

To obtain the estimated parameters, we use maximum likelihood techniques.

The log-likelihood function can be written as:

⁴¹ For more information, see Greene (2003), Chapter 21.

$$\text{Log}L = \sum_{i=1}^n e[-\lambda_i + y_i \cdot \beta' x_i - \log y_i!]$$

Sometimes, we are confronted with a problem concerning the Poisson regression because of its implicit assumption that the variance of y_i equals its mean.

The negative binomial model (Hausman, Hall & Griliches, 1984; Cameron & Trivedi, 1986, 1990) relaxes the Poisson assumption: it's a natural formulation of cross section heterogeneity. It introduces an individual unobserved effect into the conditional mean, that captures an overdispersion existing in the data:

$$\text{Log}(\lambda_i, u_i) = \beta' x_i + \varepsilon_i = \text{Log} \lambda_i + \text{Log} u_i$$

The distribution of y_i conditioned on x_i and u_i (i.e. ε_i) remains Poisson with conditional mean and

$$\text{variance } \mu_i \text{ is: } f(y_i / x_i, u_i) = \frac{e^{-\lambda_i \cdot u_i} \cdot (\lambda_i \cdot u_i)^{y_i}}{y_i!}$$

The unconditional distribution of $f(y_i / x_i)$ is: $\int_0^{+\infty} f(y_i / x_i, u_i) \cdot g(u_i) \cdot du_i$

Assuming that the distribution of u_i is a gamma distribution with a mean normalised to 1, we

$$\text{obtain: } g(u_i) = \frac{\theta^\theta}{\Gamma(\theta)} \cdot e^{-\theta \cdot u_i} \cdot u_i^{\theta-1}$$

$$\text{The density of } y_i \text{ is then: } f(y_i / x_i) = \frac{\Gamma(\theta + y_i)}{\Gamma(y_i + 1) \Gamma(\theta)} \cdot z_i^{y_i} \cdot (1 - z_i)^\theta$$

where $z_i = \lambda_i / (\lambda_i + \theta)$ with θ the parameter of the gamma distribution. This is one form of the negative binomial distribution.

The distribution has conditional mean: λ_i and conditional variance: $\lambda_i (1 + (1/\theta) \lambda_i)$.

The negative binomial model (NegBin) can be estimated by maximum likelihood.

To test the Poisson distribution against the negative binomial one, we test the hypothesis $\theta=0$ using a likelihood ratio test. The limiting distribution of the LR statistic is chi-squared with one degree of freedom. In accordance with this test, we present the non rejected model in Table 2.

Results from the analysis of the degree of involvement in a website use are presented in Table 2⁴². As opposed to the assumption we made when distinguishing between the different uses of the site, firms which use Internet to diffuse information on their activities have characteristics relatively close to firms which create a new commercial channel to distribute their products via the Web, except for few specific variables. In the remainder

⁴² We work on the sub-sample of firms having a website. In order to verify that the choice of the content is independent from the choice of creation, we use three tests of independence between two binary decisions (LR Test). The first one is between the choice of creation and the choice of a number of functions superior or equal to the mean of the number of functions in the sites of the sample. The second one is between the choice of creation and the choice of a number of information functions superior or equal to the mean of the number of information functions provided by the sites of the sample. The third one is between the choice of creation and the setting up of an e-commerce website including at least one of the six functions considered in the e-commerce score. These tests (not displayed in the paper) show that the decisions are independent.

of our study, we don't comment specifically the results concerning the total score, in order to focus our attention on the two uses the site can provide.

5.2.1. Internal factors

The resources owned by a firm don't seem to have a great importance in the decisions of using intensively the site in an informative or in an commercial way. Only the fact of being a subsidiary of a group seem to have a (small) impact on the investment decision in informative functions. Therefore, the results don't really substantiate the hypothesis 1 formulated above.

Concerning the business characteristics, it appears that selling products that fit the lifestyle of consumers as the sector of tourism does have a positive influence on the degree of involvement in the website⁴³. A little difference emerges between the informative use of the site and the commercial one. The positive effect seems, indeed, to be greater in the case of an investment dedicated to the creation of a new commercial channel. The expected number of commercial functions for firms evolving on tourism sector is about 45% higher than for firms of other sectors; and the expected number of informative functions for firms evolving on tourism sector is about 27% higher than for firms of other sectors. In the group of variables which characterise the business of the firm, the quality of the customers, the fact of selling abroad, and the dependence with a single customer highlight some differences between the two uses we distinguish. The fact that customers are predominantly households has a positive influence on the degree of involvement in the site for an informative aim, and no influence in e-commerce involvement. Selling products abroad and the dependence with one customer have only an influence on the commercial use of the site. The effects are both negative: this way, the number of commercial functions is reduced by about 0.03%⁴⁴ if the percentage of exports increases by 0.1, and by about 22% if an independent firm signs a contract with one customer for 30% or more of its sales. Therefore, the results substantiate for the most part the hypothesis 2 formulated above.

⁴³ The negative coefficient associated with the variable "Construction" shows that traditional sectors lag behind other sectors concerning the investment in a website.

⁴⁴ This negative effect seems contradictory with the hypothesis 2 but is very weak.

Concerning the attitudes and past experiences with ICTs, the ICTs score is significant only in the degree of involvement in informative use of the site. The setting up of an ICT culture and also a better perception of technologies benefits allow the firm to have the control of its site only for the competencies accumulated thanks to prior ICTs use. Thus, the firm has a greater facility to invest in an informative site instead of in commercial site for which management competencies are needed. If we observe in detail the impact of individual technologies introduced in the ICTs score (*cf.* Appendix 3, Table 5), it appears that only the setting up of a group project scheduler has a positive⁴⁵ influence on the involvement in the site whatever the use considered. The prior use of management ICTs has, this way, a positive influence on the different degree of use of the website. Concerning the age of the site, the results highlight that the older the site is, the higher the expected number of both informative⁴⁶ and commercial functions are. In conclusion, the results substantiate the hypothesis 3 formulated above totally in the case of an informative use and partially in the case of a commercial use.

5.2.2. *External factors*

Concerning the effect of competition on the degree of involvement in the website, the results highlight a difference between the two scores. On the one hand, as we discussed in the theoretical and empirical literatures, “too much” competition (“Very intensive competition”) has a negative impact on the investment in an e-commerce website, and all positions on the market are non significant. On the other hand, if we observe the results of the information score, we find that the intensity of competition has non significant effects on the number of functions chosen, but being the leader on the market has a positive influence on the investment in a site that provides more information to potential customers. Such a position removes the risk of being excluded from the market if the investment failed. The regression results go in the direction of the hypothesis 4 at least partially for the commercial use of the site.

Concerning the effect of the behaviours of other firms on the decision of an individual firm to invest in an informative site and/or an e-commerce site the follow-up of rivals is important (as for the decision of creation). So, the results substantiate the hypothesis 5.

⁴⁵ The mail service seems to have a negative influence on the involvement in an informative use of the site, because the mail can be sufficient for the firm to give information to its customers.

⁴⁶ Note that the coefficient is only significant in the Model 2.

The fact of having a brand or a trade name known at an international level has a positive influence on the investment, especially, in an e-commerce website. The expected number of commercial functions for firms with an international renown is about 23% (or 30% according to the model studied) higher than for firms known locally or nationally. As at least one level of the renown is significant, the results support the hypothesis 6.

Both a support given by a favoured partner (like a supplier) and the fact for the firm to know a lot of government initiatives have a significant influence on the number of functions adopted by firms for their sites. The results display that a privileged relationship with a supplier has a positive influence that increases the degree of involvement in the website use. Knowing a lot of Luxembourg and European initiatives concerning ICTs and e-commerce deployment has a positive influence on the degree of use of the website. In details (*cf.* Appendix 3, Table 5), the guild chamber platform that diffuses information on best practices concerning firm adoption of technologies has a positive influence on the information score (but only in the Model 1). The electronic signature law, set up to ensure security for trade, e-government and confidential data transfer, has a positive influence on the use of the site in both an informative and/or a commercial aim. The results go in the direction presented in the hypothesis 7.

Table 2. Factors influencing firms' intensity of involvement in the use of a website

	Total score		Information score		E-commerce score	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Selected model	NegBin	NegBin	Poisson	Poisson	NegBin	NegBin
	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err

Constant	0.6535*** (0.1473)	0.5256*** (0.1373)	0.4018** (0.1604)	ns	ns	-0.4552** (0.2154)
Internal factors						
Firm resources						
Small	ns	ns	ns	ns	ns	ns
Mid	ns	ns	ns	ns	ns	ns
Large	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Multi-unit organisation	ns	ns	ns	ns	ns	ns
Group	ns	0.088* (0.0520)	ns	0.097* (0.0559)	ns	ns
ICTs training	ns	ns	ns	ns	ns	ns
Business characteristics						
Industry	Ref.		Ref.		Ref.	
Construction	-0.1552* (0.0871)	-	-0.2059** (0.0961)	-	-0.2876** (0.1395)	-
Trade	ns	-	ns	-	ns	-
Horesca	0.3054*** (0.1170)	-	0.2720** (0.1272)	-	0.4448** (0.1782)	-
Transports	ns	-	ns	-	ns	-
Computing	ns	-	ns	-	ns	-
Services	ns	-	ns	-	ns	-
Household	-	0.1034* (0.0574)	-	0.1362** (0.0619)	-	ns
Exports	ns	ns	ns	ns	-0.0039*** (0.0013)	-0.0031** (0.0012)
Dependence with a consumer	-0.1356** (0.0603)	-0.1299** (0.0598)	ns	ns	-0.2268** (0.0971)	-0.2247** (0.0963)
Attitudes and past experiences with ICTs						
ICTs score	0.0264* (0.0155)	ns	0.0408** (0.0170)	0.0385** (0.0164)	ns	ns
Low connection	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Low DSL connection	ns	ns	ns	ns	ns	ns
High speed DSL	ns	ns	ns	ns	ns	ns
Management ICTs score	0.0613*** (0.0148)	0.0594*** (0.0138)	0.0416** (0.0163)	0.0423*** (0.0150)	0.0780*** (0.0230)	0.0713*** (0.0215)
Characteristic of the website						
Age of the site	0.0232* (0.0128)	0.0329** (0.0128)	ns	0.0267* (0.0139)	0.0374* (0.0202)	0.0562*** (0.0202)
External factors						
Competition						
Limited competition	ns	ns	ns	ns	ns	ns
Intense competition	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

Very intense competition	ns	ns	ns	ns	-0.1410* (0.0720)	-0.1411* (0.0722)
Leader	0.1478** (0.0681)	0.1408** (0.0680)	0.1484** (0.0750)	0.1485** (0.0742)	ns	ns
Challenger	ns	ns	ns	ns	ns	ns
Follower	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Niche	ns	ns	ns	ns	ns	ns
Market power						
Local renown	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
National renown	ns	ns	ns	ns	ns	ns
International renown	0.1366* (0.0827)	0.1850** (0.0839)	ns	0.1898** (0.0911)	0.2246* (0.1315)	0.3015** (0.1336)
Local incentives						
Rivals have an e-commerce website	0.2102*** (0.0448)	0.2364*** (0.0444)	0.1501*** (0.0492)	0.1750*** (0.0481)	0.3291*** (0.0699)	0.3637*** (0.0693)
External support						
Supplier support	0.1079** (0.0492)	0.1202** (0.0483)	ns	0.1025* (0.0523)	0.1697** (0.0764)	0.1848** (0.0751)
Governmental initiatives score	0.0409*** (0.0110)	0.0414*** (0.0110)	0.0356*** (0.0119)	0.0353*** (0.0119)	0.0565*** (0.0170)	0.0571*** (0.0171)
θ	0.0383** (0.0158)	0.0454*** (0.0162)	-	-	0.0993** (0.0404)	0.1179*** (0.0420)
LL	-1445.9956	-1454.141	-1226.3687	-1233.566	-1091.0442	-1100.3194
Likelihood-ratio test of $\theta=0$:	chi2 (1) = 7.36	chi2 (1) = 10.18	chi2 (1) = 0.00	chi2 (1) = 0.00	chi2 (1) = 7.91	chi2 (1) = 10.80
	Prob \geq chi2 = 0.003	Prob \geq chi2 = 0.001	Prob \geq chi2 = 0.500	Prob \geq chi2 = 0.500	Prob \geq chi2 = 0.002	Prob \geq chi2 = 0.001

*, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively. Standard errors are shown in brackets; ns: not significant; Ref.: reference group.

Note: for the information score (Model 2), the variable "household" is significant at the 5% level. The expected number of informative functions for firms which have predominantly households as customers is about 14% higher than for firms which have predominantly firms as customers.

5.3. The decision to reorganise the firm and the setting up of an e-commerce website

As one of the new priorities of European authorities is given to the development of e-business, we want to analyse briefly the connection that can exist between management ICTs and the setting up of a new business channel thanks to the opportunities given by the Web. If we observe the results displayed in Table 5 (*cf.* Appendix 3), we notice that the fact of possessing a management ICT linked with the business system of customers has a positive influence on the number of e-commerce functions provided on websites. In order to go further, we conduct a simultaneous study of the creation of an e-commerce website and the adoption of management technologies (ICTs taking in general and taking ICTs individually). For this purpose, we use a bivariate Probit model

that permits to estimate jointly the probability of two simultaneous events and to evaluate the correlation degree between errors terms. The procedure consists, first to regress simultaneously the creation of an e-commerce website⁴⁷ and the adoption of management ICTs with the explanatory variables of the specification “Model 1” presented above (*cf.* Table 2), except the variable “Management ICT score”, and second to calculate the correlation coefficient (ρ) between the errors of the two estimates. Then, we study the significance of the coefficient associated with ρ . We use a likelihood-ratio test which tests the null hypothesis $H_0 : \rho=0$. If ρ is different from 0 and positive, we can conclude, when the sign is positive, that there is a complementarity between the e-commerce website and management ICTs. The LR tests⁴⁸ are presented in the Table 3, and if a complementarity is found, we provide ρ to known its sign.

The results highlight a positive relationship between management ICTs whatever the ICT considered. So, one factor in the success of e-commerce is the adoption of ICTs that make more flexible the organisation in order to quickly come up to customers requirements. In details, as in the NegBin regression displayed in Appendix 3 (Table 5), this study confirms the fact that the possession of management ICTs linked with the business system of customers is complementary with the setting up of an e-commerce website. This specific analysis show that the adoption of ICTs for managing, logistics or services operations is also important when a firm choose to develop a new business channel.

⁴⁷ An e-commerce website provides at least one of the six functions introduced in the e-commerce score.

⁴⁸ The simultaneous regressions are not displayed in the paper.

Table 3. The relationship between an e-commerce website and management ICTs

Management ICTs in general	LR test H0=ρ=0	chi2(1)= 6.08733 Prob>chi2= 0.0136
	ρ	0.1724** (0.0689)
Internal system for reordering replacement supplies ("Reordering system")	LR test H0=ρ=0	chi2(1)= 1.21324 Prob>chi2= 0.2707
	ρ	ns
Invoicing and payment systems ("Invoicing system")	LR test H0=ρ=0	chi2(1)= 2.68342 Prob>chi2= 0.1014
	ρ	ns
ICTs for managing, logistics or services operations ("Logistic system")	LR test H0=ρ=0	chi2(1)= 7.68596 Prob>chi2= 0.0056
	ρ	0.2028*** (0.0718)
ICTs linked with suppliers' business systems ("Suppliers system")	LR test H0=ρ=0	chi2(1)= 2.47991 Prob>chi2= 0.1153
	ρ	ns
ICTs linked with customers' business systems ("Customers system")	LR test H0=ρ=0	chi2(1)= 10.3755 Prob>chi2= 0.0013
	ρ	0.3164*** (0.0945)
Electronic Data Interchange	LR test H0=ρ=0	chi2(1)= 2.236 Prob>chi2= 0.1348
	ρ	ns

6. Conclusion

In this article, we try to sum up the different factors than can explain the motivations for firms to invest in a website and for the degree of use this site in an informative and/or in a commercial way. At first, we try to find in the theoretical and the empirical literature the factors underlined as influencing the creation decision and the involvement of the firm when it chooses to set up a site. It permits us to formulate different hypothesis we test subsequently with the use of Probit models for the study of the creation decision, and with the use of count data models for the study of the degree of involvement in the uses of the site. The results of our empirical study show, on the one hand, that the factors influencing creation behaviours and degree of involvement in the use of the website are quite different. On the other hand, the results underline that there are many similarities in the determinants of intensity of website use both as an informational tool and as an e-

commerce one. Website creation is, above all, influenced by the resources owned by the firms, i.e. financial, human, technological ones. However, these resources do not have a great importance in the choice of the number of functions provided by the site. The small size of the firm is a brake in website setting up, but has no influence on the site use once this site is created. A position of leader on the market influence positively both the site creation and the informative use of the site, but not the commercial use. The knowledge of the different initiatives instigated by both European and Luxembourg authorities has a positive influence on firms which already created a website when they choose the number of functions they want to include in their site. Sectors selling products that fit with the lifestyle of consumers and firms that have an international renown have, as expected, a higher probability than others to use intensely their site. After all, the setting up and use of a website is, for most part, an imitating behaviour consisting in following the actions, concerning e-commerce, taken by preceding firms. The adoption of management ICTs, the subject of a complementary study, has only an influence on the website use. Analysing the links between reorganisations thanks to management ICTs and the setting up of an e-commerce website, our analysis displays a significant complementarity. In details, the influence of certain ICTs (concerning the logistic of the firm and the relationship with customers) seem to be more important than others.

One limitation of this study lies in the way we measure some potential influencing factors such as human resources. Further researches have to address this limitation by finding better proxies. As the setting up of viable business models, thanks notably to firm reorganisations, is one of the priorities in the European diary, further researches should investigate more precisely the links existing between management ICTs adoption and e-commerce website creation.

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Appendix 1 : Survey data description

Abbreviation	Description	Whole sample (1132 firms)		Firms owning a website (698 firms)		Firms with an e-commerce website (445 firms)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Internal factors							
Firm resources							
Small	Size between 10 and 49 employees	0.7394	0.4392	0.6819	0.4661	0.6787	0.4675
Mid	Size between 50 and 249 employees	0.2182	0.4132	0.2564	0.4370	0.2607	0.4395
Large	250 employees and more	0.0424	0.2016	0.0616	0.2406	0.0607	0.2390
Multi-unit organisation	Multi-unit organisation	0.1166	0.3211	0.1433	0.3506	0.1438	0.3513
Group	Subsidiary of a group	0.2792	0.4488	0.3324	0.4714	0.3461	0.4763
ICTs training	Employees has possibility to attend ICTs training	0.3560	0.4790	0.4355	0.4962	0.4652	0.4993
Business characteristics							
Industry	Industrial sector	0.1343	0.3411	0.1203	0.3256	0.1191	0.3243
Construction	Construction sector	0.2597	0.4387	0.2264	0.4188	0.2202	0.4149
Trade	Trade sector	0.2668	0.4425	0.2593	0.4386	0.2899	0.4542
Horesca	Hotels, restaurants and cafés	0.0327	0.1779	0.0415	0.1997	0.0584	0.2348
Transports	Transport sector	0.1060	0.3080	0.0989	0.2987	0.0966	0.2958
Computing	Computing sector	0.0389	0.1934	0.0573	0.2326	0.0607	0.2390
Services	Services	0.1617	0.3683	0.1963	0.3975	0.1551	0.3624
Household	1: customers are predominantly households ; 0: they are predominantly firms	0.1996	0.3999	0.1848	0.3884	0.2090	0.4070
Exports	% of the firm's sales realised abroad	19.76	32.38	19.6	31.73	19.33	30.94
Dependence with a consumer	30% or more of the firm sales concluded with a single consumer	0.2041	0.4032	0.1891	0.3919	0.1618	0.3687
Attitudes and past experiences with ICTs							
Intranet	Intranet	0.4682	0.4992	0.5616	0.4965	0.5640	0.4964
Extranet	Extranet	0.2818	0.4501	0.3539	0.4785	0.3573	0.4797
Mail service	Electronic mail service	0.8542	0.3530	0.9126	0.2826	0.9011	0.2988
Videoconference	videoconference	0.0636	0.2442	0.0860	0.2805	0.0764	0.2659
Electronic forum	Electronic forum	0.0813	0.2734	0.1175	0.3222	0.1213	0.3269
Electronic working group calendar	Electronic working group calendar	0.2527	0.4347	0.3381	0.4734	0.3438	0.4755
Project scheduler	Group project scheduler	0.1334	0.3401	0.1777	0.3825	0.1820	0.3863
LAN	Local Area Network (wireless or not)	0.9700	0.1708	0.9914	0.0924	0.9933	0.0819
ICTs score	Sum of the ICTs (without the Internet connection) (0-8)	3.1051	1.6461	3.5387	1.6758	3.5393	1.7350
Low connection	No or low connection to Internet	0.3489	0.4768	0.2493	0.4329	0.236	0.4251
Low DSL connection	DSL connection<2 Mb/sec	0.3322	0.4712	0.3711	0.4834	0.3798	0.4859
High speed DSL	DSL connection≥2Mb/sec	0.3189	0.4663	0.3797	0.4856	0.3843	0.487
Management ICTs score	ICTs systems to manage placement and reception of orders	0.4876	0.5001	0.5487	0.4980	0.6022	0.490
Reordering system	Internal system for re-ordering replacement supplies	0.3260	0.4689	0.3639	0.4815	0.4022	0.4909
Invoicing system	Invoicing and payment systems	0.4099	0.4920	0.4742	0.4997	0.5146	0.5003
Logistic system	Linked to the system for managing, logistics or services operations	0.2677	0.4429	0.3209	0.4672	0.3640	0.4817
Suppliers system	Linked with suppliers' business systems	0.1387	0.3458	0.1590	0.3660	0.1888	0.3918
Customers system	Linked with customers' business systems	0.0857	0.2800	0.1074	0.3099	0.1393	0.3467
EDI	Electronic Data Interchange	0.0698	0.2549	0.0788	0.2696	0.0966	0.2958
Management ICTs score	Sum of ICTs system of managing orders and EDI (0-6)	1.2977	1.5882	1.5043	1.6521	1.7056	1.7167

Characteristics of the website							
Age of the site	Setting up of the website in: 1-2004-2005; 2-2003; 3-2002; 4-2001; 5-2000; 6-1998-1999; 7-before 1998	-	-	4.0544	1.8315	4.1506	1.8386
External factors							
Competition							
Limited competition	Limited competition	0.1325	0.3392	0.1232	0.3289	0.1258	0.3320
Intense competition	Intense competition	0.4337	0.4958	0.4269	0.495	0.436	0.4964
Very intense competition	Very intense competition	0.4337	0.4958	0.4499	0.4978	0.4382	0.4967
Niche	The firm develops a niche on the market	0.1917	0.3938	0.1877	0.3907	0.1730	0.3787
Follower	The firm is a follower on the market	0.3163	0.4652	0.2464	0.4312	0.2494	0.4332
Challenger	The firm is a challenger on the market	0.2898	0.4538	0.3138	0.4644	0.3056	0.4612
Leader	The firm is the leader on the market	0.2023	0.4019	0.2521	0.4346	0.2719	0.4454
Local incentives							
Rivals have an e-commerce website	Competitors have an e-commerce website	0.3101	0.4627	0.3668	0.4823	0.4292	0.4955
Market power							
Local renown	The firm's brand is well-known at a local level	0.1661	0.3723	0.1218	0.3273	0.1169	0.3216
National renown	The firm's brand is well-known at the national level	0.4965	0.5002	0.5215	0.4999	0.5169	0.5003
International renown	The firm's brand is well-known at an international level	0.3375	0.4731	0.3567	0.4794	0.3663	0.4823
External support							
Supplier support	30% or more of the firm purchases transacted with a single supplier	0.3012	0.4590	0.2751	0.4469	0.3258	0.4692
Guild chamber platform	The firm knows the guild chamber's platform "Handwriek-online" that give ICTs information	0.1979	0.3986	0.1963	0.3975	0.2202	0.4149
Entreprises.lu	The firm knows the portal "entreprises.lu"	0.3242	0.4683	0.3711	0.4834	0.3775	0.4853
CASES	The firm knows the portal for information security CASES	0.0769	0.2665	0.0931	0.2908	0.0899	0.2863
Electronic signature law	The firm knows the electronic signature law	0.2783	0.4483	0.3152	0.4649	0.3326	0.4717
Electronic commerce committee	The firm knows the "electronic commerce" committee	0.0972	0.2963	0.1132	0.3170	0.1303	0.3371
Electronic commerce code	The firm knows the electronic commerce code	0.1484	0.3557	0.1705	0.3763	0.1865	0.3900
OLAS	The firm knows the Luxembourg Office of Accreditation	0.1104	0.3136	0.1261	0.3322	0.1416	0.3490
Quality label	The firm knows the quality label "Luxembourg e-commerce certified"	0.3110	0.4631	0.3481	0.4767	0.3775	0.4853
Governmental initiatives score	Sum of the knowledge of governmental initiatives (0-8)	1.5442	1.8562	1.7335	1.9522	1.8562	2.0106

Appendix 2 :

Table 4. Factors influencing the creation of a website

	Model 1		Model 2	
	Coef/Std.Err.	Marg. eff.	Coef/Std.Err.	Marg. eff.
Constant	-10.0877** (0.4408)		-0.7490* (0.4119)	
Internal factors				
<i>Firm resources</i>				
Small	-0.6769** (0.2904)	-0.2294	-0.6028** (0.2853)	-0.2083
Mid	-0.4973* (0.2931)	-0.1907	ns	
Large	Ref.		Ref.	
Multi-unit organisation	0.2486* (0.1430)	0.0882	0.2357* (0.1408)	0.0844
Group	ns		ns	
ICTs training	0.2499** (0.0987)	0.0910	0.2502** (0.0971)	0.0917
<i>Business characteristics</i>				
Industry	Ref.		-	
Construction	ns		-	
Trade	0.2593* (0.1531)	0.0934	-	
Horesca	10.1769*** (0.2881)	0.3006	-	
Transports	0.3540** (0.1786)	0.1226	-	
Computing	10.0972*** (0.3180)	0.2910	-	
Services	0.3941** (0.1694)	0.1368	-	
Household	-		ns	
Exports	ns		ns	
Dependence with a consumer	ns		ns	
<i>Attitudes and past experiences with ICTs</i>				
Intranet	0.1904* (0.1013)	0.0703	0.1886* (0.1003)	0.0700
Extranet	ns		ns	
Mail service	ns		ns	
Videoconference	ns		ns	
Electronic forum	0.4114* (0.2198)	0.1398	0.4640** (0.2169)	0.1569
Electronic working group calendar	0.3328*** (0.1272)	0.1186	0.3414*** (0.1257)	0.1223
Project scheduler	ns		ns	
LAN	0.6257** (0.3067)	0.2446	0.5035* (0.2970)	0.1970
Low connection	Ref.		Ref.	
Low DSL	0.3907*** (0.1051)	0.1401	0.3926*** (0.1037)	0.1416

High speed DSL	0.4135*** (0.1087)	0.1476	0.4444*** (0.1079)	0.1591
Reordering system	ns		ns	
Invoicing system	ns		ns	
Logistic system	ns		ns	
Suppliers system	ns		ns	
Customers system	ns		ns	
EDI	ns		ns	
External factors				
Competition				
Limited competition	ns		ns	
Intense competition	Ref.		Ref.	
Very intense competition	ns		ns	
Leader	0.3606*** (0.1385)	0.1269	0.3266** (0.1356)	0.1164
Challenger	ns		ns	
Follower	Ref.		Ref.	
Niche	ns		ns	
Local incentives				
Rivals have an e-commerce website	0.3095*** (0.0961)	0.1115	0.3501*** (0.0940)	0.1264
Market power				
Local renown	Ref.		Ref.	
National renown	0.2793** (0.1223)	0.1031	0.2580** (0.1216)	0.0959
International renown	ns		ns	
External support				
Supplier support	ns		ns	
Guild chamber	ns		-0.2289** (0.1156)	-0.0871
Entreprises.lu	0.1942** (0.1058)	0.0709	0.1997* (0.1033)	0.0733
CASES	ns		ns	
Electronic signature	ns		ns	
Electronic commerce committee	ns		ns	
Electronic commerce code	ns		ns	
OLAS	ns		ns	
Quality label	ns		ns	
LL	-611.25955		-625.55055	
Pseudo R²	0.1889		0.1699	
Correctly classified	72.08%		70.67%	

Appendix 3 :

Table 5. Factors influencing firms' intensity of involvement in the use of a website

Selected model	Total score		Information score		E-commerce score	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	NegBin	NegBin	Poisson	Poisson	NegBin	NegBin
	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err	Coef/Std.Err
Constant	0.6456** (0.2984)	0.5794** (0.2905)	ns	ns	ns	ns
Internal factors						
Firm resources						
Small	ns	ns	ns	ns	ns	ns
Mid	ns	ns	ns	ns	ns	ns
Large	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Multi-unit organisation	ns	ns	ns	ns	ns	-0.1684* (0.1010)
Group	0.0931* (0.0520)	0.0927* (0.0520)	ns	0.0950* (0.0568)	0.1413* (0.0814)	0.1437* (0.0814)
ICTs training	ns	ns	ns	ns	ns	ns
Business characteristics						
Industry	Ref.		Ref.		Ref.	
Construction	-0.1797** (0.0879)	-	-0.2231** (0.0983)	-	-0.3362** (0.1418)	-
Trade	ns	-	ns	-	ns	-
Horesca	0.3374*** (0.1181)	-	0.2949** (0.1312)	-	0.4775*** (0.1806)	-
Transports	ns	-	ns	-	ns	-
Computing	ns	-	ns	-	ns	-
Services	ns	-	ns	-	ns	-
Household	-	0.1156** (0.0580)	-	0.1411** (0.0637)	-	ns
Exports	-0.0014* (0.0008)	ns	ns	ns	-0.0043*** (0.0013)	-0.0034*** (0.0013)
Dependence with a consumer	-0.1456** (0.0598)	-0.1481** (0.0596)	-0.1148* (0.0662)	-0.1116* (0.0651)	-0.2383** (0.0967)	-0.2427** (0.0960)
Attitudes and past experiences with ICTs						
Intranet	ns	ns	ns	ns	ns	ns
Extranet	ns	ns	ns	ns	ns	ns
Mail service	ns	ns	ns	ns	-0.2388* (0.1381)	ns
Videoconference	ns	ns	ns	ns	ns	ns
Electronic forum	ns	ns	ns	ns	ns	ns
Electronic working group calendar	ns	ns	ns	ns	ns	ns
Project scheduler	0.1724*** (0.0665)	0.1546** (0.0671)	0.1429* (0.0739)	0.1257* (0.0735)	0.2148** (0.1034)	0.1786* (0.1043)
LAN	ns	ns	ns	ns	ns	ns
Low connection	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Low DSL connection	ns	ns	ns	ns	ns	ns
High speed DSL	ns	ns	ns	ns	ns	ns
Reordering system	ns	ns	ns	ns	ns	ns

Invoicing system	ns	ns	ns	ns	ns	ns
Logistic system	ns	ns	ns	ns	ns	ns
Suppliers system	ns	ns	ns	ns	ns	ns
Customers system	0.1600** (0.0739)	0.1793** (0.0748)	ns	ns	0.3386*** (0.1130)	0.3587*** (0.1149)
EDI	ns	ns	ns	ns	ns	ns
Characteristic of the website						
Age of the site	0.0215* (0.0130)	0.0321** (0.0129)	ns	0.0263* (0.0142)	0.0341* (0.0205)	0.0543*** (0.0204)
External factors						
Competition						
Limited competition	ns	ns	ns	ns	ns	ns
Intense competition	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Very intense competition	ns	ns	ns	ns	-0.1466** (0.0728)	-0.1547** (0.0731)
Leader	0.1922*** (0.0686)	0.1706** (0.0686)	0.1816** (0.0767)	0.1661** (0.0757)	ns	ns
Challenger	0.1049* (0.0632)	ns	ns	ns	ns	ns
Follower	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Niche	ns	ns	ns	ns	ns	ns
Local incentives						
Rivals have an e-commerce website	0.1970*** (0.0447)	0.2267*** (0.0443)	0.1401*** (0.0500)	0.1675*** (0.0488)	0.3198*** (0.0701)	0.3587*** (0.0694)
Market power						
Local renown	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
National renown	ns	ns	ns	ns	ns	ns
International renown	0.1459* (0.0834)	0.1946** (0.0846)	ns	0.1992** (0.0931)	0.2513* (0.1327)	0.3313** (0.1347)
External support						
Supplier support	0.1083** (0.0491)	0.1244** (0.0488)	ns	0.0976* (0.0537)	0.1697** (0.0763)	0.1871** (0.0760)
Guild chamber	0.1240** (0.0591)	ns	0.1438** (0.0660)	ns	ns	ns
Entreprises.lu	ns	ns	ns	ns	ns	ns
CASES	ns	ns	ns	ns	ns	ns
Electronic signature	0.1388** (0.0567)	0.1365** (0.0569)	0.1620** (0.0627)	0.1604** (0.0621)	0.1568* (0.0894)	0.1516* (0.0897)
Electronic commerce committee	ns	ns	ns	ns	ns	ns
Electronic commerce code	ns	ns	ns	ns	ns	ns
OLAS	ns	ns	ns	ns	ns	ns
Quality label	ns	ns	ns	ns	ns	ns
θ	0.0285* (0.0152)	0.0365** (0.0157)	-	-	0.0764* (0.0387)	0.0962** (0.0405)
LL	-1435.1982	-1445.3247	-1218.1286	-1226.3128	-1080.8537	-1092.1419
Likelihood-ratio test of θ=0:	chi2 (1) = 4.16	chi2 (1) = 6.69	chi2 (1) = 0.00	chi2 (1) = 8.6e-07	chi2 (1) = 4.84	chi2 (1) = 7.37
	Prob≥chi2 = 0.02	Prob≥chi2 = 0.005	Prob≥chi2 = 0.500	Prob≥chi2 = 0.500	Prob≥chi2 = 0.014	Prob≥chi2 = 0.003