



Understanding e-business adoption across industries in European countries

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Abstract

Purpose – The paper seeks to investigate the factors that affect the adoption of e-business by firms belonging to European Union (EU) countries, by comparing the effect across two different industries: telecommunications (telco) and tourism.

Design/methodology/approach – Data were collected from 2,459 firms belonging to EU27 countries across two industries. The data were analyzed by employing factorial analysis and relevant hypotheses were derived and tested by logistic regression analysis.

Findings – The results suggest that the perceived benefits and obstacles of e-business, technology readiness, competitive pressure, and trading partner collaboration are the drivers that are important for both industries. Through the comparison of the industries, statistically significant differences between the telco and the tourism industries, i.e. the relative importance of all drivers for e-business adoption differs between the industries, were found. The only exception is competitive pressure.

Research limitations/implications – The cross-sectional nature of this paper does not allow knowing how this relationship will change overtime.

Practical implications – The findings offer valuable insight to managerial and policy makers; they should promote information and communication technology infrastructure, information technology training programmes to employees, and trading partner collaboration with business partners in each industry mainly in the tourism industry.

Originality/value – To the best of the authors' knowledge, this paper is one of the first that examines adoption of e-business with a multi-industries comparison of EU27 countries using a research model that combines the Tornatzky and Fleischer model and the Iacovou *et al.* model.

Keywords Electronic commerce, European Union, Tourism, Telecommunication services

Paper type Research paper

Introduction

Electronic business (e-business), or the use of internet-based technologies to conduct business, is recognized as a significant area for information technology (IT) innovation and investment (Sauer, 2000). As defined in Zhu *et al.* (2006b, p. 601):

[...] e-business refers to conducting transactions along the value chain (including purchasing from upstream suppliers and selling products and services to downstream customers) by using the Internet platform (e.g. TCP/IP, HTTP, XML) in conjunction with the existing IT infrastructure.

In this study, we used the same definition of e-business. Firms using e-business obtain substantial returns through efficiency improvements, inventory reduction, sales increase, customer relationship enhancement, new market penetration, and financial returns (Amit and Zott, 2001; Barua *et al.*, 2004; Lederer *et al.*, 2001; Raymond and Bergeron, 2008; Zhu and Kraemer, 2002). The development of e-business capability



is crucial because it is not only rapidly changing the way that companies buy, sell, and deal with customers, but also becoming a more central part of their business strategies (Abu-Musa, 2004). E-business adoption becomes a noteworthy research topic because it enables the firm to perform electronic transactions along value chain activities (Straub and Watson, 2001; Zhu and Kraemer, 2002) and it represents a new way to incorporate internet-based technologies with core business, thereby potentially affecting the whole business (Zhu, 2004).

The European Commission (2005) claims that more efforts are needed to improve e-business in European firms if the Lisbon targets of competitiveness are to be achieved. Under the pressure of their main international competitors, European firms need to find new opportunities to reduce costs, improve performance and the extent to which there are common behaviours across them. For these reasons, it is important to understand why firms adopt e-business or do not. Some studies analyse e-business adoption (Lin and Lin, 2008; Zhu *et al.*, 2003, 2006a; Zhu and Kraemer, 2005) but do not compare the different drivers' importance for e-business adoption across industries.

Recent findings reveal that in the European context the most important aspect to characterize e-business adoption is the industry and its specific characteristics rather than the country the firms belong to (Oliveira and Martins, 2010). For this reason, it is important to understand e-business adoption by industry within the EU27 context. The telecommunications (telco) industry is the most advanced sector in e-business adoption. This might serve as input for promoting e-business technologies to less e-business-intensive industries. Tourism as a whole is one of the fastest growing industries worldwide. In recent years, growth rates in tourism have been higher than those of the overall world economy. From a global perspective, the European Union (EU) is still the most tourism-intensive region worldwide (W@tch, 2007). For these reasons, we focus on these two industries. In the EU context, e-business adoption differs across these industries. In 2006, for the telco industry, e-business adoption was 82 per cent; and for the tourism industry, it was 53 per cent (W@tch, 2006c).

The purpose of this paper is to identify the factors that explain e-business adoption in two different industries (telco and tourism). Specifically, we want to understand what factors are important to explain e-business adoption in each industry, and to understand if the magnitude of these factors varies across these industries in the EU27 context. To the best of our knowledge, very limited empirical research has been undertaken to evaluate the determinants of e-business adoption across different industries; this study fills this gap. To achieve our purpose, we developed a research model that is a combination of the Tornatsky and Fleischer (1990) model and the Iacovou *et al.* (1995) model. The paper is organized as follows: first, we present the theories and literature review; then we describe the research model and hypotheses, finally, we estimate and test our model, discuss our results, and offer the main conclusions and implications.

Theories and literature review

A review of the literature suggests that the technology, organization, and environment (TOE) framework (Tornatsky and Fleischer, 1990) may provide a useful starting point for studying e-business adoption (Lin and Lin, 2008; Zhu and Kraemer, 2005). The TOE framework identifies three features of a firm's context that may influence adoption of technological innovation:

- the technological context describes both the existing technologies in use and new technologies relevant to the firm;
- the organizational context refers to characteristics of the organization such as scope and size; and
- the environmental context is the arena in which a firm conducts its business, referring to its industry, competitors, and dealings with the government.

The TOE framework explains adoption of innovation. The TOE framework has been examined in a number of empirical studies on various information system (IS) domains. It was used to explain electronic data interchange (EDI) adoption (Kuan and Chau, 2001). Thong (1999) explained IS adoption and use. Pan and Jang (2008) explained enterprise resource planning (ERP) adoption. This framework was also used to explain e-business adoption (Zhu *et al.*, 2003; Zhu and Kraemer, 2005) and use (Lin and Lin, 2008; Zhu and Kraemer, 2005; Zhu *et al.*, 2006a). Empirical findings from these studies confirmed that the TOE methodology is a valuable framework in which to understand the adoption of IT innovation.

Overtime, innovations become more complex and cross the limits of individual firms. More and more inter-organizational systems (IOSs) become significant in the business world. For instance, EDI and business-to-business (B2B) e-commerce are innovations that entail integration between multiple businesses. Five years after TOE, Iacovou *et al.* (1995) analysed IOSs characteristics that influence firms to adopt IT innovations. They studied EDI adoption. Their framework is well suited to explain the adoption of an IOS. It is based on three factors: perceived benefits, organizational readiness, and external pressure. Perceived benefits is a different factor from the TOE framework that will be added into our research model, whereas organization readiness is a combination of the technology and organization context of the TOE model. Hence, IT resources are similar to technology context and financial resources are similar to organizational context. The external pressure in the Iacovou *et al.*'s (1995) model adds the trading partners to the external task environmental context of the TOE as a critical role of IOSs adoptions.

The present research combines features of the two earlier models, resulting in an integrated framework for e-business adoption. The research model proposed here comprises three dimensions, which are:

- (1) perceived benefits;
- (2) technology and organizational readiness; and
- (3) environmental and external pressure.

The perceived benefits dimension comes from the Iacovou *et al.* (1995) model. The technology and organizational readiness is a combination of technology and organizational context from the Tornatsky and Fleischer (1990) framework and organizational readiness from the Iacovou *et al.* (1995) model. The environmental and external pressure is also a combination from both earlier studies.

Research model and hypotheses

We developed a conceptual framework for e-business adoption (see Figure 1) in which the dependent variable is the e-business adoption and we stipulated six hypotheses.

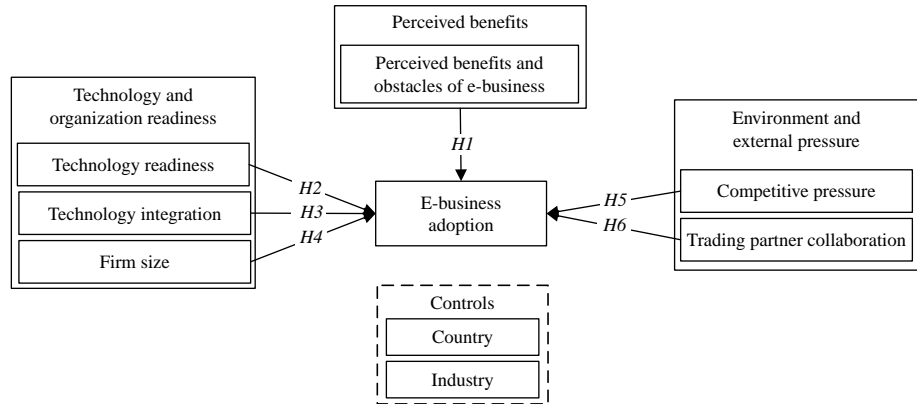


Figure 1.
Research model

Perceived benefits

Perceived benefits and obstacles of e-business. Perceived benefits refers to the anticipated advantages that e-business adoption can provide to the organization. Better managerial understanding of the relative advantage of an innovation increases the likelihood of the allocation of the managerial, financial, and technological resources necessary to use that innovation (Iacovou *et al.*, 1995; Rogers, 2003). Earlier studies argue that firms using e-business may obtain benefits such as sales increase, new market penetration, and cost reduction (Zhu and Kraemer, 2002; Zhu *et al.*, 2004). Other empirical studies also validate that positive perception of the benefits of an innovation provides an incentive for its use (Beatty *et al.*, 2001; Gibbs and Kraemer, 2004; Grover and Teng, 1994; Hsu *et al.*, 2006; Iacovou *et al.*, 1995; Kuan and Chau, 2001; Lin and Lin, 2008; Premkumar *et al.*, 1994; Son *et al.*, 2005). It is necessary to understand perceived benefits, as well as perceived obstacles, because the adoption process may be complicated and costly (Hong and Zhu, 2006; Pan and Jang, 2008; Zhu *et al.*, 2006a). The adoption of e-business requires a substantial degree of technical and organizational competence for smooth transition (Hong and Zhu, 2006); these barriers can result in resistance from users. As a consequence, it is essential to reduce the perceived barriers. Cho (2006) concluded that firms that perceive fewer obstacles to the adoption of a technology will be more likely to adopt the IT. Other empirical studies have found that obstacles is a significant barrier: to e-business adoption and use (Zhu *et al.*, 2006a), to e-commerce migration (Hong and Zhu, 2006), to ERP adoption (Pan and Jang, 2008), and to e-markets adoption (Johnson, 2010). We postulate the following:

H1. Higher benefits combined with lower obstacles is a positive predictor of e-business adoption.

Technology and organizational readiness

Technology readiness can be defined as technology infrastructure and IT human resources (Zhu *et al.*, 2006a). Technology infrastructure establishes a platform on which internet technologies can be built; IT human resources provide the knowledge and skills to develop web applications (Zhu and Kraemer, 2005). E-business can become an integral part of the value chain only if firms have infrastructures and technical skills. These factors may enable the technological capacity of the firm to adopt e-business.

However, firms that do not have robust technology infrastructure and wide IT expertise may not wish to risk the adoption of e-business, implying that firms with greater technology readiness are in a better position to adopt e-business. Several empirical studies have identified technological readiness as an important determinant of IT adoption (Armstrong and Sambamurthy, 1999; Hong and Zhu, 2006; Iacovou *et al.*, 1995; Kwon and Zmud, 1987; Pan and Jang, 2008; Zhu, 2004; Zhu *et al.*, 2003, 2006a; Zhu and Kraemer, 2005). Therefore, we postulate the following:

H2. The level of technology readiness is a positive predictor of e-business adoption.

Technology integration. Before the internet, firms had been using technologies to support business activities along their value chain, but many were “islands of automation” – they lacked integration across applications (Hong and Zhu, 2006). Evidence from the literature suggests that integrated technologies help improve firm performance through reduced cycle time, improved customer service, and lowered procurement costs (Barua *et al.*, 2004). As a complex technology, e-business demands close coordination of various components along the value chain. Correspondingly, a greater integration of existing applications and the internet platform represent a greater capacity for conducting business over the internet (Al-Qirim, 2007; Mirchandani and Motwani, 2001; Premkumar, 2003; Zhu *et al.*, 2006a). We therefore postulate the following:

H3. The level of technology integration is a positive predictor of e-business adoption.

Firm size is one of the most commonly studied determinants of IT adoption (Lee and Xia, 2006). Some empirical studies indicate that there is a positive relationship between the two variables (Grover, 1993; Hsu *et al.*, 2006; Pan and Jang, 2008; Premkumar *et al.*, 1997; Soares-Aguiar and Palma-Dos-Reis, 2008; Thong, 1999; Zhu *et al.*, 2003). However, larger firms have multiple levels of bureaucracy and this can impede decision-making processes regarding new ideas and projects (Hitt *et al.*, 1990; Whetten, 1987). Moreover, e-business adoption often requires close collaboration and coordination that can be easily achieved in small firms. There is also empirical evidence against this positive relationship (Dewett and Jones, 2001; Harris and Katz, 1991; Martins and Oliveira, 2007; Oliveira, 2008; Zhu *et al.*, 2006a, b; Zhu and Kraemer, 2005). The actual adoption of e-business may entail radical change in firms’ business processes and organization structures, which might be hindered by the structural inertia of large firms (Damanpour, 1992). In the opinion of Zhu and Kraemer (2005), size is often associated with inertia; that is, large firms tend to be less agile and less flexible than small firms. The possible structural inertia associated with large firms may slow down e-business adoption. Hence, we postulate the following:

H4. Firm size is a negative predictor of e-business adoption.

Environmental and external pressure

Competitive pressure refers to the degree of pressure felt by the firm from competitors within the industry. Porter and Millar (1985) analysed the strategic rationale underlying competitive pressure as an innovation-diffusion driver. They suggested that, by using a new innovation, firms might be able to alter the rules of competition,

affect the industry structure, and leverage new ways to outperform rivals, thus changing the competitive landscape. This analysis can be extended to IT adoption. Empirical evidence suggests that competitive pressure is a powerful driver of IT adoption and diffusion (Al-Qirim, 2007; Battisti *et al.*, 2007; Dholakia and Kshetri, 2004; Gibbs and Kraemer, 2004; Grandon and Pearson, 2004; Hollenstein, 2004; Iacovou *et al.*, 1995; Lai *et al.*, 2007; Mehrstens *et al.*, 2001; Zhu *et al.*, 2003). Therefore, we assume that:

H5. Competitive pressure is a positive predictor of e-business adoption.

Trading partner collaboration is an important factor because the value of e-business can be maximized only when many trading partners are using it (Iacovou *et al.*, 1995). As suggested by empirical evidence, the success of e-business depends on the trading partners' readiness to jointly use the internet to perform value chain activities (Barua *et al.*, 2004). In a trading community with greater partner readiness, individual adopters reveal higher levels of e-business usage due to network effects (Shapiro and Varian, 1999). Some empirical researches suggest that trading partner is an important determinant for EDI, e-procurement and e-business adoption and use (Iacovou *et al.*, 1995; Lai *et al.*, 2007; Lin and Lin, 2008; Soares-Aguiar and Palma-Dos-Reis, 2008; Zhu *et al.*, 2003, 2006b). Thus, we expect that:

H6. Trading partner collaboration is a positive predictor of e-business adoption.

Controls

In this study, we need to control for type of industry and country effects. It is usual in IS literature to use dummy variables to control these effects (Bresnahan *et al.*, 2002; Soares-Aguiar and Palma-Dos-Reis, 2008; Zhu *et al.*, 2003, 2006b). We used dummy variables to control for data variation that would not be captured by the explanatory variables mentioned above.

Methods

Sample

Our data source is e-business W@tch (2006a, b), which collects data on the use of information and communication technology (ICT) and e-business in European firms. Pilot interviews were conducted with 23 companies in Germany in February 2006, in order to test the questionnaire (structure, comprehensibility of questions). The sample drawn was a random sample of firms from the respective industry population in each of the countries, with the objective of fulfilling minimum strata with respect to company size class per country-industry cell. Strata were to include a 10 per cent share of large companies (250 + employees), 30 per cent of medium-sized enterprises (50-249 employees), 25 per cent of small enterprises (10-49 employees), and up to 35 per cent of micro enterprises with fewer than ten employees. We studied 27 EU members in two industries (telco and tourism) which had a scope of 3,708 telephone interviews with decision makers in firms, carried out in March and April 2006, using computer-aided telephone interview technology. Globally, the response rate was 13.1 per cent, which was comparable to other studies of similar scale (Zhu and Kraemer, 2005). In particular, the response rates varied from country to country, ranging from 7.1 to 32.0 per cent. We used data from the 2006 year because this was the last year with all countries of EU27 and these industries available. These data were collected by means

of representative surveys of firms that used computers. According to the methodological recommendations of Eurostat, the situation of an operator that “did not answer” or “does not know” the answer to a specific question should not imply its imputation, in any case, based on the answer of the other operators. Consequently, we obtained a smaller sample that we compared, by a proportion test, with the original one. The proportion test for the variable e-business adoption reveals that there is no statistically significant difference by industry and country. The final sample includes 2,459 firms belonging to the EU27. About 80 percent (78.1 per cent full sample, 83.1 per cent telco industry, and 74.5 per cent tourism industry) of the data were collected from owners, managing directors, heads of IT, and other senior members of IT, suggesting the high quality of the data source (Table I).

Factor analysis (FA) and reliability test

As a first step, we performed a FA of multi-item indicators to reduce the number of variables of the survey and to evaluate the validity, which is a very common analysis in innovation studies (Eid and Trueman, 2004; Oliveira and Martins, 2010; Premkumar *et al.*, 1994; Tan *et al.*, 2009; Thong, 1999; To and Ngai, 2006; Wei *et al.*, 2009). We used the principal component technique with varimax rotation (Table II) to extract four eigenvalues, which were all greater than 1. The first four factors explain 71.3 per cent of the variance contained in the data. The Kaiser-Meyer-Olkin (KMO) measures the adequacy of the sample; general KMO is 0.96 (KMO \geq 0.90 is excellent; Sharma, 1996), which reveals that the matrix of correlation is adequate for the FA. The KMO for individual variables is also adequate. All of the factors have a loading greater than 0.50 (except indicator TI4). This indicates that our analysis employs a well-explained factor structure. The four factors found are: perceived benefits and obstacles of e-business, technology readiness, trading partner collaboration, and technology integration. The factors obtained are in accordance with the literature review.

Reliability measures the stability of the scale based on an assessment of the internal consistency of the items measuring the construct. It is assessed by calculating the composite reliability for each composite independent variable. Most of the constructs have a composite reliability over the cut off of 0.70, as suggested by Nunnally (1978). Perceived benefits and obstacles of e-business, technology readiness and trading partner collaboration have a Cronbach’s alpha value, respectively, of 0.98, 0.77, and 0.82. The last dimension, technology integration, comprises four items and has a Cronbach’s alpha value of 0.61 which may be adequate for exploratory research. We decided to retain this dimension as it relates to the important issue of technology integration

Respondent’s position	Full sample		Telco		Tourism	
	Obs.	%	Obs.	%	Obs.	%
Owner/proprietor	683	27.8	335	32.9	348	24.2
Managing director/board member	553	22.5	204	20.0	349	24.2
Head of IT/DP	465	18.9	211	20.7	254	17.6
Other senior member of IT/DP department	219	8.9	97	9.5	122	8.5
Strategy development/organization	415	16.9	39	3.8	85	5.9
Other	124	5.0	133	13.1	282	19.6
Total	2,459	100.0	1,019	100.0	1,440	100.0

Table I.
Respondent’s position

Items measured	Factor 1	Factor 2	Factor 3	Factor 4
<i>Perceived benefits and obstacles of e-business</i>				
Why did your company decide to engage in e-business activities? (0 – not at all; 1 – not important; 2 – important)				
EB1 – because your customers expected it from you	0.90	0.12	0.08	0.06
EB2 – because your company believes that e-business will help to get an edge over your competitors	0.90	0.11	0.09	0.06
EB3 – because your competitors also engage in e-business	0.86	0.07	0.05	0.05
EB4 – because your suppliers expected it from you	0.83	0.10	0.10	0.07
Important obstacles for not practicing e-business in your company? (0 – not at all; 1 – not important; 2 – important)				
EO1 – my company is too small to benefit from any e-business activities	- 0.93	-0.10	-0.08	-0.03
EO2 – e-business technologies are too expensive to implement	- 0.94	-0.08	-0.06	-0.02
EO3 – the technology is too complicated	- 0.94	-0.08	-0.07	-0.02
EO4 – our systems are not compatible with those of suppliers or customers	- 0.94	-0.06	-0.05	-0.01
EO5 – we are concerned about potential security risks and privacy issues	- 0.95	-0.05	-0.05	-0.02
EO6 – we think that there are important unsolved legal issues involved	- 0.95	-0.06	-0.06	-0.01
EO7 – it is difficult to find reliable IT suppliers	- 0.95	-0.07	-0.06	-0.01
<i>Technology readiness</i>				
TR1 – sum of the following network applications: a local area network (LAN); wireless LAN; voice-over-IP; fixed line connections; wireless-local-area-networks or W-LANs, mobile communication networks; virtual private network	0.15	0.76	0.18	0.11
TR2 – sum of the following questions ICT skills: your company currently employ ICT practitioners; your company regularly send employees to ICT training programmes	0.12	0.72	0.06	0.19
TR3 – sum of the following security applications: secure server technology, for example SSL, TLS or a comparable technical standard; digital signature or public key infrastructure; a firewall	0.20	0.67	0.21	0.08
TR4 – sum of the following technologies: internet, intranet, and web site	0.26	0.62	0.31	0.04
TR5 – percentage of employees that have access to the internet	0.06	0.55	0.25	-0.18
<i>Trading partner collaboration</i>				
Does your company use online applications other than e-mail, to support any of the following business functions (0 – no, and not use internet; 1 – no; 2 – yes)?				
TP1 – to collaborate with business partners in the design of new products or services	0.13	0.17	0.89	0.04
TP2 – to collaborate with business partners to forecast product or service demand	0.13	0.15	0.88	0.11
<i>Technology integration</i>				
Does your company use any of the following systems or applications for managing information in the company (0 – do not know what this is, 1 – no, 2 – yes)?				
TI1 – an EDM system, that is an enterprise document management system	0.05	0.07	0.13	0.71
TI2 – an ERP system, that is enterprise resource planning system	0.06	0.19	0.09	0.71
TI3 – an SCM system, that is a supply chain management system	0.07	0.00	0.08	0.69
TI4 – knowledge management software	0.05	0.30	0.01	0.48

Table II.
Factor analysis

Note: The bolds are the higher loading factor in absolute value for each item

in e-business adoption. Thus, constructs developed by this measurement model could be used to test the conceptual model and the associated hypotheses.

Data analysis and results

The independent variables are in accordance with our research model, which is a combination of the Tornatsky and Fleischer (1990) model and the Iacovou *et al.* (1995) model. Perceived benefits and obstacles of e-business, technology readiness, trading partner collaboration, and technology integration were obtained by FA. All the other variables were obtained directly by the questionnaire. The dependent variable is e-business adoption, a binary variable which has value equal to 1 if firms adopt e-business and 0 otherwise (Table III).

We began our analysis by checking the multi-collinearity, for which we calculated the variance inflation factor (VIF) for the regression coefficients. The VIF ranged from a low of 1.06 to a high of 2.51. The values are below the threshold of ten, indicating that there is no problem of multi-collinearity amongst the variables (Hair *et al.*, 1998).

Since the dependent variable is binary (to adopt or not), we applied logistic regression to test the research model, and used the significance of the regression coefficients to support the hypotheses. We also computed marginal effects of independent variables. We estimated three different regressions: one for the full sample, and one for each industry (Table IV).

The goodness of fit for all regressions was assessed in three ways. First, to analyse the joint statistical significance of the independent variables, we computed the likelihood ratio test, which is statistically significant (*p*-value < 0.001 for each regression). This implies a strong relationship between the dependent variable and the independent variables for each regression. Second, we used the Hosmer-Lemeshow test (Hosmer and Lemeshow, 1980; Lemeshow and Hosmer, 1982), which reveals that there are no differences between fitted values of the model and the actual values, for any of the three regressions (*p*-values are, respectively, 0.38, 0.15, and 0.56). Finally, the discrimination power of the model is evaluated in two ways. We use the AUC, which is equal to 83, 82, and 85 per cent, respectively, for e-business adoption in full sample, telco, and tourism industries. This reveals an excellent discrimination for all regressions

Variables	Description
<i>Perceived benefits</i>	
Perceived benefits and obstacles of e-business	FA index of perceived benefits and barriers of e-business
<i>Technology and organization readiness</i>	
Technology readiness	FA index of technology readiness
Technology integration	FA index of technology integration
Firm size	The logarithm number of employees
<i>Environment and external pressure</i>	
Competitive pressure	Dummy equal to one if firms think that ICT has an influence on competition in your industry
Trading partner collaboration	FA index of trading partner
<i>Controls</i>	
Country	27 Country dummies for 27 countries
Industry	Two dummies for two industries

Table III.
Description of independent variables

Table IV.
Logistic regression for
e-business adoption in all
industries

Independent variables	Full sample		Telco		Tourism	
	Coef.	p- value	Coef.	p- value	Coef.	p- value
Perceived benefits and obstacles of e-business	0.737***	0.000	0.704***	0.000	0.788***	0.000
Technology readiness	0.788***	0.000	0.727***	0.000	0.857***	0.000
Technology integration	0.141**	0.032	0.257**	0.026	0.087	0.288
Firm size	0.004	0.931	- 0.066	0.371	0.025	0.651
Competitive pressure	0.527***	0.000	0.482**	0.029	0.590***	0.000
Trading partner collaboration	0.638***	0.000	0.547***	0.000	0.677***	0.000
Sample size		2,459		1,019		1,440
Area under the curve (AUC)		0.834		0.820		0.847

Notes: Significance at: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$; we also include dummies for the 27 countries in all regressions and industries dummies for regressions of all industries

(Hosmer and Lemeshow, 2000). We also computed the prediction accuracy: 81.2, 84.5, and 80.1 per cent, respectively. The adoption by random choices:

$$\left(\left[\frac{\text{adopters}}{\text{adopters} + \text{non-adopters}} \right]^2 + \left[\frac{\text{non-adopters}}{\text{adopters} + \text{non-adopters}} \right]^2 \right)$$

would result in 64.0, 71.8, and 59.6 per cent, respectively, for each regression, which are much less than in the case of our regressions. Thus, we conclude that the logistic regressions have much higher discriminating power than the random choice model. The three statistical procedures reveal a substantive model fit, a satisfactory discriminating power, and there is evidence to accept an overall significance of the models.

For the full sample regression, perceived benefits and obstacles of e-business, technology readiness, technology integration, trading partner collaboration, and competitive pressure are positively associated with e-business. All hypotheses ($H1-H6$) are confirmed except $H4$ (firm size). The same result is obtained for telco. For the tourism industry, the $H1$, $H2$, $H5$, and $H6$ are confirmed.

In deep analysis, we computed the statistically significant marginal effects to test the differences between telco and tourism industries (Table V). Results reveal that marginal

Table V.
Marginal effects of
logistic regression
for e-business in all
industries

Independent variables	Marginal effects			Telco vs tourism	
	Full	Telco	Tourism	Two-tailed test	p- value
Perceived benefits and obstacles of e-business	0.099***	0.067***	0.127***	- 3.900	0.000
Technology readiness	0.106***	0.069***	0.139***	- 3.253	0.001
Technology integration	0.019**	0.024**	ns	-	-
Firm size	ns	ns	ns	-	-
Competitive pressure ^a	0.076***	0.051*	0.100***	- 1.281	0.200
Trading partner	0.086***	0.052***	0.109***	- 3.208	0.001

Notes: Significance at: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$; variables with superscript "a" are binary; we also include dummies for the 27 countries in all regressions and industry dummies for regressions of all industries; ns - not significant

effects for perceived benefits and obstacles of e-business, technology readiness, and trading partner collaboration are significantly different between these two industries. In other words, competitive pressure is the unique driver that has the same marginal effect in both industries for e-business adoption.

Discussion and implications

The purpose of this paper was to identify the factors that explain e-business adoption and to understand the extent to which the magnitude of these factors varies across the two industries (telco and tourism industry) in the EU27 context. Our empirical results generally support the model. In the perceived benefits dimension, the perceived benefits and obstacles of e-business (*H1*) is a statistically significant facilitator for e-business adoption in both industries (Table IV). Therefore, for managers who think that e-business technologies are too expensive to implement, with the cost of technology decreasing, this obstacle is transposed. Also, policy makers should regulate the internet to make it a reliable commerce platform (e.g. dealing with fraud and credit card misuse), and promote the diffusion of the internet amongst end-users. This measure solves two more obstacles of e-business, which are: potential security risks and privacy issues, and legal issues involved. Moreover, the marginal effects are different between telco and tourism industries (Table V). The tourism industry is the one where this variable is more important, perhaps because in the telco industry the firms are more informed of the perceived benefits and obstacles of e-business.

In the technology and organization readiness dimension, the technology readiness (*H2*) is also a statistically significant facilitator for e-business adoption for all regressions. This means that managers and policy makers should be aware that technology readiness is constituted both by physical infrastructures and intangible knowledge, such as IT skills. For managers, investments in physical infrastructure and the hiring of employees with IT skills should be made; for current employees training programmes should be promoted. Policy makers should promote the construction of infrastructures and reduce tax laws to stimulate firms to provide IT training programmes to employees. This is in accordance with the European Commission (2008) that claims that the importance of ICT skills –, i.e. professional skills, user skills, and e-business skills – for the competitiveness and growth of the European economy has been confirmed in several high-level documents and initiatives of the European Commission. The tourism industry reveals a statistically significant higher relative importance (marginal effects) of technology readiness for e-business adoption when compared with the telco industry. One possible explanation is that tourism workers have less ICT skill and the tourism firms have fewer ICT infrastructures; consequently, due to the lack of technology readiness, this variable is more important for the tourism industry. Technology integration (*H3*) is a statistically significant facilitator only in the telco industry (Table IV). One possible explanation is that as telco firms have higher levels of IT know-how, only these firms can take advantage of technology integration, i.e. improving firm performance, improving customer service, and lowering procurement costs (Barua *et al.*, 2004). In particular, managers in the tourism industry need to improve know-how in IT workers, to take advantage of technology integration, which can provide more flexible dynamic packaging (bundling products with flexibility). Dynamic package depicts what is probably the most sophisticated and challenging e-business format in tourism in terms of technology requirements

(W@tch, 2007). Firm size (*H4*) is not statistically significant for e-business adoption in both industries. This result is in accordance with literature where firm size is a “controversial” predictor for IT adoption. This means that in the telco and tourism industries the advantage of the availability of funds being greater for large firms (Iacovou *et al.*, 1995; Rogers, 2003) does not prevail, nor does the disadvantage of larger firms having multiple levels of bureaucracy, which can impede decision-making processes regarding new ideas and projects (Hitt *et al.*, 1990; Whetten, 1987). This reveals that e-business is not a phenomenon dominated by large firms, this is special important for managers that think their firm is too small to benefit from any e-business activities.

In the environment and external pressure dimension, the competitive pressure (*H5*) is a statistically significant facilitator for e-business adoption in both industries (Table IV), and there is no statistically significant difference in terms of magnitude of importance (Table V). Hence, gaining competitive advantage is still one of the most important drivers of e-business adoption; furthermore, managers should be aware that competitive pressure (*H6*) has the same importance for e-business adoption across the industries, which reveals the same level of competition in the online market. Trading partner collaboration is a statistically significant facilitator for both industries (Table IV). Consequently, managers and policy makers should encourage the formation of networks with other players and the sharing of resources in order to satisfy the needs of diverse and ever faster changing customer requirements. This, in turn, could increase the competitiveness of the whole network (W@tch, 2007). Our analysis indicates a statistically significant higher magnitude of trading partner collaboration for e-business adoption in the tourism industry when compared to telco (Table V). One possible explanation is that the trading partners are less collaborative in the tourism industry than in the telco industry (W@tch, 2007).

There is at least one variable from each dimension that is statistically significant in e-business adoption for the two industries; in the other words the main drivers of e-business adoption across industries, are perceived benefits and obstacles of e-business adoption, technology readiness, competitive pressure, and trading partner; moreover, all three dimensions proposed are relevant for e-business adoption across different industries in the EU context. As the telco industry is the most intensive adopter and user of e-business (W@tch, 2007), it can serve as an example for other industries, and there is a business opportunity for this industry to provide e-business solutions for firms belonging to other industries.

Theoretical implications

Whilst there are many theoretical studies of e-business adoption, comparisons across industries are lacking. To promote e-business adoption and their comparison across industries, it is critical to clarify the factors that explain e-business adoption, and to conduct a deep analysis to understand if different industries have the same drivers for e-business adoption. Based on the Tornatsky and Fleischer (1990) model and the Iacovou *et al.* (1995) model, we define our research model to investigate the factors affecting the e-business adoption across the telco and tourism industries. To the best of our knowledge, this study is one of the first that examines adoption of e-business with a multi-industries comparison of EU27 countries using a research model that combines these two models. Using empirical data from 2,459 firms belonging to the EU27,

from two different industries, we found strong support for our research model, the three dimensions proposed are important for both industries. Moreover, we also found differences in the relative importance of drivers for e-business adoption for the different industries. Our results reveal that to better understand e-business adoption it is not sufficient to use industry as a control variable. It is more adequate to estimate a model for each industry. This is one of the first research efforts to provide concrete empirical support for the theories of e-business adoption in the EU27 context comparing two different industries. As the sample was not limited to data from a single country, this helps to strengthen the generalization of the model and findings.

Conclusions

E-business adoption enables the firm to perform electronic transactions along value-chain activities (Straub and Watson, 2001; Zhu and Kraemer, 2002). To promote e-business adoption, it is critical to clarify the factors that explain this adoption, and make a deep analysis to understand if different industries have the same drivers for e-business adoption. These have special importance, since recent findings reveal that in Europe the most relevant factor to characterize e-business adoption is the industry and its specific characteristics, and not the country that the firms belong to Oliveira and Martins (2010). In this paper, we have established and empirically tested the prediction model of the six determinants of e-business. In general, our hypotheses are confirmed, our research model seems appropriate. The perceived benefits and obstacles of e-business, technology readiness, competitive pressure, and trading partner collaboration are the drivers that are important for all industries. Through the comparison of the industries, we can verify that there are statistically significant differences between the telco and tourism industries. The relative importance of all drivers for e-business adoption in the telco differs from the tourism. The only exception is competitive pressure, where there is no difference between these industries.

Limitations and future studies

As in most empirical studies, our work is limited in some ways. First, the cross-sectional nature of this study does not allow knowing how this relationship will change overtime. To solve this limitation, future research should involve panel data. Second, our study investigates only adoption decisions. To provide a more balanced view of firms' adoption and assimilation of e-business into the core business activities, the extent of e-business migration from traditional platform to the internet should also be examined, as suggested by Hong and Zhu (2006). Third, we did not include the government regulation variables in our model because these variables are not available in this questionnaire. A new questionnaire should therefore be constructed for in further research. Fourth, in the tourism industry the rate of adoption between B2B and business-to-consumer (B2C) is different. Further research is needed to understand the different drivers of B2B and B2C, and across industries. Finally, we fully encourage confirmatory studies of our research model; and urge future researchers to test it in different contexts. It should be applied to other IT adoptions in order to be refined. Others studies with new samples should be used for the validation of our model. Samples of specific context or industry, such as manufacturing or service, should be gathered to further examine the applicability of this model.

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