

Which Factors Can Affect e-Public Procurement Adoption by Private Firms? The Case of Belgium

Mohamad Amin Alomar and Christian de Visscher

Université Catholique de Louvain, Belgium

Mohamad.Amin.Alomar@gmail.com

Christian.devisscher@uclouvain.be

Abstract: Firms are the main users of e-public procurement applications (hereinafter e-procurement), so their acceptance to adopt this technology is a crucial element in its successful implementation. Nonetheless, very few studies have focused on this subject. This article aims to identify and analyse the factors affecting private companies' adoption of e-procurement. Relying on several solid theories in the field of acceptance and adoption of innovation, namely the Technology Acceptance Model (TAM), the Diffusion of Innovation theory (DOI), the Technology, Organization, Environment framework (TOE) and the Iacovou *et al.* model, we constructed a research model that included the most important potential factors that can influence this variable. Our model was tested according to the survey method. Based on the data received from 760 Belgian firms spread over a wide range of economic activities, we identified five main variables that could explain about 33.5 % of the total variability of e-procurement adoption by firms: size, attitude towards change, competitive pressure, trading partners' pressure and organizational readiness. In contrast, we did not find any significant relationship between the relative advantages and e-procurement adoption. Finally, the implications for theory and practice are discussed.

Keywords: Technology Acceptance, e-procurement, survey, private firms, Belgium.

1. Introduction

Public procurement refers essentially to the process by which public authorities, such as government departments, local authorities and certain public utility operators, purchase work, goods or services from firms. Consequently, public procurement is a reciprocal relationship governed by law between public authorities and companies. This process, which takes many forms depending on the value and nature of the public contract, is traditionally conducted using the conventional paper method. In the 1980s, with the development of electronic data interchange (EDI), initiatives to digitize the procurement process began, particularly in the private sector. In 2004, European countries adopted an action plan for the implementation of the legal framework for electronic public procurement. The ministerial declaration that was unanimously approved on 24 November 2005 in Manchester by the European ministers in charge of e-government stated that:

"By 2010 all public administrations across Europe will have the capability of carrying out 100% of their procurement electronically and at least 50% of public procurement above the EU public procurement threshold will be carried out electronically". (UK presidency of the UE, 2005)

In response, Belgium helped to introduce an e-procurement system. Belgium is a federal state comprising three regions: Flemish Region (The official language is Dutch), Walloon Region (The official languages is French) and Brussels-Capital Region (Its official languages are both Dutch and French). Since 2005, the Federal Public Service Personnel and Organization (FPS P&O) has developed and supported many e-procurement applications that enable public buyers and companies to digitize public procurement procedures. E-notification (the application which allows public buyers to publish public procurements and to companies to consult them electronically) became mandatory for all contracting authorities in January 2011. Since 1 January 2013, all federal authorities have also been obliged to accept electronic tenders. E-submission (the application by which contracting authorities can electronically open tenders/requests for participation, electronically generate the report of opening and make it available. Companies can electronically submit their tenders/requests to participate and digitally sign them) is already mandatory in Flanders. These efforts have led in recent years to a significant increase in e-procurement use. Belgium is still lagging behind, however, both as regards its own objectives and at the European level. According to a study conducted by the International Data Corporation (IDC) in 2013, Belgium was ranked in 11th place in Europe in terms of intensity of e-procurement use (International Data Corporation, 2013).

In fact, very little is known about firms' acceptance to adopt e-procurement in Belgium. According to the Organisation for Economic Co-operation and Development (OECD), the percentage of Belgian companies that use e-procurement systems to offer goods or services to public authorities is still very low (see Figure 1). This study aims to highlight the acceptance to adopt e-procurement by firms in Belgium. This does, however, raise an important question: why do we care about the acceptance to adopt e-procurement systems when their use will become mandatory for both public authorities and firms?

Several studies have shown that, in mandated situations, users who do not wholeheartedly accept the innovation can delay or obstruct its implementation by underutilizing or sabotaging the new system. These reactions result from the positive or negative attitudes that users form toward this system (Brown et al., 2002). Thus, understanding the acceptance of the innovation in mandatory use settings is mainly related to the need to minimize sabotage and unfaithful appropriation of technology, and the resulting costs associated with such behaviour.

After addressing the theoretical context of innovation acceptance in the literature, we will attempt to examine and discuss the factors affecting e-procurement acceptance by firms. To address these objectives, a quantitative study, including an online survey, was performed.

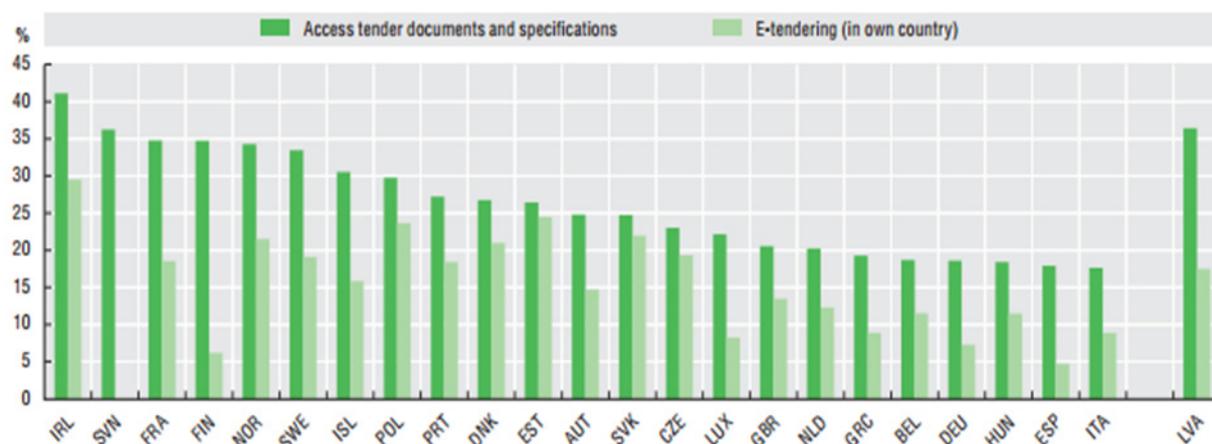


Figure 1: Businesses using electronic procurement systems, 2013. Source: OECD (2015)

2. Theoretical basis

A literature survey enables us to find several theories associated with the adoption of technology.

The Diffusion of Innovation theory (DOI) proposed by Everett Rogers in 1962 is a fundamental approach to investigations of how a new technology diffuses (Hsu et al, 2006). This theory provides a conceptual and analytical framework for describing the acceptability of innovation and explains its evolution from the invention stage to extended use. For Rogers (1995), the adoption rate of innovation is "the relative speed with which an innovation is adopted by members of a social system". This rate is influenced firstly by the perceived attributes of the innovation, which include its relative benefits, compatibility, complexity, observability and testability. According to Rogers, these five attributes can explain 49-87 % of the variance in the rate of adoption. Secondly, the adoption rate is influenced by the characteristics of the organisation itself, like as centralisation, formalisation, size, slack and interconnectedness. Although Rogers's theory seems to be quite applicable to an investigation of innovation adoption, many researchers continue to search other contexts which can influence this subject. In 1990, Tornatzky and Fleischer developed the Technology, Organization, Environment framework (TOE) to analyse and measure the adoption of technology at the organisational level (Tornatzky & Fleischer, 1990).

According to the authors, the process by which an organisation adopts and implements technological innovations is influenced by three contexts: the technological context, the organisational context and the environmental context. These three elements represent "both constraints and opportunities for technological innovation" (Tornatzky & Fleischer, 1990). The first two contexts within TOE are similar to the two categories of variables proposed in the DOI theory. However, TOE adds another very important dimension: the environmental context – which refers to the environment in which the organisation operates. It can include

many variables, such as the company’s competitors, its relations with the government, but also the regulatory environment. The TOE framework makes the DOI better able to explain innovation diffusion at the organisational level (Hsu et al, 2006). Over time, however, inter-organisational systems, such as e-commerce, B2B and Electronic Data Interchange (EDI), turn out to be significant instruments in the business world. DOI and TOE may not be able to cover all the characteristics of the new factors which can influence a firm’s adoption of technology. Iacovou, Benbasat and Dexter (1995) developed a new model to explain the adoption of EDI in small firms. Their model comprises three components:

- Perceived benefits, which had appeared as the technology context in the previous models and
- Organisational readiness, which is similar to the organisation context in the previous models
- External pressure: since e-procurement is a network interorganizational system, external pressure can play a critical role in its adoption and use by firms. External pressure refers to influences from the organizational environment. The two main sources of external pressure to adopt are competitive pressure, and more importantly, imposition by trading partners (Iacovou et al, 1995)

While these three models try to capture the factors which can influence innovation adoption at the organisational level, the Technology Acceptance Model (TAM) proposed by Davis (1989) focus on the user level. According to Davis (1989), the acceptance of a particular computer system can be explained by the user’s motivation, which is in turn influenced by external factors, including the characteristics of this system. Three main factors can explain the user’s motivation: perceived usefulness; perceived ease of use and attitude towards using the system.

Perceived usefulness and perceived ease of use are influenced by external variables, including system characteristics. While attitude is the most important determinant of use, it is influenced by perceived usefulness and perceived ease of use.

These four models have been widely studied and accepted as valid models in predicting acceptance behaviour across various information technologies and their users (see Table 1).

Our research combines features of all these four models to derive an integrated framework for e-procurement adoption at the organizational and individual levels (see figure 2).

Table 1: Practical support of models used in the research

Theory /Model	Some practical studies which used this theory/Model	Type of innovation/technology
Technology Acceptance Model	Amin at al., (2010) ; Rose & Fogarty, (2006); Behrens et al, (2005); Jaeger & Matteson, (2009) ; Kwon & Chidambaram, (2009) ; Wangpipatwong et al, (2008)	Mobile Banking ; self-service banking technologies; OASIS; Section 508 for Websites; Cellular Telephone Adoption; e-government website, e-filing
TEO	Zhu et al., (2003); Angeles, 2014 ; Pan & Jang, (2008); Lippert & Govindarajulu, (2006); Oliveira & Martins,(2010); Hsu et al, (2006)	E-Business adoption by European firms; Nike’s “Considered Index” Green Initiative; the adoption of enterprise resource planning; Web Services Adoption; e-business adoption; ; E-Business Use in U.S. Firms
Diffusion of Innovation Theory	Zhang et al, (2015) ; Jwaifell & Gasaymeh, (2013) ; Chigona & Licker, (2008); Hsu et al, (2006)	patient acceptance and use of consumer e-health innovations; Teachers' Adoption of Interactive Whiteboards; Communal Computing Facilities Adoption; ; E-Business Use in U.S. Firms
Iacovou et al. (1995)	van Heck & Ribbers, (1999) ; Oliveira & Martins,(2010); Hsu et al, (2006)	The Adoption and Impact of EDI in Dutch SME’s; e-business adoption; E-Business Use in U.S. Firms

3. Research model and hypotheses

Our research model primarily aims to identify and explain the factors affecting companies’ acceptance to adopt e-procurement. It combines features of all four previous models to establish an integrated framework. With regards to our independent variables, the first thing we attempted to do, starting from the literature, was to identify the most important factors that may influence e-procurement adoption by firms.

Our second step was to discuss these theoretical findings with many Belgian experts in fields of public procurement, e-procurement and information technology. These exploratory interviews were conducted between March and June 2015 with seven experts who already work in professions related to the implementation of e-procurement in Belgium, such as Federal Public Service Personnel & Organization; Information and Communication Technology Federal Public Service; the Economic Development Agency of the Province of Liège (SPI); the Belgian Buildings Agency and PwC Belgium. We were subsequently able to identify six potential variables that may affect e-procurement adoption by firms. The first one is the attitude towards using e-procurement as highlighted in the TAM. This construct tries to examine the acceptance of e-procurement at the user level. The second and third are environmental constructs from Iacovou et al. (1995) framework. The fourth, fifth and sixth are organizational constructs which have been consistently used in TOE, DOI and Iacovou et al (1995).

3.1 Attitude towards use (AT)

This variable has appeared in several previous theories, such as the Reasoned Action Theory proposed by Fishbein & Ajzen (1975), which was a key theoretical basis for the initial development of TAM. Attitude was defined by Fishbein & Ajzen (1975) as the “*individual’s positive or negative feelings about performing the target behaviour*”. So, in our case, attitude represents the positive or negative stance of a firm’s employees to use e-procurement. The importance of attitude as a determinant of a system’s use is supported by many practical studies like Melone (1990) ; Koh *et al.* (2010); Kamarulzaman et al., (2013), thus, we decided to include attitude in our model in order to test its influence on e-procurement adoption by firms. Our first hypothesis can be stated as follows:

H1: Employees’ attitude towards using e-procurement positively influences the adoption of e-procurement by companies.

3.2 Competitive pressure (CP)

The effect of competitive pressure on the adoption and use of innovation has received a lot of attention in the literature. However, the results regarding its impact remain contradictory., A study by Premkumar and Roberts (1999), conducted in the field of e-commerce, claimed that there is a positive relationship between competitive pressure and the adoption of new information technologies in rural small businesses. This relationship was also emphasized by Iacovou *et al.* (1995) in the field of adoption of EDI in small businesses. In contrast, Thong (1999) found that competitive pressure has very little influence on the adoption of e-commerce by small businesses. Since many studies claim the existence of a positive influence of competitive pressure on the adoption of innovation, we decided to include this factor in our research model to test its influence on the adoption of e-procurement by companies. Our second hypothesis is therefore:

H2: Competitive pressure has a direct positive impact on the adoption of e-procurement by companies.

3.3 Trading partners’ pressure (TPP)

Trading partners’ pressure was highlighted by Iacovou *et al.* (1995) as a major factor that can affect the adoption and use of technology by small businesses because the weaker partners in interorganizational relationships, especially small businesses, are extremely susceptible to coercion by their larger partners (Iacovou et al., 1995). From a practical standpoint, this relationship is supported by several studies, e.g. Hart and Saunders (1998), who found a significant relationship between pressure exerted by business partners and use of EDI. In addition, Hsu *et al.* (2006) reported the influence of this factor on the diversity of the use of e-commerce by businesses in the United States. In our case, we equate trading partners with public buyers. For the purposes of this study, public buyers refer to all contracting authorities and public enterprises subject to the legislation on public procurement in accordance with the Belgian Law of 15 June 2006. We can now state our third hypothesis as follows:

H3: Pressure from public buyers will have a positive impact on the adoption of e-procurement by companies.

3.4 Organizational readiness (OR)

Iacovou *et al.* (1995) defined organizational readiness as the availability of financial and technical resources in the organization. According to these authors, this factor is one of the three main determinants that influence the adoption of EDI by small businesses. They explained this by the low level of IT sophistication and lack of

resources among SMEs. Several other empirical studies have also found a correlation between organizational readiness and adoption of innovation by the organization (Zhu & Kraemer, 2002; Kalianna *et al.*, 2009).

Following our seven interviews and for the purposes of this study, organizational readiness will be based on three main elements: senior management support, the availability of adequate financial and technical resources and the availability of necessary computer knowledge to adopt and use e-procurement (through employee training). So we can formulate hypothesis 4 as follows:

H4: *Organizational readiness positively influences the adoption of e-procurement by companies.*

3.5 Perceived Relative advantages (RA)

The Diffusion of Innovation theory and the Iacovuo *et al.* (1995) model noted that the perceived benefit is a major determinant of the adoption of innovation. Several previous studies have claimed this relationship, including Hsu *et al.* (2006) in the field of e-commerce in the United States; Gunasekaran & Ngai (2008) in the field of e-procurement in Hong Kong; Musawa and Wahab (2012) in the field of EDI in Nigeria. However, other empirical studies have not found such a relationship between the relative advantages and the use of technology (for example, Huy *et al.* (2012) in the field of e-commerce in Vietnam). Given that there are many good advantages which may influence positively the adoption level of e-procurement by companies (e.g : Improved access to the government market; lower transaction costs; shorter procurement cycle; Communication anywhere/anytime etc.), we put forward our fifth hypothesis as follows:

H5: *Perceived Relative advantages have a direct positive influence on the adoption of e-procurement by companies.*

3.6 Size

An organization’s size, often measured in terms of number of employees, was frequently considered by the literature as an important determinant of technology adoption and use. A lot of empirical studies confirm the significant impact of this variable on adoption and use of technological innovations by organizations (Grover, (1993); Jeyaraj *et al.*, (2006); Hsu *et al.*, (2006); Batenburg, (2007); Abu-elsamen *et al.*, (2010)). These results can be justified by the fact that large organizations are better able to pay for installation and integration costs, employee training and maintenance costs than SMEs. This is why we decided to include size in our research model in order to test its influence on the adoption of e-procurement by enterprises. The sixth hypothesis can be stated as follows:

H6: *A firm’s size is positively related to its adoption of e-procurement.*

Consequently, our research model is shown in Figure 2.

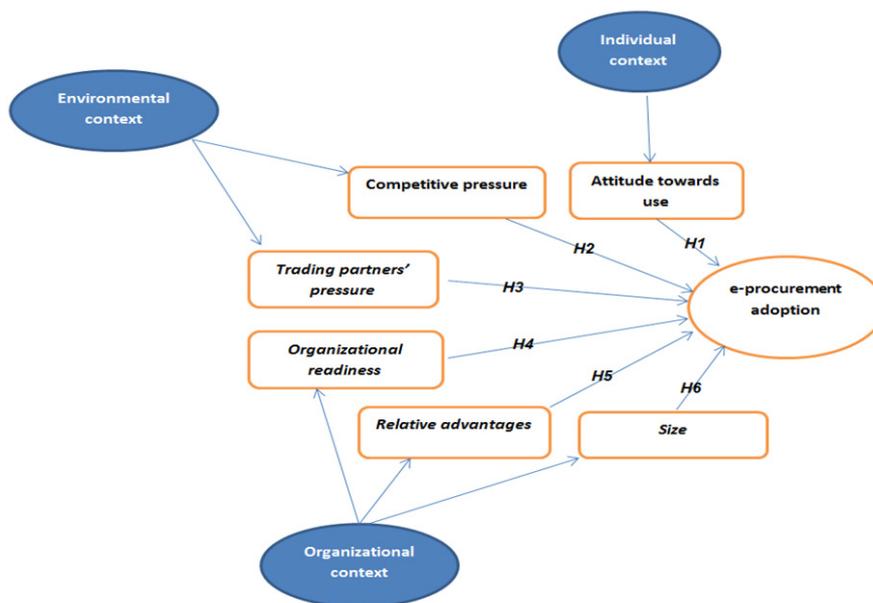


Figure 2: The research model

4. Research methodology

The survey method selected involved an electronically distributed questionnaire. The first two questions were designed to determine company size and sector.

With regards to our measurement scales, few studies have addressed the issue of e-procurement (e.g Rahim, (2008); Kaliannan et al, (2009); Aboelmaged, (2010);; Kamarulzaman et al., 2013); this is why the direct use of items from the literature was not always possible in our case. Many items were therefore developed specifically for this study (see Table 1). All participating firms were asked to evaluate their level of agreement or disagreement with every item using a scale of 1 to 7 points as follows: 1= strongly disagree, 4= neuter, 7 = strongly agree.

Table 2: Potential determinants of e-procurement acceptance by firms

Determinant	Definition used	Measurement scale
Relative advantages (RA)	The degree to which using e-procurement is perceived as being better than the idea it supersedes (Rogers, 1995)	Three items were operationalised from Koh et al. (2010) .
Competitive pressure (CP)	The degree to which the lack of use of e-procurement is perceived as a competitive disadvantage among firms (Iacovou et al., 1995)	Two items about possible competitive disadvantage due to the lack of e-procurement capability (Iacovou et al., 1995).
Attitude (AT)	Employees' positive or negative feelings about using e-procurement (from Fishbein & Ajzen (1975))	Three items operationalised from Koh et al. (2010)
Organizational readiness (OR)	Refers to the level of management support, availability of resources, and knowledge to adopt and use e-procurement.	One item operationalised from Iacovou et al. (1995) – three self-developed items
Trading partners' pressure (TPP)	Refers to the pressure exerted by public buyers on firms to adopt e-procurement.	Three self-developed items
Size	All participating firms were requested to determine their size according to the number of their employees as follows: <ul style="list-style-type: none"> • Micro-enterprise: fewer than 10 employees • Small enterprise: between 10 and 49 employees • Medium-sized enterprise: between 50 and 250 employees • Large enterprise: more than 250 employees 	According to the European Commission Recommendation (96/280/EC) of 3 April 1996 concerning the definition of small and medium-sized enterprises (number of employees only)

With regards to our dependent variable, i.e. firms' adoption of e-procurement, we used a scale of 1 to 5 as follows: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often and 5 = Always. All participating firms were asked to evaluate the frequency with which they use e-procurement applications available in Belgium when this use is voluntary, i.e. when they have the choice between using e-procurement or the classical method of procurement.. In this manner, we can estimate their level of acceptance for adopting e-procurement.

In order to take language differences between Flemish and Walloon regions in Belgium into account, we prepared two versions of our questionnaire, one in French and the other in Dutch. Sample size was calculated using Cohen's (1988) formula, taking into consideration the number of independent variables used in the analysis, the specified power of .80, an effect size of .02, and a significant alpha of .05. Desirable sample size was then determined for about 684 participants. In order to estimate the response rate, we used information from previous surveys on a similar population conducted by SPI (the Economic Development Agency of the Province of Liège (SPI) and Fedict (Information and Communication Technology Federal Public Service). On this

basis, we determined the expected response rate between 10% and 20%. Thus, in November 2015, our questionnaire was sent by e-mail – using the database of the FPS Personnel & Organisation, which is the organisation responsible for the implementation and development of e-procurement applications at the Federal level in Belgium– to a random sample of 5,000 Belgian firms.

5. The results

A total of 760 Belgian companies of all sizes and spread over most economic sectors responded to our survey, which represents a response rate of 15,2 %. Figure 3 shows the classification of respondents according to their size. We can see that the majority of the participating firms are micro-enterprises (about 40%), followed by small enterprises (28%), and then medium-sized and large enterprises (about 16% each). So, in general, we have good representative data for all company sizes.

Regarding sectors, we can see that the participating firms are spread over the main economic sectors in Belgium (see Figure 4). All received data were analysed using SPSS version 22.

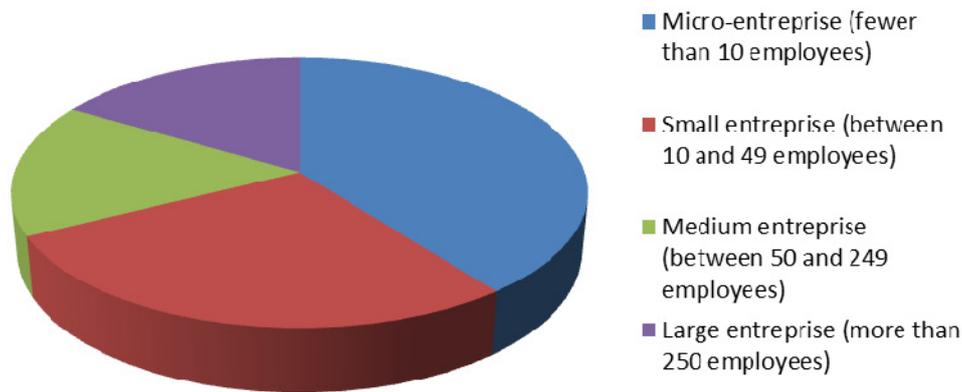


Figure 3: Participating firms according to size

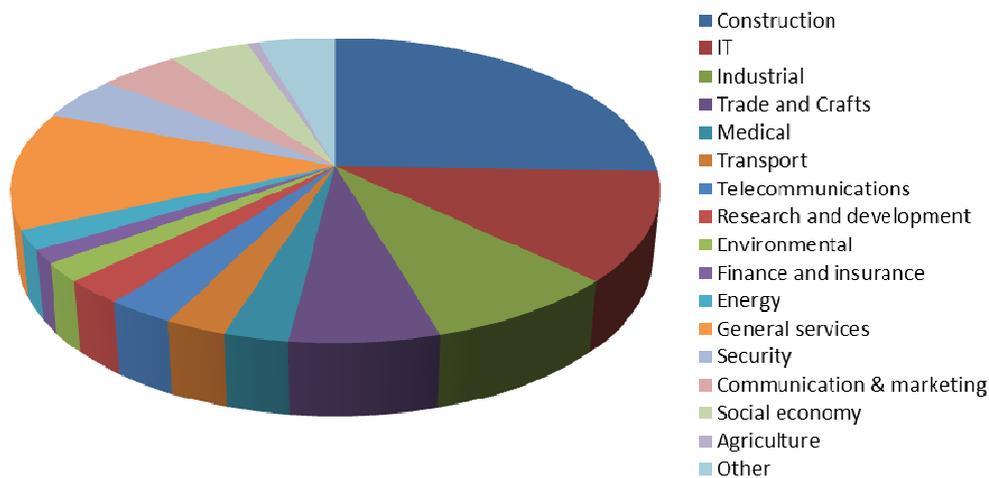


Figure 4: Participating firms according to sector

5.1 Data analyses

To test the hypotheses empirically, a multiple linear regression analysis was performed. As a predictive analysis, multiple linear regression is used to describe and to explain the relationship between one dependent variable and two or more independent variables. This analysis also used to identify the strength of the effect that the independent variables have on the dependent variable, to forecast effects or impacts of changes and to predict trends and future values.

Before conducting the multiple linear regression, we took several steps to check for possible violations of the assumptions underlying this analysis:

A test of linearity was performed. Based on the ANOVA table value sig. Deviation from linearity was 0,09 for each of the independent variables. Thus, it can be concluded that there is a linear relationship between the dependent variable and the independent variables. Multicollinearity was tested using a correlation matrix which showed that the correlation coefficients among all independent variables were smaller than 0.7, which means that no multicollinearity between independent variables. With respect to normality, the Shapiro-Welk test was performed. Results showed that this test was not statistically significant (Sig > 0,05). So, we can accept the null hypothesis and conclude that the dependent variable is normally distributed.

Principal components factorial analysis with Varimax rotation was performed in order to analyse the quality of measurements. According to Nunnally (1978), the values of the dimensions must be greater than or equal to 0.50. The results shown in Table 3 confirmed the existence of five factors with eigenvalues greater than 1. One item only was eliminated from the analysis because it did not load on any of the five factors, namely organizational readiness OR1 (value < 0.50 – see Table 3). These results therefore confirm that each of our constructs is unidimensional and factorially distinct. Cronbach’s alpha coefficient was calculated in order to ensure the reliability of our items. The results show that all our scales exceeded the recommended threshold of 0.70 (Premkumar, 2003), which suggests good reliability of the measurements selected (see Table 4)

Table 3: Factorial analysis with Varimax rotation

Items	Factors				
	1	2	3	4	5
OR1	.476	.124	.347	.109	.108
OR2			.715		
OR3			.736		
OR4			.717		
RA1		.719			
RA2		.675			
RA3		.637			
TPP1				.778	
TPP2				.757	
TPP3				.624	
CP1					.901
CP2					.796
AT1	.844				
AT2	.768				
AT3	.614				
Eigenvalues	10.934	1.602	1.489	1.218	1.125
% variance	37.540	6.966	6.472	5.294	4.893

Table 4: Cronbach Alpha analysis

Factor	No. of items	Cronbach Alpha
Organisational Readiness (OR)	3	.795
Attitude (AT)	3	.870
Relative advantages (RA)	3	.839
Competitive Pressure (CP)	2	.791
Trading Partners Pressure (TPP)	3	.765

A multiple linear regression analysis was then performed. As shown in Tables 4 and 5, according to R-squared = .335, our research model was able to explain about 33.5% of the total variance of e-procurement adoption by firms. Five factors have a significant impact on the adoption of an e-procurement system. In decreasing order of importance, these are: attitude towards change, organizational readiness, trading partners’ pressure, size and competitive pressure. We can therefore validate our hypotheses H1, H2, H3, H4 and H6. In contrast, we found that Relative Advantages does not have any significant impact on e-procurement adoption by firms (p-value = .094). Our fifth hypothesis H5 is therefore rejected (see Table 5).

Table 5: Model summary

Model	R	R- squared	Adjusted R- squared	Std. error of the estimate
1	.579 ^a	.335	.329	.69274

Table 6: Regression analysis

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	.638	.137		4.666	.000
Size	.071	.025	.092	2.803	.005
OR	.098	.025	.159	3.877	.000
1 RA	.053	.031	.084	1.675	.094
TPP	.093	.026	.146	3.537	.000
CP	.060	.021	.105	2.829	.005
AT	.131	.027	.239	4.942	.000

Dependent variable: e-procurement adoption by firms. F=52.724, Sig F= .000

6. Discussion of results

The results of our study have shown that five out of the six independent variables proposed in our research model were able to explain about 33.5% of the total variance of e-procurement adoption by companies. In descending order of importance, these are:

- **Attitude towards change** is the most important determinant of use ($\beta = .239/p\text{-value} < .001$). Our study therefore confirms TAM and several previous studies that reported a significant influence of attitude on the acceptance of technology (Koh et al. (2010); Brown et al. (2002)).
- **Organizational readiness** in turn showed a direct positive impact on the adoption of e-procurement by companies ($\beta = .159/p\text{-value} < .001$). The importance of this relationship has already been mentioned in several studies, such as Iacovou et al. (1995) in the field of EDI use by small

businesses, and Hsu et al. (2006) in the field of e-commerce in the United States. Given that organizational readiness refers essentially to the availability of necessary resources and knowledge to adopt e-procurement, this impact seems to be logical, especially for SMEs because of their limited resources.

- **Trading partners' pressure** is the third in order of importance amongst our explanatory variables ($\beta = .146/p\text{-value} < .001$). As mentioned above, trading partners in this case represent the public buyers. Under paragraph 2 of Article 52 of the Royal Decree of 15 July 2011, the contracting authority may decide for each individual contract whether it requires, allows or prohibits the use of electronic means for the submission of tenders. The contracting authority shall mention this decision in the contract documents. In the absence of any stated decision in this regard, the use of e-procurement is prohibited. We can therefore estimate what role public buyers can play in motivating and encouraging companies to adopt and use electronic channels.
- **Regarding competitive pressure**, while some studies have shown a positive influence between competitive pressure and innovation adoption (Iacovou et al., 1995), others have found the opposite (Hsu et al., 2006). This can be partly explained by the difficulty, if not impossibility, of finding an accurate measure of competition in the market because of the variety of determinants that may influence this factor. Our study, however, maintained the existence of a positive and significant direct influence of CP on the adoption of e-procurement by firms ($\beta = .105/p\text{-value} < .005$). Given that the adoption of e-procurement can help firms to have more flexible and transparent access to public procurement, it seems logical to find competitive pressure as a determinant of e-procurement adoption by firms, especially SMEs
- **Regarding company size**, our findings confirm the positive relationship between this factor and e-procurement use ($\beta = .092/p\text{-value} < .005$). Thus, our study endorses the majority of prior studies, which mentioned a significant positive impact of the company's size on its acceptance of technology (e.g. Huy et al. (2012) in the field of e-commerce for SMEs in Vietnam, and Hsu et al. (2006) in the field of e-business in the USA). Our findings regarding this factor appear to be logical because the larger the company, the greater its ability to pay for installation and integration costs, employee training and maintenance costs. Usually, larger companies have the available resources to be better equipped and adopt innovations (Batenburg, 2007).
- **Regarding relative advantages**, no significant impact was found in our case. Our study therefore goes against several previous studies, such as Hsu et al. (2006), who found a significant influence of RA on adopting e-commerce in the United States. However, our results are similar to those of other empirical studies, which did not find a significant impact of RA on the adoption of innovation, such as the study by Huy et al. (2012) in the field of e-commerce for SMEs in Vietnam. In our opinion, this result can be explained by the fact that companies are not yet sufficiently aware of the benefits expected from the adoption of e-procurement. According to our statistics, we find that about a quarter of businesses remained non-committal on our questions regarding this scale (they chose to answer our questions by selecting 4 on a scale of 7 which means: "neutral"). This shows the high degree of lack of information about the expected benefits of this project.

7. Conclusion and implications

The empirical results suggest that our research model can usefully explain the adoption of e-procurement by firms. Five of the proposed independent variables could explain about one-third of the total variance of this adoption. In descending order of importance, these are: attitude towards change, organizational readiness, trading partners' pressure, competitive pressure and size. In contrast, we did not find any significant relationship between relative advantages and e-procurement adoption by firms. Decision-makers in Belgium can use these findings to develop a more effective plan to promote the adoption of e-procurement amongst enterprises. Such plan can considerably help to reap the maximum of benefits of this system.

Despite our research model being tested using data from Belgian firms, we used a general method that can usefully be applied in the context of other European countries.

Our method has two main limitations. Firstly, there are many other important factors in the literature that can influence technology adoption, however, for practical reasons – especially regarding the number of questions included in our questionnaire – we could not test their impact on e-procurement adoption by firms. Future research could therefore focus on these factors, such as organizational structure, system openness,

government regulations, etc. Secondly, the survey method does not allow questioning of respondents and is not possible to elicit information in respect of language, history, thoughts and feelings of participants. Qualitative research which can examine these problems is therefore recommended in the future.

References

- AboelImaged M. G., 2010. Predicting e-procurement adoption in a developing country, *Industrial Management & Data Systems*, 110(3), pp. 392 – 414.
- Abu-elsamen M. Chakraborty K & Warren D., 2010. A Process-Based Analysis of e-Procurement Adoption, *Journal of Internet Commerce*, 9, pp. 243-253.
- Amin H. Baba R. & Muhammad M. Z 2010. An analysis of mobile banking acceptance by malaysian customers, *Sunway Academic Journal*.
- Angeles R. 2014. Using the Technology-Organization-Environment Framework for Analyzing Nike's "Considered Index" Green Initiative, a Decision Support System-Driven System, *Journal of Management and Sustainability*, 4(1), pp. 69-113.
- Arrow, K., 1962. Economic Welfare and the Allocation of Resources for Invention, in Nelson, R. (ed.), *The Rate and Direction of Invention Activity: Economic and Social Factors* (Princeton University Press, Princeton, New Jersey, U.S.A.).
- Azmi A. C. & Bee N. L., 2010. The Acceptance of the e-Filing System by Malaysian Taxpayers: A Simplified Model, *Electronic Journal of e-Government*, 8(1), pp. 23-32.
- Batenburg R. 2007. E-procurement adoption by European firms: A quantitative analysis, *Journal of Purchasing & Supply Management*, 13, pp. 182-192.
- Behrens, S., Jamieson, K., Jones, D., & Cranston, M., 2005. Predicting system success using the Technology Acceptance Model: A case study. In *16th Australasian Conference on Information Systems* (Paper 70).
- Brown S.A., Massey A.P., Montoya-Weiss M.M. & Burkman J.R. 2002. Do I really have to? User acceptance of mandatory technology, *European Journal of Information Systems*, 11, pp. 283- 295.
- Chigona W. & Licker P., 2008, Using Diffusion of Innovations Framework to Explain Communal Computing Facilities Adoption Among the Urban Poor, *Information Technologies and International Development*, 4(3), pp. 57-73.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Second Edition. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Davis F. D., (1989), Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, 13(3), p. 319-340.
- Fishbein, M., & Ajzen, I., 1975. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*, Reading, MA: Addison-Wesley.
- Grover, V., 1993. An empirically derived model for the adoption of customer-based interorganizational systems. *Decision Sciences*, 24(3), pp. 603–640.
- Gunasekaran, A & Ngai E. W.T., 2008, Adoption of e-procurement in Hong Kong: An empirical research, *Int. J. Production Economics*, 113, pp. 159-175.
- Hart, P. & Saunders, S., 1998. Emerging electronic partnerships: Antecedents and dimensions of EDI use from the supplier's perspective. *Journal of Management Information Systems*, 14(4), pp. 87–111.
- Hsu P. F., Kraemer K.L. & Dunkle D., (2006). Determinants of E-Business Use in U.S. Firms. *International Journal of Electronic Commerce*, 10(4), pp. 9-45.
- Huy L.V., ROWE F. & TRUEX D., 2012. An empirical Study of Determinants of E-commerce Adoption in SMEs in Vietnam an economy in transition. *Journal of Global Information Management*, 20(3).
- Iacovou, C.L., Benbasat, I. & Dexter, A.S., 1995. Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly*, 19(4), p. 465–485.
- International Data Corporation (2013) , Study on e-Procurement Measurement and Benchmarking MARKET, Brussels, p. 88.
- Jaeger, P. T. and Matteson, M., 2009, e-Government and Technology Acceptance: the Case of the Implementation of Section 508 Guidelines for Websites. *Electronic Journal of e-Government* , 7 (1), p. 87 – 98
- Jeyaraj, A., Rottman, J. & Lacity, M., 2006. A review of the predictors, linkages, and biases in IT innovation adoption research. *Journal of Information Technology*, 21(1), pp. 1-23.
- Jwaifell M. & Gasaymeh Al., 2013, Using the Diffusion of Innovation Theory to Explain the Degree of English Teachers' Adoption of Interactive Whiteboards in the Modern Systems School in Jordan: A Case Study, *Contemporary educational technology*, 4(2), pp. 138-149
- Kalianna, M., Raman, M. & Dorasamy, M., (2009). E-procurement adoption in the Malaysian public sector: organizational perspectives. Enterprise Distributed Object Computing Conference Workshops, EDOCW 2009. 13th, IEEE, pp. 189-194.
- Kamarulzaman N. H., Mukherjee A. & Faizal Zainal Rashid M. (2013), E-Procurement Adoption in the Agro-Based Sector: A Malaysian Perspective, *Journal of International Food & Agribusiness Marketing*, 25, p. 35-55.
- Koh C.E., Prybutok V. R., Ryan S. D., & Wu Y., (2010). A Model for Mandatory Use of Software Technologies: An Integrative Approach by Applying Multiple Levels of Abstraction of Informing Science, *The International Journal of an Emerging Transdiscipline*, 13, p. 177-203.

- Musawa M.S. & Wahab E., 2012. The adoption of electronic data interchange (EDI) technology by Nigerian SMEs: A conceptual framework. *Journal of Business Management and Economics*, 3(2), p. 55-68.
- Kwon H. S & Chidambaram L., 2000, A Test of the Technology Acceptance Model The Case of Cellular Telephone Adoption. Proceedings of the 33rd Hawaii International Conference on System Sciences.
- Lippert S. K. & Govindarajulu C., (2006), Technological, Organizational, and Environmental Antecedents to Web Services Adoption, *Communications of the IIMA*, 6(1), pp. 147- 160.
- Melone N.P., (1990). A theoretical assessment of the user-satisfaction construct in information systems research, *Management Science*, 36, pp.76–91.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- OECD (2015), *Government at a Glance 2015*, OECD Publishing, Paris. Available at [http://dx.doi.org/10.1787/gov_glance-2015-en], accessed on 20/09/2016
- Oliveira, T. & Martins, M.F. (2010a). Firms patterns of e-business adoption: Evidence for the european union- 27, *The Electronic Journal Information Systems Evaluation Volume*, 13(1), pp 47-56.
- Oliveira T & Martins M. F. (2010b), "Understanding e-business adoption across industries in European countries" , *Industrial Management & Data Systems*, 110(9), p. 1337-1354.
- Pan M-J & Jang W-Y. (Spring 2008). Determinants of the adoption of enterprise resource planning within the technology organization environment framework: Taiwan's communications industry, *Journal of Computer Information Systems*, 48(3), p. 94-102.
- Premkumar G. (2003). A meta-analysis of research on information technology implementation in small Business. *Journal of Organizational Computing and Electronic Commerce*, 13(2), p. 91-121.
- Premkumar, G., Ramamurthy, K. & Crum, M. (1997). Determinants of EDI adoption in the transportation industry. *European Journal of Information Systems*, 6(2), p. 107–121.
- Premkumar G. & Roberts, M. (1999). Adoption of New Information Technologies in Rural Small Businesses, *Omega: The International Journal of Management Science* 27: 467–484.
- Rahim, M. M., (2008), Identifying Factors Affecting Acceptance of E-procurement Systems: An Initial Qualitative Study at an Australian City Council, *Communication of IBIMA*, 3, p7-17.
- Rogers E. M. (1983), *Diffusion of Innovations*, 3rd edition. The Free Press, New York.
- Rogers, E. M. (1995). *Diffusion of innovations*, 4th edition. New York: Free Press
- Rose J. & Fogarty G. (2006), "Determinants of perceived usefulness and perceived ease of use in the technology acceptance model: Senior consumers' adoption of self-service banking technologies", *Academy of World Business, Marketing & Management Development Conference Proceedings*, 2(10), p. 122-129.
- Teo, T.S.H, Lim, V. & Lai, R. (1999). Intrinsic and Extrinsic motivation in Internet Usage. *Omega*, 27(1), pp. 25-37.
- Teo, T.S.H., Ranganathan, C. and Dhaliwal, J. (2006). Key dimensions of inhibitors for the deployment of webbased business-to-business electronic commerce, *IEEE Transactions on Engineering Management*, 53(3), p 395-411.
- Tornatzky, L. G., & Fleischer, M., 1990. *The processes of technological innovation*. Lexington, MA: Lexington Books.
- Thong J.Y.L., (1999). An Integrated Model of Information Systems Adoption in Small Businesses, *Journal of Management Information Systems*, 15(4), pp. 187-214.
- UK presidency of UE, (2005), ministerial declaration, Manchester, p. 6. Available at : <http://www.umic.pt/images/stories/noticias/051124declaration.pdf>, [Accessed on 20/09/2016].
- Van Heck E. & Ribbers P. M., (1999), "The Adoption and Impact of EDI in Dutch SME's", Proceedings of the 32nd Hawaii International Conference on System Sciences – 1999.
- Wangpipatwong S. Chutimaskul W & Papisatorn B.,(2008), "Understanding Citizen's Continuance Intention to Use e-Government Website: a Composite View of Technology Acceptance Model and Computer Self-Efficacy", *Electronic Journal of e-Government*, 6(1), p. 55-64.
- Zhang X., Yu P. Yan J, and Ton A M Spil I. (2015), "Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic", *BMC Health Serv Res*, 15:71.
- Zhu, K. & Kraemer, K. (2002). E-commerce metrics for net-enhanced organizations: Assessing the value of e-commerce to firm performance in the manufacturing sector. *Information Systems Research*, 13(3). p. 275-295.
- Zhu, K., Kraemer, K. & Xu, S. (2003). E-Business adoption by European firms: A cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, 12(4), p. 251–268

Appendix A

Scales of Constructs

Organizational Readiness

- We have the material resources to use the e-procurement system
- We have the human skills needed to use the e-procurement system
- We have received adequate training on how to use the applications of e-procurement
- The top management of our company is innovative and favorable towards the use of e-procurement.

Perceived relative advantages

- The use of e-procurement allows us to reduce costs in our operations
- The use of e-procurement can improve the image of our company
- The use of e-procurement can improve trade relations with the public sector

Trading partner's pressure

- Public purchasers encourage us to use the e-procurement system
- Public purchasers bring us the help needed to use the e-procurement system
- We believe that public purchasers are favorable to the adoption of e-procurement.

Size

- Micro-enterprise: Fewer than 10 employed
- Small enterprise: between 10 and 49 employed
- Medium-sized enterprise: between 50 and 250 employed
- Large enterprise: more than 250 employed

Attitude

- Use e-procurement system instead of traditional procedures (paper) public procurement is a good idea
- Use of e-procurement makes the establishment of trade relations with the public sector more attractive and interesting
- The use of e-procurement corresponds to how we wish to work.

Competitive pressure

- We may miss many opportunities in the public sector to benefit of our competitors if we do not use e-procurement.
- Using e-procurement provides competitive business advantage

Adoption of e-procurement

Could you please evaluate the frequency with which you use e-procurement applications available in Belgium when this use is voluntary? (i.e. when you have the choice between using e-procurement or the classical method of procurement)