

Web-based procurement systems: Intention of adoption by Portuguese organizations

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1. Abstract

In this study, we have developed a conceptual model for electronic-procurement systems (EPS) adopted by Portuguese Organizations incorporating six intentions of adoption determinant factors. In order to do this job, we integrate the technology-organization-environment framework and the institutional theory. Data will be collected from the 2500 biggest companies working in Portugal, to test the model. Based on literature, logistic regression method is the most appropriate data analysis method to test our hypothesis. We think that we can get evidence to say that EPS intention of adoption by Portuguese organizations is related to the firm size, scope, technology competence and the perception the companies main decision makers have about the lack of trading partner readiness to implement EPS. We also suggest that the bigger is the perception of companies about the extent of adoption by competitors, the stronger is their intention to adopt EPS. And finally the level of perception of competitors' success adopting EPS is also a factor that has a positive influence on the EPS adoption intention. We hope to get evidence to say so.

Keywords: e-procurement systems, adoption intention, Portugal, B2B, logistic regression, survey method, research proposal.

2. Introduction

The present research proposal has three main objectives. First, it intends to be a starting point for the research project in the scope of the Ph.D. that I'm doing at the "Instituto Superior de Economia e Gestão" (ISEG) in Portugal. Second, we believe that the opportunity to present it at the 10th IFPMM Summer School on Advanced Purchasing Research is a good way to improve the job we've been doing. Beyond that, this research proposal is focused on the identification of the determinant factors, drivers or antecedents of web-based procurement systems (WBPS or EPS¹) that lead Portuguese companies to adopt the EPS. We know that a lot of companies have adopted this type of system but much more have not implemented it yet. Hence, understanding the adoption drivers and barriers becomes increasingly important. However, such issues have not been thoroughly studied in the literature, and it is also true

for EPS. This proposal is composed of four parts. In the first one, we present the topic, its importance and contribution to the current body of knowledge as well as the research questions. Next, we give an explanation of the theories that support the research model and present the six hypotheses under investigation. The third component of this paper is the study methodology that should be used in order to answer the research questions. A survey method is proposed in order to acquire the necessary data to empirically test the research model. The sample will be composed of the biggest 1000 Portuguese companies. This is our assumption, because we believe, based on product life cycle, the EPS is nowadays an issue of the big companies. A questionnaire will be sent to people that we consider the main decision-makers regarding EPS adoption. They are the Chief Information Officer and the Chief Purchasing Officer. Finally, a set of future perspectives and limitations of the study, that we consider relevant, are presented.

¹ We will use the term EPS to denote the Web-based Procurement System

2.1. The importance of the topic and the research questions

Electronic Commerce (EC) - the electronic pre-processing, negotiation, performance and post-processing of business transactions between commercial subjects (ECaTT, 2001) - will support firm efficiency efforts. There is an overwhelming consensus about the EC growth over the next 10 years (Carter *et al.*, 2000). The Internet (including intranet, extranet, and Internet technology) and the World Wide Web will be the backbone of electronic commerce once several issues are addressed. A very powerful communication integration is underway matching future improvements in the Web with the adoption of enterprise-based systems. This trend is being driven by the need for speed in both decision making and product and service fulfillment.

The topic of this research proposal is "buying". Cox (2001), says that there are three key generic business competencies. The first is the demand management competence - the ability to understand current and future markets and to sell existing and future products and services within them. The second key competence is the transformation competence or the ability of turning supply inputs into more valuable supply outputs through a value adding process. And the third key business competence is concerned with the procurement and supply management - the ability to acquire required supply inputs at the quality required and with the lowest total cost of ownership. So if we have information technology (EPS) that can help this activity become more effective and efficient we can posit that those technological components are of great importance to some, if not all, firms that have to perform the procurement activity.

Another important contribution to evaluate the importance of the EPS topic is the study of Frohlich & Westbrook (2001). They found that manufacturing firms with the greatest degree of supply chain integration were strongly associated with higher levels of performance. In fact it was an assumption, but this was the first time that it had been demonstrated empirically with a large international group of companies. Undoubtedly, the EPS makes a contribution in order to improve the degree of integration between a certain firm (the buyer organization) and its suppliers. So we can also say

that the firms adopting an EPS can obtain performance gains. That's why we think the topic is an important one to study and understand especially within different contexts.

Web-based procurement is a recent issue that is in its infancy. However the number of companies using some kind of EPS model is big enough to deserve an investigation effort in order to better understand the phenomena. Taking into account the existing literature and the value of the information system to improve operational efficiency we observe that a major part of the firms do not use the system. So why some adopt and implement it and others do not do it? This led us to the **key research questions** that motivate this work:

- 1.1) What are the determinant factors that lead Portuguese organizations to adopt web-based procurement systems?
But knowing the factors that lead companies to adopt an EPS is not enough. It is also important to know their relative importance, their explanatory power. This is the driver to another research question:
- 1.2) What are the most important factors that explain the adoption of the EPS?

While answering the main research question, we will try to answer other important research questions:

- 2.1) What is the EPS adoption intention by Portuguese organizations?
- 2.2) Will there be some differences across industries that discriminate the EPS adoption intention? What are they?
- 2.3) Will there be some differences between EPS adopters and non adopters? What are the factors that distinguish those two groups?

2.2. Expected contribution to the body of knowledge

There is a recent study predicting intention to adopt financial EDI systems (Teo, Wei & Benbast, 2003). There is also another recent study predicting e-busines adoption intention (Zhu *et al.*, 2002). The first one uses institutional theory as a lens to understand the factors that enable the adoption of inter-organizational systems. The second one uses

the technology-organization-environment framework. However none of the models is appropriate to evaluate EPS adoption intention. The present research proposal uses both theories in order to develop a new model and empirically test it with data gathered in the main Portuguese companies. In fact, the research model is a new one, it is supported by the theory and we want to test it in order to get empirical evidence to support the presented hypothesis. Beyond that, with the data we are expecting to gather, it will be possible to improve our knowledge of the present situation of the Portuguese organizations concerning the potential of development of the B2B market. That will be useful for both the political agents and B2B software vendors and consultants. The politicians will be able to define better policies regarding financial support or other kind of programs to support the productivity improvement of the Portuguese economy, which currently has one of the lowest growth productivity rates in Europe. On the other hand, software vendors and consultants will be able to improve the quality of their plans to attack the B2B market, because with the expected confirmation of the hypotheses of this research, they will know which the main factors affecting the organizations intention of EPS adoption are. Undoubtedly this will help them improve their sales and marketing plans resulting in better performance.

3. Theory and hypothesis

3.1. Web-based procurement systems (EPS)

A significant proportion of organizational resources are devoted to managing inter-organizational processes, such as procurement of goods and services from other companies, collaboration for product development, and financial transactions between companies. Among these, the procurement of goods and services, called business-to-business (B2B) procurement, involves the largest cost for an enterprise, with many organizations spending 50% to 60% of their revenues on goods and services (Kalakota & Robinson, 1999). Yet, information technology applications have focused

mostly on more structured processes, such as manufacturing, leaving most procurement processes inefficient and ineffective. *Procurement usually covers two types of purchases – direct and indirect. **Direct purchases** involve materials, such as raw materials and components, which go into the finished products sold to the customer. Indirect purchases, on the other hand, involve goods and services that are not part of the finished product, but support the internal business activities. Examples of such items are computers, office equipments, operating supplies and office supplies. **Indirect procurement**, involves a wide variety of items of different complexities, and caters to a range of internal needs and preferences. In addition, unlike direct items which are managed through company-wide standards and controls, indirect purchases are highly decentralized and have multiple and, in many cases, incompatible applications within the same organization. Thus, managing indirect procurement through traditional IT systems has been a major challenge to information systems (IS) professionals. The use of the Internet for procurement has generated great excitement among organizations because of its potential to reduce procurement costs and improve strategic sourcing (Buxman & Gebauer, 1999). The availability of electronic markets and industry specific B2B exchanges has enriched the choices available for organizations to manage their procurement (Bakes, 1998).*

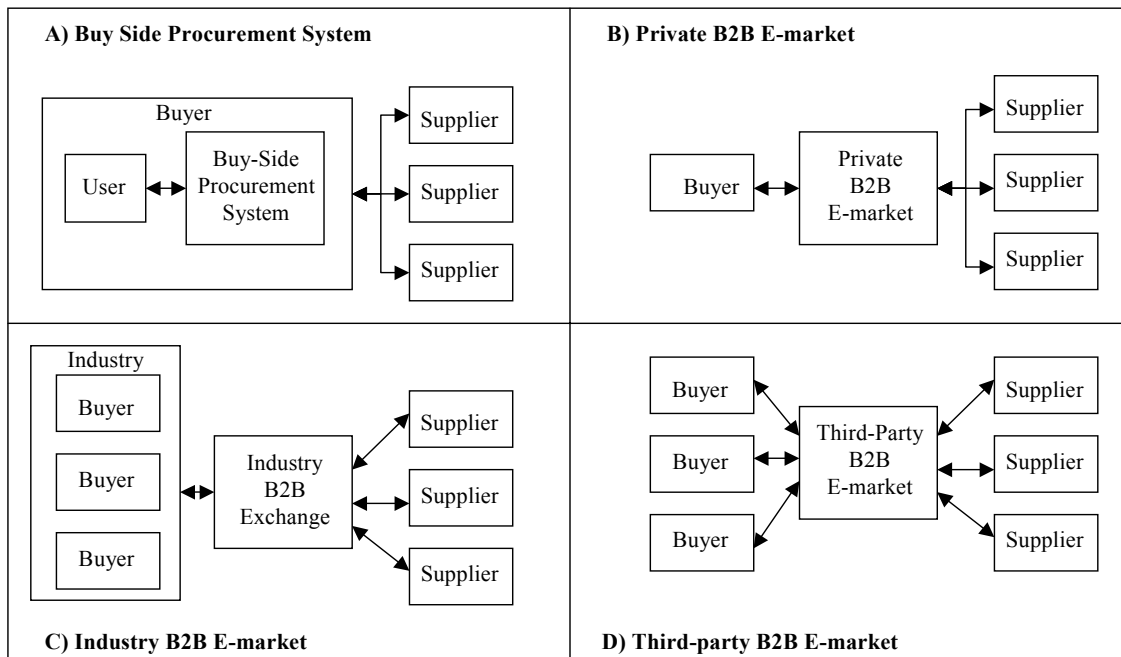
However, from the point of view of B2B procurement, Subramaniam & Shaw (2002) have identified four models of electronic procurement systems (Figure 1).

These models reflect the different ways that a buyer or supplier can choose to execute a B2B transaction (Phillips & Meeker, 2000). Each model creates value for the buyer and seller in unique ways and organizations typically use more than one, if not all, models. A brief discussion of the models follows.

3.1.1. Buy-side procurement system

This form of procurement system is developed and implemented by large buyer organizations to Web-enable their purchases with selected suppliers. The entire procurement cycle, covering product development, transactions and procurement

Figure 1 - Electronic procurement models



Source: Subramaniam & Shaw (2002)

management are Web-enabled and integrated. This actually creates a virtually integrated inter-organizational system (IOS) between the buyer and the seller, like the EDI (Electronic Data Information) system, but with greater scope and capabilities. The two major areas of emphasis of this system are transaction efficiency and process control.

3.1.2. Private marketplace

Some organisations form their own electronic markets to aggregate their suppliers to get competitive price for products. The suppliers are limited to those who wish to trade with the buyer-owned private e-market, which limits the extent of liquidity and competition possible. The emphasis of private electronic markets is on reducing the procurement price of the items, but the organisation forming the marketplace has control over how the market operates. Private e-markets also reduce search costs for locating sellers and serve as exchange mechanisms for proprietary knowledge of the enterprise. Examples of such marketplaces are Siemens's Quicktoprocare and Walmart's RetailLink.

3.1.3. Industry B2B exchange

Each organisation building a private e-market limits the liquidity of each market and forces suppliers

to work with multiple markets. Hence, organisations in some industries form consortiums and build industry-specific B2B exchanges. This model aggregates buyers and sellers in the specific industry. As this is an industry-wide effort, it is easy to build liquidity with suppliers wanting to participate where most of the industry purchases are going to be. The emphasis of industry-wide exchanges is to increase transparency of the process and force competition among suppliers, which results in lower prices for buyers. This model also reduces the search costs for both buyers and sellers.

3.1.4. Third-party marketplace

These marketplaces are created by companies called market-makers, (or infomediaries), who have both technological and domain expertise. Third-party marketplaces can be *horizontal* or *vertical*. Horizontal marketplaces aggregate buyers and sellers across a particular function across multiple industries. www.bizdirect.pt is a Portuguese example of such a horizontal marketplace. Vertical marketplaces aggregate buyers and sellers across a particular industry across multiple functions. One example in Portugal is www.econstroi.com. Third-party marketplaces are suitable in **fragmented markets** (buy side or sell side), where locating the buyer or

seller is very expensive and in **standard and commodity products**, where price and availability are the major purchase criteria. Third-party markets provide value by lowering the product price for the buyers, and lowering the search costs for both buyers and sellers (Baños, 1998).

3.2. Resource based view, dynamic capabilities and EPS

A potential framework for augmenting the theoretical basis of EPS value is the **resource-based view** of the firm, which links firm's performance to organisational resources and capabilities. Firms create performance advantages by assembling resources that work together to create organisational capabilities (Wernerfelt, 1984; Peteraf, 1993). To create sustainable advantages, these resources, or resource combinations, would have to be economically valuable, relatively scarce, difficult to imitate, or imperfectly mobile across firms (Barney, 1991). Resources can be combined and integrated into unique clusters that enable distinctive abilities within a firm (Teece *et al.*, 1997). RBV (Resource Based View) has been widely accepted in strategic management literature. In the information systems literature, the RBV has been used to explain how firms can create competitive value from IT assets, and how sustainability resides more in the organisation's skills to leverage IT than in the technology itself. IT payoffs depend heavily on "fitting the pieces together" i.e., on exploiting relationships among complementary resources. Computers, databases, technical platforms, and communication networks form the core of a firm's overall IT infrastructure resources. Although the individual components that go into the IT infrastructure are commodity-like, the process of integrating the components to develop an integrative infrastructure tailored to a firm's strategic context is complex and imperfectly understood (Weill & Broadbent, 1988). The resource-based view has been extended with the **dynamic capabilities** perspective (DCP) to address the realities of high-velocity markets and rapid technological change. DCP refers to the ability of a firm to achieve new forms of competitive advantage by renewing technological, organisational, and managerial resources to achieve congruence with the

changing business environment (Teece *et al.*, 1997; Eisenhardt & Martin, 2000). In this environment, capabilities that enable rapid and purposeful reconfiguration of a firm's resources are the means through which unique resources can be obtained. This model suggests that dynamic capabilities are essentially change-oriented capabilities that help firms reconfigure their resource base to meet evolving customer's demands and competitor's strategies. The ability to foresee technological change and adopt the appropriate strategies may create a trajectory of growth that would create a performance advantage (Teece *et al.*, 1977).

Capabilities are dynamic because the firm must continually build, adapt, and reconfigure internal and external competencies to achieve congruence with the changing business environment when the rate of technological change is rapid, time-to-market is critical, and the nature of future competition and markets are difficult to determine (Teece *et al.*, 1997). Dynamic capabilities create resource configurations that generate value-creating strategies (Eisenhardt & Martin, 2000). As EPS supported by digital networks provide business processes with capabilities for speed, strategy is fast becoming a dynamic process of recreating and executing innovation options to gain competitive advantage (Teece *et al.*, 1997). Applying the dynamic capabilities theory for understanding a firm's ability to create value through the business use of digital networks, Wheeler (2002) proposes the Net-enabled Business Innovation Cycle, considering that Net-enabled business innovations require timely and ongoing reconfiguration of firm resources. Zahra and George (2002) article reinforces its appropriateness in the Information Systems context.

Consistent with DCP, Electronic Procurement can be considered to be a dynamic capability. Net-enhanced organisations continually reconfigure their internal and external resources to employ digital networks to exploit business opportunities. Thus, Net-enhanced organisations exemplify the characteristics of dynamic capabilities as they engage routines, prior and emergent knowledge, analytic processes, and simple rules to turn IT into customer value (Wheeler, 2002; Sambamurthy *et al.*, 2001).

Because this study exploits the IT value literature to the domain of Internet-enabled e-business

initiatives, it is natural to ask if Internet initiatives are different from pre-Internet technologies (e.g., PC, mainframe, legacy systems). In fact, the economic characteristics of the Internet are significantly different from those of pre-Internet computer technologies. The Internet is unique in terms of *connectivity*, *interactivity* and open-standard *network integration* (Kauffman *et al.*, 2001). These characteristics have very different impacts on customer reach and richness of information. Prior to the Internet, firms often used stand-alone, proprietary systems to communicate limited data. It was difficult or costly for a firm to connect to its customers, suppliers, and business partners. In contrast, the Internet enables a two-way, real-time information exchange between a firm and its customers and suppliers (Straub *et al.*, 2002).

Given these unique characteristics of the Internet, many organisations have embraced B2B e-commerce. Yet, the way that B2B e-commerce is embedded in business processes differs. In fact, it is how firms leverage their investments to create unique Internet-enabled resources and firm-specific capabilities that determine a firm's overall B2B e-commerce effectiveness. Firms leverage benefits from the Internet when they embed B2B e-commerce capability in their organisational processes in a way that produces sustainable resource complementarity. **Complementarity** represents an enhancement of resource value and arises when a resource produces greater returns in the presence of another resource than it does alone. For instance, the integration of B2B e-commerce capability and IT infrastructure may improve connectivity, compatibility, and responsiveness of firm information systems, which leads to greater efficiency and lower costs. Information systems can embody rigidity and incompatibility, especially when they are based on proprietary pre-Internet platforms for software and hardware. "Islands of automation" are often seen in many organisations, where various Information Systems exist and run separately from each other and not integrated internally with other parts of the corporate information systems or externally with suppliers and business partners. Data re-entry is often needed to be done manually, increasing costs and errors. The business processes captured in such systems can become easily outdated. The

connectivity and open-standard data exchange of the Internet may help remove incompatibility of the legacy information systems. A mainframe-based legacy IT system (such as EDI) that only marginally improves performance under ordinary conditions may produce substantial advantages when combined with the Internet - its greater connectivity allows more direct interaction with customers and tighter data sharing with suppliers. Internet-based B2B e-commerce can be used to enhance traditional IT systems in many ways. For example: using Web-based graphical interface to improve the user-friendliness of ERP systems, implementing Internet-based middleware to make EDI-connections more flexible and affordable for smaller businesses, using XML-based communication to increase the ability of exchanging invoice and payment documents online between companies, and analysing online data to better understand customer demand.

For these reasons, it is important to focus on resource complementarity as a feasible path to B2B EC effectiveness. The resource-based view provides a solid theoretical foundation for studying the contexts and conditions under which B2B EC may produce performance gains. Particularly, it points toward a more balanced perspective, one that acknowledges the commodity view of the technology per se, while allowing the possibility of performance associations arising from combining B2B EC capabilities with IT infrastructure and other complementary resources.

In conclusion we can say that Resource Based View and Dynamic Capabilities theories support that an EPS has enough value to deserve a specific project research in order to determine the level of EPS adoption intention in Portugal. Those theories also supply sufficient theoretical basis to posit that EPS has a positive impact on firm financial performance. However that is an excellent issue to be explored in future studies and deserve a longitudinal perspective.

4. Conceptual model for EPS adoption intention

To study the adoption of general technological innovation, Tornatzky and Fleischer (1990) developed the technology-organization-environment framework,

which identified three aspects of a firm context that influence the process by which it adopts and implements technological innovation: organizational context, technological context, and environmental context. Organizational context is typically defined in terms of several descriptive measures: firm size; the centralization, formalization, and complexity of its managerial structure; the quality of its human resource; and the amount of slack resources available internally. Technological context describes both the internal and external technologies relevant to the firm. This includes existing technologies inside the firm, as well as the pool of available technologies in the market. Environment context is the arena in which a firm conducts its business - its industry, competitors,

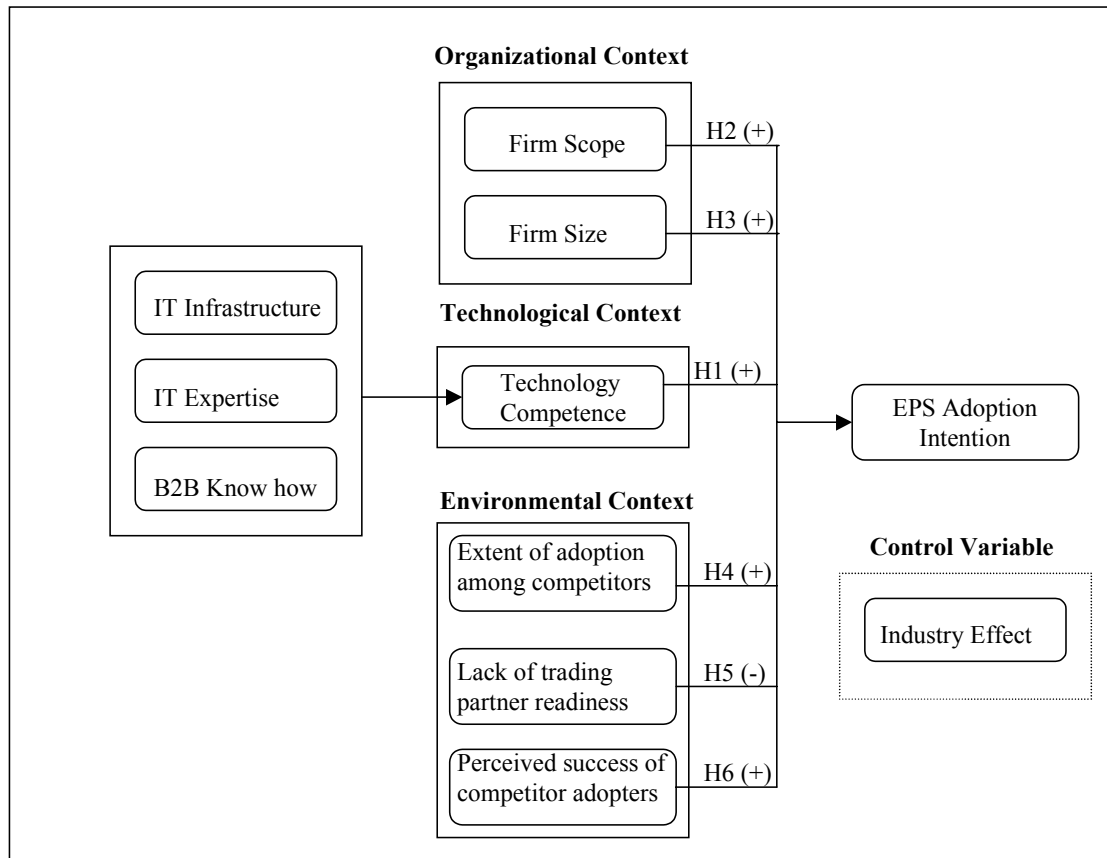
access to resources supplied by others, and dealings with government (Tornatzky & Fleischer, 1990).

Based on the technology-organisation-environment framework, we propose a conceptual model for e-business adoption, shown in Figure 2. This conceptual model posited six predictors for EPS adoption intention within the three-context framework, and is controlled for industry effects.

4.1. Dependent variable

The dependent variable in the conceptual model in Figure 2 is the EPS adoption intention (EAI). A business intent of EPS adoption refers to its concrete plan to implement it within one year.

Figure 2 - Conceptual Model for EPS Adoption Intention



4.2. Technological context

In the existing literature, technology resource has been consistently demonstrated as an important factor for successful IS adoption (Crook & Kumar, 1998; Kuan & Chau, 2001). Hence, this study posited technology competence as an adoption driver, which,

as conceptualized to be a second-order construct, encapsulates three sub-constructs:

- (1) IT infrastructure - **technologies** that enable Internet-related businesses.
- (2) IT expertise – **employees’** knowledge of using these technologies; and

(3) B2B know how - **executives'** knowledge of managing online procurement.

By these definitions, technology competences constitute not only physical assets, but also intangible resources since expertise and know-how are complementary to physical assets (Helfat, 1997). The above viewpoints lead to the following hypothesis:

H1: Firms with higher levels of technology competence are more likely to adopt EPS.

4.3. Organizational context

4.3.1. Firm scope

The existing literature has proposed that the larger the scope, the greater the demand for IT investment (Dewan *et al.*, 1998; Hitt, 1999), which suggested us to posit scope as a facilitator for EPS adoption. The role of scope as an adoption predictor can be explained from two perspectives. First, greater scopes lead to higher internal coordination costs, higher *search costs* and *inventory holding costs* (Chopra & Meindl, 2001). Since business digitalisation can reduce internal coordination costs (Hitt, 1999), and since B2B EC can lower search costs for both *sellers* and *buyers* (Bakos, 1998), to achieve demand aggregation and to improve inventory management, firms with greater scopes are more motivated to adopt e-business. Second, firms with greater scopes have more potential to benefit from synergy between web-based and traditional business processes. Typical examples are using Web-based search to help IS's users to locate physical stores, using Web-based graphical interfaces to improve the user-friendliness of ERP systems, and linking various legacy databases by common Internet protocols and open standards. These perspectives lead to the following hypothesis:

H2: Firms with greater scope are more likely to adopt EPS.

4.3.2. Firm size

Firm size has been consistently recognised as an adoption facilitator (Damanpour, 1992). With regard to EPS adoption, larger firms have several advantages over small firms. Larger firms

- (1) tend to have more slack resources to facilitate adoption;
 - (2) are more likely to achieve economies of scale, an important concern due to the substantial investment required for e-business projects;
 - (3) are more capable of bearing the high risk associated with early stage investment in e-business; and
 - (4) possess more power to urge trading partners to adopt technology with network externalities.
- Therefore, it is reasonable to hypothesise:

H3: Larger firms are more likely to adopt EPS.

4.4. Environmental context

4.4.1. Extent of adoption among competitors

Sociological research on threshold models (Krassa, 1988) suggests that decisions to engage in a particular behaviour depend on perceived number of similar others in the environment that have already done likewise. Hence, if enough similar organisations do things in a certain way like that it gives rise to that particular course of action being legitimated or taken for granted throughout a sector, others will follow suit to avoid embarrassment of being perceived as less innovative or responsive (Goodstein, 1994). So, in the context of EPS adoption, we can hypothesise that:

H4: Greater perceived extent of adoption of EPS among its competitors will lead to greater intent to adopt EPS.

4.4.2. Lack of trading partners readiness

A firm's EPS adoption decision may be influenced by the adoption status of its trading partners along the value chain, since for an electronic trade to take place, it is necessary that all trading partners adopt compatible electronic trading systems and provide Internet-enabled services for each other. Furthermore, the Internet is fundamentally about connectivity. EPS may necessitate tight integration with suppliers, which goes beyond the walls of an individual organisation (Zhu *et al.*, 2002). Accordingly, a lack of trading partner readiness may hinder EPS adoption.

H5: Firms facing a lack of trading partner readiness are less likely to adopt EPS.

4.4.3. Perceived success of competitors Adopters

Although there are no studies directly examining mimicry of IT practices, there is implied evidence that followers, out of competitive necessity, imitate pioneers that have successfully exploited IT, especially in the banking and airlines industries (Coopeland & Mckenney, 1988). Therefore, in the context of EPS adoption, potential adopters will be more likely to adopt it if they perceive that EPS has conferred success on other competitor adopters. Hence we can hypothesize that:

H6: Greater perceived success of competitors that have adopted EPS will lead to greater intention to adopt EPS.

4.5. Control variable

Industry effect will be used as independent variable to control data variation not explained by the explanatory variables.

5. Methodology

At this moment of the research proposal, we think it is important to raise the question "What methodology fits the research questions?" A qualitative methodology or a quantitative one? Based on Duncan (1979) we know that sometimes the functions of each method are complementary rather than contradictory. In fact, in some studies the best strategy may be to use both approaches. This is true when the researcher is interested in discovering the nature and characteristics of a phenomenon and, at the same time, ascertain causes and/or relationships between it and other phenomena.

Qualitative methods take a phenomenologist reference. This approach is concerned with understanding human behavior from the actor's frame of reference. Qualitative methods yield descriptive data, which enables the researcher to see the situation as the actors see it. The Qualitative methods then ask the following questions:

1. What's going on here?
2. What are the forms of the phenomenon?
3. What are the variations in this phenomenon?

Quantitative methods take a different approach, a positivist one. Their focus is on the following questions:

1. What are the causes of a social phenomenon, the forms it assumes and variations it displays?
2. What are the consequences of the phenomenon, the forms it assumes and variations it displays?

Therefore, taking the research questions raised in the introduction of this document and the theory that was presented, we should choose a quantitative method. In fact, we want to know the causes or determinant factors that lead an organization to adopt a certain information system, the EPS.

The research we are proposing is a correlational study. We want to establish a relation between one dependent variable and a set of other independent variables. Mitchel (1985) suggests that we should pay attention to several important issues in order to evaluate a correlational study: sample, response rate, respondents vs non-respondents, type of method (Ad, Mail, Delivered Questionnaire; Personal Interview), reliability (Cronbach alpha, test-retest, interrater, split half), citations of reliability and/or validity (citations of studies using the same measures), test for method variance, significant correlations, and holdout sample or cross-validation. Certainly not all cited issues are of great relevance to this study, but we will analyse some of them in order to design the best possible research proposal.

5.1. The method

We propose to use the **survey method** to test the model because it provides a basis for establish a general rule, allows replicability and has statistical power. Besides, we do not have in any document or database or other secondary source, the data we need to test the model. Only through a questionnaire administered to a Chief Information Officer and/or Chief Purchasing Officer, the main decision-makers of the EPS adoption, it will be possible to gather the data. The interview is an option but only in the pilot study.

5.2. The sample

We propose to test the conceptual model in the Portuguese market. So we will need to send a

questionnaire to the 2500 bigger companies (the unit of analysis) working in Portugal belonging to the manufacturing, services and trading/commerce industries. Then a follow-up will be done in order to improve the response rate that in Portugal is not very high (10 to 20 % is the expected value). We believe the key potential benefits of EPS lies in operational efficiency gains and cost reduction for large traditional companies so these companies should have an adoption intention of EPS significantly different from zero. Also, as we are looking for generalizability we should do a study to several industries. That's why the model contemplates a control variable for that purpose.

5.3. Measurement

5.3.1. Operational definitions of constructs and scales

Operationalizing, or operationally defining a concept to render it measurable, is done by looking at the behavioral dimensions, facets, or properties denoted by the concept. These are then translated into observable and measurable elements so as to develop an index of measurement of the concept. Based on Sharma (1996) Table 1 is a proposal to measure the different concepts, dimensions and elements. Table 1 also shows us the proposed scales to use in this research proposal.

Table 1 - Proposed measures and scales

Concept	Dimension	Element	Scale
EPS Adoption Intention (A)			Binary/Dichotomous scale; A firm is classified as an adopter (1) if it has a concrete plan to implement EPS by 2005.
Firm Scope (B)		Number of establishments	Ratio scale
Firm Size (C)		Number of employees	Ratio scale
Technology Competence (D)	IT Infrastructure	N° of PCs	Ratio scale
		N° of Local Area Networks	Ratio scale
		IT Stock = Total purchase value of IS	Ratio scale
		IT Intensity = IT stock / N° Employees	Ratio scale
Extent of adoption among competitors (E)			Interval scale: a 7-point Likert scale
Lack of trading partner readiness (F)			Interval scale: a 7-point Likert scale
Perceived success of competitor adopters (G)			Interval scale: a 7-point Likert scale
Industry Effect	Industry Concentration	Hrfindhal-Herchman Index (K)	Ratio scale

5.3.2. Goodness of measures

Now that operationalization of the variables and scaling is complete it is important to make sure that the instrument that was developed to measure EPS adoption intention is indeed accurately measuring the variables and so the dependent variable. This ensures that in operationally defining perceptual and attitudinal variables, we have not overlooked some important dimensions and elements or included some irrelevant ones.

5.3.2.1. Item analysis

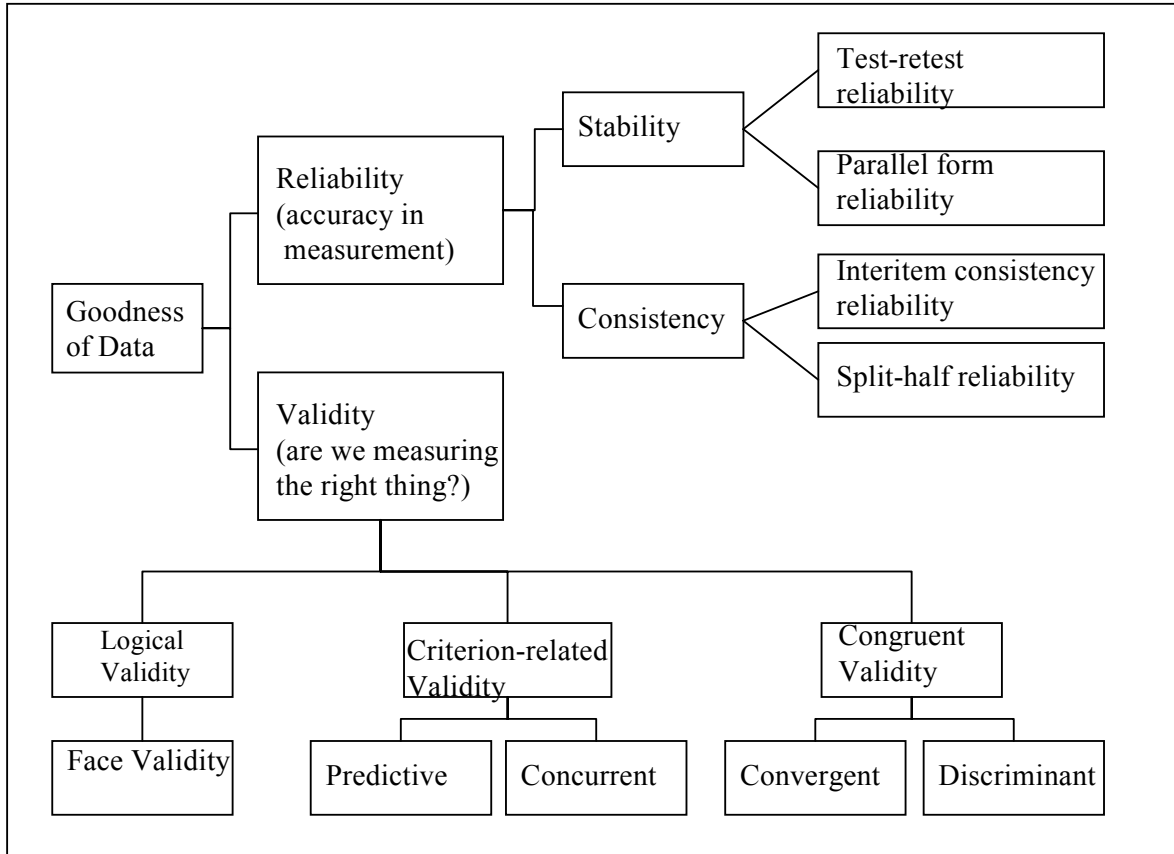
Item analysis is done to see if the items in the instrument belong there or not. Each item is examined for its ability to discriminate between those subjects whose total scores are high and those with low scores. In item analysis, the means between the high-score group and the low-score group are tested to detect significant differences through the t-test. The items with a high t-value are highly discriminant and should be used on the instrument.

5.3.2.2. Reliability and validity

Reliability tests how consistently a measuring instrument measures whatever concept it is measuring. Validity tests how well an instrument that is developed

measures the particular concept it is intended to measure. The framework in Figure 3 will be used in order to assure the reliability and validity of measures on this study. Sekaran (2003) defines all the tests reported in Figure 3.

Figure 3 - Testing goodness of measures



5.4. Data analysis strategy

5.4.1. Logistic regression

When we have well defined groups of independent and dependent variables we can use the available data analysis techniques reported in Table 2 (Sharma, 1996).

In this study we want to find a relation between one nonmetric dependent variable, the EPS Adoption Intention (A) and a set of metric and nonmetric independent variables (see Table 1). Based on Table 2, we could use discriminant analysis or logistic regression. However because the independent variables are a mixture of categorical and continuous variables, the multivariate normality assumption will no hold (Sharma, 1996). In these cases we should use logistic regression, as it does not make any

assumptions about the distribution of the independent variables. So using this data analysis technique we can say that the logistic model is

$$\ln [\text{odds } (A=1 | B, C, D, E, F, G)] = \beta_0 + \beta_1 B + \beta_2 C + \beta_3 D + \beta_4 E + \beta_5 F + \beta_6 G + \sum_i l_i$$

where A stands for EPS adoption intention, B for firm scope, C for firm size, D for technology competence, E for extent of adoption among competitors, F for lack of trading partner readiness, G for perceived success of competitor adopters and the l_i 's ($i = 1, \dots, 3$) stands for industry dummies. This model is consistent with our conceptual framework in Figure 2 and the six hypotheses defined earlier. Testing the six hypotheses is equivalent to testing whether coefficients β_j 's ($j = 1, \dots, 6$) are non-zero: Significant and positive coefficients imply adoption facilitators while significant and negative coefficients imply inhibitors.

Table 2 - Dependence statistical methods

		Dependent Variable			
		One		More than one	
		Metric	Nonmetric	Metric	Nonmetric
Independent Variable: One	Metric	<ul style="list-style-type: none"> Regression 	<ul style="list-style-type: none"> Discriminant Analysis Logistic Regression 	<ul style="list-style-type: none"> Canonical correlation 	<ul style="list-style-type: none"> Multiple group Discriminant Analysis (MDA)
	Nonmetric	<ul style="list-style-type: none"> t-test 	<ul style="list-style-type: none"> Discrete discriminant analysis 	<ul style="list-style-type: none"> MANOVA 	<ul style="list-style-type: none"> Discrete MDA
More than one	Metric	<ul style="list-style-type: none"> Multiple Regression 	<ul style="list-style-type: none"> Discriminant Analysis Logistic Regression 	<ul style="list-style-type: none"> Canonical correlation 	<ul style="list-style-type: none"> MDA
	Nonmetric	<ul style="list-style-type: none"> ANOVA 	<ul style="list-style-type: none"> Discret discriminant analysis Conjoint Analysis 	<ul style="list-style-type: none"> MANOVA 	<ul style="list-style-type: none"> Discrete MDA

5.4.2. Discriminant analysis

As we want to find factors that make a difference between different industries we should use this technique. For the same reasons we should use this technique in order to check for factors that discriminate between EPS adopters and non adopters. SPSS, AMOS or LISREL will be used in order to try to answer those research questions.

6. Limitations

As we said at the beginning of this paper this work is one more contribution in direction to the seminar and project investigation phases of the Ph.D. In spite of searching a lot and reading nearly about 80 references, we know there are much more to read and understand in order to make a better project investigation.

We have in mind that the big issue on the development of this investigation will be data access. In Portugal the executives have not a good attitude in what concerns to research inquiries. To be successful, managers of those firms have to understand the value of the research project. And that's not an easy job! Otherwise they will not "lose time", filling the questionnaire.

The research proposal that we have presented here is only a first step in order to understand the EPS adoption, implementation and firm performance impacts. In fact, a complete study should include the implementation and firm performance impact of the EPS. However, the EPS is a new system in Portugal. So it is necessary some time to evaluate the impact of a new technological solution. Anyway, such a study should be a longitudinal one and not a cross-sectional like this one. We believe that in two or three years that kind of study will be possible in Portugal. Thinking about it we will build the questionnaire in order to get the necessary data for a future longitudinal study.

Another important issue is that the companies in our sample are the 2500 bigger ones in Portugal. We do not know whether the results would apply if we extend the sample to smaller firms.

7. Conclusions

This is a research proposal. It is now impossible to draw any conclusions since the empirical work has not been done yet. We hope to have another opportunity to present our conclusions, after the empirical job is done. However we can say that a lot

of work is going to be done in order to overcome the normal obstacles we have mentioned before and to get enough evidence to support the hypotheses.

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