Electronic Procurement: The Supplier Perspective

ABSTRACT

E-procurement systems make purchasing activities more effective in terms of both time and cost. However, over the past years there is evidence that some of the expected benefits have not been achieved. Among several causes, supplier's low adherence to such platforms has been regarded as one. The focus of this work is in supplier adoption of e-Procurement. It will help to better address the issues actually faced by suppliers within e-Procurement. We have conducted a questionnaire-based survey to 721 Portuguese companies and performed an empirical analysis of the data. The findings from this work provide evidence that the supplier perceived indirect benefits and business partner pressures are most important to e-Procurement adoption while barriers have a negative impact on their adoption. The main critical success factors on e-Procurement adoption are also presented.

Keywords: e-Procurement, Suppliers, Collaboration, e-Commerce, B2B, IT adoption.

INTRODUCTION

Procurement is a common business activity since companies depend on goods and services provided by other companies. It is estimated that about 75% of sales revenue will be applied to the purchase of goods or services (Cagno, 2004). Suggested by its name, e-Procurement is the application of information technologies in the procurement process. Gershon (1999) considers e-Procurement as the whole process of acquisition from third parties over the internet; this process spans the whole life cycle from the initial concept and definition of business needs to the end of the useful life of an asset or end of a services contract. E-Procurement allows part or all of purchase activities to be conducted electronically, leading to cost reduction in goods, improved order processing times and gains in transparency (Pereira & Alturas, 2007). E-Procurement has the potential to provide cost and time reductions when ordering from suppliers, and helps to achieve a well-integrated supply chain. A survey conducted in the UK showed that the majority of companies believed that implementation of e-Procurement solutions were critical for the success of their business in the future (Stein & Hawking, 2004). Also an increasing number of public institutions identified electronic purchasing as a priority to e-Government. Many implemented or are in the process of implementing e-Procurement systems. The adoption of e-Procurement in public administration has a huge impact since governments spend large amounts in acquiring materials and services. Some of the benefits are the cost reduction in goods, services and order processing, better transparency to the suppliers and e-commerce development (Pereira & Alturas, 2007).

Companies are approaching e-Procurement implementation with different strategies. Davila *et al.* (2003) identified two main types of companies. The first type is moving aggressively to adopt e-Procurement, frequently experimenting with various solutions. The second type adopts a more conservative strategy by selectively experimenting, typically with one technology. The latter group relies on these limited experiences to provide the capabilities to move quickly into the technology as a dominant design appears.

An e-Procurement system depends on several critical success factors (CSF). Among the different CSF identified in the literature, supplier adoption is one of the most important (K. Vaidya, Sajeev A.S.M., & Callender, G. , 2004). A successful e-Procurement system is required to have suppliers willing and able to trade electronically (Benton, 2005). However users of e-Procurement reported that they can acquire goods over the Internet from only 15 % of their supply base (Davila, et al., 2003). A report

from the European Union (EU) also confirms that only 13% of EU companies are receiving orders online and 27% placing orders online with suppliers (EC, 2005). Engaging suppliers in the process (especially smaller companies) has proven to be difficult given the level of investment required and the different needs of their customer base in terms of technologies and internal procedures. Although suppliers play an important role in the global success of e-Procurement implementations, their adoption factors have been studied very little (Gunasekaran, McGaughey, Ngai, & Rai, 2009).

Users of e-Procurement technologies reported that they can acquire goods over the Internet from only 15% of their supply base (Davila, et al., 2003). A report from EU also confirms that only 13% of EU companies are receiving orders online and 27% placing orders online with suppliers (EC, 2005). Engaging suppliers in the process (especially smaller companies) has proven to be difficult given the level of investment required and the different needs of their customer base in terms of technologies and internal procedures. A successful e-Procurement system is required to have suppliers willing and able to trade electronically. For example, a key learning from a study conducted by the Australian Government (AGIMO, 2005) was that supplier adoption is important to the overall success of an e-Procurement program. They concluded that the more suppliers in the system, the more inclined buyers will be to use it. If suppliers are not correctly involved, then a low adoption rate can constrain users from leveraging the full associated capabilities from e-Procurement solutions. The lack of a critical mass of suppliers accessible through the organization's e-Procurement system might limit the network effects that underlie these technologies, delaying the acceptance and adoption of the solution.

In this study, we will examine the main factors affecting supplier adoption of e-Procurement. While the majority of the actual literature focuses only on the buyer side of e-Procurement (Gunasekaran & Ngai, 2008; Soares-Aguiar & Palma-Dos-Reis, 2008), the focus will be on the seller side. Moreover, the identification of the perceived benefits, perceived barriers, CSF and business partner influence will help the research community and the business community to produce a deeper understanding about e-Procurement adoption by suppliers.

BACKGROUND

Procurement Process

In Figure 1, a generic purchasing process is presented. Usually it involves all or part of the activities presented. In the request of supply, technical features, quantity and delivery conditions are specified. Next company looks for the most adequate supplier in the market or in a more restricted list. The selection of the supplier is based on the quality and the pricing of the bids received and finally the selected supplier prepares and delivers goods/services and sends the invoice.
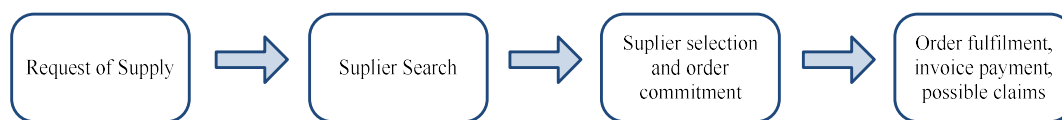
Figure 1. The purchasing process. Adapted from Caridi et al. (2004).

Accordingly to Sparks and Wagner (2003) a purchasing process can range from strategic buying, transactional buying or spot buying. In the first, the main objective is to establish long-term relationship between customers and suppliers and requires a careful vendor selection and a long-term agreement on the supply management. Next, transactional buying implies repetitive purchases with the same vendor, based on yearly blanket orders or outline agreements. Finally, spot buying occurs when urgent requests come out and all the pre-qualified suppliers are not capable of fulfilling them.

Gershon (1999) defines procurement as 'the whole process of acquisition from third parties and covers goods, services and construction projects. This process spans the whole life cycle from the initial concept and definition of business needs through to the end of the useful life of an asset or end of services contract. Thus, Gershon (1999) provides a complete definition of Procurement. However, he doesn't refer anything about the strategic importance of the procurement function.

According to Croom and Giannakis (2002) the purchasing department has been acquiring a more strategic role, coupled with the term Procurement, which continuously strives for new methods of supply, trying to establish collaborative relationships with a selected list of suppliers. Procurement has become a strategic source for firms to compete, since most corporations spend between 50 to 80 percent of sales on goods and services (Cammish & Keough, 1991). Firms need to strategically acquire the materials and services that will enhance their ability to achieve high quality levels, fast delivery and cost savings for exceeding customer requirements (Carr & Pearson, 1999). Thus, the procurement includes all the purchase cycle of a product or service and plays a strategic role, either by its high financial impact or by serving as input to all production of the company.

Definition of E-Procurement

E-Procurement can be seen as part of an automated purchasing system. It is designed to facilitate the acquisition of goods by a commercial or government organization over the Internet. Buyers may log on to the system to view supplier catalogues, and to place orders (Botto, 2003). E- Procurement can be defined as a process which allows any designated user to requisition a product or service through a web interface, which then generates a purchase order to send to a supplier (Falk, 2005). According to the Chartered Institute of Purchasing & Supply e-Procurement is about using the Internet to operate the transactional aspects of requisitioning, authorizing, ordering, receipting and payment processes for the required services or products (CIPS, 2009). This study has determined that this definition is too narrow since they disregard several important activities: the aggregation of orders, monitoring of the supplier's performance, managing and mitigating supplier-connected risks or contract management. Thus, a better definition is that e-Procurement is provided by Gershon (1999). He considers e-Procurement as the whole process of acquisition from third parties over the internet; this process spans the whole life cycle from the initial concept and definition of business needs to the end of the useful life of an asset or end of a services contract.

E-Procurement Tools

E-Procurement is viewed as an end to end solution that integrates and streamlines many procurement processes horizontally trough the organization. In Figure 2 a full e-Procurement lifecycle is presented. The author divides it in the e-Sourcing cycle and Purchase to Pay Cycle (P2P). In the e-Sourcing companies look to what the market has to offer in terms of products or services. Strategic decisions are also performed, like contracts and important sourcing partnerships. In the purchase to pay cycle, the decision of what to buy, when and to whom has already been taken. The focus here is in the execution of the purchase order. Industry and academic analysis indicate that this ideal model is rarely achieved and e-Procurement implementations generally involve a combination of the different tools (K. Vaidya, Sajeev, & Callender, 2006).
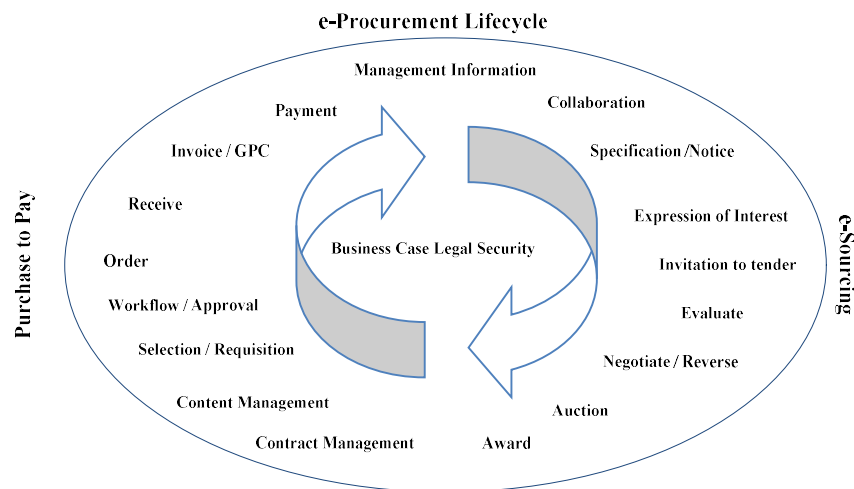
Figure 2. e-Procurement Lifecycle. Adapted from CIPS (2009).

FRAMEWORK FOR THE ADOPTION OF E-PROCUREMENT

Through an extensive literature review some variables were identified as contributing positively or negatively to supplier's adoption of e-Procurement. A framework was developed to structure these variables. Those were divided into perceived benefits, perceived barriers, CSF and business partner influence (Figure 3). This was adapted from the framework developed by Gunasekaran and Ngai (2008) to study e-Procurement adoption.
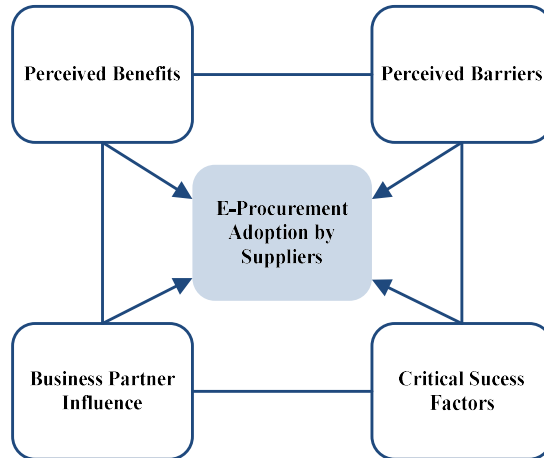

Figure 3. Framework for e-Procurement adoption by suppliers.

Perceived Benefits

On this research, we define benefits as the factors having positive impact on the intention to adopt e-Procurement. Gunasekaran and Ngai (2008) describe it as the perceived benefits of e-Procurement as seen by companies having tremendous implications whether one goes for the technology or not.

Sales growth and reach new market

For suppliers, the adoption of e-Procurement may be an opportunity to expand sales. According to Sharifi, Kehoe and Hopkins (2006) they will find e-Procurement attractive because they could easily and cost effectively reach new customers. A greater exposure to larger buying communities, with improved reach, range and efficiency, increases the potential for more transactions. Also, by making the electronic catalogue accessible in a direct way to all employees and buyers, or using e-hubs and e-commerce communities, the seller can widely increase the number of sales orders (Berlak & Weber, 2004). After the implementation, e-Procurement systems can function as a new sales channel improving the chances of sales growth. Suppliers also appreciate the chance to develop new business thought participation on electronic reverse auctions. According to Beall *et al.* (2003) even the most reluctant participants, rarely refuse the chance to participate. This is expected, since electronic reverse auctions (e-RAS) represent a new sales opportunity. For Moser (2002) the fact that supplier´s can change their bids during an online-auction also increases their changes to win the contract. This is because online auctions improve the visibility over the negotiation process. They allow seeing online the competitor price, and while they know how lower they can bid, the chances of winning the action are improved.

Reductions in order processing costs and better operational efficiency

The integration between the buyer and the seller systems allows the exchange of information automatically. Therefore, it is possible for the buyer to make an order more quickly. This will also reduce the chance of occurring errors that are common when an order is dependent on paper (Berlak & Weber, 2004). Linking to a customer directly and collaborating to ensure accurate and on-time delivery provides better service and lower overall procurement costs to the customer. This can

result in much more collaborative buyer-seller relationships. As a preferred supplier, or if the buyer begins to provide forecasts of requirements to its vendors, the supplier can begin to predict and prepare for individual buyer requirements well ahead of time, reducing the uncertain on sales (Neef, 2001). Other potential benefits of e-Procurement include lower marketing and sales costs (Beall, et al., 2003). The mere conversion of paper documents to electronic can free up employees for higher value tasks such as price negotiation and post bid analysis (Moser, 2002).

Better negotiable transparency

E-Procurement tools have been seen as able to provide a better negotiable transparency compared to traditional means. The conclusions of a study conducted by Beall *et. al* (2003) indicated that suppliers considered electronic reverse auctions a fairer process of doing business because they "level the playing field" through increased transparency and much more information. Carayannis and Popescu (2005) analyzed and evaluated the e-Procurement projects carried out by European Commission. They concluded that the transparency of EU public procurement market was improved by a systematic use of electronic tendering. The improvements on the transparency allowed the involved parties to know how the system is intended to work, and all potential suppliers have the same information about procurement opportunities, award criteria, and decision process. Croom and Jones (2007) reinforced the idea that e-Procurement has the potential to improve transparency in supply management, in purchasing companies through greater consolidation of purchases. They also found the majority of respondents had reduced their supply base and had a closer relationship with those remaining. Beall *et. al* (2003) also showed that most of the services associated with goods purchased like design repair, emergency delivers and so forth were now included in the specifications of e-RAS, allowing suppliers to fairly price and bid in the complete package of goods and related services, and allowing the buying firms better know what they were paying for.

Improved relationship with clients

In considering how e-Procurement will impact buyer-seller relationships Ellram and Zsidisin (2002) argue that the adoption of e-Procurement contributes to closer buyer–supplier relationships. Therefore, while e-Procurement technology may not deliver improved levels of trust, it has been found that e-Procurement transactions are more likely to be established first between partners in high trust relationships. In addressing this issue, both Croom (2001) and Kumar and Peng (2006) support the view that increased use of e-Procurement and inter-organizational systems enhance opportunities and tend to create more effective customer–supplier relationships over time. According to a EU report "companies maintaining long-term relationships with suppliers and customers are more likely to use technologies supporting inter-company collaboration, in comparison with their peer-group in the same sector" (EC, 2008). However, the number of companies using collaborative tools in Europe is relatively low when compared with non users. The adoption of e-Procurement solutions by supplier´s can improve the relationship with the buyer. But this may depend on the type of tools used by the purchaser. For certain goods the use of tools like electronic reverse auctions may have the opposite effect, by destroying the trust and mutual interdependence between the buying company and a key strategic supplier (Beall, et al., 2003). A good buyer supplier relationship leads to a more robust e-procurement initiative. In Scotland, the government e-Procurement program promoted the collaborative behavior between support staff, buyers and suppliers. Building multi-national and multi-disciplinary networks can also facilitate and foster the exchange of knowledge and develop practical standards (AGIMO, 2005).

Gain of competitive advantage

Increased profitability of a supplier will result in an advantage being gained over its competitors. E-Procurement allows procurement activities to be conducted 24 hours a day, 7 days a week, and 365 days a year. It allows going beyond the geographical barriers giving a distinct advantage over other competitors. These improvements in competitiveness are further highlighted by Wong and Sloan (2004). Gains of competitive advantage, reducing order fulfillment costs, and increased profitability are seen as some the most important perceived benefits of e-Procurement for suppliers.

Perceived Barriers

Perceived barriers are considered as factors not contributing to the intention to adopt e-Procurement. Identifying the barriers themselves is part of the major managerial function in developing the right plan for the adoption of e-Procurement among suppliers (Gunasekaran & Ngai, 2008).

Price reduction pressures

Buyers are concerned that e-Procurement technologies will push prices down to the point where suppliers cannot invest in new technology, product development, upgrade facilities, or add additional productive capacity. Additional price pressures can even push suppliers down if they have a poor understanding of their cost structure (Davila, et al., 2003). Suppliers need to know how low they can bid, and still observe an acceptable return. They also must consider the buyer´s location to calculate shipping costs, and their financial status (Moser, 2002). White and Daniel (2004) concluded that strategic considerations are among the key inhibitors of e-Procurement adoption, as some of the methods deployed in e-Procurement tools such as reverse auctions are perceived to potentially damage long-term supplier relationships, by pushing prices down.

Implementation, integration, and maintenance cost

According to Tanner *et al.* (2008) a main objection of e-Procurement in organizations is the high installation costs of new solutions and it must be taken seriously. The cause, is the high heterogeneity of the supplier and buyer IT environments, organizational structures and business processes. Hawking *et al.* (2004) also identified implementation costs as one of the barriers to e-Procurement adoption in Australia. According to Koorn *et al.* (2001) initial implementation costs may be substantially higher than with those of an EDI system, unless an online intermediary with low enrolment fees is chosen. The potential administrative and implementation costs which will be incurred as companies utilize e-Procurement should also been taken into account. As with all technological adoption, the relatively high cost of maintaining and implementing an e-Procurement system is a major factor when deciding the adoption of e-Procurement (Teo & Ranganathan, 2004).

Lack of interoperability between systems

For e-Procurement technologies to succeed, suppliers should provide e-catalogues in the formats required by customers, reflecting custom pricing or special contractual agreements and send updates on a regular basis (Davila, et al., 2003). However, no common standard has yet emerged for web catalogs. Small suppliers often end up having to provide and regularly update catalogue data in a number of different formats to meet each buyer's specifications. Whereas this approach is satisfactory for small numbers of buyers or suppliers, it is not scalable to many buyers or suppliers. With a large company, there may be hundreds or thousands of suppliers. Each supplier may have thousands of catalogue items (Kim & Shunk, 2004). Hawking *et al.* (2004) support that barriers to e-Procurement also include lack of interoperability and standards with traditional communication systems. Developing standards and systems for facilitating effective interoperability will facilitate the adoption of e-Procurement. However, there is still considerable uncertainty and a lack of clear direction regarding standards for data interchange. Until a clear industry standard is identified and supported, this challenge will continue for all participants (AGIMO, 2005).

Lack of legal support

In the EU, Julia-Barcelo (1999) reviewed EU regulation of electronic contracts. Difficulties highlighted by Julia-Barcelo were: lack of specific legal regulation, different national approaches, validity of electronic documents, enforceability or evidentiary problems. Wong and Sloan (2004) also questioned the legal validity of electronic information exchange and considered it as a barrier to e-Procurement. It showed that only 26% of the respondents agreed that electronic documents were admissible as written proof during transactions. The uncertainty surrounding the legal issues of e-Procurement was the top barrier in e-Procurement within Northern Ireland's construction industry. The parallel use of paper copies and electronic documents leaded to difficulties on achieving a fully internet solution using e-Procurement tools (Eadie, Perera, Heaney, & Carlisle, 2007).

Lack of information security

According to Neef (2001) some of the reasons for companies not moving into e-Procurement are related to concerns over security and trust. For most companies, some of their most important assets are their buying plans, their pricing models, and their new product designs. Many executives are concerned that once information goes outside the company firewall, these key assets may be exposed to competitors. The lack of security in transactions is an important barrier to e-Procurement (Eadie, et al., 2007). A PriceWaterhouseCoopers survey with senior business leaders in the U.K., Germany, France, and the Netherlands found that security issues were cited as the most important factor holding back e-procurement progress. This was particularly true in the case of direct procurement (ComputerWeekly, 2000). Concerns about security represent barrier to the systems integration between buyers and suppliers. According to Davila *et al.* (2003) providing other companies with intranet access to company internal data, or integrating applications with company information systems is still unusual. This observation reinforces the prudence that companies demonstrate on integrating e-Procurement technologies into existing systems and relationships.

Lack skill and knowledge

Archer *et al.* (2008) conducted a paper with the objective to identify and measure the perceived importance of barriers in the small medium enterprise (SME) community to the adoption of e-Procurement. Few differences were found between adopters and non-adopters. They noticed a lack for education for all SME management on the benefits and drawbacks to using e-business solutions. Some of the informal comments they received indicated that there is a lack of knowledge of e-business and its benefits. The respondents disagreed significantly with the statement "we know what kind of e-business solution is right for us". This shows the need for education about e-Procurement applications.

Critical success factors

The factors critical to the use of e-Procurement have been identified based on previous experience and literature available. The critical success factors could be defined as the best practices for the successful use of the e-Procurement system. It encompasses also the successful utilization of the system.

Initial training

According to Eadie *et al.* (2007) for the successful use of e-Procurement in companies, training is compulsory and should be given, mitigating the effects of the lack of knowledge on this area. Panayiotou *et al.* (2004) also considered training as a critical success factor for e-procurement implementation. The adequate training of the employees will enable them to take advantage of the new system. It should be assured that employees are able to see the benefits derived from e-Procurement technology (Kothari, Hu, & Roehl, 2005). When establishing the electronic reverse auctions implementations framework for the UK public sector the OGC (2005) considered supplier training as part of that framework. Free ongoing training sessions were offered to suppliers. This was responsibility of the change manager, one of the elements recommended by OGC as being critical to help to achieve successful organizational change when implementing e-Procurement.

Integration with current systems

A study conducted in the Swiss market revealed that the lack of supplier involvement and infrastructure to optimize B2B processes was an obstacle to integrate B2B scenarios. The integration solutions are not always offered appropriate to suppliers and the majority of companies agree that the position of the suppliers is insufficiently considered (Tanner, et al., 2008). Large companies are increasingly streamlining and integrating their procurement processes, often with advanced e-Procurement schemes based on standardized data exchange. As a result, smaller firms that cannot comply with the technical requirements of their customers, run the risk of elimination from the supply chain (EC, 2008). Large companies must provide several means for suppliers to access their e-Procurement applications. Otherwise smaller suppliers may not be able to meet the requirements.

Top management support

If an organization wants to implement e-Procurement successfully top management has to support the e-Procurement implementation into their business. When the top executive level advocates e-commerce, an organization can elevate the importance of e-Procurement for the organization (Pani & Agrahari, 2007). This is even more relevant in SME companies. Due to its reduced hierarchy, the decision to go or not for e-Procurement should be made by top management. Gunasekaran and Ngai (2008) considered top management support as a critical success factor for e-Procurement adoption between Hong Kong industries. Top management involvement and support was viewed by 70% of the respondents as one of the most important of all the factors affecting e-Procurement adoption (Teo & Ranganathan, 2004). Therefore top management support is positively associated with the adoption of e-Procurement.

Business process reengineering

The complex relationship between the members of the supply chain leads to different level on accessing and managing information. Gilbert (2000) said that companies were jumping onto e-Procurement without fully understand the inter-organizational collaboration and network effects underlying these technology models, the investment required to move the right information from suppliers to employees, and the complexities of integrating these technologies with existing Enterprise Resource Planning systems. So companies should not model their current paper-based processes into e-Procurement. An implementation of an e-Procurement platform, as any new system, represents an opportunity to reengineering business processes (TIBCO, 2008). The simple introduction of technology into existing processes, may lead to duplication of work, without providing the expected benefits.

Adoption process support

Finally, the supplier must be supported throughout the adoption process. This was evident in Scotland and Italy where a supplier engagement process was developed, documented and facilitated to ensure that suppliers business and technical requirements were met. The result was a high incident in supplier activity. In contrast, the buyer centric approach adopted in Western Australia meant that suppliers did not understand the benefits of joining e-Procurement and therefore were reluctant to join (AGIMO, 2005). According to Corini (2000) supplier participation is critical to the successful implementation of any e-procurement solution. He says that without supplier participation the software is useless. Moreover Neef (2001) recommends that key suppliers should be seen as an integral part of the e-Procurement project, provided with clear and attainable milestones and directly included in the change management plan.

Business Partner Influence

Previous research on EDI has found that business partner influence plays an important role in technological adoption. For example, Chwelos *et al.* (2001) concluded that external pressure and readiness is considerably more important than perceived benefits in EDI adoption. Hart and Saunders (1997) concluded that firms with greater power can influence their trading partners to adopt EDI. However, when firms use coercive power to force trading partners to adopt EDI, less powerful partners may be left more vulnerable. And, over time this perceived vulnerability may become a constraint in inter-organizational relationships that prevents improvements in coordination through expanded use of EDI. More recently, Oliveira and Martins (2010) concluded that trading partner collaboration is an important driver for e-business adoption in EU 27 countries context. Similar results were found for e-Procurement. Grandon and Pearson (2004) identified external pressure as influencing e-commerce adoption. Further Teo *et al.* (2009) examined various factors associated with the adoption of e-Procurement. They found that business partner influence was positively associated with the adoption of e-Procurement.

RESEARCH FOCUS

E-procurement systems can be classified in a number of ways. Kim and Shunky (2004) classify them according to their location. They may be located at the supplier, the buyer or a third party provider.

For the buyer side, systems typically owned by large companies, it is their responsibility to ensure that enough suppliers are adopting the system.
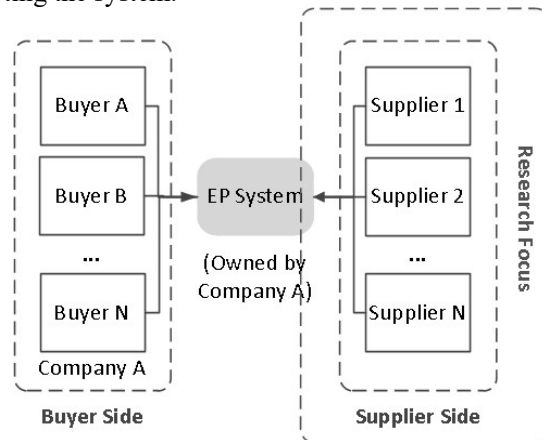

Figure 4. Research Focus.

The aim of this work is to gain an understanding of the factors affecting e-Procurement adoption by suppliers, with a focus on buyer centric e-Procurement systems, in which typically suppliers have less bargain power (Figure 4). In this context, the buyer plays the role of an initiator, while suppliers act as followers. Consequently, it is fundamental to answer the following question - What are the major factors for the adoption of e-Procurement by suppliers?

EMPIRICAL RESULTS AND ANALYSIS

Characteristics of Data

The industry classification from 721 inquired companies is shown in Table 1. The responses include a broad range of companies based on different types of markets served and products sold. As such, the sample appears to be representing of a wide range of different companies. About 93% of the companies of this sample can be classified as small or medium companies while 7% are considered large companies. About 87% of the respondents were people in relatively high positions at their companies. The high hierarchical levels of respondents provides some assurance on the validity of responses, since the respondents in higher management levels could generally be expected to be more familiar about their companies' e-Procurement activities than those from lower levels.

Table 1. Industry type, firm size classification and job position.

Industry type	Freq.	%
Financial Services	10	1.4
Retail	188	26.1
Marketing & Advert.	27	3.7
Eng. & Construction	71	9.8
Logistics	13	1.8
Services	247	34.3
Manufacturing	134	18.6
Tourism	31	4.3
Total	721	100.0

Classification	Freq.	%
Small	566	78.5
Medium	101	14.0
Large	54	7.5
Total	721	100.0

Job position	Freq.	%
President/Director	396	54.9
Department Manager	233	32.3
Others	92	12.8
Total	721	100.0

Companies were asked to imagine that their company was invited by a client to use an electronic procurement tool, and to classify the intention of their adoption. Figure 5 shows that the majority of the respondents were open to future initiatives of e-Procurement.
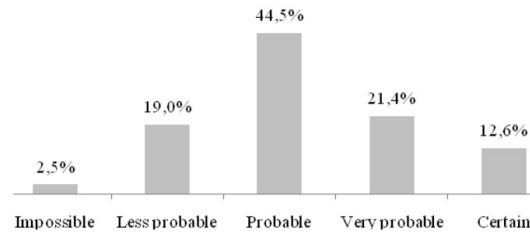
Figure 5. Intention to adopt e-Procurement.

The supplier's perception about the benefits of e-Procurement plays a major role in e-Procurement, starting with the decision to go for e-Procurement. Table 2 shows that companies strongly agree that the adoption of e-Procurement will contribute to: achieve a better operational efficiency, reduce order processing costs and provide gains in competitive advantage. However, respondent companies are in average less optimistic about benefits such as improved relationship with clients, negotiable transparency and sales growth.

Table 2. Perceived benefits.

Perceived benefits	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
Sales growth	2.6	7.6	32.3	46.0	11.4
Reach new markets	1.5	6.7	25.5	51.7	14.6
Reductions in order processing costs	1.7	5.1	19.3	49.9	24.0
Better operational efficiency	1.4	3.6	11.9	55.5	27.6
Better negotiable transparency	2.5	8.9	34.1	40.5	14.0
Improved rel. with clients	2.5	10.8	27.9	46.0	12.8
Gain of comp. advantage	1.7	4.2	22.2	52.7	19.3

The concerns of companies regarding the adoption of e-Procurement have a tremendous influence on its success. Companies were asked what factors could prevent them from adopting e-Procurement (

Table 3). Some companies strongly agree with the lack of information security. However, companies agree that the integration costs and maintenance of a new system are the main impediments against the adoption of e-Procurement. The majority of respondents disagrees or strongly disagrees that price reduction pressures and implementation costs were causes for not implementing e-Procurement.

Table 3. Perceived barriers.

Perceived barriers	Strongly disagree	Disagree	Uncertain	Agree	Strongly agree
Price reduction pressures	5.4	27.7	39.0	24.3	3.6
Implementation costs	5.1	30.7	33.6	27.0	3.6
Integration costs and maintenance	1.7	13.3	25.0	51.0	9.0
Lack of interoperability between systems	1.5	17.5	26.9	45.8	8.3
Lack of legal support	1.8	19.1	23.0	49.5	6.5
Lack of information security	3.3	21.1	21.1	41.7	12.8
Lack of skill and knowledge	4.4	25.1	25.1	37.4	7.9

The respondents were asked what they saw as being critical for their successful adoption and use of e-Procurement (Table 4). The integration with current systems and initial training has been viewed as critical. Top management support and business process reengineering have also been considered as important by the majority of the respondents. However, in comparison to the other factors they were considered the less critical.

Table 4. Critical Success Factors.

CSF	Unimportant	Less important	Important	Very important	Critical
Initial training	1,0	3,1	31,1	24,3	40,6
Integration with current systems	0,7	3,2	27,3	25,8	43,0
Top management support	1,5	4,6	29,0	30,8	34,1
Business process reengineering	2,4	8,3	36,3	34,0	19,0
Adoption process support	1,4	3,2	28,4	32,0	35,0

The influence of business partners plays a crucial role in e-Procurement adoption. About 74.8% of the respondents admitted to have some kind of influence from business partners to use e-Procurement tools (Table 5).

Table 5. Business partner influence.

Business partner influence	Frequency	Percentage
No influence	182	25.2
Some business partners have recommended us to use e-Procurement.	315	43.7
Some business partners have requested us to use e-Procurement	172	23.9
Majority of business partners have requested us to use e-Procurement	52	7.2

Validity, Reliability and Correlation

As a first step, we performed a factor analysis (FA) of multi-item indicators (the references of the multi-indicators used are in Appendix) to reduce the number of variables of the survey and to evaluate the validity. We used the principal component technique with varimax rotation (see Table 6) to extract five eigen values, which were all greater than one. The first five factors explain 64.4% of variance contained in the data. The Kaiser-Meyer-Olkin (KMO) measures the adequacy of sample; general KMO is 0.83 (KMO ≥ 0.80 is good (Sharma, 1996)), which reveals that the matrix of correlation is adequate for FA. The KMO for individual variables is also adequate. All the factors have a loading greater than 0.50. This indicates that our analysis employs a well-explained factor structure. The five factors found are: direct perceived benefits, indirect perceived benefits, perceived barriers of price and costs, perceived barriers and CSF. The factors obtained are in accordance with the literature review. However, there are two variables (perceived benefits and perceived barriers) for which the FA suggests two factors instead one. This reveals that the items of perceived benefits don't have the same factor. These items can be divided into direct and indirect perceived benefits in accordance with other authors (Gunasekaran & Ngai, 2008).

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). All constructs have Cronbach's alpha value higher than 0.70, except perceived barriers of price and cost. For this reasons we excluded this factor from our analysis.

Table 6. Factor Analysis.

		Factors			
1		2	3	4	5
Direct perceived benefits (Alpha = 0.836)					
Sales growth	0.09	0.24	-0.02	0.86	0.09
Reach new markets	0.11	0.21	0.05	0.85	0.07
Indirect perceived benefits (Alpha = 0.816)					
Reductions in order processing costs	0.15	0.77	0.01	0.06	0.10
Better operational efficiency	0.17	0.83	0.05	0.08	-0.05
Better negotial transparency	0.15	0.73	-0.01	0.17	0.06
Improved relationship with clients	0.17	0.61	0.00	0.33	-0.11
Gain of competitive advantage	0.22	0.55	0.05	0.51	-0.07
Perceived barriers of price and costs (Alpha = 0.482)					
Price reduction pressures	0.04	0.05	0.03	0.16	0.79
Implementation costs	-0.02	-0.08	0.34	-0.06	0.68
Perceived barriers (Alpha = 0.768)					
Integration costs and maintenance	0.12	0.03	0.54	-0.02	0.41
Lack of interoperability between systems	0.06	0.12	0.67	-0.10	0.35
Lack of legal support	0.04	0.07	0.78	-0.10	0.16
Lack of information security	0.04	-0.06	0.76	0.06	-0.07
Lack of skill and knowledge	0.08	-0.03	0.71	0.18	-0.01
CSF (Alpha = 0.875)					
Initial training	0.81	0.04	0.15	0.08	-0.05
Integration with current systems	0.82	0.12	0.12	-0.01	-0.01
Top management support	0.79	0.22	-0.01	0.05	-0.01
Business process reengineering	0.73	0.21	0.02	0.18	0.12
Adoption process	0.83	0.18	0.02	0.08	0.06

The results of the spearman's rank correlation test are shown below in Table 7. Spearman's rank correlation coefficient is used as a measure of linear relationship between two sets of ranked data (Hill & Hill, 2008). Spearman's rank correlation coefficient (ρ) will take a value between -1 and +1. A positive correlation is one in which the ranks of both variables increase together. A negative correlation is one in which the ranks of one variable increase as the ranks of the other variable decrease (Altman, 1991). Once the value of the difference is significant, that is, its p-value below 0.05, we consider that there is a statistically significant relationship between each of the factors (obtained by factor analysis) and the intention to adopt e-Procurement. The perceived indirect benefits and business partner influence are the most correlated factors.

Table 7. Correlation between perceived factors and business partner influence with the intention to adopt e-Procurement by suppliers.

	Spearman's rank correlation	
	ρ	p-value
Perceived direct benefits (obtained by FA)	0.163	< 0.0001
Perceived indirect benefits (obtained by FA)	0.335	< 0.0001
Perceived barriers (obtained by FA)	-0.108	0.0036
CSF (obtained by FA)	0.119	0.0013
Business partner influence (obtained directly from survey)	0.334	< 0.001

SOLUTIONS AND RECOMMENDATIONS

Among several factors associated with the success of e-Procurement implementation, supplier's adherence to such platforms has been regarded as critical. Two main types of supplier perceived benefits were identified with the FA: direct benefits and indirect benefits. Direct benefits are associated with marketing and sales, and represent an opportunity for the company to generate financial gains in the short term. Indirect benefits are related to benefits obtained in the medium and long term that may not directly result in financial gains, but may contribute to improvements on the organizational performance and sustainability of the company. The recommendations are that companies need to explain to their suppliers the real benefits of adopting e-Procurement. Thus it is necessary to develop a communication plan in order to increase the benefits awareness both in the short and mainly in the long term.

As shown, the barriers have a negative impact on the intention to adopt e-Procurement. The main barriers are the costs of integration and maintenance as well as the lack of legal support. Suppliers generally do not consider that e-Procurement leads to a decrease in selling prices. Some informal comments also suggested that the lack of "human interaction" in e-Procurement is not suitable for some types of business, especially in complex products that require significant human interaction. As affirmed by Kothari *et al.* (Kothari, et al., 2005), no advanced technology can replace human interactions in establishing and maintaining business relationships.

All the critical success factors were considered very important in implementing e-Procurement. Less importance was given to business process reengineering. One possible cause is the lack of experience with e-Procurement by business respondents. Compared with benefits and business partner pressure, CSF is less correlated with supplier intention to adopt e-Procurement.

Business partner pressure has a positive and significant influence on the adoption of e-Procurement by suppliers. This is consistent with other studies on technology adoption. For example Chwelos *et al.* (2001) showed that the pressure from business partners in the adoption of EDI contributes more than the perceived benefits of those who will adopt. However, through our analysis we can conclude that the influences of business partners and the indirect benefits have similar importance on e-Procurement adoption.

FUTURE RESEARCH DIRECTIONS

The respondents from our study were from Portuguese companies. Future studies might explore the differences between Portugal and other countries, or between the industries analyzed.

Despite convinced that the proposed objectives for this study were achieved; it is important that future works solve some of the limitations of this study and contribute to the advancement of this area. Some of the factors identified in the literature review were related to the adoption of e-Procurement in a general way and not specifically related to the supplier adoption on buyer centric e-Procurement systems. A deeper analysis on the factors affecting supplier adoption on other models may help to identify additional factors.

Another limitation of the study is that the framework used by Gunasekaran and Ngai (2008) has not yet been widely tested in the literature. Thus, future studies should use this framework in order to test its applicability under other conditions. Future studies may also ponder the analysis of dependency between the factors identified and the intention to adopt e-Procurement. For example the application of logistic regression or structural equations on the present framework may provide more empirical evidence on the impact of each factor on e-Procurement adoption.

REFERENCES

AGIMO (2005). Case Studies on E-procurement Implementations: Italy, New South Wales, New Zealand, Scotland, Western Australia. Canberra: Australian Government Information Management Office.

Altman, D. G. (1991). *Practical Statistics for Medical Research*. London: Chapman & Hall.

Archer, N., Wang, S., & Kang, C. (2008). Barriers to the adoption of online supply chain solutions in small and medium enterprises. *Supply Chain Management: An International Journal, 13*(1), 73-82.

Beall, S., Carter, C., Carter, P. L., Germer, T., Hendrick, T., Jap, S., et al. (2003). *The role of reverse auctions in strategic sourcing*: CAPS Research.

Benton, P. (2005). E-Procurement's Missing Link. *IT Adviser*(39).

Berlak, J., & Weber, V. (2004). How to make e-Procurement viable for SME suppliers. *Production Planning & Control*, 15-22.

Botto, F. (2003). Dictionary of e-Business: A Definitive Guide to Technology and Business Terms. USA: John Wiley & Sons.

Cagno, E., Giulio, A.D., Trucco, P. (2004). State-of-art and development prospects of e-procurement in the Italian engineering & contracting sector. *Project Management Journal, 35*(1), 24-29.

Cammish, R., & Keough, M. (1991). A strategic role for purchasing. *Mckinsey Quarterly*, 22-50.

Carayannis, E. G., & Popescu, D. (2005). Profiling a methodology for economic growth and convergence: learning from the EU e-procurement experience for central and eastern European countries. *Technovation, 25*(1), 1-14.

Caridi, M., Cavalieri, S., Pirovano, C., & Diazzi, G. (2004). Assessing the impact of e-Procurement strategies through the use of business process modelling and simulation techniques. *Production Planning & Control, 15*(7), 647-661.

Carr, A. S., & Pearson, J. N. (1999). Strategically managed buyer–supplier relationships and performance outcomes. *Journal of Operations Management, 17*(5), 497-519.

Chwelos, P., Benbasat, I., & Dexter, A. S. (2001). Research report: Empirical Test of an EDI Adoption Model. *Information Systems Research, 12*(3), 304-321.

CIPS (2009). The Chartered Institute of Purchasing & Supply. Retrieved from http://www.cips.org/

ComputerWeekly (2000). Bosses voice e-procurement fears. Retrieved from http://www.computerweekly.com/Articles/2000/07/20/176837/bosses-voice-e-procurement-fears.htm

Corini, J. (2000). Integrating e-procurement and strategic sourcing. *Supply Chain Management Review, 4*, 70-75.

Croom, S. (2001). Restructuring supply chains through information channel innovation. *International Journal of Operations and Production Management, 21*(4), 504-515.

Croom, S., & Jones, A. (2007). Impact of e-procurement: Experiences from implementation in the UK public sector. *Journal of Purchasing and Supply Management, 13*(4), 294-303.

Croom, S. R., & Giannakis, M. (2002). Strategic e-Procurement in Global Pharmaceuticals (GP). *Caps Research*.

Davila, A., Gupta, M., & Palmer, R. (2003). Moving procurement systems to the internet: the adoption and use of e-procurement technology models. *European Management Journal, 21*(1), 11-23.

Eadie, R., Perera, S., Heaney, G., & Carlisle, J. (2007). Drivers and Barriers to Public Sector e-Procurement within Northern Ireland´s Construction Industry. *ITcon, 12*, 103-120.

EC (2005). Overview of International e-Business Developments. Brussels: European Commission.

EC (2008). The European e-Business Report 2008 - The impact of ICT and e-business on firms,sectors and the economy. Brussels: European Commission.

Ellram, L. M., & Zsidisin, G. A. (2002). Factors that drive purchasing and supply management's use of information technology. *IEEE Transactions on Engineering Management, 49*(3), 269-281.

Falk, M. (2005). ICT-Linked Firm Reorganisation and Productivity Gains. *Technovation, 25*(11), 1229−1250.

Gershon, P. (1999). Review of civil procurement in central government. UK: HM Treasury.

Gilbert, A. (2000). E-procurement: problems behind the promise. *InformationWeek*, 48-62.

Grandon, E. E., & Pearson, J. M. (2004). Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & Management, 42*(1), 197-216

Gunasekaran, A., McGaughey, R. E., Ngai, E. W. T., & Rai, B. K. (2009). E-Procurement adoption in the Southcoast SMEs. [doi: DOI: 10.1016/j.ijpe.2009.05.013]. *International Journal of Production Economics, 122*(1), 161-175.

Gunasekaran, A., & Ngai, E. W. T. (2008). Adoption of e-procurement in Hong Kong: An empirical research. *International Journal of Production Economics, 113*(1), 159-175.

Hart, P., & Saunders, C. (1997). Power and trust: Critical factors in the adoption and use of electronic data interchange. *Organization Science, 8*(1), 23-42.

Hawking, P., Stein, A., Wyld, D. C., & Foster, S. (2004). E-procurement: is the ugly duckling actually a swan down under? *Asia Pacific Journal of Marketing and Logistics, 16*(1), 3-26.

Hill, M. M., & Hill, A. (2008). *Investigação por Questionário* (2 ed.): Edições Silabo.

Julia-Barcelo, R. (1999). Electronic contracts: a new legal framework for electronic contracts: the EU electronic commerce proposal. *Computer Law & Security Report, 15*(3).

Kim, J.-I., & Shunk, D. L. (2004). Matching indirect procurement process with different B2B e-procurement systems. *Computers in Industry, 53*(2), 153-164.

Koorn, R., Smith, D., & Müller, C. (2001). e-Procurement and Online Marketplaces. *The Netherlands: Compact*.

Kothari, T., Hu, C., & Roehl, W. S. (2005). e-Procurement: an emerging tool for the hotel supply chain management. *International Journal of Hospitality Management, 24*(3), 369-389.

Kumar, N., & Peng, Q. (2006). Strategic alliances in e-government procurement. *International Journal of Electronic Business, 4*(2), 136-145.

Moser, E. P. (2002). E-Procurement-Reverse Auctions and the Supplier's Perspective. *Pharmaceutical Technology, 26*(5), 82-85.

Neef, D. (2001). e-Procurement:From Strategy to Implementation. USA: Prentice Hall.

Nunnally, J., & Bernstein, I. (1978). *Psychometric theory*.

OGC (2005). eProcurement in action:A guide to eProcurement for the public sector. London: Office of Government Commerce.

Oliveira, T., & Martins, M. F. (2010). Understanding e-business adoption across industries in European countries. *Industrial Management & Data Systems, 110*(9), 1337-1354.

Panayiotou, N. A., Gayaialis, S. P., & Tatsiopoulos, I. P. (2004). An e-procurement system for governmental purchasing. *International Journal of Production Economics, 90*(1), 79-102.

Pani, A. K., & Agrahari, A. (2007). *E-Procurement in Emerging Economies:Theory and Cases*. India: Idea Group Pub.

Pereira, P., & Alturas, B. (2007, October). Factores Críticos da Adesão das PME´S Nacionais, Fornecedoras de Materiais de Escrítorio ao Procedimento Aquisitivo Público em Portugal: Uma Proposta de Investigação. Paper presented at the Conferência IADIS Ibero – Americana.

Sharifi, H., Kehoe, D. F., & Hopkins, J. (2006). A classification and selection model of e-marketplaces for better alignment of supply chains. *Journal of Enterprise Information Management, 19*(5), 483-503.

Sharma, S. (1996). Applied Multivariate Techniques. *John Wiley& Sons, USA*.

Soares-Aguiar, A., & Palma-Dos-Reis, A. (2008). Why do firms adopt e-procurement systems? Using logistic regression to empirically test a conceptual model. [Article]. *IEEE Transactions on Engineering Management, 55*(1), 120-133.

Sparks, L., & Wagner, B. A. (2003). Retail exchanges: a research agenda. *Supply Chain Management: An International Journal, 8*(3), 201-208.

Stein, A., & Hawking, P. (2004). 2B or not 2B: The real story of B2B e-procurement *Australian CPA 74*(2), 30-33.

Tanner, C., Woumllfle, R., Schubert, P., & Quade, M. (2008). Current Trends and Challenges in Electronic Procurement: An Empirical Study. *Electronic Markets, 18*(1), 6-18.

Teo, T. S. H., Lin, S., & Lai, K.-h. (2009). Adopters and non-adopters of e-procurement in Singapore: An empirical study. *Omega, 37*(5), 972-987.

Teo, T. S. H., & Ranganathan, C. (2004). Adopters and non-adopters of business-to-business electronic commerce in Singapore. *Information & Management, 42*(1), 89-102.

TIBCO (2008). The Case for Business Process Management.

Vaidya, K., Sajeev A.S.M., & Callender, G. (2004). *e-Procurement Initiatives in the Public Sector: An Investigation into the Critical Success.* Paper presented at the Annual International Purchasing & Supply Education & Research Association (IPSERA), Catania, Italy.

Vaidya, K., Sajeev, A. S. M., & Callender, G. (2006). Critical Factors That Influence E-Procurement Implementation Success in the Public Sector. *Journal of Public Procurement, 6*(1/2), 70-99.

White, A., & Daniel, E. M. (2004). The impact of e-marketplaces on dyadic buyer-supplier relationships: evidence from the healthcare sector. *Journal of Enterprise Information Management, 17*(6), 441-453.

Wong, C., & Sloan, B. (2004, September). *Use of ICT for e-procurement in the UK construction industry: a survey of SMES readiness.* Paper presented at the ARCOM Twentieth Annual Conference.

APPENDIX

Table 8. Perceived benefits, perceived and barriers, and critical success factors and literature support for each item.

Items	Authors
Perceived benefits	
Sales Growth	(Beall, et al., 2003; Berlak & Weber, 2004; Moser, 2002; Sharifi, et al., 2006)
Reach New Markets	(Beall, et al., 2003; Sharifi, et al., 2006)
Reductions in order processing costs	(Berlak & Weber, 2004)
Better operational efficiency	(Beall, et al., 2003; Berlak & Weber, 2004; Moser, 2002; Neef, 2001)
Better negotiable transparency	(Beall, et al., 2003; Carayannis & Popescu, 2005; Simon Croom & Jones, 2007)
Improved relationship with clients	(AGIMO, 2005; Beall, et al., 2003; S. Croom, 2001; EC, 2008; Ellram & Zsidisin, 2002; Kumar & Peng, 2006)
Gain of competitive advantage	(Wong & Sloan, 2004)
Perceived barriers	
Price reduction pressures	(Davila, et al., 2003; Moser, 2002)
Implementation costs	(Hawking, et al., 2004; Koorn, et al., 2001; Tanner, et al., 2008)
Integration costs and maintenance	(Teo & Ranganathan, 2004)
Lack of interoperability between systems	(AGIMO, 2005; Davila, et al., 2003; Hawking, et al., 2004; Kim & Shunk, 2004)
Lack of legal support	(Eadie, et al., 2007; Julia-Barcelo, 1999; Wong & Sloan, 2004)
Lack of information security	(Davila, et al., 2003; Eadie, et al., 2007)
Lack of skill and knowledge	(Archer, et al., 2008)
Critical success factors	
Initial training	(Eadie, et al., 2007; Kothari, et al., 2005; OGC, 2005; Panayiotou, et al., 2004)
Integration with current systems	(EC, 2008; Tanner, et al., 2008)
Top management support	(Gunasekaran & Ngai, 2008; Pani & Agrahari, 2007; Teo & Ranganathan, 2004)
Business process reengineering	(Gilbert, 2000; TIBCO, 2008)
Adoption process support	(AGIMO, 2005; Corini, 2000; Neef, 2001)