

Adoptive Deficiencies and E-Procurement Lag among Hospitals in Ghana : A Logistic Regression Analysis

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ABSTRACT

The inability of public hospitals in Ghana to integrate electronic information in their supply chain systems has been a great disadvantage and affecting value for money and sustainability. Even though these government hospitals have technological equipment in operations that are closely related to e-Procurement tools, they practice the paper-based transaction system of procurement due to inadequate knowledge of e-Procurement procedures. Our study investigates the other critical barriers beside technology that are not well in place hence the lag in e-procurement adoption in these hospitals. We sampled the views of supply chain management officers in selected hospitals in Ghana and applied a fitted logistic regression model as the main analytical tool to explore the effect of constraining factors on e-procurement adoption in Ghanaian hospitals. We observed a non-negligible effect of weak financial deployment, employee motivation, organizational structure, organizational culture, related and support systems or system interoperability, management support, supplier compatibility, regulatory frameworks such as legal framework, operational standards and benchmarks as supplementary constraints to e-procurement adoption in the hospitals

Keywords: E-Procurement, SCM, ICT, EU, EC, PPA, www, SCMU, SCM, SCMU, CSF

I. INTRODUCTION

Recent years have seen improvements on the internet and the ability of individuals to make purchases online. Because of these improvements, many companies have looked to the internet to improve their supply chain management (SCM). Increasing the use of e-Procurement is of strategic importance for achieving the smart and sustainable growth objective of the European Union (EU) 2020 strategy (Peris et al, 2013). EU has been working hard for the adoption of e-Procurement in the governments of member states; overall action plans for the development of electronic Government (e-Government) occurred during the new millennium (Beauvallet et al 2011). In what could be seen as the future of procurement globally, the European Commission (EC) has set the deadline for all public sector buyers to carry out procurement electronically by 2016 (PPA, 2012).The electronic procurement (e-

Procurement) system is an internet- based advanced mechanism electronically with the suppliers of goods, works and services as per the rules and regulations applicable to public tendering systems and practices (Brussels, 2012).

E-Procurement is more than just a system for making purchases directly with suppliers while managing all interactions between them. This includes management of correspondence, bids questions and answers, previous pricing and multiple e-mails sent to multiple participants (Rajkumar, 2001). The e-Procurement system supports companies to register online to qualify for participating in the tenders offered by different government entities. According to Bof and Previtali (2007), twenty years ago, Malone, Yates and Benjamin formulated the Electronic Markets Hypothesis (EMH). They forecasted that network technologies would change markets, a theory that has been the subject of

great debate ever since. The EMH predicted that electronic markets would become the favored mechanisms for coordinating material and information communication for technologies.

According to them, such technologies would create an electronic communication effects, which in turn, would lower communication, costs, enable the electronic aggregation of demand and supply information, as a result, enhance the ability of firms to more closely coordinate their economic activities. Since their initial forecasts, it has become much quicker and convenient for the buyer to screen suppliers and product offers using the electronic communication and information sharing capabilities of the World Wide Web (www) that we still use. Ageshin's 2001 study (cited in Vaidya et al, 2006) shows that e-Procurement increased in the second half of 1999 when online auctions and product catalogs became common place on the internet and continued to expand. The convenience online buying offered, even in its infancy, led e-Procurement to reach as high in transactions in 1999. This study concluded that eighty-five percent of firms that made use of e-Procurement systems were highly satisfied with its benefits.

A good e-Procurement system helps a firm to organise its interactions with its crucial suppliers. It provides those who use it with a set of built-in monitoring tools to help control costs and assure maximum supplier performance. It provides an organized way to keep an open line of communication with potential suppliers during a business process. The system allows managers to confirm pricing, and leverage previous agreement to assure each new price quote is more competitive than the last (Peris et al, 2013). Public procurement is an important function of government which has to satisfy requirements for goods, works, and services in a timely manner. Furthermore, it has to meet the basic principles of good governance: transparency, integrity and value for money (Vaidya et al, 2006). However, working with a supply chain that offers the lowest cost with the environmental sustainability service is vital for public/government agencies like hospitals. While the supply chain management (SCM) is interested in improving quality, it looks to cut costs wherever possible. Doctors, nurses and other end users of the supplies look to use the best products as soon as possible. The SCM stakeholders of the government hospitals must delicately balance the wishes of both the hospital management and end users. The Supply Chain

Management Unit (SCMU) of the government hospitals was established as part of the hospital management's strategy of achieving value for money, economy transparency in the use of public funds, ensuring continuous availability of goods and services, and enhancing the operations of the hospital healthcare delivery (PPA, 2012).

The SCMU's main objective is to bring together the efficient and effective operation of procurement, monitoring and evaluation, stores, inventory control, and contract management activities under one unit to ensure effective management. The rationale is to improve co-ordination in the various interfaces to reduce unnecessary cost, stock-outs, etc to the lowest level possible while ensuring continuous availability of goods and services to support quality healthcare delivery. The centralized SCMU is responsible for procurement of goods including drugs, general services like sanitation, technical services and assist in the procurement of works and consultancy. According to a 2012 procurement digest (monitoring and evaluation) conducted by the PPA, Ghana (PPA, 2012).

In order to sustain the procurement environment from traditional methods of vendor/buyer interactions which are paper based, many organizations are using strategic sourcing software to enable them actually negotiate with a larger number of suppliers easily (Beauvallet et al, 2011). According to Mettler and Rohner (2009), the prerequisites for understanding the adoption and diffusion of the automated procurement systems in government hospitals are the study of the activities and organizational structures of the entities responsible for the procurement in public hospitals. In Ghana, traditionally, public procurement has involved a number of communication mediums to facilitate procurement process between the parties (buyers and suppliers). These have included the use of mail, phone, fax and more recently e-mails to suppliers. This paper-based is the major system adopted by the public hospitals (PPA, 2012). There is an increasing concern with sustainable development and impact of businesses on society and the environment. This indicates that government agencies are keen to demonstrate sustainability and corporate social responsibility and reduce impacts on the environment (Walker and Brammer, 2009).

Studies have identified that communicating and collaborating with suppliers electronically can aid

environmental supply chain management, although such studies have tended to be conducted in manufacturing contexts (Sharfman et al, 2007). E-Procurement has been investigated in a public sector context; and in the public domain can be seen as the use of ICT to support delivery of public procurement policy transparency and efficiency (Carayannis and Popesan, 2005). The greatest e-commerce potential will be realized when all transactions can be transmitted electronically from the buyer to the distributor and fully integrated into existing provider systems. The inability of public hospitals in Ghana to integrate electronic information in their supply chain systems has been a great disadvantage and affecting value for money and sustainability. Even though these government hospitals have technological equipment in operations that are closely related to e-Procurement tools, they practice the paper-based transaction system of procurement due to inadequate knowledge on e-Procurement procedure which is very new to the practice. This tendency investigation as to the other critical barriers beside technology that are not well in place hence the lag in e-procurement adoption in these hospitals.

RELATED LITERATURE

E-Procurement adoption poses a great many challenges for both public and private organizations (Kraemmer, 2003). One serious impediment to adoption is the lack of awareness of e-Procurement procedure and its implications for organizational performance. In this section, an attempt to develop a theoretical framework for the adoption of e-Procurement in the government hospitals had been laid emphasis on other studies. Vaidya et al, (2006), developed a conceptual framework (Fig.2.1) by surveying a number of specialized reports on e-Procurement initiatives in the UK, US, and Australian public sectors readily available to practitioners and decision-makers. The survey was a conceptual model showing a number of unique factors regarded as instrumental in the success of public sector e-Procurement adoption and implementation. For example, it was found that e-Procurement projects have a greater reach and scope than traditional IT development projects. Security and controls and standards and interfaces emerged as more important requirements than those in other IT projects. Key differences in the approach to the development of e-Procurement projects were also noted during the study. Interestingly, the legal and legislative issues did not

emerge as Critical Success Factors (CSFs), although factors such as top management support and performance measurement were found to be critical projects.

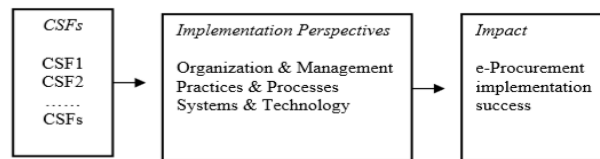


Figure 1 : A conceptual framework on e-Procurement adoption and implementation success. Source: Vaidya et al, (2006)

The framework (Fig. 2.2) was developed by Gunasekaran and Ngai (2008) on the basis of Vaidya et al, (2006) study and literature review on other e-Procurement adoption models in figure 2.1. The building blocks of e-Procurement adoption were: perceived benefits of e-Procurement, perceived barriers of e-Procurement, critical success factors of e-Procurement adoption, and perceived organizational performance with e-Procurement. The framework, as presented in Fig. 2.2, has been used to study the status of the adoption of e-Procurement in public organizations. The details of the framework were discussed below.

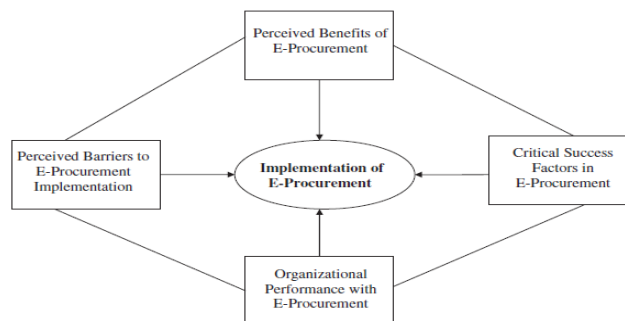


Figure 2. A conceptual framework for e-Procurement adoption and implementation
Source: Gunasekaran and Ngai (2008)

The perceived benefits of e-Procurement as seen by companies have tremendous implications whether one goes for the technology or not. In many cases, the real benefits including strategic impact, intangibles, and non-financial outcomes are not spelled out, resulting in companies not recognizing the true value of e-Procurement in the supply chain and in turn helping to provide the best possible customer service.

Peleg et al. (2002) study three possible strategies a company might choose to follow, namely strategic

partnership, in which a company signs a long-term contract with a single supplier, so that future prices are known in advance; online search, in which the Internet is used for selecting the supplier with whom an order will be placed. Unit price, in this case, is assumed to be random, but its distribution is known in advance, and it is assumed to be a function of the number of suppliers contacted for a price quote; and a combined strategy, under which a supplier is used as a long term partner, but a second source might be chosen through the Internet (Peleg et al., 2002).

Attaran (2001) classifies e-Procurement benefits into three different categories: strategic, which concerns organizational changes and market advantage; opportunity, which is mainly related to improved and explored relations with present or even new suppliers; and operational, which means cheaper and more efficient purchasing processes. Roche (2001) emphasizes the benefits coming from immediate availability of information, paperless processes, and supply chain integration.

The adaptors of e-Procurement systems worldwide, such as Cisco, Chevron, and Eastman Chemicals, have demonstrated substantial improvements in several ways. The benefits of e-Procurement should include improved control of vendor relationships, accurate order fulfillment processes, improved effectiveness of the purchasing process, achievement of higher service levels, reduced prices from the key suppliers, reduced inventory-carrying costs, and reduction of the order cycle (Panayiotou et al., 2004).

The successful adoption of e-Procurement depends on the barriers present in the system. Identifying the barriers themselves is part of the major managerial function in developing the right pathway for the adoption of e-Procurement. The barriers could stem from infrastructure, strategy, people, culture, etc. Liao et al. (2003) highlight the problems associated with procurement: untrue floor prices, improper alteration supplements, improper procedures in awarding contracts, information leaks, taking bribes and improper benefits for some favored companies, and careless supervision and resource distribution. Behavioral and political dimensions have a great influence in defining the procurement process and its effectiveness. In many cases, the communication has been distorted by the individuals to pursue their own interests in the

organization. E-Procurement will facilitate shared information and hence open communication, and there will be fewer behavioral and political impacts. Some of the perceived barriers one should include against adopting e-Procurement are insufficient resources, lack of motivation of people, resistance to new technology, lack of top management support, etc (Liao et al. 2003).

Critical success factors (CSFs) in E-Procurement

The factors that are critical to the successful adoption of e-Procurement have to be identified based on previous experience, the literature available, seminars, etc., with the objective of determining the CSFs for the adoption of e-Procurement (Vaidya et al, 2006). This could be even defined as the best practices for the successful adoption of the e-Procurement system.

In e-Procurement systems, critical success factors should include efficient processes without excessive idle times, the existence of monitoring and evaluation systems that permit the continuous improvement of the process, and adequate training of the employees in order to enable them to take advantage of the new system (Panayiotou et al., 2004).

According to Kim and Shunk (2004), e-commerce is not something that can be instantly plugged into by an existing workplace, and implementing e-Procurement is not a simple matter. Its introduction will require changes, updates, replacements, and adaptations throughout the infrastructure. Successful e-Procurement is more concerned with the fundamental procurement aspects than with the electronic aspects. Plans for new ways of doing business, particularly when expressed using technological jargon, are generally not well received. It may need changes in the way people work, as well as in the strategies of the organization (Vaidya et al, 2006).

Perceived Organizational Performance of E-Procurement

Optimum organizational performance is the key objective of any organization. Therefore, any change in the process or technology should have a positive impact on a company's performance. E-Procurement does have some implications for process improvement but more important is how this improvement, affects organizational performance in both financial and non-

financial terms. E-Procurement has several advantages (Raghavan and Prabhu, 2004): reduced overall procurement costs compared with current traditional methods, shorter-order processing and fulfillment cycles, reduction in administrative costs, improved strategic sourcing, and reduced inventory costs.

Fu et al; (2004) present an implementation of an e-Procurement model. The following are the critical success factors in the successful implementation of e-commerce: feasible measures, step-by-step transformation, promotion incentives, and government support, the commitment of top management, and system operation and maintenance mechanisms. Once the strategy was clearly set up, the top management team took the lead in mapping out an implementation plan and a complete set of measures. The enterprise also provided sufficient incentives to suppliers and made good use of the external resources to promote the project.

II. METHODS AND MATERIAL

Data

Purposively, the medical superintendents, procurement officers, pharmacists, store managers and contract administrators of the four government hospitals were considered in the investigation for data collection. The hospitals were Komfo Anokye Teaching Hospital, Tafo Government Hospital, Suntreso Government Hospital and Manhyia Government Hospital. Those professionals were considered as the research population because they are involved in the entity tender committee of the supply chain management and have much experience in the current procurement practices of the government hospitals.

The total population of these respondents is twenty (20). Five (5) persons were contacted from each hospital. An authentic data was therefore obtained from a census sampling that amounts to twenty (20) which was analyzed for a reliable outcome. Data was collected by administering a closed-ended questionnaire that was self-administered by the respondents at scheduled times. Since the activities and information of the SCMUs are always confidential as one of the procurement ethics and as a right to privacy (especially to suppliers), formal registrations were made at the government hospitals under study before permissions were granted for the

ultimate survey at their various departments and units. Data was therefore collected as part of the answers provided to the questionnaires and literature review was conducted to support the following purposes.

Analytical Model

Our study employed a fitted logistic regression model as the main analytical tool to explore the effect of constraining factors on e-procurement adoption in Ghana. We begin our consideration of the interpretation of logistic regression coefficients with the situation where the independent variable is nominal scale and dichotomous (i.e. measured at two levels). This case provides the conceptual foundation for all the other situations. We assume that the independent variable, x , is coded as either zero or one. The difference in the logit for a subject with $x = 1$ and $x = 0$ is:

$$g(1) - g(0) = \beta_0 + \beta_1 - \beta_0 = \beta_1.$$

In order to interpret this result, we need to introduce and discuss the measure of association termed the odds ratio. The possible values of the logistic probabilities may be conveniently displayed in a 2×2 as shown in Table 1

Table 1. Values of the Logistic Regression Model When the Independent Variable Is Dichotomous

Outcome Variable (Y)	Independent Variable (X)	
	x=1	x=0
y = 1	$\pi(1) = \frac{e^{\beta_0 + \beta_1}}{1 + e^{\beta_0 + \beta_1}}$	$\pi(0) = \frac{e^{\beta_0}}{1 + e^{\beta_0}}$
y = 0	$1 - \pi(1) = \frac{1}{1 + e^{\beta_0 + \beta_1}}$	$1 - \pi(0) = \frac{1}{1 + e^{\beta_0}}$
Total	1.0	1.0

The odds of the outcome being present among individuals with $x=1$ is defined as:

$$\pi(1)/[1-\pi(1)].$$

Similarly, the odds of the outcome being present among individuals with $x=0$ is defined as:

$$\pi(0)/[1-\pi(0)].$$

Nevertheless, if the coding scheme is different from the (0,1) then the odds ratio formula needs to be modified, but for the purpose of this study, all the dichotomous variables will be coded using the (0, 1) coding scheme. The interpretation given for the odds ratio is based on the fact that in many instances it approximates a quantity called the relative risk. This parameter is equal to the ratio:

$$\frac{\pi(1)}{\pi(0)}.$$

It follows that the odds ratio approximates the relative risk;

$$\text{iff}[1-\pi(0)]/[1-\pi(1)] \approx 1.$$

This holds when $\pi(x)$ is small for both $x=1$ and 0. A $100(1-\alpha)\%$ confidence interval (CI) estimate for the odds ratio is obtained by first calculating the endpoint of a confidence interval for the coefficient, β_1 , and then exponentiating these values. Under the assumption that the logit is linear in the continuous covariate, x , the equation for the logit is:

$$g(x) = \beta_0 + \beta_1 x.$$

It follows that the slope coefficient, β_1 gives the change in the log odds for an increase of "1" unit in x , that is:

$$\beta_1 = g(x+1) - g(x)$$

for any value of x . Most often the value of "1" is not clinically interesting. Hence to provide a useful interpretation for a continuous scale covariate we need to develop a method for point and interval estimation for an arbitrary change of "c" units in the covariate. The log odds ratio for a change of c units in x is obtained from the logit difference $g(x+c) - g(x) = c\beta_1$ and the associated odds ratio is obtained by exponentiating this logit difference:

$$OR_{(c)} = OR(x+c, x) = \exp(c\beta_1)$$

An estimate may be obtained by replacing β_1 with its maximum likelihood estimate ($\hat{\beta}_1$). An estimate may be obtained of the standard error needed for confidence interval estimation is obtained by multiplying the

estimated standard error of ($\hat{\beta}_1$) by c . Hence the endpoints of the $100(1-\alpha)\%$ confidence interval (CI) estimate of $OR_{(c)}$ are

$$\exp \left[c\hat{\beta}_1 \pm Z_{1-\frac{\alpha}{2}} \times cSE(\hat{\beta}_1) \right] \dots \dots \dots (3.21)$$

Since both the point estimate and endpoints of the confidence interval depends on the choice of c , the particular value of c should be clearly specified in all tables and calculations.

Analysis of Data

The computation of the crude odds ratio for e-procurement adoption risk factors, X , is given by the estimate $Exp(B)$. The crude odds ratio of e-procurement adoption risk factor determines the influence it has on the e-procurement adoption. The Wald's and log likelihood ratio tests are also performed to ascertain the significant effect of the e-procurement adoption risk factors. A probability value of less than or equal to 0.05 was considered to be statistically significant. Hence the inclusion of that e-procurement adoption risk factor as important in determining the e-procurement adoption outcome $Y=0$ or 1. The parameters of the model were estimated using maximum likelihood approach.

Table 3. Logistic Regression Predicting Likelihood of e-procurement adoption

Variable	Estimates	S.E .	Wald	D f	P-Values	e^{β}
Resource Availability (Financial Resources)	0.591	0.140	17.688	1	0.000	1.805
Resource Availability (Technology)	-0.290	0.069	17.787	1	0.000	0.748
Resource Availability (Skilled Manpower)	0.404	0.193	4.376	1	0.036	1.498
Facilitating Conditions (National Culture)	0.168	0.131	1.650	1	0.199	1.183

Facilitating Conditions (Organisational Culture)	0.744	0.389	3.660	1	0.056	2.104
Facilitating Conditions (Organisational structure)	0.364	0.243	2.242	1	0.136	1.439
Facilitating Conditions (employee motivation)	-5.620	0.521	116.294	1	0.000	0.004
Related and Support Systems (Interoperability Condition)	0.617	0.260	5.630	1	0.018	1.853
Supplier Compatibility	0.094	0.239	0.156	1	0.693	1.099
Regulatory/Legal Framework	-0.395	0.235	2.795	1	0.692	1.098
Operational Standards and Benchmarks	0.360	0.690	0.272	1	0.602	0.698
Management Support	-2.927	1.104	7.033	1	0.008	0.054
Industry Pressure	2.793	0.263	111.112	1	0.000	16.329
Other factors	0.153	0.077	3.907	1	0.048	1.165
Constant	3.036	0.330	84.459	1	0.000	20.828

The estimates for each independent variable are interpreted relative to the referenced category. The estimated odds ratio for all parameters is presented in table 2. The lack of technology is 0.748 more likely to contribute to e-procurement adoption delay with a 95% confidence interval (p-value=0.000) is statistically significant. The odds ratio of 1.805 and a confidence interval of 95%, indicates that lack of financial resources is 1.805 as likely to affect e-procurement adoption delay, giving a similar statistically significant results. Lack of skilled manpower is 1.748 as likely to influence e-procurement adoption delay at 95% confidence interval (p-value=0.036). Similarly, the results indicate that the odds of e-procurement adoption delay increases by a factor of 1.853 with a confidence interval of 95% when there is a lack of related and Support Systems or lack of system interoperability (p-value=0.018). The table shows an odds ratio of 0.004 indicating that, lack of employee motivation contributes 0.004 times to e-procurement adoption delay with 95%

confidence interval (p-value=0.000) after controlling for other factors in the model. Management support is 0.054 more likely to influence e-procurement adoption delay with 95% confidence interval (p-value=0.008) is statistically significant. The odds ratio of 16.329 and a confidence interval of 95% (p-value=0.000), indicates that industry pressure is 16.329 more likely to influence e-procurement adoption delay giving similar statistically significant results. Other factors is 1.165 more likely to influence e-procurement adoption delay at 95% confidence interval (p-value=0.048). The results suggest a non-negligible effect (p-value=0.056) of organizational culture to influence e-procurement adoption delay. National culture orientation and organizational structure had probability values of more than 0.05, which means that these predictor variables are not significant with 95% confidence interval. It is noted that the e-procurement adoption risk factors; resource availability (financial resources), resource availability (financial resources), resource availability (skilled manpower), facilitating conditions (employee motivation), management support, industry pressure, other factors and related and support systems (interoperability condition) are significant at $\alpha = 0.05$ with their respective significance values equal to 0.000, 0.000, 0.036, 0.000, 0.008, 0.000, 0.048 and 0.018. Therefore, these e-procurement risk factors are relevant in predicting to influence e-procurement adoption among hospitals in Ghana.

III. CONCLUSIONS AND RECOMMENDATION

It has been reiterated that despite the years of experience of the procurement officials and the number of years Ghanaian hospitals have been practicing procurement, they are affected by speed and efficiency of the activities due to the paper-based method of procurement still in use. While there are structures and resources in place to support e-Procurement the hospitals have not been able to fully adopt e-procurement system into its supply chain practices. A review of the analyzed data suggests that the availability of technology or integration software (ERP) for electronic procurement offers an unprecedented opportunity to reduce processing costs, enhance transparency and increase efficiency for all parties. Such electronic technologies are by themselves not enough to achieve the desired objective. Thus e-procurement adoption must be done with careful consideration of socio-cultural conditions, employee

motivation, organizational structure, organisational culture, related and support systems or system interoperability, management support, supplier compatibility, regulatory frameworks such as legal framework, operational standards and benchmarks and other external/industry pressure etc. This makes the e-procurement adoption process open, interoperable and has adequate security and privacy safeguards to preserve and promote the integrity of a competitive procurement environment. At a minimum, electronic methodologies within the procurement should adopt clear procedures that reduce confusion and allow access to all qualified bidders. Further, any process should not affect the legal rights and responsibilities of all parties: suppliers, consultants, construction managers and contractors. This study serves to establish common parameters for all public hospitals to adopt the electronic procurement.

Related to the observed low rate of e-Procurement adoption, there is an urgent need for research that can ascertain variations in e-Procurement adoption based on organization differences, business size differences and complexity of products. This is a necessary prerequisite to enable the development of a predictive framework or model of e-Procurement adoption. This can also assist in identifying firms, management styles and activities where e-Procurement is likely to either excel or lag. E-Procurement is still a relatively recent phenomenon and the need for the research framework examined in this paper is apparent in terms of the inconsistency between proclaimed national and organization benefits deriving from a faster uptake, and the slowness of adoption. A predictive model of e-Procurement processes can be used to improve the formulation and targeting of procurement industry. Innovation policy can be used on how to access these advantages and the removal of impediments. Improvement in the rate of e-Procurement adoption will have the national economic benefit through improved productivity that can strengthen the national competitive advantage in rapidly adopting firms and organizations. However, there is no call for the business sector to be innovative in the use of e-Procurement, for the sake of innovation. Management orientation needs to be towards effectiveness and practicability. Frameworks on the electronic tendering process and online pharmacy must be studied.

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