

# **A MODEL BASED ON TECHNOLOGY, ORGANIZATION, AND ENVIRONMENT FOR ELECTRONIC PROCUREMENT SYSTEM USAGE**

*Ganesh. P. Sahu, College of Business, California State University Monterey Bay, Seaside, CA 93955, 831-917-3246, gsahu@csumb.edu, gsahu@mnnit.ac.in*

*Babita Gupta, College of Business, California State University Monterey Bay, Seaside, CA 93955, 831-582-4186, bgupta@csumb.edu*

*Deepak Kumar Singh, BBD University, Lucknow, India, +91-959-821-3700, dsinghel@gmail.com*

## **ABSTRACT**

Electronic procurement is the use of information and communication technology to assist with the procurement function of organizations over the Internet. A model based on Technology, Organization, and Environment (TOE) is proposed for electronic procurement usages to identify the factors leading to e-procurement usages behaviour by business organizations in developing countries. These factors fall into three categories, known as technological, organizational and environmental characteristics. The relationships between these factors and the actual usages intention will provide insight to practitioners and solution providers on how to ensure successful e-procurement usage in the organizations.

## **INTRODUCTION**

Procurement is more than just the purchasing of goods and services. In an enterprise, procurement encompasses all activities involved in obtaining material and services and managing their inflow into an organization toward the end user [1]. Traditionally, procurement has involved a number of communication mediums including the use of mail, phone, fax, EDI and recently, e-mail and the internet to facilitate procurement process between the various parties. The unique features of the web-based technologies can potentially support and improve the activities of procurement process through transforming traditional paper-based processes to e-procurement [1]. A series of benchmark studies by Aberdeen Group found that performance improvement due to e-procurement activities are significant. As a result of their e-procurement initiative, enterprises on average displayed a 35% improvement in spend under management, with a 41% in reduction maverick spend. Additionally, enterprises reduced their requisition-to-order cost by approximately 100%, and more than halved their transaction cycle time [2]. Exploratory studies have indicated that many organizations are pursuing electronic means to conduct business, that there are a number of factors influencing the adoption of electronic commerce, and that these may be summarized as e-procurement, e-sourcing and e-collaboration [3, 4, 5, 6]. Though a substantial number of research studies have been done in the area of e-procurement adoption, there is still a gap in understanding the factors that will lead to enhanced e-procurement usages in organizations. With this background, a model is proposed in this study to identify the determinants of electronic procurement usages by business organizations. Factors in the proposed model are adapted from the Technology, Organization, and Environment (TOE) framework.

## **RESEARCH MODEL**

Based on the review of literature and socio-economic environment of the developing countries, factors for enhancing e-procurement usage are identified and presented in a Research Model illustrated in Figure 1. These factors are categorized into three main categories following the TOE framework; the categories are Technological, Organizational and Environmental.

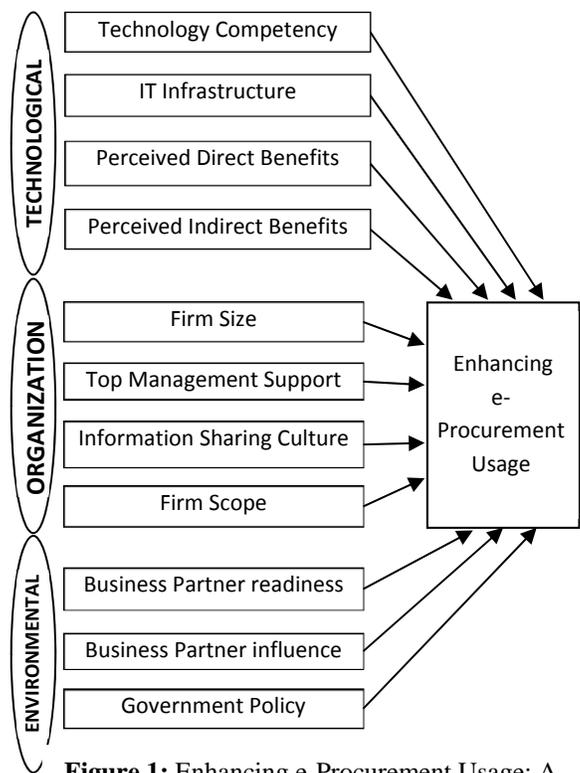
## Technological Factors

Costs and benefits of adopting e-procurement are most frequently cited as one of the major drivers for initial usage of adopting e-procurement [5]. Perceived benefits are the anticipated or expected advantages that can be provided to organizations [7]. Executives in the organization do not prefer sophisticated software and applications. A computer application perceived to be easier to use than another is more likely to be accepted by end users [8]. The same principle is considered to be applied to e-procurement adoption and usage. Hence, the perceived competency required for electronic procurement usage has influence to the willingness of a company to use it. Due to the open nature of the Internet, security is one of the main concerns of business organizations. Computer viruses and hacker attacks may cause immense losses. As a result, the lower the security risk the user perceive, the higher is the likelihood to adopt electronic procurement systems. There are four factors specified within the technological context: these are technology competency, IT infrastructure, perceived direct benefits, and perceived indirect benefits.

*Technology Competency:* Technology competency represents the totality of institutional technological knowledge resident within an organization. This institutional knowledge is comprised of the sum of technological expertise by all members of an organization and is reflected in the technological sophistication of their operations. Firms that do not have much IS experience may be unaware of new technologies or may not want to take a risk to adopt them. Dholakia and Kshetri [9] suggested that technologies already existing in an organization influence the future adoption of a new technology. Therefore, it is hypothesized that: *Technology Competency is a predictor of E-procurement usage.*

*IT Infrastructure:* IT infrastructure meant the hardware, software, and all related network which enables both forward and backward linkages of the IT systems [10]. Premkumar [11] found IT infrastructure to be an important determinant of IS adoption. The adoption and usage of new technologies can bring significant changes to the work practices of businesses and resistance to change is a normal organizational reaction [12]. Therefore, it is important, especially for businesses, that the changes are compatible with its infrastructure, values and beliefs. It is hypothesized that *IT Infrastructure is a predictor of E-procurement usage.*

*Perceived Direct Benefit:* Studies have been conducted to determine the drivers and barriers for the adoption of e-procurement. Costs and benefits of adopting e-procurement are most frequently cited as one of the major drivers for initial usage of adopting e-procurement [5]. Perceived benefits are the anticipated or expected advantages that can be provided to organizations [7]. In Chau's and Hui's [13] study on the adoption of EDI, direct benefits are primarily intended for operational savings and are related to the internal efficiency of the organization. Direct benefits include reduction in transaction errors and transaction costs, improved data accuracy and information quality, and faster application process. It is hypothesised that *Perceived Direct Benefit is a predictor of E-procurement usage.*



**Figure 1:** Enhancing e-Procurement Usage: A Research Model

*Perceived Indirect Benefit:* Indirect benefits are associated with the impact of adopting EDI for management of business process and relationships. Indirect benefits include better customer services and improved relationship with business partners. Both types of benefits affect the adoption of IT, and can be applied to the context of e-procurement. With this factor taken into the consideration it is hypothesized that *Perceived Indirect Benefit is a predictor of E-procurement usage.*

### **Organizational Factors**

Previous research [14, 15] has generally found that larger firms tend to adopt new technologies more rapidly than their smaller counterparts. Likewise, larger firms are more likely to adopt e-commerce [16]. One possible explanation is that larger firms have sufficient financial and technological resources available to pay the installation costs and ongoing expenses during usage. Bigger organizations have a greater need to stay at the technological forefront than those organizations which are smaller in size. There are four factors covered under the organizational context. The factors are firm size, top management support, information sharing culture and firm scope.

*Firm Size:* Firm size has been considered as a good predictor of IT adoption in organizations. Large firms have more resources, greater economies of scale, and can take greater risks associated with innovation adoptions [14, 17, 18, 19]. The small firms, because of their resource constraints, are less likely to adopt newer technologies. However, small firms are more agile and flexible than large firms. When controlled for technological and financial resources, larger firms use technology to a lesser degree [19]. While this may be true for a mature technology, small firms cannot risk resources to adopt unknown or immature innovations. Since e-procurement standards are still evolving, this research proposes the notion that large firms can absorb the risks of web services adoption. This leads to following hypothesis: *Firm size is a predictor of E-procurement usage.*

*Top Management Support:* Top management support refers to the extent of commitment and resource support provided by the top management for the innovation [11]. Top management is the decision maker of the firm and its support is significant to ensure that there is commitment to resourcing the implementation of innovation [20] and to overcoming barriers and resistance to change and innovation [21]. It is argued that the top management's belief about the positive impact of e-procurement on the organizations' performance will influence their decision regarding the adoption and the amount of resources committed to the adoption. Prior studies confirmed that top management support is positively associated with an innovation adoption (e.g. [11, 22]). With these factors taken into the consideration it is hypothesized that *Top Management Support is a predictor of E-procurement usage.*

*Information Sharing Culture:* Intra-organizational information sharing includes cross-functional exchange of information. For an effective e-procurement system to perform, the system must be integrated with other internal IS such as finance and inventory management [23]. Inter-organizational information sharing would include sharing important information with business partners. For instance, buyers must be willing to share information so as to facilitate communication and flow of goods and services between both parties. However, holding information is often equivalent to developing bargaining power, where the information may be considered as critical and confidential by the buyer [23]. Sharing this information can alter the buyer's position in the buyer-supplier relationship. Organizations need to understand that information sharing may potentially benefit both parties for mutual performance gains [24]. Hence, an organization's willingness to share information can have positive relationship with the adoption of e-procurement. It follows that *Information sharing culture is a predictor of E-procurement usage.*

*Firm Scope:* Firm scope, another common organizational factor, is defined as the geographical extent of the organization's operations. Prior research has shown a positive relationship between firm scope, IT use and value added [18, 19, 25]. In the context of e-procurement, an organization that has operations in several geographic areas with many business partners will achieve more benefits through the use of a standardized technology than an organization with narrow scope. This leads to the following hypothesis: *Firm scope is a predictor of E-procurement usage.*

### **Environmental Factors**

A firm's e-procurement system adoption decision may also 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. E-procurement system may necessitate tight integration with suppliers, which goes beyond the walls of an individual organization [18]. Accordingly, a lack of trading partner readiness may hinder e-procurement system adoption. Government policy, regulations and encouragement is a positive predictor for successful implementation and acceptance of any new system by the organizations. Three factors, within the environmental context considered are partner readiness, partner influence and government policy.

*Business Partner Readiness:* Business Partner Readiness is the degree to which the customers and suppliers of the organization are willing and ready to conduct their business activities electronically [26]. In an electronic business environment, it is necessary that all trading partners adopt compatible electronic trading systems and provide internet-enabled services for each other so that they can engage in electronic interactions and transactions simultaneously. This is because some organizations may be motivated to adopt e-procurement and be ready to adopt the technology, but are unable to do so due to the lack of readiness on the part of the trading partner. In the manufacturing sector, for instance, organizations rely on business partners to perform important activities, from logistics to assembly and distribution [1]. An e-procurement research study [27] has identified partner readiness as one of the significant antecedent of e-procurement adoption. Thus, it is hypothesized that there is a positive relationship between partner readiness and e-procurement usage. It is hypothesised that *Business Partner Readiness is a predictor of E-procurement usage.*

*Business Partner Influence:* Business partner influence refers to the pressures exerted by the competitive environment and the imposition by trading partners, parent company, or regulations [28]. Teo et al. [29] recommended that organizations that invest in information system due to pressures from customers or competitors may gain competitive advantage compared to others that fail to do so. Hence, when more competitors become e-procurement-capable, firms are more inclined to use e-procurement technology in order to maintain their competitive position. Further, requests from powerful partners to use certain innovations generally have more influence on firms than similar requests from less powerful partners [30]. Prior studies revealed that business partner influence is statistically significant to the technology adoption [22, 31]. Thus, it is hypothesized that there is a positive relationship between business partner influence and firms' e-procurement usage. With this factor taken into the consideration it is hypothesized that *Business Partner influence is a predictor of E-procurement usage.*

*Government Policy:* Government policy and regulations are known as major facilitators of e-procurement system adoption through subsidies and trading policies [18]. On the recommendations of the experts from manufacturing industry and academic it is considered as an important variable for the study of e-procurement usage in Indian manufacturing industries. Thus it is hypothesized that *Government policy is a predictor of E-procurement usage.*

### Measurement of Dependent Variable

The dependent variable considered for this study is *Enhancing E-procurement Usage*. Various measures of the usage of IT/IS adoption have been used in prior studies, including volume, functionality [1], percentage use [19], and time [31]. The usage of mobile business applications was measured by the functionality of mobile business applications and the volume (i.e. number of instances the task is performed wirelessly) [32]. Batenburg [31], on the other hand, operationalized the extent of e-procurement usage by the percentages of total purchases conducted online. The current study, however, conceptualized the usage of e-procurement in Indian manufacturing firms via the concepts of usage of e-procurement by using four measurement items: “The number of items procured electronically”, “The variety of items procured electronically”, “The number of functional units that can procure items electronically”, and “The number of internal business processes that process items electronically” [33].

### CONCLUSION

A comprehensive review of literature has been carried out to identify the important factors which may influence “enhancing the e-procurement usage”. The eleven identified factors are classified into three major categories, namely technological, organizational, and environmental. The categorization of the factors has been done on the basis of Technology, Organization, and Environment framework. Further, based on these eleven identified variables and the objective function a research model has been developed for “enhancing electronic procurement usage”. Since extant literature in this research area is very limited, findings of this study may help to identify the actual determinants of enhancing electronic procurement usage in organizations.

### REFERENCES

- [1] Gebauer, J., and Segev, A. (1998). Assessing Internet-based Procurement to Support the Virtual Enterprise. In *Proceedings of the CALS Expo International and 21st Century Commerce*, Long Beach, California, October 26-29, 1998.
- [2] Aberdeen Group (2007). *E-procurement: Trials and Triumphs*, Aberdeen Group, Boston, MA.
- [3] Bartezzaghi, E., and Ronchi, S. (2003). Internet Supporting the Procurement Process: Lessons from Four Case Studies. *Integrated Manufacturing Systems*, 14(8): 632-641.
- [4] More, E., and McGrath, M. (2002). An Australian Case in E-Health Communication and Change. *Journal of Management Development*.21(8): 621-632.
- [5] Kheng C. B., Al-Hawamdeh S. (2002). The adoption of electronic procurement in Singapore. *Electronic Commerce Research*.2(1-2):61-73.
- [6] Min, H, Galle WP. (2003). E-purchasing: profiles of adopters and non-adopters. *Industrial Marketing Management*. 32(3):227-33.
- [7] Chwelos, P, Benbasat I, Dexter A. S. (2001). Research report: empirical test of an EDI adoption model. *Information Systems Research* 12(3): 304-321.
- [8] Rogers, E. M. (1985). *Diffusion of innovations*, The Free Press (4th ed.), New York, 1985.
- [9] Dholakia, R. R. and Kshetri, N. (2002). Factors impacting the adoption of the internet among SMEs. *Small Business Economics*, 23(4): 311-22.
- [10] Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed). New York: Free Press.
- [11] Premkumar, G. (2003). A Meta-Analysis of Research on IT Implementation in Small Business. *Journal of Organizational Computing and Electronic Commerce*, 13(2): 91-121.
- [12] Premkumar, G. and Roberts, M. (1999). Adoption of New Information Technologies in Rural Small Businesses. *Omega International Journal of Management Science*, 27(4): 34.

- [13] Chau, P. Y. K., and Hui K. L. (2001). Determinants of small business EDI adoption: an empirical investigation. *Journal of Organizational Computing and Electronic Commerce* 11(4):229–252.
- [14] Thong, J. Y. L. (1999). An Integrated Model of Information Systems Adoption in Small Businesses., *Journal of Management Information Systems*. 15(4): 187-214.
- [15] Teo, T. S. H., Tan M. (1998). An empirical study of adopters and non- adopters of the Internet in Singapore. *Information and Management*. 34(6):339–45.
- [16] Teo, T. S. H., Ranganathan C. (2004). Adopters and non-adopters of business- to-business electronic commerce in Singapore. *Information and Management*. 42(1):89–102.
- [17] Kuan, K.K.Y. and Chau, P.Y.K. (2001). A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework, *Information & Management*, 38(8): 507-521.
- [18] Zhu, K., Kraemer, K. L. and Xu, S. (2003). Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors, *European Journal of Information Systems*. 12(4): 251-268.
- [19] Zhu, K. and Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information Systems Research*, 16(1): 61-84
- [20] Grover, V. (1993). An Empirically Derived Model for the Adoption of Customer-Based Inter-organizational Systems. *Decision Sciences*. 24(3): 603-639.
- [21] Teo, T. S. H., Tan M, Wong K. B. (1998). A contingency model of Internet adoption in Singapore. *International Journal of Electronic Commerce*. 2(2):95–118.
- [22] Teo, T. S. H., Lin, S., and, Lai, K. H. (2009). Adopters and non-adopters of e-procurement in Singapore: An empirical study, *Omega* 37: 972 – 987
- [23] Lai, K. H., Bao Y, Li X. (2008). Channel relationship and business uncertainty: evidence from the Hong Kong market. *Industrial Marketing Management*. 37(6):713–24.
- [24] Yao, D-Q, Yue X, Liu J. (2008). Vertical cost information sharing in a supply chain with value-adding retailers. *Omega*. 36(5):838–51.
- [25] Zhu, K., Kraemer KL, Xu S, Dedrick J. (2004). Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial services industry. *Journal of Management Information Systems*. 21(1):17–54.
- [26] Barua, A., Konana, P., Whinston, A. B. and Yin, F. (2004). Assessing internet enabled business value: An exploratory investigation. *MIS Quarterly*, 28(4): 585-620.
- [27] Aguiar, A.M. ; Ramamurthy, K. ; Reis, A.P. (2008). Electronic Procurement Systems: An integrative model to explain Procurement Performance. *Industrial Engineering and Engineering Management*, 2008. IEEM 2008. IEEE Publication, pp1490-1494
- [28] Joo, Y. and Kim, Y. (2004). Determinants of Corporate Adoption of E-Marketplace: An Innovation Theory Perspective. *Journal of Purchasing and Supply Management*, 10: 89-101.
- [29] Teo, T. S. H., Devadoss P, and Pan SL.(2006). Towards a holistic perspective of customer relationship management (CRM) implementation: a case study of the Housing and Development Board, Singapore. *Decision Support Systems*. 42(3):1613–1627.
- [30] Iacovou, C. L., Benbasat, I., and Dexter, A. S. (1995). Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly*, 19(4): 465-485.
- [31] Batenburg, R. (2007). E-procurement adoption by European firms: A quantitative analysis. *Journal of Purchasing & Supply Management*, 13: 182-192.
- [32] Gebauer, J. and Shaw, M. J., (2004). Success Factors and Impacts of Mobile Business
- [33] Massetti, B, Zmud RW. (1996). Measuring the extent of EDI usage in complex organizations: strategies and illustrative examples. *MIS Quarterly*, 20(3): 331–345.