

Application of e-Procurement Technologies for Selecting Suppliers of Agro-Based SMEs in Malaysia

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ABSTRACT

E-procurement is one aspect in supply management that has become popular among companies in Malaysia. There is an argument whether adopting e-procurement technology is a strategic choice for companies' purchasing strategies. The objectives of this study are to investigate factors that influence the application of e-procurement technologies in selecting potential suppliers of agro-based SMEs in Malaysia and to determine whether these SMEs have the intention to increase the application of e-procurement in selecting their suppliers. An online survey was carried out and only 190 responses (63.3%) were received from selected agro-based SMEs. Statistical analyses such as descriptive analysis, factor analysis and logistic regression analysis were used to analyse the data. The results revealed selection efficiency, security and legal environment, commitment, delivery acceleration, cost and quality as the factors related to the intention of SMEs to increase the application of e-procurement. A vigorous use of e-procurement and strong support from the top management by providing sufficient e-procurement resources to be utilized in agro-based SMEs are a few among many relevant implications discussed in this paper.

Keywords: e-procurement, agro-based SMEs, supply management, purchasing

INTRODUCTION

E-procurement is one aspect in supply management that has become popular among companies in Malaysia. E-procurement gives companies the opportunity of following purchasing processes wherein sourcing raw materials and other resources can be done in a paperless environment. This environment permits companies to share

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the information on a real-time basis and is fast and secure. Purchasing processes typically involve a large amount of information processing and communication, which needs to be managed carefully. There is an argument on whether adopting e-procurement technology is a strategic choice for companies' purchasing strategies. Although e-procurement has been reported to have positive impacts on business transactions (Angeles and Nath, 2007; De Boer *et al.*, 2002; Gunasekaran and Ngai, 2008; Kheng and Al-Hawamdeh, 2002) the level of e-procurement adoption is still at a very slow rate as companies need to consider several aspects before they decide to invest on and adopt the new technology. Details on e-procurement technology are essential to increase companies understanding about the technology and to help them avoid the possibility of making a wrong decision. Most companies failed to effectively implement e-procurement technology because of poor implementation of the technology (Bradley, 2005). Besides, Gunasekaran *et al.* (2009) stated that companies are not thinking about their e-procurement strategies and fail to involve key suppliers at the earliest stage of implementation of e-procurement. This may lead to difficulty in finding good suppliers who could supply high quality products.

There are concerns among suppliers towards adopting e-procurement and e-commerce especially with respect to the level of suppliers' involvement in using e-procurement technologies. Such concern as described by Van Weele (2005) is about which suppliers are appropriate to make a deal. The question here is whether they are ready to be engaged in electronic connection and willing to follow and establish this electronic form of functions for buying and purchasing. There are also some key concerns regarding the acceptance of e-procurement technology by suppliers and ability of the technology to maintain an established relationship with the suppliers (Van Weele, 2005). Other questions we might want to ask relate to whether the suppliers are willing to change their traditional procurement method to e-procurement, whether close relationships can be maintained once e-procurement is applied and whether e-procurement could be the right tool to facilitate companies to select potential suppliers. According to Van Weele (2005), these questions are crucial to helping companies strategize their e-procurement in order to increase effectiveness of supplier communication in a more complex, multi-tiered supply chain, select the right suppliers and to develop a strong partnership with existing supply chain partners. The strong partnership will make them more competitive for purchasing contracts. The right type of e-procurement technologies and what factors influence the application of e-procurement could be determined if companies have a complete understanding of their purchasing processes and supplier' requirements. This is important as companies need to understand the value-creating benefits and strategies that e-procurement has and at the same time drive their suppliers and customers to aggressively exploit the advantages of the technology. The 'traditional'

purchasing transactions will now get slowly replaced by more advanced purchasing transactions and companies can focus more on increasing their competitive strategy.

In Malaysia, small and medium enterprises (SMEs) comprise more than 99% of business establishments and 80% of them are categorized under micro level (Department of Statistics, 2005). Most of these SMEs particularly agro-based SMEs are involved in low value-added activities which focus more on 'traditional' than 'modern' productions and business transactions. These problems are due to many issues and challenges faced by the agro-based SMEs such as lack of advanced technologies for production and business transactions, lack of marketing and distribution capabilities to penetrate the regional and global market, low quality packaging and labelling of products, low productivity among the small entrepreneurs and low participation by bumiputera entrepreneurs (Mohd Salleh, 2005). Thus, the Third Industrial Master Plan (IMP3) highlighted the need to push these SMEs to become major players in the agro-based industry.

With great potential of agro-based products and the availability of internet technologies in the market, e-procurement can become a part of business transactions in agro-based SMEs, helping them to remain competitive. E-procurement technology has now captured the attention of companies and there is evidence which shows that this technology will become an important tool in assisting procurement activities and to select potential suppliers in companies, particularly SMEs (Chan and Lee, 2003). Although this technology has assisted SMEs in selecting their suppliers (Gunasekaran *et al.*, 2009), whether it is the right tool and what factors influence the application of e-procurement to select suppliers still remain unsolved. The concept of e-procurement application has been widely described in the literature. However, studies on how SMEs particularly in Malaysia use e-procurement technology, factors critical to its implementation and its contribution are lacking. Thus, the objectives of this study are to investigate factors that influence the application of e-procurement technologies in selecting potential suppliers of agro-based SMEs in Malaysia and to determine whether these SMEs have the intention to increase the application of e-procurement in selecting their suppliers.

LITERATURE REVIEW

The Advantages of E-Procurement Technologies

E-procurement is an example of a set of advanced Internet technologies. According to Croom and Brandon-Jones (2007), e-procurement refers to the use of integrated information technology systems for procurement functions, including sourcing, negotiation, ordering, receipt and post-purchase review. E-procurement provides companies the simplicity of a purchasing processes wherein sourcing of materials

and other goods can be done electronically commonly using the internet. E-procurement normally includes a system for making purchases online. It is a collection of web technology-based purchasing solutions aimed at simplifying commercial transactions within and between organizations (De Boer *et al.*, 2002; Dooley and Purchase, 2004; Van Weele, 2005). Based on De Boer *et al.* (2002), Dooley and Purchase (2004), Kheng and Al-Hawamdeh (2002), Segev and Gebauer (2001) and Van Weele (2005), e-procurement technologies can be categorized into several types. Table 1 presents a brief description of e-procurement technologies.

Table 1 Types of e-procurement technologies

Types	Description
Electronic Auction (e-auction)	E-auction is the process of bidding products over the Internet and the auction is most often traded in real time. E-auction enables companies to purchase goods or services from suppliers who offer the lowest price or a combination of the lowest price and other aspects.
Electronic Tendering (e-tendering)	E-tendering involves the process of sending requests for invoices (RFI), request for purchases (RFP) etc. to suppliers and receiving the responses from the suppliers using web-based technology. E-tendering allows buyers and suppliers to securely manage their interactions during tendering process via online.
Electronic Sourcing (e-sourcing)	E-sourcing refers to the process of identifying or finding new possible suppliers for a specific category of purchasing requirements using Internet technology. The Internet enables companies to interact with potential suppliers in a broad range and assist them on suppliers' selection.
Electronic Informing (e-informing)	E-informing is a form of electronic procurement that is not directly associated with the step in a basic purchasing cycle like contracting or ordering. It is actually the process of gathering and distributing related information about purchasing from buyers, suppliers and other parties using Internet technology.
Electronic Catalogue (e-catalogue)	E-catalogue is an innovative digital medium in which information about products and services may be placed within an executable file (.exe) that can be distributed by email or made downloadable from a website. E-catalogue does not require any other software to run it and offers enormous benefits for businesses that communicate with internal and external customers via the Internet or an Intranet.

Table 1 (*Cont'd*)

Electronic Maintenance Repair and Operation (e-MRO)	E-MRO focuses on the process of creating and approving purchasing requisitions, placing orders and receiving goods or services ordered using system software based on Internet technology. The system involves the use of electronic infrastructure to transfer purchase orders, invoices, payments and other relevant information for indirect products and services.
Web-based Enterprise Resource Planning (Web-based ERP)	Web-based ERP system involves the procurement of direct goods/product related items (goods that are directly used to produce finished products) and any related transactions such as purchase order, invoices, payments and other necessary documentation via online.
Web-based Electronic Data Interchange (Web-based EDI)	Web-based EDI systems are a cost-effective way to automate the exchange of structured documents on business arrangements between trading partners as all transactions are done electronically. The system enables companies to replace expensive EDI communication with less costly web communication and provides them real time information about market conditions.

Source: De Boer *et al.* (2002), Dooley and Purchase (2004), Kheng and Al-Hawamdeh (2002), Segev and Gebauer (2001) and Van Weele (2005)

Many e-procurement studies revealed key factors which drive e-procurement application and lead to creating value added in the supply chain. Croom (2000), Kheng and Al-Hawamdeh (2002) and Roche (2001) claimed the advantages of e-procurement are that they simplify traditional procurement processes, enhance choices in supplier selections, improve buyer-supplier relationships, increase market transparency, lower purchasing prices and transactions costs, reduce administrative costs, shorten order fulfilment cycle time, lower inventory levels, provide a two-way communication of real-time purchasing information, and establish a closed collaboration between companies and their partners. E-procurement also enables to fasten the ordering system, allows wider choice of suppliers, simplifying procurement processes, provide better control over procurement spending and employee compliance, able to access to more alternative buyers, reduces paperwork and duplication of tasks, enhance relationships with business partners, improved service and receive better prices from suppliers (Bendoly and Schoenherr, 2005; Eadie *et al.*, 2010; Moon, 2005; Panayiotou *et al.*, 2004).

Furthermore, the application of e-procurement technologies enable companies to achieve better information which can increase the efficiency of procurement processes and provide an opportunity to enhance competitiveness and profitability

(Carayannis and Popescu, 2005; Presutti Jr., 2003; Puschmann and Alt, 2005). On the other hand, Presutti Jr. (2003) indicated that e-procurement allows the companies to analyse how much they spend on purchasing products. While Sanders (2005) supported that the application of e-procurement in business allows supply chain members to achieve inter-firm coordination and integrate business processes. Cagliano *et al.* (2003) also agreed that the use of e-procurement has the potential to promote supply chain integration by providing efficient, timely and transparent business information to the appropriate parties. In short, there are key drivers that lead to the application of e-procurement which contributes to overall firms' performances and creates value for both buyers and suppliers of the firms. The summary of the drivers is presented in Table 2.

Table 2 Drivers of e-procurement application

Drivers	Reference
● Process cost savings (tender/purchase process)	● Knudsen (2003); Minahan and Degan (2001); Martin (2008)
● Service/material/product cost savings	● Minahan and Degan (2001); Martin (2008)
● Transaction administration cost savings	● Davila <i>et al.</i> (2003); Panayiotou <i>et al.</i> (2003)
● Reduced administration costs	● Egbu <i>et al.</i> (2003); Hawking <i>et al.</i> (2004); Raghavan and Prabhu (2004)
● Increasing profit margins	● McIntosh and Sloan (2001); Wong and Sloan (2003); Ribeiro (2001)
● Strategic cost savings	● Knudsen (2003)
● Enhanced inventory management	● Hawking <i>et al.</i> (2004); Martin (2008)
● Decrease in cost through reduced staffing levels	● Davila <i>et al.</i> (2003); Egbu <i>et al.</i> (2003)
● Shortened overall procurement cycle times	● Knudsen (2003)
● Shortened communication cycle times	● Minahan and Degan (2001)
● Reduction in time through greater transparency (less objections)	● Panayiotou <i>et al.</i> (2003)
● Reduction in evaluation time	● Panayiotou <i>et al.</i> (2003); Martin (2008)

Table 2 (Cont'd)

● Reduction in time through improved internal workflow	● Panayiotou <i>et al.</i> (2003)
● Reduction in purchasing order fulfilment time-contract completion	● Davila <i>et al.</i> (2003)
● Reduction in time through increased visibility	● Kalakota <i>et al.</i> (2001)
● Increased quality through increased competition	● Kalakota <i>et al.</i> (2001)
● Increased quality through benchmarking (market intelligence)	● Hawking <i>et al.</i> (2004)
● Increased quality through visibility in the supply chain	● Minahan and Degan (2001); Hawking <i>et al.</i> (2004)
● Increased quality through efficiency	● McIntosh and Sloan (2001); Ribeiro (2001); Martin (2008)
● Increased quality through improved communication	● Hawking <i>et al.</i> (2004)
● Gaining competitive advantage	● Wong and Sloan (2003)

Source: Adapted from Eadie *et al.* (2010)

E-Procurement and Supplier Selection

Weber *et al.* (1991) indicated that attitude, willingness for business and after sales service were the three factors which affect supplier selection. On the other hand, Min (1994) revealed seven main factors that were chosen by firms to select suppliers from international market. The factors are financial terms, quality assurance, perceived risks, service performance, buyer-supplier partnerships, cultural and communication barriers and trade restriction. Other studies on supplier selection revealed management capability, production capacity and flexibility, design and technological capability, financial stability, experience, geographical location and electronic transaction as the important factors which influence the firms to select their suppliers (Bottani and Rizzi, 2005; Petroni and Braglia, 2000).

Undoubtedly, e-procurement has facilitated firms to have direct links with suppliers, leading to reduced paperwork thereby a paperless environment, reduce overhead associated with buying process and shortening of the purchasing cycle (Gunasekaran *et al.*, 2009; Roger, 1995). Peleg *et al.* (2002) described e-procurement as a powerful tool for cost reduction and productivity improvement. E-procurement also facilitates integrating multiple supplier catalogues into a single buyer-managed view of catalogue. The technology enables purchasing personnel to review product purchase profiles and in turn facilitates supplier negotiations (Rajkumar, 2001). The

e-procurement system works as a connection and integration between companies and their suppliers. It provides companies with an organized way to keep an open line of communication with potential suppliers during the purchasing processes. With overwhelming online transactions in the market, e-procurement is becoming an important tool to assist firms that have more than a single supplier supplying the same product to the firm (Kar, 2009). Furthermore, according to Kar (2009), it is beneficial to source from more than one supplier as one supplier may not have the technical competence to provide for the complete requirement of the firms. Therefore, having multiple suppliers may fulfil the needs of the firms. Angeles and Nath (2007) studied the critical factors behind e-procurement process. They revealed success factors such as reducing the number of suppliers, consolidating suppliers and contracts and involving preferred and strategic suppliers in planning for e-procurement. These success factors provide a clear indication that lowering the possible number of total suppliers who applied for a tender to the number of possible suppliers who would actually be more suitable in the supplier prequalification stage would play a key role in the success of an e-procurement implementation process. Figure 2 shows factors identified based on literatures reviewed and which influence the application of e-procurement technologies in selecting suppliers. The framework of the study was developed based on these factors and testing of the relationship was conducted to further understand the nature of the relationship towards the application of e-procurement in selecting the suppliers.

METHODOLOGY

Online surveys using a structured questionnaire were conducted in this study. The questions were developed using a 5-point Likert Scale to address the issues on use of e-procurement technologies in selecting suppliers. The questionnaire was sent to Malaysian agro-based SMEs in Klang Valley wherein their addresses were obtained from Malaysian Directory of Small and Medium Industry/Small and Medium Enterprise (SMI/SME). Of all SMEs listed in Klang Valley, only 300 firms were involved in agro-based activities and thereby selected to be the targeted respondents. A pilot survey was conducted with 10 agro-based SMEs prior to the actual survey to validate the questionnaire. Data was analysed using statistical analyses such as descriptive analysis, factor analysis and logistic regression analysis. Descriptive analysis was used to describe the profile of the SMEs and the application of e-procurement technologies among agro-based SMEs.

Factor analysis was used to find the latent factors that influence the application of e-procurement in selecting suppliers. Further, logistic regression analysis was used to predict a discrete outcome from a set of variables that maybe continuous,

discrete, dichotomous, or a mix of any of these (Agresti, 1996). It was conducted to indicate whether the e-procurement users have the intention to increase the application of e-procurement in selecting suppliers or otherwise and to understand the relationship between the factors identified among the e-procurement users.

Logistic regression generates the coefficients of a formula to predict a logit transformation of the probability of presence of the characteristic of interest as follows:-

$$\text{logit}(p) = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \dots + b_k X_k$$

where,

p is the probability of presence of the characteristic of interest.

The logit transformation is defined as the logged odds as below:-

$$\text{odds} = \frac{p}{1-p} = \frac{\text{probability of presence of characteristic}}{\text{probability of absence of characteristic}}$$

and

$$\text{logit}(p) = \ln \left[\frac{p}{1-p} \right]$$

The logit model for this study is written as follows:-

$$Y_i = \beta_0 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) + \beta_4(X_4) + \beta_5(X_5) + \beta_6(X_6) + \beta_7(X_7) + e$$

where,

Y_i = 1 if the respondents have the intention to increase the application of e-procurement, 0 otherwise

β_0 = Constant (Intercept)

β_i = Coefficients of X_i

X_1 = Selection efficiency

X_2 = Management efficiency

X_3 = Security and legal environment

X_4 = Commitment

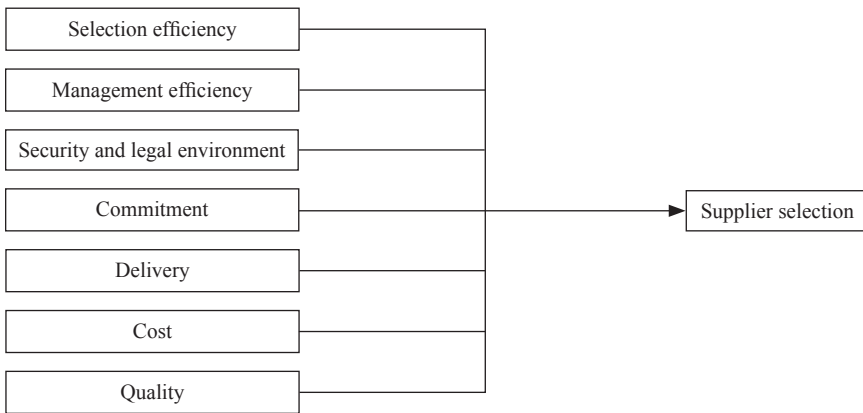
X_5 = Delivery

X_6 = Cost

X_7 = Quality

e = Error term

The dependent variable was dichotomous and it has two categories; 1 = intention to increase the application of e-procurement or 0 = otherwise. The model consisted of seven determinants of intention to increase the application of e-procurement which were selection efficiency, management efficiency, security and legal environment, commitment, delivery, cost and quality. All the determinants (independent variables) were the latent factors from factors analysis where factor scores were used for the analysis. The analysis was conducted to determine the influential factors of e-procurement application and to test the relationship of the factors towards supplier selection as depicted in Figure 1.



Source: Adapted from Bottani and Rizzi (2005); Eadie *et al.* (2010); Gunasekaran *et al.* (2009); Min (1994); Nath (2007); Peleg *et al.* (2002); Petroni and Braglia (2000); Roger (1995); Weber *et al.* (1991)

Figure 1 Factors influencing the application of e-procurement in selecting suppliers

RESULTS AND DISCUSSION

Profile of SMEs

From a total of 300 respondents, only 190 SMEs (63.3%) responded to the survey. Majority of the respondents were purchasing managers which accounted for 54.7% (104 respondents). About 53.7% of the SMEs have been established for less than 5 years and only 10% of them were established for more than 10 years. The remaining percentage (36.3%) was from the SMEs that have been established from between 5 to 10 years. The results indicated that majority of the SMEs were involved in food-based products and processing activities (75.8%), followed by horticulture

Application of e-Procurement Technologies for Selecting Suppliers of Agro-Based SMEs in Malaysia (27.9%), and fruits and vegetables (21.1%). Only 2.1% of the SMEs were involved in non food-based crops and forestry.

Application of E-Procurement Technologies

From 190 responses, the results in Table 3 revealed that 94 of the SMEs (49.5%) did not use e-procurement in their firms (non-users). The remaining 96 SMEs (50.5%) were known as the users of e-procurement. The four most popular e-procurement technologies for procurement activities used by e-procurement users were e-sourcing (55.2%), Web-based ERP (46.9%), e-informing (41.7%), and e-tendering (40.6%). The application of E-MRO and Web-based EDI represented about 33.3% and 32.3% respectively. E-reverse auction only represented a small fraction of total responses by the SMEs with only 9.4% of them having used the technology.

Table 3 Application of e-procurement technologies

E-Procurement	Frequency (N)	Percentage (%)
Users	96	50.5
Types of e-procurement		
● E-Sourcing	53	55.2
● Web-based ERP	45	46.9
● E-Informing	40	41.7
● E-Tendering	39	40.6
● E-MRO	32	33.3
● Web-based EDI	31	32.3
● E-Reverse	9	9.4
Non-Users	94	49.5

Factor Analysis on the Implementation of e-Procurement Technologies

About 20 relevant statements were asked to the e-procurement users and the statements were related to the perception of e-procurement implementation factors among the users. In order to determine the significant factors contributing to the implementation of e-procurement, exploratory factor analysis (EFA) was conducted. Principle component analysis (PCA) was carried out to explore the validity of the items. The results showed that the KMO value is 0.842 and Bartlett's test of sphericity is significant at the level 0.000. Therefore, the data is suitable for PCA. Factor loadings greater than 0.50 are considered to be reliable, thus a factor loading of 0.50 was used as the cut-off point. The total variance explained was 65.876%,

which is moderate. This factor solution in the data reduction efforts goes with 34.124% of information lose. Each of the three derived factors was briefly reviewed and is labelled in Table 4.

Factor 1 was labelled *selection efficiency* as all the contributing variables emphasized on the perceived benefits that are related to the efficiency of selecting the best suppliers and materials for the firms. The first component or factor has seven significant factor loadings, all of which were positively correlated and the eigenvalues was 6.588. The total variance explained was 32.939% while the most highly correlated variable was reduce time spent on material purchasing, followed by increase in the number of suppliers who are interested in making a deal and a suitable tool for selecting suppliers of major or frequent purchased products or services. Therefore, the results imply that one of the major considerations when a SME wants to implement e-procurement is that it is based on the factor of selection efficiency. Factor 2 was labelled *management efficiency* which consists of eight significant variables with eigenvalues of 3.795. The variables that are relevant to this factor were reduce operating and inventory costs, enhance decision making process, improve management information, improve market intelligence, enhance the company's image in the market, reduce staffing levels in procurement activities, simplify purchasing processes, and reduce the costs of purchasing materials which was explained by about 18.975% of the variance in the data. Since all of the items were concerned with the improvement in management process for the procurement activities, therefore we could say that the management efficiency could play a significant role as a motivating factor in the implementation of e-procurement technologies by a SME. Factor 3 was labelled *security and legal environment* which consists of five variables with eigenvalues of 2.793. The five variables that are relevant to this factor were potential loss of proprietary and confidential information, no common accepted standard, increased transactions transparency and data integrity, internet security concern, and legal legitimacy issues. The total variance explained by this factor was 13.963%. Thus, we could summarize that the security and legal environment could also play the role of a motivating factor in the implementation of e-procurement technologies by the SMEs. Since all of the three derived factors have now been given appropriate labels, it is important to also test their reliability using Cronbach's alpha.

The alpha values for e-procurement implementation factor constructs were 0.953, 0.859, and 0.889 respectively. This indicates that all of the factors derived from the analysis were reliable as an alpha value of 0.70 or higher indicates a sufficient internal reliability. The three derived factors from this section were included in the logistic regression as independent variables.

Table 4 Factors loading on implementation factors of e-procurement

Variables	Component		
	1	2	3
Factor 1: Selection Efficiency			
Reduce time spent on material purchasing	.914		
Increase the number of suppliers who are interested in making a deal	.910		
A suitable tool for selecting suppliers of major or frequent purchased products or services	.894		
Reduce the time spent on selecting suppliers	.893		
Improve the chance of getting the best suppliers	.893		
Reduce time to source materials	.868		
Improve the communication between company and suppliers	.727		
Factor 2: Management Efficiency			
Reduce operating and inventory costs		.790	
Enhance decision making process		.761	
Improve management information		.735	
Improve market intelligence		.732	
Enhance the company's image in the market		.722	
Reduce staffing levels in procurement activities		.715	
Simplify purchasing processes		.628	
Reduce the costs of purchasing materials		.559	
Factor 3: Security and Legal Environment			
Potential loss of proprietary and confidential information			.853
No common accepted standard			.837
Increase transactions transparency and data integrity			.831
Internet security concern			.810
Legal legitimacy issues			.752
Eigenvalue	6.588	3.795	2.793
% of Variance	32.939	18.975	13.963
Cumulative % of Variance	32.939	51.913	65.876

Factor Analysis on the Application of e-Procurement for Selecting Supplier

The exploratory factor analysis using principal components with varimax rotation was conducted to understand the underlying motivating factors in the application of e-procurement for selecting suppliers. About 17 relevant statements were asked to the e-procurement users and the statements were related to the users' perception

of the application of e-procurement for selecting suppliers. The KMO analysis (0.871) and Bartlett's test (0.000) were significant and the variables were valid for further analysis. The application of the Scree plot and a review of the eigenvalues had identified four factors from the 17 variables. The factor loadings, eigenvalues, and variance are presented in Table 5 and factor loadings greater than 0.50 were considered reliable. The total variance explained from the analysis was 79.483%. This factor solution in the data reduction efforts goes with 20.517% of information lose.

Table 5 Factors loading on e-procurement application for supplier selection

Variable	Component			
	1	2	3	4
Factor 1: Commitment				
Assist in enhancing suppliers' willingness to participate in firm's new product development and value analysis	.892			
Assist in maintaining a proven track record of suppliers	.869			
Assist in maintaining the long-term relationship with established suppliers	.867			
Assist in searching suppliers who provide a good after-sales service	.866			
Assist in getting suppliers who are willingness to share confidential information	.854			
Assist in improving honest and frequent communication with suppliers	.853			
Assist in enhancing suppliers' commitment to continuous improvement in products and processes	.842			
Assist in getting suppliers who made effort into using advanced technologies in procurement activities	.827			
Factor 2: Quality				
Assist in getting innovative suppliers		.939		
Assist in searching ethical suppliers		.906		
Assist in getting suppliers who commit to quality		.886		
Assist in maintaining the references or reputation of suppliers		.854		
Assist in obtaining up-to-date suppliers' information		.832		

Table 5 (Cont'd)

Factor 3: Cost				
Assist in reducing costs related to purchasing materials with suppliers				.895
Assist in searching suppliers who could provide flexible contract terms and condition				.882
Factor 4: Delivery Acceleration				
Assist in searching flexible suppliers who have the ability to respond to unexpected demand				.874
Assist in searching suppliers who meet delivery due dates				.846
Eigenvalues	6.895	3.754	1.812	1.050
% of variance	40.560	22.085	10.663	6.175
Cumulative % of variance	40.560	62.644	73.307	79.483

Factor 1 in the analysis was labelled *commitment* which has eight significant factor loadings, all of which were positively correlated and its eigenvalues was 6.895 which explained 40.560% of variance in the data. The three variables that most highly correlated variables were assist in enhancing suppliers willingness to participate in SME's new product development and value analysis (0.892), followed by assist in maintaining a proven track record of suppliers (0.869), and assist in maintaining the long-term relationship with established suppliers (0.867). Since all the contributing variables emphasized on the commitment of the suppliers to the SMEs, we could conclude that commitment was one of the factors that could contribute to the application of e-procurement for selecting suppliers in a firm. This finding is consistent with study conducted by Roger (1995). Factor 2 was labelled *quality* and there are five variables that were associated with Factor 2. They were assist in getting innovative suppliers (0.939), assist in searching ethical suppliers (0.906), assist in getting suppliers who commit to quality (0.886), assist in maintaining the references or reputation of suppliers (0.854), and assist in obtaining up-to-date suppliers' information (0.832). The contributing variables eigenvalues is 3.754 which explained 22.085% of the variance in the data. Thus, this factor is named quality, as all five variables related to the firm's strategic decision to search for highly qualified and high quality suppliers. Factor 3 was labelled *cost* as all of the variables in this factor focus strongly on issues relating to the costs associated to procurement activities. The variables were assist in reducing costs related to purchasing materials with suppliers (0.895), and assist in searching suppliers who could provide flexible contract terms and condition (0.882). The eigenvalues for

Factor 3 is 1.812 and the variance explained about 10.663% of the data. The factor represents the intention of SMEs to reduce their expenses towards procurement activities. Thus, we could conclude that costs may contribute to the application of e-procurement in selecting suppliers by a SME. This finding is also consistent with Li (2008), Premkumar (1999), and Roger (1995). Factor 4 was labelled **delivery acceleration** which consists of two variables namely assist in searching flexible suppliers who have the ability to respond to unexpected demand (0.874) and assist in searching suppliers who meet delivery due dates (0.846). The factor eigenvalues was 1.050 and the variance explained 6.175% of the data. The name was selected since all of the variables in this factor were associated with the delivery requirement in searching for suppliers using e-procurement technologies.

Therefore, we could conclude that delivery acceleration is one of the factors that can contribute towards the application of e-procurement technologies to select potential suppliers for a firm. This is also consistent with Roger (1995). Reliability test was conducted using Cronbach's alpha to the four derived factors and the alpha values for the internal factors constructs were commitment (0.955), cost (0.938), quality (0.799), and delivery acceleration (0.777) respectively. The four derived factors from this section were included in the logistic regression as independent variables.

Logistic Regression Analysis

Logistic regression analysis was conducted in order to understand the relationship between the factors identified among the users of e-procurement (96 users). The dependent variable takes the value of one if the respondents indicated that they have the intention to increase the application of e-procurement and a value of zero if they indicated otherwise. The values for the independent variables were the factor scores from the factor analysis on the implementation of e-procurement technologies (Table 4) and the application of e-procurement in selecting suppliers among e-procurement users (Table 5). The result of the logit model is shown in Table 6. Based on the logistic regression analysis, six variables were found to be significantly related to the dependent variable. The variables were selection efficiency, management efficiency, security and legal environment, commitment, cost, delivery, and quality. Based on the logit model, all of the factors except management efficiency were significant. The significant factors were selection efficiency ($p = 0.002$), security and legal environment ($p = 0.027$), commitment ($p = 0.001$), cost ($p = 0.004$), delivery ($p = 0.001$), and quality ($p = 0.034$). From this result,

we could indicate that an increase in the selection efficiency factor increases the application of e-procurement by 5.850 times. The finding was anticipated due to the fact that when firms utilized e-procurement; it resulted in an increase in the efficiency of suppliers and materials selection in the SMEs. The SMEs will be encouraged to increase the application of e-procurement to ensure the effectiveness of procurement activities in the firms. Furthermore, an increase in security and legal environment factors will result in an increase in e-procurement application by 3.077 times. This is due to the fact that with an increase in the security and legal environment, the SMEs will most likely increase the implementation level of e-procurement, thus establishing trust between the firms and the suppliers. This may lead to the establishment of a long-term relationship and future business engagements. For commitment factor, an increase in this factor will increase the likelihood of e-procurement application by 5.788 times. Commitment by the suppliers to continue the application of e-procurement will assist the SMEs to further develop strategies in taking the advantages of e-procurement in the future. A similar finding was found in Hawking *et al.* (2004) that a good commitment through improved communication with the suppliers leads to better quality of the supplies. Based on the logit model, an increase in the delivery factor will increase the likelihood of the application of e-procurement among the users by 5.558 times. The result indicated that the specific requirement by the SMEs in terms of delivery must be met in order to ensure the effectiveness of e-procurement application in the firms. The highest likelihood for an increase in e-procurement application was contributed by the cost factor. An increase in the cost factor will result in an increase of e-procurement application by 7.396 times. This indicates the importance of cost factor in ensuring the effectiveness of e-procurement application in the firms. Reduction in costs by using e-procurement will result in higher profit for the SMEs and thus they will be most likely to develop strategies to become a more advanced user of e-procurement in the future. Lastly, from the logistic regression analysis, the result revealed that quality was the factor which has a relationship with the e-procurement application. It shows that an increase in the quality factor will increase the likelihood of a SME to increase the application of e-procurement by 3.141 times. This is consistent with findings in Hawking *et al.* (2004), Kalakota *et al.* (2001), Martin (2008), McIntosh and Sloan (2001), Minahan and Degan (2001) and Ribeiro (2001) that quality can be increased through increased competition, benchmarking (market intelligence), through visibility in the supply chain, efficiency, and improved communication.

Table 6 Relationship between implementation and supplier selection factors with respondents' intention to increase the application of e-procurement

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Selection efficiency	1.766	.573	9.517	1	.002*	5.850
Management efficiency	1.124	.721	2.432	1	.119	3.077
Security and legal environment	1.453	.659	4.867	1	.027*	4.276
Commitment	1.756	.508	11.936	1	.001*	5.788
Delivery acceleration	1.715	.589	8.476	1	.004*	5.558
Cost	2.001	.614	10.638	1	.001*	7.396
Quality	1.145	.540	4.485	1	0.034*	3.141
Constant	-2.047	.590	12.044	1	0.001*	.129

-2 Log likelihood = 51.880

Percentage of correct prediction = 86.5%

Note: *significant at 5% level of significance

CONCLUSION

The results from this study provide a better understanding of the factors associated with the application of e-procurement in agro-based SMEs in Malaysia. With the potential benefits that e-procurement technology offers, it has attracted many firms to progressively apply e-procurement in their purchasing activities and supplier selection. In this study, the factors namely commitment, quality, cost and delivery acceleration were revealed as important factors which influenced the SMEs to select their potential suppliers. The results also revealed selection efficiency, security and legal environment, commitment, delivery acceleration, cost and quality as the factors related to the intention of SMEs to increase the application of e-procurement. With these findings, the SMEs could have detailed information on how to establish a strong and close relationship with their suppliers and develop competitive strategies in order to improve their competitiveness level in the market. This study entails three contributions. First, this study provides valuable inputs on the current scenario of agro-based SMEs with reference to the application of advanced internet technologies. Second, it contributes to the knowledge base of e-procurement application particularly in the agriculture sector among agro-based SMEs supply chain players. Third, this supports the notion that e-procurement has positive effects on online transactions in the agriculture sector among agro-based SMEs. The conclusion from this study is that continuous efforts are needed from agro-based SMEs supply chain players towards the application of advanced technologies in order to support the government intention of developing the agriculture sector as the third engine of growth. Further, a vigorous use of e-procurement and strong support from the top management by providing a sufficient e-procurement resource

Application of e-Procurement Technologies for Selecting Suppliers of Agro-Based SMEs in Malaysia

to be utilized by agro-based SMEs are some of the main actions needed to be taken up by the SMEs. This study suggests that future research should focus on first, to obtain responses on the application of e-procurement technologies from suppliers' perspectives and second, to investigate which of the factors will contribute towards improving the efficiency of procurement activities using e-procurement technologies in the agriculture sector. Finally, being informed of the e-procurement factors and challenges will assist agricultural players in participating more vigorously in online transactions.

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Application of e-Procurement Technologies for Selecting Suppliers of Agro-Based SMEs in Malaysia

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