

A Framework of E-Procurement Technology for Sustainable Procurement in ISO 14001 Certified Firms in Malaysia

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ABSTRACT

With the current emerging development pattern in Malaysia, E-Government has been unveiled by the Malaysian Government to be one of the multimedia super corridor flagship applications to implement digital technology to improve government operations. E-procurement was originally utilized by businesses to minimize turnaround times and prices, but recently it was often used as a platform for sustainable procurement. However, there have been few attempts to investigate E-procurement technology in Malaysia concerning sustainable procurement. Also, there is no consistent and reliable framework of E-procurement technology for sustainable procurement practices. The focal area of this research is ISO 14001 accredited firms in Malaysia, the population of these organizations is 55, sample size (N)=162 respondents including procurement managers, executives and staff which are involved directly or indirectly in the process of procuring products and services. This study is conceptual and aims to explore how the adoption of E-procurement technologies influence sustainable procurement practices within ISO 14001 accredited firms in Malaysia.

1. Introduction

Adopting recent digital technologies is revolutionizing the procurement function. The diffusion and implementation of modern and evolving technologies provide tremendous potential to improve production and efficiency while simultaneously protecting natural resources and reducing the cumulative environmental effects that are central to accomplishing sustainable development goals (SDG). The advent of the internet has revolutionized means of information sharing, processing and using within organizations to improve their strategic advantage [1]. Procurement plays a crucial part in achieving sustainable results through the growth, production, management, and preservation of ties between organizations and their supply chains [2]. Organizations progressively perceive that implementing information technology to their procurement procedures can gain substantial competitive benefits. The rising significance of the internet has provided possibilities for the enactment of E-procurement (EP), which is defined as using the internet or digital systems to conduct the procurement procedure for organizations to boost productivity [3]. The Boston Consulting Company's latest research finds that 9 of the top 20 Fortune 500

businesses have indicated that emerging technology is essential to their procurement operations in their annual reports [4]. Because of the environmental, economic and social impact of procurement processes and regulations, the call for sustainable practices in ISO 14001 companies has become globally important [5]. Besides, in [6], [7] authors have claimed that the designing and manufacturing sector absorbs huge quantities of non-renewable assets and products by its procedures and operations, like processing and distribution, which consume significant amounts of carbon generating high greenhouse gas (GHG) emissions. Moreover, the procurement process in the ISO 14001 and manufacturing organizations has been increasingly challenged to make a significant impact on sustainable development goals through the incorporation of social and environmental parameters in the procurement practices [8]. And this is why sustainable procurement has been instituted to promote sustainability in ISO 14001 organizations procurement. Sustainable procurement is elaborated as infusing procurement requirements and parameters that are constant with environmental protection, economic growth and societal progress through enhanced product and service quality, resource efficiency and resource management on a life-long basis [3], [9]. Numerous elements, like sustainable procurement practices (SPP), recycling, renewable activity have been discussed in the literature [10], [11], but approaches and initiatives to guarantee that

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SPP is widespread and rapidly implemented within the ISO certified organization are limited in the literature. According to certain figures, EP could minimize production costs by 5 to 10 percent, boost efficiency by 30-50 percent and dramatically enhance productivity, consistency and risk management [4]. Also, a new survey from the McKinsey Consultancy Company shows that chief buying officers anticipate an average savings rise of 40 percent, 30-50 percent less period spending on the transactional acquisition and a 50 percent decrease in value leakage owing to automated procurement systems [12].

This study is supported by the associated principle of the theory Technology Acceptance Model (TAM). The perceived usefulness and ease of use determine the attitude of an individual concerning their intent to use innovation and technology to act as an intermediary for the actual use of the procurement system [13]. TAM is the most cited and accepted model among other models and theories in studies of IT literature to examine the determining factors of technology reception and its application in e-commerce, online banking and supply chain [14], [15]. To ensure sustainable procurement practices, organizations need to conduct an evaluation among employees concerning the execution of E-procurement. The Malaysian Government embraced the effort to use e-Government for some of its activities. The e-Government Multimedia Super Corridor (MSC) introduced in 1997 was planned to fulfill the Vision 2020 objectives. The introduction of online procurement was the first step to resolve government procurement problems [16]. Certification of ISO 14001 proved to be an important factor in industrial practice for technical modernization. ISO 14001 is now the prevailing universal standard for the evaluation of environmental management processes (EMS). This directs emphasis on a variety of important fields, including manufacturing methods and technologies. Organizations with formal environmental protection programs (ISO 14001) have strong positive relations with several parameters of sustainable procurement also the organizational performance [17].

1.1. Problem Statement

In 2002, a system of E-procurement was established in Malaysia. Nevertheless, the Ministry of Finance has 30,000 public service providers enrolled, which does not effectively seem to have an existing E-procurement infrastructure [18]. Handfield et al., [19] recommend that ISO 14001 certification may be a guiding force for the adoption of sustainable environmental management standards, and is a crucial topic open to discussion and, ultimately for research in organizations. For many factors, the E-procurement analysis in ISO 14001 organizations is significant. Firstly, ISO 14001 certified organizations account for a large portion of today's economies and provide advantages to the firm. Secondly, the capacity of E-procurement is very important in contributing to the overall competitiveness of such companies [20]. The slow pace of adoption and the gradual nature of E-procurement approval is another substantial issue in implementing EP in ISO certified organizations [17]. Gunasekaran et al., [21] further stated that SME does not consider EP benefits to be sufficient. While evidential analysis has demonstrated that EP has a significant effect on sustainability efficiency in the scope of big enterprises [22]-[25], no studies have so far inspected the relationship between EPT and SPP in the context of ISO 14001 accredited organizations [3], [26]. In other terms, less attention is paid to E-procurement innovations [27],

[28]. Organizations can reduce the difficulties normally posed by planning and implementing a sustainable procurement strategy by the use of standard practices in E-procurement [29]. Sustainable procurement is the purchasing ecofriendly goods and services, and also the establishment of environmental standards in agreement, taking into account natural, social and economic considerations [30, 31]. The research concerning sustainable procurement practices is lacking particularly in Malaysia [32], [33]. Many of the research conducted on both existing procurement paradigms, i.e. EPT and SPP, found implementing the two paradigms independently [34], [35]. This strategy has culminated in a slow rate of adoption of both practices [7], [36] which hinders the ability to promote E-procurement and sustainable procurement effectively and efficiently. Limited studies have addressed possible relationships and compatibility between them [6]. However, the mechanism by which E-procurement processes influence the management of the sustainable supply chain is still an unexplained concern [37]. The theoretical fusion of the two paradigms attracted minimal attention from the researchers such as, [3] and [38] suggested the contributions of E-procurement to sustainable procurement initiatives in the procurement of projects. Nevertheless, the scarcity of comprehensive research and amalgamation frameworks for interventions to support the research paradigm prompts to find approaches to be combined and commonly used to support the two paradigms in the ISO 14001 industry. In the sense of sustainable procurement, it implies that E-procurement techniques are scarcely examined [3]. This study is aimed at establishing an integrated framework of approaches in accredited ISO 14001 corporations for E-procurement technologies for sustainable procurement activities. This research proposes a framework to analyze the relationship between EPT and SPP.

1.2. Conceptual Framework

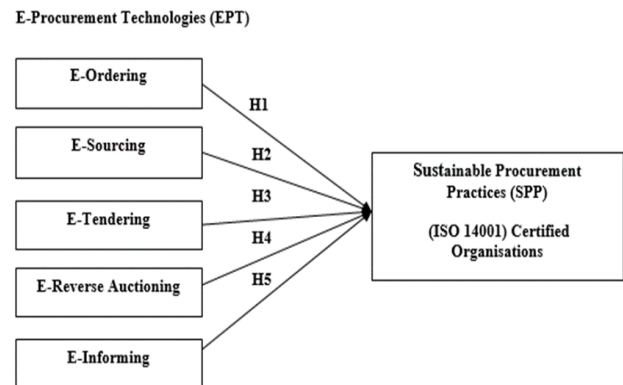


Figure 1: Theoretical Framework to Enhance Sustainable Procurement Practices

2. Literature Review

2.1. Sustainable Procurement Practices (SPP)

Sustainable growth is generally conceptualized as 3Ps representing the parameters of the Triple Bottom Line (TBL) [39]—that is, environmental (the planet), economic (profit) and social (people). Potential buyers must extend the conventional factors so that they incorporate 3P (Planet/Profit/People), whom they purchase, who / from which they purchase, their contractual terms of buying and their manufacturing processes in their purchasing sectors. They ought to include meaningful effects on this context of their decision-making criteria. Sustainable procurement is part

of a broader debate on greening the supply chain of an organization [37]. Scholars have concluded that the organizational tendency to implement new technologies and strategies linked positively to the degree of its decentralization [40]. When adopting new techniques that assume a certain degree of risk, the members of the organization must have both the authority and the confirmation that such behavior is permissible. Sustainable acquisition and supply chain management approaches have been consistently correlated with various strategic advantages such as advantageous environmental effects, positive changes in social wellbeing, enhanced perceptions of the public, cost savings, increased profitability of businesses, boosts procurement operations and stronger organizational performance [8], [41], [42]. Several states, organizations and agencies at different levels around the globe have been encouraged to implement acquiring strategies and policies that promote environmentally sustainable products and services under the Environmental Management System (EMS) [9], [43]. Successful institutionalization often calls for a strong degree of trust and coordination between the institution and its supplier network. Because of these indicators, few firms may be unable to engage in the transformation of the organizational culture to meet the demands of operational sustainable procurement. Likewise, provided that organizational values influence procurement actions on an individual basis [44]. Sustainable procurement needs manufacturers to purchase goods using renewable materials such as non-toxic, reusable and biodegradable; it promotes the elimination of waste and the reduction of hazardous materials [45]. Sustainable procurement has 12 parameters, namely environment, product differentiation, health, philanthropy, civil rights, purchasing from small local industries, policies and regulations, effective leadership, specific tendering and evaluation criteria, performance monitoring and reporting, competitive lead and technical competence. The ecosystem is one of the programs involved in the life-cycle review (LCA) by-product development; manufacturer demands comprising recycling, waste decrease and re-use; procurement of sustainable packing and buying of recycled packing. Programs to promote the integration of vendors included the purchase by firms operated by women or racial minorities [46]. On the other side, security initiatives include the smooth flow of goods onto business premises and the protected functioning of manufacturer infrastructure and also a thorough review of building management acquisition strategies. Human rights issues involve giving employees a minimum wage, tracking working practices and complying with labour legislation and regulations [46]. Also, it is essential for companies, through purchasing small and local vendors, to help local communities and economies and to obey procurement rules [33]. Good leadership often plays a significant role in a company's growth. It is seen as a vital factor as it ensures the strategic action strategy of the company. Besides, Mpeera Ntayi and Mugume [47] claimed that distributors should be assessed, recorded and controlled permanently and distributors should provide constructive feedback. As per Metcalf and Benn [48], one of the most significant facets of a corporation's success is its internal competitive edge. Meehan and Bryde [11] have said that technical skills are essential for understanding, gaining and

facilitating the change of attitudes among acquisition workers [37]. Several measures to promote sustainable procurement activities have been taken by the Government of Malaysia [49]. For the preparation of a corporate sustainability mechanism in Malaysia, the Ministry of Energy Green Technology and Water (MEGTW), and the Malaysian Finance Department are responsible. The government has the authority to elect to buy greener products and services and also to inspire businesses that take part in ecologically sound operations. There is a range of environmental initiatives, including sustainable technologies and development, emission reduction and implementation of an EMS and ISO 14001 registration in Malaysia. As mentioned by the Malaysia Department of Statistics (2019), the number of eligible accredited organizations of ISO 14001 in Malaysia until Q2- 2019 was 1586 and seen immense growth. This is a positive benefit since the EMS is a collective contribution to sustainable development by retailers, rather than a product-focused strategy. Furthermore, Mansi [50] stated that the current literature on sustainable procurement studies in emerging or developing countries including the Asian region is limited.

2.2. E-procurement technologies (EPT)

E-procurement is an electronically operated functionality [51], [52] that integrates the use of ICT and buying assets to process buying orders, exchange information to contractors and to promote buying decisions. Additionally, rapid purchase cycle times offer greater versatility and even more precise order placement details [18], [53]. Based on [3], 26 driving elements display EPT as a tool for S Such drivers have been classified into six key dimensions, namely digital management, unified procurement authority, threat, integration, data analysis, and an enabling supplier partnership, that can support in handling the sustainable procurement systems through the use of ICT.

E-procurement is defined as implementing technology arrangements in the procurement phase, including purchasing, buying, tendering, auctioning and bargaining, within the framework of supply chain management [54]. The EPT is divided into five main applications: E-informing, E-reverse auctioning, E-ordering, E-tendering, and E-sourcing. Technology Acceptance Model (TAM) is an extension of the Theory of Reasoned Action (TRA) introduced by Fred Davis in 1989. TRA theory is mainly based on the idea of technology acceptance; TAM replaced TRA with two standard technological features perceived usefulness and perceived ease of use [55]. The technology acceptance model was introduced to identify the scale of usage of information systems and justified by Davis (1993). Perceived ease of use and perceived usefulness are the fundamental constructs of the Technology Acceptance Model (TAM) which can better predict with an individual's attitude and their intention towards EPT adoption and actual usage in procurement practices [56]. This theory brings an understanding that acknowledgment and use of innovation is a function of the user's emotions about the system and its perceived benefits. An individual's positive or negative attitude predicts the individual's actual behavior towards the usage of the technology. Quesada et al., [57] determined that EPT adoption has a positive effect on employee perception of both sustainable procurement procedures and procurement performance. The behavioral objectives of EPT are largely described by the specific attitude of

the individual and have a further impact on perceived performance and subjective quality [27]. Moreover, [58] concluded that E-procurement technology contributes to supply chain performance positively and smoothen the procurement process. The research on E-procurement has gained substantial coverage in the literature since utmost studies examine electronic procurement from the perspective of major companies e.g. [54]-[60], electronic procurement in SME [21], [29], [61].

2.3. Influence of E-informing on SPP in ISO 14001 certified organization

E-informing is an internet-enabled data knowledge retrieval tool for interested parties to collect and share knowledge. The extent to which specific and exclusive data is distributed to a supply chain participant, therefore, allows the online knowledge exchange to include more competitive sourcing processes and better supply chain efficiency [38]. Information sharing doesn't just impart data to partners but additionally gives adequate, timely and precise data. E-informing also includes aspects such as credibility and accuracy of information shared. Moreover, e-informing provides a mechanism for organizations to control, facilitate, and conserve on exchange costs, as it improves information streams and lessens uncertainty. The e-informing application helps the organization in providing adequate information from time to time and reduces the occurrence of corruption activity ultimately leads to better procurement practices [62]-[64].

H1. E-informing influences SPP in ISO 14001 certified organizations positively.

2.4. Influence of E-ordering on SPP in ISO 14001 accredited organization

The E-ordering application empowers the business to decrease costs, increase efficiency and improve client support in this way improved sustainability in procurement practices. Moreover, Gunasekaran et al., [21] declare that e-ordering is an e-commerce function where an organization permits clients to demand goods or services through web-portal. Since Internet technology is booming, having a web-based ordering system can help increase sales as it facilitates clients to put in a request for the organization's services [62]. Kim and Shunk [65] contend that e-ordering is the way toward making and approving buying requisition, submitting buying orders, receiving products and services requested, by utilizing a web-enabled software structure that improves the procurement process and supply chain performance [38]. Interested parties are provided with a web-enabled portal with adequate knowledge on procurement, such as tender advertisements, evaluations and outcomes of placement. Such permeability and receptiveness upgrade responsibility in managing the sustainable procurement and barred potential complicity and advantage by government authorities and purchasers [63].

H2. E-ordering influences SPP in ISO 14001 accredited organizations positively.

2.5. Influence of E-sourcing on SPP in ISO 14001 accredited organization

E-sourcing is the process of distinguishing and selecting new suppliers to deliver products and services in a predefined category through electronic means. It is a web-based application that empowers a collaborative innovation in the period of the procurement process between supplier and buyer. The organizations are employing e-sourcing which is one of the systematic e-purchasing practices to reduce costs. The e-sourcing provides a cooperative environment for suppliers and buyers by giving a centralized platform where they can share data adequately. A single line platform also offers proposals from the different vendors for the e-sourcing program [66]. In this way, the organization can choose the supplier strategically to achieve a competitive advantage. New technology has offered to ascend to better approaches for sourcing relevant suppliers, directing business and improving procurement as well as operational performance. The utilization of the technology has prompted expanded efficiency, services and procurement practices [67].

H3. E-sourcing influences SPP in ISO 14001 accredited organizations positively.

2.6. Influence of E-tendering on SPP in ISO 14001 accredited organization

E-Tendering is an application where the organization advertises through electronic requests or e-tender notices where the invoices and purchase requests, offers from suppliers, receive bids and informing suppliers about the award of contracts employing the use of web-based information exchange. E-Tendering is the way toward sending RFI (Request for Information) as well as RFP (Request for the Proposal) to suppliers and accepting responses using web technologies [67]. Industries, such as manufacturing and construction, can gain numerous advantages by implementing e-tendering, such as time and cost cutbacks in the tendering and bidding process, ensuring secure access to tendering work, improving efficiency, etc., and maintaining sustainability in the procurement procedure [68]. E-tendering usage in the purchasing process has advantages like screening and selection of qualified suppliers automated reduce the price, enhance flexibility in requests process, and quality. This leads to the greening of procurement practices and significant for supply chain performance [38]. E-tendering makes the automation of many operational tasks and procurement processes [69]. It is a protected platform that enables purchasers and suppliers to trade virtual. E-tendering structures extend the tendering requirement process up to the completion of contracts when the details and documentation are exchanged digitally

H4. E-tendering influence SPP in ISO 14001 accredited organizations positively.

2.7. Influence of E-reverse auctioning on SPP in ISO 14001 accredited organization

E-reverse auctioning (ERA), also called "downward price auctions" referred to a web-based bidding mechanism that happens based on real-time procurement contracts by the eligible vendor

database [57]. The ERA has advantages to both the seller and buyer. ERA application in procurement reduces the cost under a reduction in sustainable procurement cycle time [70]. While [37] that the use of EPT like e-reverse auctioning has led to increased effective performance and efficiency in the procurement procedure. For the buyer, ERA has advantageous aspects such as reduced costs, reduced cycle time, discounted costs, create standards, increase geographical range, and it promotes accountability and transparency of the bidding procedure.

H5. E-reverse auctioning influence SPP in ISO 14001 certified organizations positively.

The literature contains a variety of articles explaining the problems of e-procurement and sustainable procurement. Whereas some empirical research [33], [71] concentrated on application expansion for sustainable procurement, fewer [53], [55] looked primarily at the deployment and cost-effectiveness of e-procurement uptake. Also, part of the research investigating SPP discussed the objectives and barriers/challenges of sustainable procurement [72], [73] while [74] looked at the views of corporate buyers on the effect of e-procurement systems on knowledge management and logistic fulfillment of quality. Review findings in both sustainable procurement and E-procurement [31], [75], [76] reviewed scientific developments trends and issues in the literature for E-procurement and sustainable procurement separately. Other studies explored the classification and assessment requirements for SPP [77], [78] and the development of collective procurement systems to lead to sustainability through a green economy for the construction and destruction of waste. There is scarce research focused on a detailed analysis of how these two fields could be integrated, which poses certain challenges in the pursuit of productivity and efficiency within procurement. Therefore, this study addresses the gap with the development of an incorporation system that provides a forum to promote research participation in supporting both measures in the future. Moreover, the research by [38] identified the relationships between e-procurement and sustainable procurement. Walker and Brammer [38] outlined the minimal research of EPT and SPP in literature, and progressively disclosed that connections between some social dimensions of SPP and EPT tend to be less established, while support structures may be developed to improve EP. This shows the need to develop how well these two approaches can be best integrated to improve sustainability and profitability in the procurement process.

3. Methodology

The study proposes the quantitative method. This study has utilized a positive approach and methodology because the collected data will be objective and quantitative. Deductive reasoning was often used to place hypotheses and construct comprehension until the findings were tested through scientific data. The questionnaire survey is the main instrument used to assess the proposed framework. The sampling methodology that was being picked is probability sampling. Probability sampling is led by randomly choosing a sample where every one of its subjects in the sample possesses all the qualities of the research

population. For this research, simple random sampling is used because the sampling frame was prepared and the sample represents the population. The most significant explanation behind using probability sampling in this study is that it makes samples that are profoundly representative of the population. It is likewise an unbiased random selection and a representative sample is significant in drawing inferences from the outcomes of the research. Consequently, this method is completed towards employees of the procurement department of ISO 14001 certified organization to accomplish the objective of this research. The population composed of employees of procurement departments from 55 organizations with ISO 14001 certifications of Johor, Malaysia. Hence, according to Krejcie and Morgan (1970) table for determining the sample size of the finite population, the sample size of this study comprises of 162 individuals from ISO 14001 accreditation organizations. Such respondents include procurement executives, procurement supervisors, and procurement personnel who are actively or indirectly engaged in the procurement of products or services. This research proposes techniques for demographic analysis SPSS and SEM modeling for data analysis and reflective models for estimation. One of the most significant and regular questions concerning if there is a statistical relationship between a reaction variable or dependent variables (Y) and illustrative or independent variables (Xi). An alternative to answer this question is to utilize regression analysis to model its relationship. The independent variable in this study is E-procurement technologies (E-Ordering, E-Sourcing, E-Tendering, E-Reverse auctioning, E-Informing) while the dependent variable is the Sustainable procurement practices. There are different kinds of regression analysis. The type of the regression model relies upon the sort of the distribution of Y; if it is continuous and approximate normal we use linear regression model.

In the multivariate regression, Y has a normal distribution with mean

$$Y = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p + \sigma(Y), \text{sd}(Y) = \sigma \text{ (independent of X's)}$$

In this study, the equation of multivariate regression is

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \text{ where;}$$

Y = Sustainable procurement practices

α = Autonomous factors

X1 = E-Ordering

X2 = E-Sourcing

X3 = E-Tendering

X4 = E-Reverse auctioning

X5 = E-Informing

e = error term

Bs = Beta coefficients of independent variables

PLS-SMART is the preferred software tool for this simulation. The model of E-Procurement for Sustainable procurement is formulated by using Partial Least Squares Structural Equation Modeling (PLS-SEM) techniques. SEM is primarily used to study structural relationships between variables for the purpose to establish predictive and theoretical linkages [79]. SEM is employed to create a measurement model that best fits data at hand and a structural model to test the causal relationship among the constructs. It allows the researcher to support the developed theories and to select the best model by extending the standard

multivariate analysis methods including regression, factor analysis, correlation and analysis of variance (ANOVA).

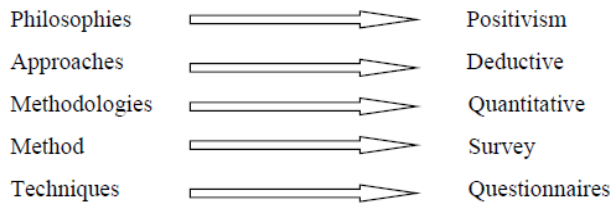


Figure 2. Summary of the selected Research Philosophy Approach

4. Conclusion

The primary aim of this research is the implementation of EPT for S A new framework of E-procurement technologies for sustainable procurement will be articulated. The framework helps to improve the ecological and environmental change recognized from National Priority Area (NPA). Procurement of eco-friendly products as well as services using E-procurement inventions that cause less pollution, make economic and efficient use of resources and energy and increase interest in sustainable products and services. This research provides a roadmap of proactive planning and decision-making for industry professionals, decision-makers, business contractors and providers to facilitate sustainable e-commerce growth and sustainable procurement in ISO 14001 certified sustainable development organizations and to meet government requirements. Also, legislatures, decision-makers and regulatory committees became more productive and structured to develop plans and regulations for sustainable procurement in Malaysia. Throughout the integration context, the elements are specified to direct the execution of the future research plan to strengthen procurement processes. The implementation of sustainable procurement in Malaysia by E-procurement technologies would benefit the civil, ecological and economic aspects and thus improve citizens' quality of life. This work is therefore intended to fill a significant gap in the literature and to increase our awareness of E-procurement in context with sustainable procurement practices in Malaysia ISO 14001 certified organization. By addressing this gap, the significance of this study is justified.

Conflict of Interest

The authors declare no conflict of interest.

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