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Using the UTAUT Model to analyze e-procurement adoption in Malaysian Construction Industry

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Abstract

This paper seeks to provide further understanding of issues surrounding acceptance of e-procurement by contractors in the Malaysian Construction Industry. The Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003) was employed to determine the strength of predictors for contractors to accept and use e-procurement. Questionnaires were administered to 115 contractors, during seminars and workshops organized by CIDB. Analysis of Moments Structures (AMOS) 24 and Statistical Package for the Social Sciences (SPSS) 24 were used to analyze the data collected. The measurement and structure model was appraised using Structural Equation Modeling. The findings show that performance efficacy, effort efficacy, social influence and facilitating condition have significant effect on e-procurement usage since the p-value for all the cases are less than 0.05. The researcher therefore recommends that future studies should include other variables to improve the variance explained by the predictors, since there are variations in the research environments.

Keywords: Effort Expectancy, Performance Expectancy, Social Influence, Facilitating Conditions, Use Behaviour

1. Introduction

The construction industry is important to national wealth creation as it acts as a catalyst for economy development (CIDB, 2006). 90% of the companies undertaking construction work are small and medium sized enterprises (SMEs). They play an important role as general contractors on small and medium sized projects and as sub-contractors for large construction companies. It is government policy for the SMEs to be able to deliver a safer, higher quality and more standardized product that can be maintained easily. It is also the government's aim for the industry to be a world-class, innovative and knowledgeable global solution provider (CIDB, 2006). To realize the aim, one aspect to highlight is the use of e-procurement or e-perolehan in Malaysian construction sector.

Malaysian government embarked on the e-perolehan project in 1999 to transform the public procurement landscape. Since Malaysian government is a major purchaser of goods and services

from the private sector spending a total of RM35 billion annually, e- Procurement or specifically e-perolehan project is seen to be an effective tool to ensure value for money as well as transparency and accountability in the public procurement process (Maniam et al., 2010).

Despite the fact that construction is mainly a service industry, a majority of its activities require material handling and assembly functions. E-Procurement is critical to construction because it involves a number of partners on each project who has the need for

inventory management in order not to delay the project or to tie space and money on excess inventory while also complying with specifications and other variables (Pheng and Meng, 1997). Beyond the obvious transaction cost savings and access to suppliers, e-Procurement can offer product standardization, quality assurance, inventory management and the opportunity to manage material flows down the value chain (i.e. the contractor having input in subcontractors choices, the owner having input in contractors choices, etc.).

According to Khu et al., (2012), despite the introduction of e-procurement in Malaysia since early 2000, many SMEs still perceive e-procurement as infeasible. In addition, they find that e-procurement is not widely adopted yet among SMEs. SMEs are at the core of the Malaysian construction industry and account for about 90% of companies undertaking construction work (CIDB, 2006). As of November 2007, e-Procurement has also not widely adopted in the construction sector and will take longer to be developed than originally anticipated (New Straits Times, 29th November 2007). Raja Roslan et al., (2009) in their research at Universiti Teknikal Malaysia Melaka (UTeM) also find that traditional method of procurement is still widely used as compared to e-procurement. With e-procurement being equipped in Malaysian construction industry, the above situation strike researcher's curiosity whether the contractors are the right target in utilizing e-procurement, or whether the contractors are having problems in using the e-procurement effectively in performing their jobs.

There are many models that can be used to analyse the usage of e-procurement among the contractors. One of the recent models is UTAUT model proposed by Venkatesh et al. (2003). This research is conducted to explain the factors that can significantly determine the usage of this technology in Malaysian construction industry, which is between contractors and Malaysian Government.

2. UTAUT model

Venkatesh et al. (2003) noticed that IS or IT researchers were confronted with a choice among a multitude of models and were bound to choose constructs across models or choose a favoured model, thus ignoring the contribution from alternative ones. They felt the need for a synthesis in order to reach a unified view of users' technology acceptance.

Venkatesh et al. (2003) reviewed and compared the eight dominant models that have been used to explain technology acceptance behaviour. These models included Theory of Reasoned Action

(TRA), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), combined TAM - TPB, Diffusion of Innovation (DOI), Socio Cognitive Theory (SCT), Motivational Model (MM), and Model of PC Utilization (MPCU). From the findings, they found that the constructs that do have a direct effect on behavioural intentions and usage are: performance expectancy, effort expectancy, social influences, and facilitating conditions. The terms are explained as follows:

Performance Expectancy (PE) *is the degree to which an individual believes that using the system will help him/her to attain gains in job performance.*

Effort Expectancy (EE) *is the degree of ease associated with the use of system.*

Social Influence (SI) *is the degree to which an individual perceives that important others believe he/she should use the new system.*

Facilitating Conditions (FC) *is the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.*

The UTAUT was formulated by leading researchers in the technology acceptance domain. The model was formulated based on conceptual similarities among eight dominant models in the field. According to its Venkatesh et al. (2003), the UTAUT is a definitive model that synthesized what is known and advances cumulative theory while retaining a parsimonious structure. Although published studies adopting this model are still scarce, this does not undervalue the power of this model compared to all other technology acceptance models.

All the original UTAUT constructs were used to develop the theoretical model of this research except for behavioral intention to use the system, since the contractors in the study were already using the e-procurement. In addition, there is a research where intention partially mediated the relationship (Ismail and Ali., 2014). This research also excludes the moderating variables from the origin model. The concept framework model used in the research is illustrated in figure 1 below.

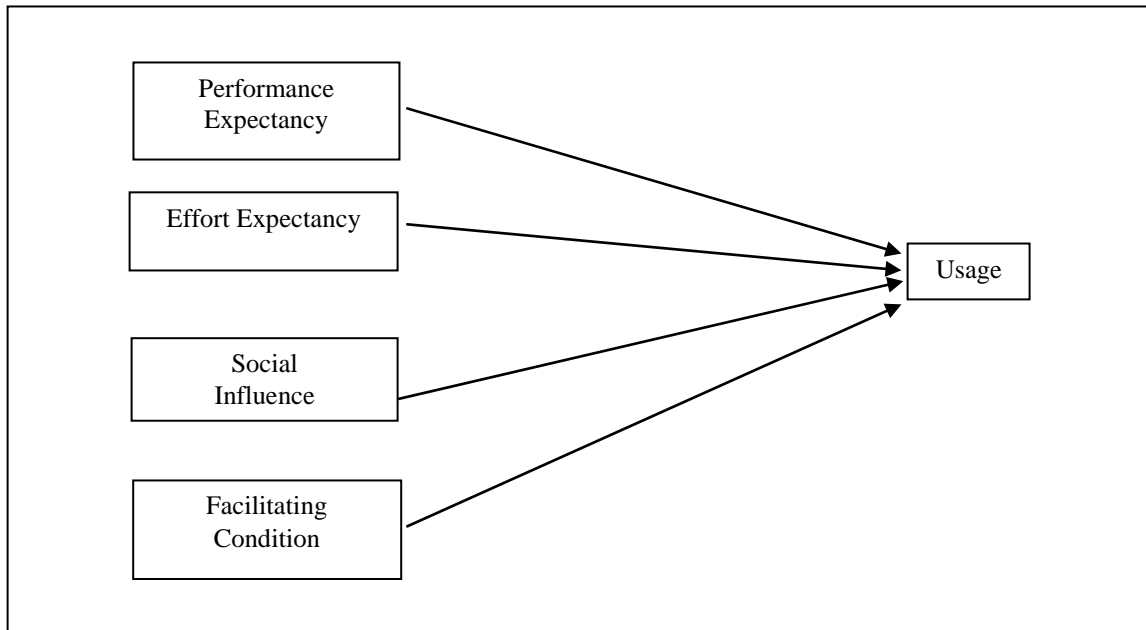


Figure 1: UTAUT model used in this study, modified from Venkatesh et al. (2003)

Based on the theoretical framework in Figure 1, the following hypotheses are derived.

- H₁ Performance Efficacy has significant effects on e-Procurement Usage
- H₂ Effort Efficacy has significant effects on e-Procurement Usage
- H₃ Social Influence has significant effects on e-Procurement Usage
- H₄ Facilitating Condition has significant effects on e-Procurement Usage

3. Research Methodology

The data reported in this paper were extracted from a survey of 115 of G4 and G5 Malaysian construction firms, conducted as part of a PhD research project in 2017. This study shall focus only to G4 and G5 middle size contractors because they are under classification of SME companies which sales turnover between RM1 millions to RM5 millions. The groups are also chosen because they still have not widely used e-Perolehan (Khu et al., 2012), even though they are organized companies and involved with complex and important projects. The following sections explain the details of the method used for this study.

3.1. Measurement development

Items designed to measure the construct were adopted from previous studies and refined through several procurement managers, then were reviewed by faculty members to assess face and content validity. Specifically, the development of a construct are based on the adoption of relevant research streams. All items related to UTAUT model are based on a 7- point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). These measures are self-reported perceptual measures.

3.2. Demographic profiles

The survey used for data collection was pretested with two procurement managers and academic staff members before official administration. The survey questionnaire was distributed to representatives from construction companies who attended the seminar and workshops programs under CIDB. Three rounds of distributions were carried out and 115 responses were received.

A range of demographic characteristics was analyzed from the extracted data subset. The majority of the respondents held a job title of engineer and site manager. Further, the respondents had an average of 11 and 20 years of experience in the industry. The length of a manager's tenure gave some reassurance of the validity of the sample, since they were more likely to be knowledgeable about the strategies and activities of the companies. In terms of e-Procurement usage, majority (40.4%) of the respondents are moderate users.

4. Findings

For the purpose of data analysis and testing of hypotheses the study uses Structural Equation Modelling (SEM) and IBM-SPSS-Amos software, the framework in Figure 1 is converted into Amos Graphic as shown in Figure 2 by putting the required residual for regression equation.

Prior to data input into the model and executing Structural Equation Modelling (SEM), the study needs to assess the data distribution for normality as part of the requirement for parametric statistical analysis (Awang, 2014; 2015). Unlike other software which employ traditional Generalized Least Square (GLS) estimator which is not robust to skewed data, the IBM-SPSS-Amos employ the robust estimator namely the Maximum Likelihood Estimator (MLE). This estimator (MLE) is robust to skewed data; the assessment of normality is only based on the skewness of data distribution. As such, it is only adequate to show that the data distribution does not depart from normality. According to Awang (2014; 2015), the range of skewness between -1.5 to 1.5 are still acceptable since data distribution within that range does not depart from normality. Based on the data characteristics shown in Table 1, the value of skewness for all constructs fall within the stated range. Thus, the study can proceed into modelling and executing SEM.

Table 1: The Assessment of normality for data

Variable	min	Max	skewnes s	c.r.	kurtosis	c.r.
Facilitating_C	3.000	7.000	-0.520	-3.360	0.348	1.123
Social_I	3.000	7.000	-0.469	-3.027	0.807	2.603
Effort_E	3.000	7.000	-0.541	-3.491	0.796	2.569
Performance_E	3.000	7.000	-0.762	-4.918	0.956	3.085
eP_Usage	3.000	7.000	-0.700	-4.522	1.150	3.712

AMOS 20.0 statistical software was used to evaluate the construct validity and the reliability of

the measurement instrument. The results of factor loadings, construct reliability and average variance extracted are shown in Table 2 which offers adequate evidence of validity and reliability, since factor loadings exceed 0.5, while construct reliability figures exceed the recommended level of 0.7.

Table 2: Standard item loadings, Composite Reliability and Average Variance Extracted

Construct	Indicator (sub-construct)	Factor loading	Construct reliability	Average variance extracted
Usage	pu 1	0.67	0.875	0.638
	pu 2	0.81		
	pu 3	0.84		
	pu4	0.86		
Performance expectancy	pe 1	0.82	0.914	0.681
	pe 2	0.89		
	pe 3	0.75		
	pe 4	0.82		
	pe5	0.84		
Effort expectancy	ee 1	0.79	0.921	0.700
	ee 2	0.85		
	ee 3	0.85		
	ee 4	0.87		
	ee 5	0.82		

Social influence	si1 si2 si3 si4 si5	0.79 0.87 0.90 0.87 0.83	0.930	0.727
Facilitating condition	fc 1 fc 2 fc 3 fc 4 fc 5	0.83 0.77 0.84 0.91 0.89	0.928	0.722

The researchers utilised the principles stated in Hair et al., (2006 as cited in Samuel and Hillar., 2014) to conduct the appraisal of the structural model. To assess the fitness of a model, Hair et al (2006) also state that it is ideal to use at least one absolute and one incremental fit measure in addition to χ^2 and the associated degrees of freedom. Earlier researchers have recommended the following cut off for model appraisal: $\chi^2/df < 3$ (Bagozzi, R.P., & Yi., 1988), AGFI > 0.8 (Chau, P.Y. K & Hu P.J.H 2001), RMSEA < 0.08 (Brown M. W. & Cudeck R ,1993), CFI > 0.9 (Bagozzi, R.P., & Yi. 1988), NFI > 0.9 (Hair et al., 1998). Table 3 provides a list of fit indices, recommended threshold values and their corresponding authors, and the paper's fit indices which clearly fall within the acceptable region. Hence the result revealed that the measurement model fit with the data collected.

Table 3: Recommended and actual values of fit indices

Fit Indices	Recommended Value	Actual Values	Authors
χ^2/df	<3	1.757	(Bagozzi, R.P., & Yi., 1988)
AGFI	>0.8	0.856	(Chau, P.Y. K & Hu P.J.H 2001)
RMSEA	<0.08	0.055	(Browne M. W. & Cudeck R ,1993)
NFI	>0.9	0.897	(Hair et al.,1998)
CFI	>0.9	0.952	(Bagozzi, R.P., & Yi. 1988)

The Regression Path Coefficients are shown in Figure 2.

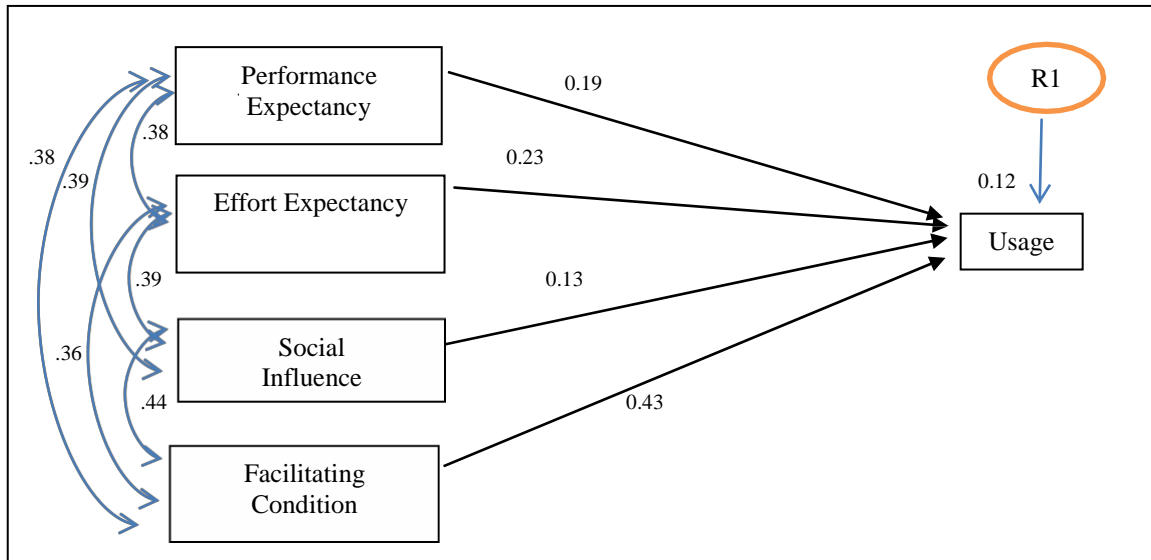


Figure 2: The Regression Path Coefficient

The Regression Equation extracted from Figure above is as follows:

$$1. \quad eP_Usage = 0.12 + 0.19Performance_Expectancy + 0.23Effort_Expectancy + 0.13Social_Influence + 0.43Facilitating_Conditions$$

The significance of the Regression Coefficient is shown in Table 4.

Table 4: The Regression Coefficient and its Significance

			Estimate	S.E.	C.R.	P-Value	Result
eP_Usage	<---	Performance_Expectancy	0.194	0.053	3.626	0.001	Significant
eP_Usage	<---	Effort_Expectancy	0.234	0.059	3.982	0.001	Significant
eP_Usage	<---	Social_Influence	0.132	0.063	2.098	0.036	Significant
eP_Usage	<---	Facilitating_Condition	0.428	0.054	7.937	0.001	Significant

Table 4 and Figure 2 show the relationships between the exogenous variables; Effort Expectancy, Performance Expectancy, Social Influence and Facilitating Conditions, and the endogenous variable; e- procurement usage. Based on table 4 also, all the four hypotheses are supported since the p-value for all the cases are less than 0.05 which are significant. The findings show that performance efficacy (0.19 p<0.05), effort efficacy (0.23 p<0.05), social influence (0.13 p<0.05) and facilitating condition (0.43 p<0.05) have significant effect on e-procurement usage.

5. Discussion and conclusion

The objective of this paper is to determine the factors significantly influence e-Procurement usage in Malaysian construction industry. UTAUT model is used because it was formulated by leading researchers in the technology acceptance domain and very few research use the model in the construction industry. This study has confirmed that all the four independent variables of UTAUT

model significantly influence e-procurement usage.

This study provides insights into contractors' behaviour towards e-procurement usage when the Venkatesh et al. (2003) model was applied. The study concludes that of the hypotheses stated, Effort Expectancy, Performance Expectancy, Social Influence and Facilitating conditions positively influence the usage of e-procurement. It is therefore imperative upon Malaysian government to ensure that e-procurement is made friendly, easy to use and with requisite technical support. The study also concludes that when these interventions are applied, contractors then incorporate the e-procurement into their work and appreciate the value of the technology provided and in turn advise their colleagues to use them.

This paper used only the exogenous variables from UTAUT model which are Effort Expectancy, Performance Expectancy, Social Influence and Facilitating Conditions. It did not address the effect of the moderating variables presented in the original UTAUT model. The researcher therefore recommends that future studies include other variables to improve the variance explained by the predictors, since there are variations in the research environments. The research also used the contractors from group G4 and G5 based on CIDB classification. The researcher therefore recommends that future studies include contractors from other classifications for more reliable results and conclusions.

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