Examining Adoption of e-Procurement in Public Sector Using the Perceived Characteristics of Innovating: Indonesian Perspective

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Abstract. This study aims to examine factors affecting adoption of e-procurement in public sector with special reference to Indonesian context. The Perceived Characteristics of Innovating defined by Moore and Benbasat [1] used as the framework. Based on a survey to 87 contractors/suppliers in the city of Yogyakarta, the study finds that only trialability that affects use intention of e-procurement among the contractors/suppliers. The survey conducted in the early stage of e-procurement implementation is of the possible explanations. Government policy that forces the contractors/suppliers to use the e-procurement also partakes in this context. Practical implication of the findings are also discussed in the paper.

Keywords: e-procurement, e-government, adoption, Indonesia, the Perceived Characteristics of Innovating.

1 Introduction

During the last decade, governments from all over the world have tried to take advantage of information technology (IT) to improve their business processes. IT offers the opportunity for the government to better deliver its information and services and to interact with all its citizens, businesses, and other government partners in a more effective manner [2].

Adoption of e-government has increased in most countries but at the same time the rate of adoption varies from country to country. Generally, developing countries, including Indonesia, are lagging behind in e-government adoption compared to developed countries [3, 4].

In the context of Indonesia, where transparency in public sector is still facing a great burden, the advent of e-government gives a hope on a one side and at the same time a challenge in another. It is hoped that e-government will improve transparency of governmental-related processes, such as public procurement, but the existing challenges are not easy to deal with. One of key challenges is combating widespread corruption in the public procurement.

In order to cope with such a problem, in 2007 the Indonesian government started using e-procurement as an advancement of e-government features. National Planning Board took the lead in this initiative. In the national level, the e-procurement can be

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assessed at http://www.pengadaannasional-bappenas.go.id. In addition to the use of such system in the national level, the central government has also instructed local governments to adopt the same e-procurement systems gradually taken the readiness of the local government into account [5].

In many developing countries, including Indonesia, often a system that is already developed is underutilized, which in turn the optimal benefits cannot be harvested. Dooley and Purchase [6] found that one of factors influencing e-procurement usage is contractors'/suppliers' participation and intentions. Most previous studies focused on advantages of using e-procurement from the perspective of the users (in this case, the local government) and not from contractors/suppliers' point of view (e.g. [7, 8]). Against this backdrop, the current study aims to address the following research questions: what factors affecting intention to adopt the e-procurement in public sector among the contractors/suppliers?

The extended Perceived Characteristics of Innovating (PCI) proposed by Compeau et al. [9] will be used as a framework. The PCI originally was developed Moore and Benbasat [1] and has received a significant attention through repetition and validation in a variety of contexts (e.g. [9, 10]).

The rest of paper will be organized as follows. In the next section, theoretical basis of e-procurement will be presented along with theory on diffusion of innovation and the PCI. Research design will be explained in third section, followed by section presenting and discussing results of the study. Section of conclusion brings this paper to an end.

2 Theoretical Framework

In this section, issues related to e-procurement is briefly discussed, followed by giving theoretical basis for diffusion of innovation, and more specifically, the perceived characteristics of innovating that is used in the study.

2.1 e-Procurement

According to Croom and Brandon-Jones [8], e-procurement refers to "the use of integrated (commonly web-based) communication systems for the conduct of part or all of the purchasing process; a process that may incorporate stages from the initial need identification by users, through search, sourcing, negotiation, ordering, receipt and post-purchase review." There are several kinds of implementation of e-procurement. Some e-procurement systems in place provide information only, while other facilitate transaction [11].

E-procurement offers benefits to the organization through purchase process efficiency gains and price reductions, enhanced collaborative relationships, and significant opportunity for improving the internal service and status of the purchasing function [12]. In addition, more specifically in public sector, e-procurement also offer other benefits such as enhanced transparency, better access for non-local bidders, better access for Small and Medium-Sized Enterprises (SMEs), and corruption avoidance [11].

Previous studies (e.g. [6, 13]) found several critical success factors (CSFs) in implementing e-procurement. Some of the factors are end-users uptake and training,

supplier adoption, system integration, re-engineering the process, top management support, performance measurement, and implementation strategy. In line with the CFSs, there are also several barriers take cope with in implementing e-procurement systems, include expensive implementation cost, limited resources, technology barriers, governing body resistance, and supplier resistance [7].

2.2 Diffusion of Innovation

According to Taylor and Todd [14], the problem of innovation diffusion can be approached from several levels. Some researchers have approached from a macro-view within a societal context or at country level (e.g. [15, 16]). Other researchers have examined this issue at an organizational level (e.g. [10, 17]) and still other researchers have approached this issue by investigating the determinants of adoption and usage by an individual (e.g. [18]).

The adoption and use of IT at organizational and individual levels have received a great deal of attention in recent information systems literature. Rogers [19] also discussed the diffusion of innovation at these two levels. Our study of e-procurement adoption falls into the organizational level.

Taylor and Todd [14], further distinguish the research on the determinants of IT usage into two streams: those based on intention-based models, exemplified by such theories as Technology Acceptance Model (TAM), and diffusion of innovation, exemplified by Roger's diffusion of innovation theory and the PCI model proposed by Moore and Benbasat [1]. In this study, e-procurement is both an innovation and a technology.

Rogers' [1] classical work on the area of diffusion of innovation has been widely used in the study of technology adoption. He defined diffusion of innovation as "the process by which an innovation is communicated through certain channels over time among the members of a social system" [19].

An innovation is characterized as "an idea, practice, or object that is perceived as novel by an individual or other unit of adoption" [19]. Rogers' review of a large number of studies of adoption and diffusion of innovation unearthed five general characteristics of innovations that regularly affect adoption, namely: relative advantage, compatibility, complexity, observability, and trialability.

Relative advantage refers to "the degree to which an innovation is perceived as better than the idea it supersedes" [19]. This characteristic may be measured in economic terms, social prestige, convenience, and satisfaction. The more advantageous an innovation, the faster the rate of adoption will be.

Compatibility is "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" [19]. An innovation's incompatibility with cultural values can hinder its adoption. Compatibility of an innovation with a prior idea can speed up its rate of adoption. Complexity represents "the degree to which an innovation is perceived as relatively difficult to understand and use" [19]. The simpler or less complicated an innovation, the higher the speed of adoption will be.

Trialability refers to "the degree to which an innovation may be experienced with on a limited basis" [19]. Some innovations are difficult or even impossible to be tried

before adoption, while some are not. When an innovation is possible to be tried out before adoption, it will be easier to decide either to adopt or to reject the innovation.

Further, Rogers [19] defines observability as "the degree to which an innovation is visible to others". The results, either benefits or detriments, of some innovations are easy to measure, observe and communicate to others, while it is difficult for some other innovations. The easier it is for potential adopters to see the positive results of an innovation, the more likely they are to adopt it, and vice versa.

2.3 The Perceived Characteristics of Innovating

The Perceived Characteristics of Innovating (PCI) developed by Moore and Benbasat [1] consists of eight antecedent constructs to predict intention of technology adoption. The PCI model is based on Rogers' [19] model of diffusion of innovation. It may be recalled that Roger's model incorporates five innovation characteristics as antecedents to any adoption decision: relative advantage, compatibility, complexity, trialability, and observability as aforementioned.

The PCI model incorporates three of those constructs – relative advantage, compatibility, and trialability – as in their original definitions. Moore and Benbasat replaced the complexity construct of Rogers' model with ease-of-use construct from Plouffe et al. [10]. Ease-of-use represents "the degree to which [an innovation] is easy to learn and use" [1]. Visibility and result demonstrability constructs replace the observability construct in Rogers' model [1].

Visibility "is the degree to which an innovation is visible during its diffusion through a user community" as defined by Plouffe et al. [10]. Moore and Benbasat [10] define result demonstrability as "the degree to which the benefits and utility of an innovation are readily apparent to the potential adopter". Image represents "the degree to which the use of [an innovation] enhances one's image or status within the organization" [1].

Finally, voluntariness reflects "the degree to which the use of [an innovation] is perceived as being voluntary" [1]. Altogether, the PCI incorporates eight constructs: relative advantage, ease-of-use, compatibility, trialability, visibility, image, result demonstrability, and voluntariness.

The PCI has been used in IS research to predict intention to adopt of a variety technology (e.g. [10, 20, 21]). In a study on smart-card adoption among Canadian government employees, Gagliardi and Compeau [22] found that out of the eight antecedent constructs in the PCI model, seven were significant predictors to adoption intent. Only compatibility was not significant.

A study conducted by Agarwal and Prasad [20] used three constructs from the PCI model (usefulness, compatibility, and ease-of-use) along with additional constructs. They found that only compatibility predicted intention to adopt World Wide Web. In another study, Agarwal and Prasad [23] found that compatibility, trialability, visibility, and voluntariness had direct and significant effects on Internet usage, whereas the effects of relative advantage and ease-of-use were not significant. In another study on adoption of expert system application, Agarwal and Prasad [21] discovered that relative advantage affected intention to adopt significantly, while ease-of- use and compatibility did not.

Plouffe et al. [10] study found that among the PCI antecedent constructs, six – relative advantage, compatibility, trialability, visibility, image, and voluntariness – had

significant effect on intention to adopt smart card-based payment systems. In that study, they used both the PCI model and the TAM and compared them. They found that the PCI model was superior over the TAM as it explained 45% of total variance compared to 32.7% for the TAM.

Compeau et al. [9] extended the PCI with three additional constructs. Compatibility was separated into three construct as proposed by Karahanna et al. [24]. These three reflect compatibility with preferred work style, values, and previous experience. Compeau et al. [9] defined the compatibility with preferred work style as "the degree to which the innovation is perceived as being consistent with the way the potential adopter would like to work, even if that is not the way they work now", while compatibility with prior experience reflects "the degree to which the innovation is perceived as being consistent with the prior experience of potential adopters". Compatibility with values is defined as "the degree to which the innovation is perceived as being consistent with the existing values of potential adopters" [9].

In addition, result demonstrability in the PCI was divided into two constructs, namely communicability and measurability. Communicability is defined as "the degree to which the result of using the innovation can be easily communicated to others", while measurability represents "the degree to which the impact of the innovation can be assessed" [9].

Moreover, Compeau et al. [9] also re-conceptualized visibility in the original PCI termed as other's use and defined as "the degree to which potential adopters are aware of the people using the innovation." Using the extended PCI, Compeau et al. [9] examined the adoption of comprehensive hospital computer systems by non-physician employees. They found that several constructs significantly linked to each other, while relative advantage, voluntariness, and communicability were found to have a significant relationship to use intensity. However, other constructs (e.g. measurability, others' use, image, compatibility with values) were revealed to have a significant indirect impact on use intensity. In the final model, Compeau et al. [9] dropped compatibility with preferred work style since the lack of validity of the construct. This made the extended PCI proposed by Compeau et al. [9] consists of 10 construct, namely: (1) relative advantage; (2) compatibility with prior experiences; (3) compatibility with values; (4) ease of use; (5) image; (6) communicability; (7) measurability; (8) trialability; (9) voluntariness, and (10) others' use.

3 Research Design

3.1 Research Setting

e-Procurement has been formally adopted by the Indonesian government since April 2007 following up the Ministrial Decree of National Development Planning No. 002/MPPN/04/2007. Since that time, e-procurement has been implemented in the central government level, and gradually in the local government level. However, before the decree issued, several government agencies has used e-procurement in some extents.

In Indonesia, public expenditures account for 30% to 40% of total national spending. Even, in some government departments, public procurement expenditures may

reach 70% of total annual budgets. Public procurement expenditure, therefore, is important, as are the sound processes and proper management that must accompany measures must be thoroughly implemented to reduce and minimize the potential for irregularities and misconduct [11].

According to Transparency International [11], in 2008, Corruption Perception Index of Indonesia is 2.6 (out of 10, 10 = no corruption, 0 = maximum corruption) which reflects perceptions of rampant corruption, but represents an improvement over its score of 2.3 in the 2007. Corruption that affects public procurement in Indonesia, involves a wide spectrum of individuals and organizations, including political leaders, judicial figures, senior administrators, and officials in procurement roles, as well as suppliers and contractors [25]. Several sources of figures indicate that between 10% to 50% of the procurement budget had been misappropriated (e.g. [26, 27]).

In Indonesia, the use of e-procurement has saved between 20% and 40% of the procurement budget of the central government from 2004 until 2006 [26]. Experience from the city of Surabaya (East Java) proved that e-procurement gave 50% savings for small contract and 23% for big ones [11].

The city of Yogyakarta, the study site, is known as student city and cultural city, with more than a half million population, where a rich blend of cultures from all corners of Indonesia meets. The government of Yogyakarta started to implement e-procurement system since March 2008. Since March until December 2008, 160 contractors/suppliers have been registered. Training for using the procurement systems have been held in December 2008 until January 2009. In the beginning of 2009, Yogyakarta was awarded by the Transparency International Indonesia as the cleanest city from corruption in Indonesia

3.2 Research Instrument

This recent study is considered as quantitative in nature. A questionnaire was developed as the main research instrument. Items in the questionnaire were based on those developed by Compeau et al. [9], as an extension of the PCI defined by Moore and Benbasat [1]. The 47 items was used to measure nine constructs, namely relative advantage (8 items), compatibility with prior experiences (4), compatibility with values (4), ease of use (6), image (4), communicability (4), measurability (3), trialability (6), and voluntariness (5). Other's use construct was excluded as when the survey conducted, e-procurement was in the early implementation stage. Use intention was operationalized using three items developed in this study. Each item was measured using 5-point Likert scale anchored by strongly disagree (score = 1) and strongly agree (score = 5).

As the questionnaire was already tested [9], we did confirmatory factor analysis to examine the validity of the questionnaire. The reliability of the questionnaire was measured using Cronbach's alpha. All analyses were done with help of statistical software SPSS. The confirmatory factor analysis unveiled that not all items were valid. Items with factor loadings less than 0.3 were dropped. Factor analysis was done using principal component extraction method and varimax rotation method.

Subsequently, using only valid items, reliability test was conducted. As the result, from 47 items represented nine constructs, only 24 items were valid and represented five constructs, namely relative advantage (8 items), compatibility with values (4),

ease of use (5), measurability (3), and trialability (4). Compatibility with prior experiences, image, and voluntariness were dropped because the items used to measured respective constructs were unreliable as indicated by Cronbach's alpha less than 0.6 [28]. Descriptive statistics of the constructs and result of reliability test is summarized in Table 1.

Table 1. Descriptive statistics of the constructs

Construct	No. of items	Mean*	Standard deviation	Cronbach's alpha
Relative advantage	8	3.74	0.27	0.73
Compatibility with values	4	2.52	0.29	0.84
Ease of use	5	3.59	0.31	0.79
Measurability	3	3.20	0.35	0.77
Trialability	4	3.98	0.40	0.73
Use intention	3	4.12	0.49	0.81

Notes: Measured using 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

3.3 Sample and Data Collection

Respondents of the study were contractors/suppliers of the public procurement carried out by the city of Yogyakarta. The questionnaire was distributed to 130 contractors/supplier in the list who has attended e-procurement training, but only 90 who were willing to fill in the questionnaire, where 87 of them were valid for further analysis. The data collection was conducted in February and March 2009, both through face-to-face meeting and e-mail communication. However, several unstructured interviews with some procurement officials were also carried out to get a more complete picture of grand design on e-procurement implementation in the city of Yogyakarta. In addition, several unstructured interviews were also done to the contractors/suppliers.

Out of 87 respondents, 90.8% are male. Average age of the respondents is 30.6 years, with the vast majority (52.9%) of them age 25-30 years. The respondents with university level education account for 75.9%, while other has senior high school education level. As much as 62.1% of them are contractors, while the rest serve as suppliers.

The positions of 26.4% of the respondents are managers/directors, while other are staffs dealing with procurement in their firms. At average, the firms' age is 8.4 years, with 8 employees at average. The respondents have been being contractors/suppliers for government procurement for 7.1 years at average, ranging from 3 to 11 years. At average, they have used the Internet in supporting business for 6.7 years with online time 19 hours per week. Out of the respondents, 73.6% has used in e-procurement to participate in public procurement, while the rest have attended the training, but have never used it.

4 Results and Discussion

As can be seen in Table 1, with exception of use intention, scores for all construct are considered to be moderate. Even, the score of compatibility with values is less than

3.0, meaning that the respondents perceive that e-procurement does not fit with values they believe in. In the context of this study, the values might be manifest as permissive values to unethical business practices or even illegal ones, such as involving "the insider", as procurement officials called, in giving uneven information or opportunity for all the contractors/suppliers, or making unethical deal between the contractors/suppliers that violates the level of the playing field.

In general, we might conclude that the respondents score the e-procurement somewhat positive as regards its relative advantage, ease of use, measurability, and trialability. However, intention of the respondents to adopt/use e-procurement systems provided is high as indicated by score of 4.12. Then, what factors affecting this use intention?

Table 2. Results of regression analysis

Construct	**Beta**	***t***
Relative advantage	-0.09	-0.70
Compatibility with values	-0.10	-0.78
Ease of use	0.13	1.04
Measurability	0.13	1.25
Trialability	0.41	3.12 *
Summary:		
F (9,77) = 5.40* R square = 0.29	Adj R square = 0.23	

Notes: * $p<0.01$

Table 2 shows the result of regression analysis. From five constructs, only trialability that affects use intention significantly in positive direction, while other four do not have direct significant effect on use intention. Since the implementation is in its early stage, relative advantage of using e-procurement is not persistent from the eyes of the contractors/suppliers. As stated earlier, despite the fact that 73.6% respondents has used in e-procurement to participate in public procurement, but they have participated only in one to three tenders.

Ease of use might not an issue in the adoption process, since the respondents have been using the Internet for several years. This is the fact that so far the e-procurement systems introduced is automation of conventional public procurement processes without any substantial business process changes. It is not surprising that the respondents that have got used with such the processes in the public procurement as they have been in the business longer than seven years at average will not find any significant difficulties in using the e-procurement systems.

Again, since the respondents have been acquainted with the e-procurement systems for a short time, the impact of it is still difficult to measure. This is might be of explanation why measurability is found to have no significant impact on use intention.

The only determining factor of use intention in this study is trialability. This might be associated with uncertainty inherent in the e-procurement systems because they have never used or have been used it in a short time. A cross-country study conducted by Hofstede [29] found that Indonesia is of countries with high score on uncertainty avoidance. He defines uncertainty avoidance as ''the degree to which members of a

society feel uncomfortable with uncertainty and ambiguity''. Adoption of a new technology involves risk and uncertainty. People in countries with a high score on uncertainty avoidance are more risk-averse and do not approve of making changes [30] and hence has a lower adoption rate to new technology/innovation [31].

Training conducted by the local government for the contractors/suppliers, then, could be considered as very influential in making them adopt the systems since they have opportunity to try the systems, and thus reduce the degree of uncertainty. Implementation strategy chosen that takes readiness of both the local government and the contractors/supplier into consideration should be appreciated.

However, trialability only explains 23% of total variance of use intention, meaning that there are other factors affecting the use intention in a larger power. Government's policy that forces to use the e-procurement systems gives the contractors/suppliers no choice. This factor might be the reason why the degree of use intention among the contractors/suppliers is very high as indicated in the interviews. However, since not all contractors/suppliers come with various internal capabilities, initiatives to leveling the playing field, such as ensuring equal information access and training should be well designed.

Table 3. Results of mean comparisons

Demographic variable	Use intention		*t*
	Low	High	
Age of firm	4.14	4.09	0.38
Procurement experience	4.20	4.01	1.76*
Size of firm	4.11	4.12	-0.11
Internet experience	4.15	4.09	0.60

Notes: * $p<0.1$

In searching of additional explanation of e-procurement use intention among the contractors/suppliers, several demographic variables believed to have impact on the degree of use intention are analyzed. The variables are age of firm, procurement experiences, size of firm, and Internet experience of the contractors/suppliers. Procurement experience is measured in years since a firm has participated in public procurement in the first time, while size of firm is measured using number of permanent employees. Internet experience represents how long a firm has been using the Internet, and is measured in years. Due to small variances in the data, all variables are converted into nominal scale with two categories (labeled as 'low' and 'high') using the mean as cut-off point. Table 3 summarizes the results of mean comparisons using independent-sample t-test.

As can be seen in Table 3, e-procurement use intention does not differ between younger and older firms, between smaller and larger firms, and between those with less and more Internet experience. But, we find that e-procurement use intention between the firms with a longer experience in public procurement is significantly less than those with a shorter experience. Resistance to changes among "the older players" might be higher than those "the new coming players" in public procurement. The change from conventional to e-procurement in some extent might be seen as a threat for the firms that

have a longer experience as contractors/suppliers in public procurement. However, their use intention is still considered high as indicated by score greater 4.00. Condition where the policy of the government gives contractors/suppliers no choices other than adopting e-procurement might have a great impact.

5 Concluding Remarks

The recent study has examined the factors affecting the use intention to e-procurement among contractors/supplier of public procurement with special reference to Indonesian context. The study found that only trialability that has significant impact on use intention. The recent study conducted in the early stage of e-procurement implementation might of the explanations of the finding. The study also found that adoption rate among the new coming contractors/supplier is significantly higher than among the older players. This finding leads to an implication that the government should provide the contractors/suppliers a chance to try the e-procurement before they use it. Training on and giving comprehensive information about the e-procurement are among the initiatives might be carried to reduce uncertainty perceived by the contractors/suppliers.

Despite the fact that the government's policy has forced the contractors/suppliers to use the e-procurement systems, gradual implementation strategy that the contractors'/suppliers' readiness into consideration is of possible best option. However, it is possible that similar study that might be conducted in future when the contractors'/suppliers' e-procurement experience is more mature, will give different results and hence different ways will be required to deal with the situation.

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