



(RESEARCH ARTICLE)



Efficiency Hypothesis Testing in an e-Procurement Implementation Assessment Model Framework: A Case Study of Bangladesh's Roads and Highways Division

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Abstract

In 2011, the e-Government Procurement (e-GP) guideline 2011 is adopted to start electronic procurement in public sector. However, since the e-GP system was first implemented, a great deal of investigations or analyses have not been conducted to determine how well its tender efficiency measured. This research aims to investigate the essential variables that contribute to the successful implementation of an electronic procurement system in Bangladesh. Another goal is to identify e-procurement implementation issues and build an efficient e-procurement implementation assessment model. Survey questionnaires were employed to collect data from eleven Roads and Highways Division (RHD) zones as a population. The study sample size of the bidders was 139. Hypothesis test has been done choosing MLR model of SPSS software. *Efficiency* was one of the eight hypothesis tests in the study. Findings proved that model was fit. The article helps readers comprehend the key elements that could affect the efficiency of public procurement. By attaining efficiency in public procurement, the study promises a significant contribution to saving public money.

Keywords: e-GP guideline 2011; e-Procurement assessment model; Hypothesis test; e-Procurement; Public procurement efficiency; CPTU.

1. Introduction

The Central Procurement Technical Unit (CPTU) promulgated the Public Procurement Act 2006 (IPPA 2010) and the Public Procurement Rules 2008 to create a legal framework. Following that, Bangladesh used the old manual tendering procedure governed by the Acts and Rules. Despite this, public procurement agencies remain challenged in ensuring an efficient and transparent system. Based on the technological height of the electronic government procurement (e-GP) system developed and implemented by the CPTU of the Ministry of Planning, Bangladesh adopted the e-Procurement implementation (CPTU 2011) in the public procurement area in 2011. The e-GP system is currently in use. However, PEs and all bidders continue encountering complications, and assessments haven't been completed since the e-GP system's deployment (Akando 2016; Marcella 2006). The final goal is to forecast the critical effects of various factors impacting the deployment of e-Procurement in RHD that helped to design an e-procurement assessment model. Information and communication technology (ICT) brings innovation in public procurement through application of e-procurement in public system. Many modern researchers argue (Ali et al. 2021; Ebere et al. 2023) that an e-procurement system is a perfect alternative to reduce transaction costs in public procurement. In the midst of a competitive environment, integrating newer technology and processes has become necessary (Innocent RUZINDANA and Kalaskar Prashant B. 2016). Speed of customer service is an essential in the service sector and Supply Chain Management (SCM). Effectiveness, efficiency, and innovation are all tied to this. By enhancing teamwork through enhanced

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procurement performance, adoption of e-Procurement contributes to improved client services and customer happiness. This study highlights the factors affecting the adoption of e-Procurement, & how this e-Procurement affected the procurement performance of RHD in Bangladesh. This paper looks at the critical success factors (Basheka et al. 2012) focusing on the requirements for e-procurement implementation assessment and determining the factors that have a significant effect on e-procurement efficiency in RHD.

1.1. Research Question

To evaluate the e-GP platform, which was launched in 2011, a better e-Procurement assessment model can be created. As a result, the central research questions of the study were:

Q. What are the different factors that influence the adoption of the e-procurement implementation assessment model in RHD?

1.2. Specific Objective

Following the research question, beneath objective was taken into consideration to make a hypothesis and survey questionnaires.

Objective- To predict the significant effects of different factors influencing adopting the e-Procurement implementation assessment model in RHD development project procuring.

1.3. Statement of Hypothesis

On the basis of the objective and research questions, we also formulated the following hypothesis to be tested:

Hypothesis- Effective e-Procurement implementation assessment significantly depends on *efficiency*.

1.4. Motivation and Novelty

The study's motivation is to theoretically design an e-procurement implementation assessment model for RHD in Bangladesh. The theory is that the e-procurement assessment model will contribute to overcoming shortcomings and establishing a sustainable e-procurement system in Bangladesh. Efficiency is one of the factors in the assessment framework. The novelty of the study is in the theoretical design of a new e-procurement implementation evaluation conceptual framework and model, which has been created for the first time in the RHD of Bangladesh. Additionally, a hypothesis test was conducted to assess the fitness of the model.

1.5. Significance of study

The findings of this research work will be very useful to the Central Procurement Technical Unit (CPTU) in Bangladesh for e-GP policy upgrade and also it will help in e-Procurement Implementation Assessment framework formulation. The academicians, students, researchers, Procurement entities, bidding communities will learn from the findings.

2. Literature Review

2.1. Theoretical Review

The study accepted the contingency theory (Candela A. and Ulises F. 2022). This notion made it easier to conceptualize the idea of improving organizational performance. Adoption of e-procurement increased value for money and bidder completion rates in public procurement institutions.

2.2. Empirical Review

This chapter examines the e-Procurement application scenario in Bangladesh and e-Procurement-related regulations and models in broadening perspectives on critical success factors. The term "success factors" outlines the particular areas where, if the results are good enough, a company will have a competitive advantage in terms of performance. For the organization to prosper, these are the areas where it must succeed. In contrast, if the results in these areas are insufficient, the firm's efforts will be futile. An organization can develop a known point of reference to better analyze its business's performance (Kevin 2016) and achieve goals by defining CSFs. These suggestions about critical success factors aided in developing the study's conceptual assessment model framework. To build a conceptual framework for

the in-depth study (Rashid and Uddin 2019) and to pursue data appropriately using SPSS software, variables are divided into dependent and independent variables, as shown in **Table 1**.

The researcher identifies various lists of CSF in the literature study that can be treated as independent variables to create a conceptual framework for this research.

Table 1 Variables Identification for the Proposed Assessment Framework

SL	Dependent Variable	Independent Variable
	<i>efficiency</i>	<i>e-payment process (registration money, tender schedule money, earnest money, security money)</i> <i>cost</i> <i>time</i>

Data Source: Literature Review Survey, 2020

3. Methodology

All bidders of Roads and Highways Department (RHD) in Bangladesh were population. The study used survey questionnaires. The RHD bidders were considered respondents. The scope of the study was four wings of RHD in Bangladesh, which are 11 zones, 31 circles, and 70 divisions. Visits to the RHD 11 zones of several PE offices yielded significant data. The survey's sample size bidders were 139 respondents. E-Procurement related bidders in RHD were randomly selected for the survey using a stratified sampling technique. All questionnaires were created following the study's objective. Quantitative data was collected from bidders with a 5-point Likert scale [Scale: 1= Not Satisfied, 2= Slightly Satisfied, 3= Moderately Satisfied, 4=Very Satisfied, 5= Extremely Satisfied]. The SPSS software was used for analysis. A multiple Linear Regression model was used to show the relationship of the dependent variable with independent variables.

3.1. Objective Wise Data Collection Tools

Based on the objective of the study, research questions, motivation, and tools have been shown in **Table 2**

Table 2 Objective-Wise Data Collection Tools

Study Objective	Question	Motivation	Tools
To predict the significant effects of different factors influencing adopting the e-Procurement implementation assessment model in RHD development project procuring.	What are the different factors that influence the adoption of the e-procurement implementation assessment model in RHD?	To test factors that contribute to e-procurement assessment.	Structured survey questionnaire (5 points Likert scale)

4. Results

4.1. Hypothesis

Effective e-Procurement implementation assessment significantly depends on *efficiency*.

4.1.1. Inferential test

From the conceptual framework **Table 2.1**, variables are-

dependent variable $Y = \text{efficiency}$

Three independent variables are

$X_1 = \text{e-payment process (registration money, tender schedule money, earnest money, security money)}$;

$X_2 = \text{cost};$

$X_3 = \text{time};$

Here three independent variables X_1, X_2, X_3 are influencing the variable Y .

Regression Model is $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon_i$

If X influence Y , then $\beta_1, \beta_2, \beta_3$ would exist. The value of $\beta_1, \beta_2, \beta_3$ cannot be zero.

Null hypothesis $H_0: \beta_1 = 0, \beta_2 = 0, \beta_3 = 0$

Alternative hypothesis $H_a: \beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0$

Table 3 Bidders Respondents' Statistics of Efficiency

	Mean	Std. Deviation	N
Efficiency	4.24	0.748	139
e-payment process	3.81	0.609	139
Cost	3.67	0.685	139
Time	4.18	0.836	139

Data Source: Field Survey, 2020

From the **Table 3** shows that the total number of bidders who responded in the study were 139.

Table 4 Model Summary of Correlation on Efficiency

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. Change
1	0.901 ^a	0.811	0.807	0.329	0.811	193.328	3	135	0.000

Data Source: Field Survey, 2020

From **Table 4**, the R -value represents the simple correlation of 0.901, which indicates a degree of correlation. Therefore, the analyzed correlation value is 90.1%, indicating a positive strong correlation.

By the R^2 value of **Table 4**, the dependent variable 'efficiency' is 81.1% depending upon three independent variables. This value indicates that 81.1% of the variance in *efficiency* can be predicted from the variables *e-payment process, cost, and time*. Noted that this was an overall measure of the strength of the association.

Table 5 Regression Fit (ANOVA) Test on Efficiency

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62.595	3	20.865	193.328	.000 ^b
	Residual	14.570	135	.108		
	Total	77.165	138			

a. Dependent Variable: efficiency, b. Predictors: (Constant), time, e-payment process, cost

Data Source: Field Survey, 2020

The regression model successfully predicts the dependent variable from ANOVA **Table 5**'s Sig value, indicating that the regression equation accurately fits the data. In this case, sig=.000, and less than .05. The regression model is significant

and statistically appropriate overall. Analysis confirms that having three independent variables increases efficiency by a significant amount.

Table 6 Dependency Test (Coefficients) on Efficiency

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	0.529	0.203		2.603	0.010
	e-payment process	0.032	0.053	0.026	0.613	0.541
	Cost	0.127	0.048	0.117	2.636	0.009
	Time	0.746	0.038	0.834	19.769	0.000

Data Source: Field Survey, 2020

From the above coefficients **Table 6**,

$$\text{efficiency } (Y) = .529 + .032 * e\text{-payment process } (X1) + .127 * \text{cost } (X2) + .746 * \text{time } (X3)$$

Here from the data analysis, $\beta_0 = .529$, $\beta_1 = .032$, $\beta_2 = .127$, $\beta_3 = .746$

So, $\beta_1 \neq 0$, $\beta_2 \neq 0$, $\beta_3 \neq 0$

So, null hypothesis H_0 is rejected, and alternative hypothesis H_a is accepted. So, it is tested that three independent variables (*e-payment process*, *cost* and *time*) influenced dependent variables *efficiency* (Y).

Now, analyze the Significance of Individual Coefficients from the Coefficient **Table 4.4-**

e-payment process

Sig=.541, i.e. $p > .05$ means *e-payment process* had no significant influences on *efficiency*.

The coefficient value is .032 means *efficiency* increases by .032 times for changing 1 unit of *e-payment process*, keeping all other independent variables are constant.

cost

Sig= .009 i.e. $p < .05$ means *cost* had significant influences on *efficiency*.

The coefficient value is .127 means that *efficiency* increases by .127 times of one unit change of *cost*, keeping all other independent variables are constant.

time

Sig= .000, i.e. $p < .05$ means *time* had significant influences on *efficiency*.

The coefficient value is .746 means that *efficiency* increases by .746 times of 1 unit change *time*, keeping all other independent variables are constant.

5. Discussion

The Analyzed correlation value is 90.1%, indicating a high (Evans 1996) degree (positive strong) correlation. The R^2 value of the dependent variable '*efficiency*' has 81.1%, depending upon three independent variables. The study got the sig value is 0.00 which is less than the p-value. So, overall, the regression model is significant and statistically fit. According to the test result described above, efficient e-Procurement implementation evaluation significantly increases efficiency.

6. Conclusion

The RHD has been one of the largest public procurement departments of using the e-GP system in Bangladesh since 2011. This is why it was chosen all bidders as population. The researcher analyses data to predict the significant effects of numerous factors that influence e-Procurement implementation in RHD development project procuring. The researcher suggested a conceptual framework based on the critical literature assessment and research gap analysis. Dependent variable *efficiency* in this conceptual framework had 3 independent variables. The hypothesis test's proofed that H_a (alternative hypothesis) was accepted. As a result, it has been concluded that efficiency is the factor in assessing effective e-procurement.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

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Authors Short Biography

	<p>Md. Abdur Rashid is an Oracle Certified Professional (OCP). He completed his Master of Science in Computer Science and Engineering in 2011 from East West University (EWU) from Dhaka and Bachelor degree in Electrical and Electronics Engineering in 1993 from Rajshahi University of Engineering and Technology (RUET) and obtained 1st class at both degrees. He is a Fellow of Institute of Engineers Bangladesh (IEB) and Life Member of Bangladesh Computer Society (BCS). At present he is working as Director (Admin & Finance) at National Academy for Planning and Development (NAPD) in Bangladesh. He published 10 articles in reputed international journals. He completed 7 national level researches. He is now PhD fellow of Bangladesh University of Professionals in Bangladesh.</p>
	<p>MOHAMMAD SHORIF UDDIN earned his Doctor of Engineering (Ph.D.) from Kyoto Institute of Technology in 2002, Japan, Master of Technology Education from Shiga University, Japan in 1999, Bachelor of Electrical and Electronic Engineering from Bangladesh University of Engineering and Technology in 1991 and MBA from Jahangirnagar University in 2013. His academic journey began in 1991 as a Lecturer at the Bangladesh Institute of Technology, Chittagong (Currently named Chittagong University of Engineering and Technology). In 1992, he joined the Computer Science and Engineering Department of Jahangirnagar University and at present, he is a full-time Professor in this department. Throughout his career, he has made significant contributions, including serving as the Chairman of the Computer Science and Engineering Department and as the Teacher-in-Charge of the ICT Cell at Jahangirnagar University. He has an extensive international research background, having undertaken postdoctoral research at several renowned institutions, including the Bioinformatics Institute in Singapore, Toyota Technological Institute in Japan, Kyoto Institute of Technology in Japan, Chiba University in Japan, Bonn University in Germany, and the Institute of Automation, Chinese Academy of Sciences in China. His professional and research interests encompass a wide range of areas, including computer vision, image security, data science, artificial intelligence, and machine learning. He has a prolific publication record, with over 200 research papers published in prestigious venues such as Elsevier, Springer, IEEE, ACM, Wiley, Oxford University Press, SPIE, and Optica. Additionally, he holds two patents for his innovative scientific work and has edited numerous books and authored several book chapters, published by Springer and Elsevier. He is honored as a Fellow of IEB and BCS, a Senior Member of IEEE, and serves as an Associate Editor of IEEE Access.</p>