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Time and Cost Efficiency Analysis of Manual and e-Procurement Systems in Roads and Highways Department: TEC Meeting Arrangement Perspective

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ABSTRACT: *Public procurement ensures accountability, time, and cost savings in procuring goods, works, and services. All government departments use manual and electronic tendering processes to purchase goods and services. The Roads and Highways Department (RHD) is one of the big public departments designated as the study's target population. Manual and e-procurement tendering systems are used by all RHD procurement entities (PE). However, time and cost reduction are significant challenges in the manual tendering process. Because, it involves a lengthy process for Tender Evaluation Committee (TEC) meeting arrangements. However, no time and cost comparison study of the manual and e-GP tendering processes for TEC meeting arrangement has been done in RHD after e-procurement inception in 2011. This study uses a stratified sampling strategy to compare the time and cost of a manual tendering procedure to an e-tendering approach, targeting RHD PE officers as samples. The independent samples t-test model was used to compare two groups utilizing the mean value of TEC meeting arrangement time and cost of the e-tender system and the manual tender system as a continuous normally distributed variable. This study makes a unique contribution by comparing the time and cost efficiency of two sets of manual and e-tender procurement methods. The e-procurement system, according to the survey results, reduced excessive times and costs at TEC meeting arrangements. The findings will also be used to enhance academic research and to improve e-GP policy requirements.*

KEYWORDS: e-GP policy guideline; procurement efficiency; t-test; TEC meeting arrangement time; e-procurement; accountability; TEC meeting arrangement cost

INTRODUCTION

The Government of Bangladesh has the primary legislation known as Public Procurement Act 2006 (PPA 2006) that focuses on public procurement issues. In addition, there is other secondary legislation like Public Procurement Rules 2008 (PPR 2008). These PPA 2006 and PPR 2008 are used to accomplish all public procurement in Bangladesh. Since 2011, the Electronic Government Procurement (e-GP) system (CPTU e-GP 2020) has been adopted. The

e-GP has been introduced to bring more efficiency, transparency, fairness and competition in all public procurement by the World Bank (WB 2002) recommendations. The e-GP system is running now, but the problem is that bidders, procurement entities and other stakeholders are thinking about the efficiency of the e-GP system from the time and cost perspective. Whether the e-GP system is effective or not in a time and cost context? How would the nation benefit from the last innovative approach like the e-GP system? The optimal solution in terms of efficiency and quality (Onosakponome 2011) is the factor to be considered in the e-procurement system. The primary purposes of this research are (i) to find the challenges experienced during the e-Procurement implementation, (ii) to compare the procurement efficiency of the manual purchase with the e-Procurement purchase, and (iii) to predict the significant effects of different factors that influence e-Procurement implementation. In this research investigation, the researcher considered the most significant development procurement entity (PE) (RHD 2020) of the Government of Bangladesh – the Roads and Highways Department (RHD). The primary motivation of this study is to fill the gap in the literature on the relative time and cost involvement of both systems. This study performs the independent sample t-test to find the efficiency in terms of TEC meeting arrangement time and cost perspective in RHD.

Problem statement

In 2011, Bangladesh's government began using e-procurement application software for public procurement, such as the e-GP system. The government's goal is to purchase all public goods, works, and services using e-Procurement software. Another goal is to attain 100% public procurement by 2020 via the e-tendering system (SFYP 2015). As a result, even after the e-Procurement system for public procurement is implemented, there may still be some bottlenecks that hinder the e-GP system from being adopted successfully.

After opening the tender documents by Tender Opening Committee (TOC) members, After all, it takes a long time for TEC members to arrange a meeting for the manual tender system. TEC members become reluctant because meeting document preparation for comparative study (CS) is time-consuming. Many papers and tender evaluation criteria have to be examined. Papers have to be photocopied for each TEC member, so cost is involved. The problem is that there is no comparison between the e-Procurement and manual tendering systems regarding the time and cost context of TEC meeting arrangements.

Rationale of the study

According to the literature review, no in-depth research has been done to compare the time and cost involved in the TEC meeting arrangements for manual and e-procurement bidding processes in RHD to determine efficiency. Furthermore, no extensive research has been conducted on examining the TEC meeting arrangement performance of the e-GP system over time since its start in 2011.

The study's results will assist academics, students, researchers, and PE officers. The ultimate goal (Becker 2018) is to undertake a Key performance indicator (KPI) based quality evaluation to identify potential flaws in future e-tendering processes. Therefore, based on the prior explanation, conducting this study is rational.

RELATED LITERATURE

E-GP system in Bangladesh

E-GP system is a secured web-based application software hosted in the CPTU data centre. The e-GP system is developed (CPTU FAQ 2020), through which PE and bidders perform the following procurement-related tasks.

- Publishing Annual Procurement Plan (APP)
- Inviting Tender
- Preparation of Tender documents/Tender Applications/Tender Proposals
- Tender Submission, Tender Opening, Tender Evaluation, Contract Award Notices
- Contract Management System
- Performance monitoring by PMIS

Turn to e-Procurement

E-Procurement (CPTU About 2021) is a paperless process in which the government, as a buyer, communicates with the bidder's community via secure web-based application platforms, free of any difficulties, delays, or physical insecurity (Sanewu, 2016).

According to Illias (Ilias 2021, p 2), e-procurement is the purchase of products and services through the use of the internet or an electronic network. The objectives of e-procurement are to increase transparency, accountability, boost bidding competition, support process monitoring and auditing, and meet the demand for up-to-date information.

E-Procurement outcomes

e-Procurement outcomes are commonly identified in the context of Bangladesh and other countries (Marcella 2006):

Intermediate outcomes:

- Better services
- Cost savings
- Time savings

TEC Roles and Responsibilities

The TEC meeting is significant in the tender process steps because the TEC meetings' decision will be a recommendation for awarding a tender to a responsive bidder. The head of procuring entity (HOPE) will give final approval based on TEC members' suggestions.

The Evaluation Committee's function is to carry out tenders or proposals' technical and financial evaluation. Tender "evaluation committee" means a Tender or proposal evaluation committee constituted under section 7 of PPA-2006. According to the Business Process Re-engineering (BPR) part of e-Guideline appendix 2, the TEC committee consists (CPTU 2011) of a chairman and at least two other members for the e-procurement system. In the e-GP system, TEC members get their dashboard after login in using their user name and password. According to 3.6.1.4 of e-Guideline, TEC members will get auto email and SMS after the user is created from the e-GP system. According to 3.6.2.3 of the e-GP Guideline, the e-GP system will generate a draft result of the evaluation that helps reduce the time and avoid the cost of paper printing. Evaluators will get the auto-generated report and take the TEC decision for HOPE approval. Point 3.6.2.5 of the e-Guideline revealed that TEC meetings could be held online or offline.

METHODOLOGY

The purpose of research design (Asenahabi 2019) is to convert a research problem into data that can be evaluated to produce meaningful answers to research questions. The investigation was carried out in four wings, eleven zones, thirty-one circles, and seventy divisions of Roads and Highways divisions (RHD). RHD PE officers provided primary data via survey questionnaire methodologies. A total of 402 respondents were included in the study, including PE officers and contractors. Regarding the time and cost-effectiveness survey, the 83 PE officers who replied to the questionnaire. The questionnaires used in the study were structured. A survey was conducted to assess the procurement effectiveness of manual and e-Procurement purchases in terms of time and cost. An independent sample t-test model was used to compare the procurement efficiency in time and cost contexts for the TEC meeting arrangements survey.

RESULTS AND DISCUSSION

T-test for comparing procurement efficiency between manual procurement and eprocurement

The researcher compared manual procurement efficiency with the e-Procurement of the RHD in *TEC meeting arrangement* perspective in the context of time and cost. The study's objective helped assess the improvement of saving time and cost in public procurement after using the e-GP system. For inferential analysis, the *independent samples t-test* was done to test the comparison of two groups based on the mean value.

Details SPSS interpretation and observations are-

TEC meeting arrangement time

Here, Test Variable(s) i.e. two independent variable(s) are:

TEC meeting arrangement time (e-GP system) and TEC meeting arrangement time (manual system) whose means have been compared between the two groups.

Let consider, Null hypothesis $H_0: \mu_1 = \mu_2$

Alternative hypothesis $H_a: \mu_1 \neq \mu_2$

μ_1 = population means for TEC meeting arrangement time for e-tender.

μ_2 = population means for TEC meeting arrangement time for the manual tender.

Significance level $p=\alpha = 0.05$

Confidence interval level = 95%

T-Test results and Interpretation-

Table 1 Group statistics for TEC meeting arrangement time

	Tender Type	N	Mean	Std. Deviation	Std. Error Mean
Hour	Etender	83	2.0033	3.72437	.40880
	Manual	83	5.1464	4.59154	.50399

Source: Researcher's Field Survey, 2020

Group statistics of **Table 1** show that the average TEC meeting arrangement time, i.e. mean value for e-tender time and manual system time, are 2.0033 & 5.1464 days, respectively. This indicates that *the present e-tender TEC meeting arrangement time is lower than the manual TEC meeting arrangement time*.

Table 2 t-test for comparing TEC meeting arrangement time between e-tender and manual tender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hour	Equal variances assumed	6.167	.014	-4.843	164	.000	-3.14313	.64894	-4.42449	-1.86178
	Equal variances not assumed			-4.843	157.304	.000	-3.14313	.64894	-4.42489	-1.86137

Source: Researcher's Field Survey, 2020

But from the Independent Samples T-Test **Table 2**, we observed from Levene's test that the F value is 6.167 & its Sig. value is 0 .014. Here, the sig value (.014) is less than the p-value (0.05), i.e., significant. This indicates that equal variances are not assumed here and rely on the second row of output.

The second-row t value is -4.843, negative, left tailed & the Sig. (2-tailed)/2 = 0.000/2= 0.000. Here, the sig value is less than the p-value, which is significant. This indicates that the Null hypothesis H_0 is rejected & the alternative hypothesis H_a is accepted, i.e. $\mu_1 \neq \mu_2$. This states that the *e-tender* TEC meeting arrangement *average time is not equal to the manual* TEC meeting arrangement *average time.*

TEC meeting arrangement cost

Here, Test Variable(s) i.e. two independent variable(s) are:

TEC meeting arrangement cost (e-GP system) and TEC meeting arrangement cost (manual system) have been compared between the two groups.

Let consider, Null hypothesis H_0: $\mu_1 = \mu_2$

Alternative hypothesis Ha: $\mu 1 \neq \mu 2$

μ_1 = population means for TEC meeting arrangement cost for e-tender.

μ_2 = population means for TEC meeting arrangement cost for manual tender.

Significance level p=α = 0.05

Confidence interval level = 95%

Table 3 Group statistics for TEC meeting arrangement cost

	Tender Type	N	Mean	Std. Deviation	Std. Error Mean
Taka	Etender	83	4742.1687	3824.25253	419.76625
	Manual	83	5968.6747	4094.84142	449.46724

Source: Researcher's Field Survey, 2020

Group statistics of **Table 3** shows that the average TEC meeting arrangement cost i.e. mean value for e-tender cost and manual system cost is taka 4742.1687 & 5968.6747, respectively. This indicates that the present e-tender TEC meeting arrangement cost is lower than the manual tender TEC meeting arrangement cost.

Table 4 t-test for comparing TEC meeting arrangement cost between e-tender and manual tender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Taka	Equal variances assumed	.321	.572	-1.994	164	.048	-1226.50602	614.99960	-2440.84399	-12.16806
	Equal variances not assumed			-1.994	163.239	.048	-1226.50602	614.99960	-2440.88605	-12.12600

Source: Researcher's Field Survey, 2020

But from the Independent Samples T-Test **Table 4**, we observed from Levene's test that the F value is .321 & its Sig. value is 0 .572. Here, sig value (.572) is greater than p-value (0.05), i.e. which is not significant. This indicates equal variances assumed here and relied on the first row of output.

The first-row t value is -1.994, negative, left tailed & the Sig. (2-tailed)/2 = 0.048/2= 0.024. Here, the sig value is less than the p-value, which is significant. This indicates that the Null hypothesis H_0 is rejected & the alternative hypothesis H_a is accepted, i.e. $\mu_1 \neq \mu_2$. This states that the e-tender TEC meeting arrangement average cost is not equal to the manual TEC meeting arrangement average cost.

CONCLUSIONS

The study focused on public procurement efficiencies like TEC meeting arrangement time and cost. Primary data was collected from respondents who worked as PE officers in RHD. The t-test sig value is smaller than the p-value of .05 which is significant in the cases of procurement tender TEC meeting arrangement time and cost context. Therefore, the null hypothesis H_0 has been rejected, and the alternative hypothesis H_a has been accepted. Furthermore, the analysis explored a time and cost comparison between the manual tendering system and the e-procurement system in terms of efficiency. Therefore, the t-test result of this study showed that e-procurement in RHD saved time and reduced cost at the tender process level of TEC meeting arrangement. In addition, this study makes a novel contribution by encouraging all procurement entity (PE) offices to use e-procurement for public purchases.

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