

Assessment of Electronic Procurement Practices on Project Delivery, Case Study of Selected Construction Companies in Oyo State

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ABSTRACT

This study investigated the use of e-Procurement in selected construction firms in Oyo state, Nigeria. The data were derived using a well-structured questionnaire survey involving 104 respondents. Descriptive statistical and correlation analyses were used to analyze the data. Findings show that the use of electronic procurement in the selected construction firms for carrying out procurement function is high with majority of the professionals affirming the use of the system, the four categories of e-Procurement used were e-mail, static websites, web.2.0 technologies and portals that have capabilities of supporting the execution of functions limited to intra and inter firm communication and exchange of project information and data. Consequently, between 84 percent and 76 percent of the respondents used these e-Procurement technologies for communication of information, exchange of bill of quantities, project reports, CAD drawings and project specifications. Consequently, factors with the highest positive impacts on the use of these technologies in the firms were the speed of transactions, lower transaction cost and ease of use. The study implies that the selected construction firms in Oyo state Nigeria predominantly use e-mails and websites to support the execution of pre-award phase of construction procurement. Finding also shows that there is positive relationship between e-Procurement (e-Notifying, e-Exchange, and e-Submission of bid) and Project delivery. The study suggests that to accelerate the rate of uptake of e-Procurement and maximize its benefits in the Nigerian construction industry, there is a need to improve the quality and quantity of ICT infrastructure across the country; and to embark on aggressive enlightenment campaigns, training and skill development programs in the use of e-Procurement in the construction industry in this country.

Keywords : Procurement, Construction, Construction Companies, Project Delivery, ICT.

I. INTRODUCTION

The construction industry is categorized as being an information-intensive industry and described as one of the most important industries in any developed country, facing a period of rapid and unparalleled change, Industry Science Resources [9]. According to Ibe, Aduwo, Tunji – Olayeni, Ayo – Vaughan and Uwakonye [8], the advent of the Internet in the 1990s, has led to the increase in the use of Internet-

supported information and communication technologies (ICTs) by construction firms to manage intra and inter-firm activities. However, one aspect of this development that has shown great potential for improving the performance of the construction industry is the use of electronic communications and transaction processes when buying supplies and services or conducting tendering for works, which is referred to as electronic (e-) Procurement Bauasa, Kourtidis, Liljemo, Loozen, Rodrigues and Snaprud

[2]. The e-procurement golden book defines electronic procurement (e-procurement) as the use of electronic communications and transaction processes to buy supplies and service or conduct tendering for works Bauasa et al., [2].

The UN Procurement Practitioner's handbook UN [17] identified two main phases in the e-procurement process. These are the pre-award phase comprising e-Notification; e-Submission; e-Evaluation; and e-Awarding; and the post award phase consisting of activities such as e-Ordering; e-Invoicing; and e-Payment. Each activity in these two phases can be executed using a wide range of e-Commerce communication media and/or e-Procurement technologies and tools.

The adoption of e – Procurement in the construction industry as opined by Laryea and Ibem [11] is an innovative approach in maximizing the potentials of the industry. Hashim, Said, and Idris [7] in their research into the value of e – procurement in Malaysia stated that the benefits of e – procurement in the construction industry includes; an increase in process quality, reduced procurement cost, user satisfaction, increased responsiveness, improved customer service, product innovation, market expansion, reduction in purchasing cycle time, reduction in staff time and managerial effectiveness. In the UK, Eadie, Perera and Heaney [5] as cited by Ibem et al [8] observed that in public and private sector organizations, there was a correlation between the size, procurement spending and sector an organization belonged to and e-Procurement use. The authors found that the perceived benefits in time and cost savings, increased quality, visibility in the supply chain, efficiency, and effective communication associated with e-Procurement were the key factors that influenced e-Procurement use. Apart from the studies on the potential applications of e-Commerce in South African Construction Industry, Chege, Coetzee and Malachi [4] and e-Tendering in Nigeria,

Oyediran and Akintola, [13], there is a paucity of published empirical studies on e-Procurement in construction supply chain management; and the key issues associated with it in the African context. As a result, very little is known of e-Procurement use in the construction sectors of African countries.

Several research efforts have been concentrated on the implementation of information and technology tools in the Nigerian construction industry. However, no prior attempt has been made at assessing the factors, challenges and opportunities of e procurement fully especially the pre award phase of e-Procurement which include (e-Ordering; e-Invoicing; and e-Payment) or quantifying the level of benefits being achieved or the problems being experienced by industry stakeholders who have been using electronic means to perform procurement functions as the traditional procurement method is still dominant in the Nigerian construction sector and this trend may likely continue. The adoption of Information Communication Technology (ICT) in the construction industry has nonetheless been found desirable borrowing from its impact in other sectors of the economy, especially the services sector.

The aim of this study is to investigate the use of e-Procurement technologies and tools to conduct construction procurement activities related to execution e- Notification, e-Exchange and e-Submission towards a successful Project Delivery with the following objectives;

1. To identify categories of e-Procurement technology and tools are more widely used to execute execution e- Notification, e-Exchange and e-Submission aspects of Project delivery by firms in Oyo state
2. To establish the effect of e-Procurement practices (execution e- Notification, e-Exchange and e-Submission) on Project delivery.

- To ascertain the factors that have positive influence on the use of e-Procurement in Oyo state

The study would help contractors, project managers, clients and all parties involved in construction projects about ways of improving their current method of e-Procurement (execution e- Notification, e-Exchange and e-Submission). This research will also serve as a resource base to other scholars and researchers interested in carrying out further research in this field subsequently, if applied would go to an extent to provide new explanation to the topic

II. REVIEW OF LITERATURE

Procurement implies gaining merchandise as well as administrations from an outside source. The term obtainment is broadly utilized as a part of government; numerous privately owned businesses utilize the terms buying and outsourcing, Almadani [1]. In today's market, many organizations introduce themselves to the world by means of their web website; they delicate and react to tenders utilizing web-empowered innovations, oversee and control their bookkeeping and data trade utilizing electronic means, and they additionally utilize groupware web advancements for sharing learning, basic leadership, coordination, and venture control. Moving from paper-based to question situated information models has changed a great part of the acquisition procedure and enhances production network reconciliation, Walker & Rowlinson, [18]. Moon [12] stated that e-procurement is a described as a comprehensive process in which IT system has been used to establish agreements for the acquisition of products or services (contracting) or purchase products or services in exchange of payment(purchasing). E-procurement has various elements like electronic ordering, internet bidding, purchasing cards, reverse auctions and integrated automatic procurement systems.

Forms of E-Procurement

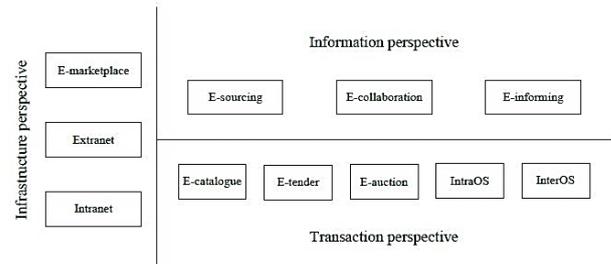


Figure 1. descriptive model describing forms of E-procurement

The diagram above is a descriptive model describing the most common forms of e-procurement, Boer, Harink and Heijboer [3]. The model presents the forms of e-procurement from three main perspectives: information, transaction, and infrastructure. The information perspective focuses on the use of e-procurement in facilitating information flows (e.g., informing suppliers regarding the next reverse auction date via e-mail). These perspective of e-procurement are e-sourcing, e-collaboration, and e-informing (Boer et al. [3]; Knudsen, [10]; Reunis [14]; Schoenherr & Tummala, [15]). The transaction perspective focuses on the use of e-procurement in facilitating transactions (facilitating cash flow, e.g., when purchasing goods or services at an e-auction). The main forms these perspective of e-procurement are e-catalogue, e-tender, e-auction, Intra OS, and Inter OS (Boer et al., [3]; Knudsen, [10]; Reunis [14]; Schoenherr & Tummala, [15]; Teo, Lin and Lai [16]). Finally, the infrastructure perspective refers to packaging and securing e-procurement functionalities (e.g., an e-marketplace secures access to e-auctions and ensures that they are easy to find). Common infrastructure environments used to enable and to control access to e-procurement functionalities are e-marketplace, intranet, and extranet (Boer et al., 2002).

III. RESEARCH METHODOLOGY

In line with the research title, the population for this study involves all the employees of the selected

construction companies in Ibadan metropolis, Oyo State which involves Lumia consult ltd, Ratcon Construction, Reynolds Construction company, Kopek construction company, Detos infinity ltd, Sapient construction company. The use of questionnaire were employed in getting relevant data's from them. The entire professionals in the population were given equal chances of being included in the sample. A sample of one hundred and forty one (141) construction professionals would be used; convenience and random sampling method were used for the research. The study will cover a sample of the following level of profession; Architect, Client, Contractor, Construction/ Project Manager, Engineer, Quantity Surveyor and Procurement/ Supply Chain Official.

To get the sample size the Yaro Yamani (1964)

method was used. Which is $n = \frac{N}{1+Ne^2}$

Where;

n = sample size,

N= population size,

e = Level of significance (error),

1= A constant number. For the purpose of this study, our level of significance (e) = 5% or 0.05, that is 95% confidence limits. Since n=?

N=141,

e = 0.05

Substituting the above value into the formula

$$n = \frac{141}{1+141(0.05)^2}, \quad n = \frac{141}{1+141(0.0025)}, \quad n = \frac{141}{1+0.3525}, \quad n = \frac{141}{1.3525} = 104$$

The sample size of the population is 104 and the researcher issued the same number of questionnaire to the staffs of the companies to answer. The entire questionnaire issued to the issued to the sample size was collected immediately because of the method of collection to determine the minimum number of respondents from each of the section of work in the

population. Bowely's proportional allocation formula was applied thus:

$$n_1 = \frac{n_1(n)}{N}$$

Where

n1= number of each company, n= total sample size,

N= Population

The populations of the construction companies are as follows and using the Yaro Yamani Sample size calculation formula, a sample size of 104 was derived and the Bowley's Proportional allocation formula was applied to determine the number given to each company as stated below.

Table 1. Populations of the selected construction companies

S/N	COMPANY NAME	POPULATION	Sample size for each company.
1	Lumia consult ltd.	15	11
2	Ratcon construction company	28	21
3	Reynolds construction company	36	26
4	Kopek construction company	24	18
5	Detos infinity Ltd.	21	15
6	Sapient construction company	17	13
Total		141	104

The descriptive statistics and inferential statistics analysis method was used for the analysis of the data collected. The software that would be used to carry

out this analysis is the Statistical Package for Social Sciences (SPSS).

IV. RESULTS AND DISCUSSION

1) Demographic information of the Respondents

Approximately 63% of the respondents for this study were male while Female constitutes the remaining 37%. This may be attributed to the stereotype that the construction industry is a male dominated industry in the study area. It is shown that majority of the respondent (50.6%) were single, (48.1%) were married and only (1.3%) divorced. This shows that there are more singles in the 6 construction companies in question than married men, while only a meager percentage of the respondents are divorced. It is evident that the survey covered key stakeholders in the Nigerian construction industry. However, of the 104 respondents, the majorities (31%) were contractors, Followed by Engineers (19%), Quantity surveyor (14%), Supply Chain Officers (13%), Architects (11%), Project Managers (7%) while only 6% clients. This shows that there are more engineers and contractors in the construction industries than Architects and project managers, this may be due to the fact that engineers and contractors dominate the field and the fact that they do more of the technical work in the industry

Level of E-Procurement Awareness and usage

From the research conducted, it was observed that 85 (82%) of the professionals are aware of the use of e-procurement in Ibadan, Oyo state while the remaining 19 (18%) professionals are not even aware of the use of e-procurement System. Out of the 85 professionals that are aware of the use of electronic procurement in the construction industry, 60 of those professionals (71%) have used the system in carrying out procurement function while the remaining 25 (29%) have not used it before. This also show that e-procurement is becoming widely adopted in construction companies in Ibadan metropolis of Oyo state as majority of the professionals have used the

system to carry out one procurement function or the other. The research shows that 84% of those that have used e-procurement (50) used it to announce and notify clients or partners about the project, while the remaining 16% claimed not to have used it to notify or announce before. The use of e-procurement system to notify partners, clients or project team members is also discovered to have a high adoption rate in the construction industries in focus.

Table 2 shows that Email system (36%) is the most widely used tool to announce and notify contractors and partners, followed by Portals (30%), Website based system having only 10% and Web 2.0 having the least percentage of 7%.

Table 4.2 E-Procurement System and tools for announcing and notifying

	Frequency	Percentages
Emails	18	36%
Portals	15	30%
Website Based	10	19%
Web 2.0	7	15%
	50	100%

Source: Field survey 2016

The use of E-procurement to exchange project information

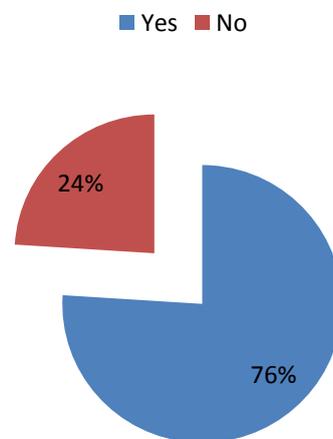


Figure 2

Figure 2 above shows from the research that 76% of those that have used e-procurement (47) used it to share variety of project information such as specifications, CAD drawings, Architectural drawings etc, while the remaining 24% claimed not to have used it to exchange project information before. This shows the adoption of e-procurement system to exchange project information is high among construction professionals. From the research carried on in this study, it was discovered that Bill of quantities was the most shared project information (93%), project report (86%), Specifications (74%), CAD drawings (67%), Work program (58%), Tender documents and proposals (48%), while payment certificates has the least percentage of 34%. (Table 3)

Table 3. Project Information shared on E-procurement tools.

Project Information**	Percentages
Bill of quantities (n=44)	93%
Project report(n=40)	86%
Specifications (n=35)	74%
CAD drawings (n=31)	67%
Work program (n=27)	58%
Tender documents and proposal (n=23)	48%
Payment certificate (n=16)	34%

Table 4. Factors influencing the use of e-Procurement technologies and tools

	Mean	Stand. Dev	Rank	Influence
Greater speed of transaction in e-Procurement	4.05	0.89	1 st	High
Lower cost of transaction in e-Procurement	3.97	0.91	2 nd	High
Easy for consultants and contractors to respond electronically to job requirements	3.79	0.94	3 rd	High
It is easy to use electronic procurement systems and tools	3.68	0.95	4 th	Medium

****Multiple responses**

Source: Field survey 2016

The use of E-procurement to carry out tendering and bid proposals submission

The research also shows that 64% of those that have used e-procurement used it submit bids and carrying out the tendering process, while the remaining 36% claimed not to have used it to submit bids neither have the used it to carry out the tendering process. This analysis shows that although e-procurement system is being used to carry out tendering process, it is the least adopted with only 64% of the professionals using the system as compared to the use of the system for e-Notifying and e-Exchange whose adoption rate is above 75%. Analysis of the system and tools used in carrying out the tendering process and bid submission process shows that the e-mail system has the highest percentage of 31%, while the least used of these system and tools is the web 2.0 which has 12%

Factors influencing the use of e-Procurement technologies and tools

Table 4 presents a summary of the factors that influenced the adoption of the e-Procurement technologies and tools amongst the respondents arranged in the order of importance.

Availability of adequacy of technological and internet infrastructure to support the use of electronic procurement	3.64	1.01	5 th	Medium
Reliability of electronic procurement systems and tools	3.64	0.84	6 th	Medium
Compatibility of Electronic procurement systems and tools with the existing organizational policies and processes	3.57	0.87	7 th	Medium
The ease of integration of e-Procurement systems and tools into the existing organizational processes	3.53	0.93	8 th	Medium
Availability of good institutional and organizational infrastructure to promote the use of electronic procurement	3.53	0.93	9 th	Medium
The ease at which consultants and contractors engage with electronic procurement systems and tools	3.51	0.94	10 th	Medium
Adaptability and willingness of people to switch to the use of electronic procurement systems and tools	3.38	0.98	11 th	Low
Interoperability of different e-procurement systems and tools	3.29	0.84	12 th	Low
Availability of favorable public policies to promote the use of electronic procurement in Nigeria	3.24	1.01	13 th	Low
Security and data protection challenges in the use of e-procurement	3.23	0.94	14 th	Low
Ease of transitioning from paper-based procurement to electronic systems and tools	3.19	1.01	15 th	Low

Source Field survey 2016

Effect of e-notifying on Project delivery

The Pearson product correlation coefficient was employed in establishing the relationship between E-notifying and organizational project delivery as shown in table 5 below. The coefficient of correlation (r), showed a positive correlation (r=0.345) and coefficient of determination (r²= 0.119) which shows that (11.9%) change in E-notifying can be explained by a unit change in Project delivery. Similarly, the Pearson product correlation coefficient was employed in establishing the relationship between Electronic exchange and Project delivery as shown in table 6

below. The coefficient of correlation (r), showed a positive correlation (r=0.462) and coefficient of determination (r²= 0.213) which shows that (21.3%) change in project delivery can be explained by a unit change in e-exchange process. The Pearson Product-Moment Correlation Coefficient was also used in the

analysis to establish the relationship between the variables constituting E-bidding and those other variables constituting Project delivery as shown in table 7 below. The coefficient of correlation (r), showed a very weak positive correlation (r=0.197). The positive nature of the correlation means that as the firm intensifies effort into the E-bidding, Project delivery also increases.

		E-exchange	Project Delivery
E-exchange	Pearson Correlation	1	.462**
	Sig. (2-tailed)		.000
Project delivery	Pearson Correlation	.462**	1
	Sig. (2-tailed)	.000	

** . Correlation is significant at the 0.05 level (2-tailed).
Source: Field survey 2016

V. CONCLUSION

First, the study shows that of the 104 respondents who participated in the survey, 84 percent of them have used e-Procurement systems and applications to receive or disseminate information on tender opportunities, while around 76 percent of them have engaged in the exchange and submission of construction project information and data electronically. The four categories of e-Procurement technologies used were e-Mails; static websites, Web 2.0 technologies and portals. These categories of e-Procurement technologies are similar to those identified in previous studies (Ibem et al [8]; Oyediran and Akintola, [13] and Laryea and Ibem, [11]). This result suggests that there is generally a high usage of e-Procurement systems and applications to support the execution of these three aspects of construction procurement activities in Nigeria; and the e-Procurement use in this country is at its infancy. Comparing this result with Eadie et al. [5] that revealed 27% adoption rate; and that the private sector was lagging behind the public sector in the adoption of e-Procurement in the South African construction industry; it can be established that there is 84% adoption rate of e-Notification aspect of e-Procurement in construction and that the private sector is taking the lead in Ibadan Metropolis area of Oyo state Nigeria.

In addition, the result also reveals that among those who have used e-Procurement systems and applications to execute e-Notification, e-Exchange of information and e-Submission of project information and data, the most commonly used applications were e-mails recording 32%, 30% and 31% of the respondents, respectively followed by websites and portals. This shows that a greater percentage of the respondents used e-mails to exchange project information and data. Notably, e-mail and websites have been identified by Laryea and Ibem [11] as network technologies that facilitate the transfer and/or exchange of project data and information among participants in construction projects.

Second, the study also found that the respondents used the four categories of e-Procurement systems and applications identified in this study carry out two basic kinds of procurement tasks, namely; communication; and exchange seven different types of project data and information. The result specifically shows that 93% of the respondents indicated that they used these applications to exchange or submitted bill of quantities followed by 83 % and 74% of the respondents who used them to exchange project reports and project specifications, respectively.

This suggests that the three basic of project information exchanged electronically are bill of quantities, project reports and specifications. This

		E-Notifying	Project Delivery
E-Notifying	Pearson Correlation	1	.345**
	Sig. (2-tailed)		.002
Project Delivery	Pearson Correlation	.345**	1
	Sig. (2-tailed)	.002	

** . Correlation is significant at the 0.05 level (2-tailed).

finding is similar to the practice in the UK where Eadie et al, [6], [5] reported the use of these e-Procurement technologies and tools in the exchange of project information between clients and contractors.

Furthermore, it is also evident from the study that of the 15 factors considered to have influence on the use of the identified e-Procurement technologies and tools, four of them (i.e. factors 1, 2, 6 and 14) are related to the relative advantage of e-Procurement over paper-based method; three factors (7, 8 and 12) are related to compatibility of e-Procurement with the existing work process; while five factors (i.e. 3, 4, 10 11 and 15) deal with the ease of use (complexity) of e-Procurement technologies. This finding suggests that the main reasons who claimed to be using the identified e-Procurement technologies in the study area are linked to the advantages of these technologies over the paper-based method in terms of speed of transaction, lower transaction cost and ease of use.

VI. RECOMMENDATION

First, there is a need to improve the quality of, and access to ICT infrastructure and increment in level of awareness and personnel trainings across the country. With the migration of e-Procurement technologies to the cloud framework in multiple realms, manifesting in anywhere access and cost effective applications; improving access to Internet facilities must be considered as part of a core strategy to promote e-Procurement use in the Nigerian construction sector. Countries like the UK, USA, Australia and Canada known to be leading adopters of e-Procurement in construction have ubiquitous access to reliable internet facilities and this has contributed to critical mass uptake of e-Procurement in these countries.

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