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E-PROCUREMENT ADOPTION IN THE NIGERIAN BUILDING INDUSTRY: ARCHITECTS' PERSPECTIVE

¹Eziyi O. IBEM, ²Egidario B. ADUWO, ³Emmanuel A. AYO-VAUGHAN

^{1,2} Department of Architecture, College of Science and Technology, Covenant University
Ota, Ogun State, Nigeria, e-mail: ¹ibem.eziyi@covenantuniversity.edu.ng
²egidario.aduwo@covenantuniversity.edu.ng
³ Department of Architecture, Bells University and Technology University, Ota
Ogun State, Nigeria, e-mail: ³kunlevaughan@gmail.com

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Abstract: e-Procurement adoption by architects in the Nigerian building industry was investigated using data derived via a questionnaire survey of 75 architects in consulting and contracting firms, government and clients' organizations. The data were analyzed using descriptive statistics, Pearson product-moment correlation and content analyses, and the results reveal that most of the organizations employing architects were not using e-Procurement. However, the very few adopters identified used e-mails and websites in communicating, exchanging project information, and sourcing for building services, materials and equipment. The key barriers to the uptake of e-Procurement among architects in the survey were unreliable power supply, low level of awareness among people; and the lack of forum to exchange ideas on e-Procurement use. The paper emphasized the need to address these challenges to ensure a critical mass uptake of e-Procurement by architects in Nigeria.

Keywords: e-Procurement, Building projects, Architects, Nigeria

1. Introduction

One of the principal roles of the architect in building procurement process is the management of the relationships between the design disciplines and those between the design team, the construction team and other specialist suppliers or subcontractors [1]. As a service-oriented profession, one aspect of Information and teleCommunication Technologies (ICTs) application that can assist architecture practitioners to achieve success in the design and construction management tasks is electronic (e-) Procurement. e-Procurement refers to the use of electronic communications and transaction processes to buy supplies and services or conduct tendering for works [2]. It is an aspect of e-

Commerce that involves the use of the Internet-based ICTs to support the execution of individual or all stages of procurement activities, including e-Notification, e-Tendering, e-Submission, e-Award, e-Sourcing, e-Invoicing and e-Payment.

Although *Klinc et al.* [3] have observed that the construction industry is relatively in the early phase of adopting modern web-based technology, *Tepavčević et al.* [4] reveal that in the past two decades, digital technology has rapidly changed architectural practice. This has resulted in the increasing adoption of web-based technologies and transaction processes in the Architecture, Engineering and Construction (AEC) industry. The benefits of web-based technologies in construction supply chain management have been identified to include increase in process quality and flexibility, reduction in procurement cost and time, increase user satisfaction, improved customer service and managerial effectiveness; reduction in errors, fraud and corruption as well as promoting faster response time[5], [6]-[10].

In Nigeria, issues related to e-Tendering in construction [11], the barriers to e-Procurement adoption [12] and the factors influencing the adoption of e-Procurement [13] in the building industry have been investigated. However, there is very little understanding of the extent to which architects use e-Procurement in the building industry.

In view of the fact that the society is increasingly adapting itself to new situations and technologies [14], there is a need to understand how the architecture profession is aligning itself with current developments in the use of web-based technologies. Therefore, the aim of this study was to investigate e-Procurement adoption among architects in the Nigerian building industry. The key research questions addressed in this research are:

- What are the levels of awareness and adoption of e-Procurement by professional architects in Nigeria?
- To what extent do professional architects in Nigeria use e-Notification, e-Submission, e-Sourcing and e Payment aspects of e-Procurement?
- What are the perceived barriers to e-Procurement adoption by architects in Nigeria?

This study contributes to knowledge by providing a fresh insight into the diffusion and adoption of e-Procurement among architects in Nigeria. It also improves understanding of the perceived barriers to e-Procurement adoption from architects' perspective. Findings of this research have implications for architectural education and practice and add to the current discourse on e-Procurement in construction.

2. Review of related literature

2.1. Theoretical foundation

A review of the published literature shows that the use of ICTs in construction is innovation adoption. Consequently, several theoretical frameworks related to innovation adoption have been used in research on e-Procurement use in construction. *Oliveira and Martins* [15] however explained that in terms of innovation adoption at organizational

level, the Diffusion of Innovation Theory (DIT) and the Technology, Organizational and Environmental (TOE) framework are the most commonly cited theories.

The DIT posits that there are five steps in the process of innovation adoption. These are awareness, attitude formation, decision, implementation, and confirmation [16]. The first step, which is awareness, is defined as the extent to which an adopting unit has knowledge about the existence of an innovation, provided with information on how it functions and its potential benefits and forms a general opinion of what it is [16], [17]. This suggests that there is a relationship between the levels of awareness and adoption of an innovation. In addition, *Rogers* [16] also identified the five attributes of innovation that affect its adoption by individuals or organizations to include its relative advantage, compatibility, complexity, observability, and triability. *Rogers* [16] made it clear that the relative advantage of an innovation is the degree to which it is perceived to be better than the existing idea, practice, knowledge or tool in bringing benefits to an organization, while compatibility is the extent to which the innovation is consistent with existing business processes, practices and values systems in an organization. He also noted that the complexity is the degree to which people perceive an innovation to be difficult to use; observability is the degree to which the results of the adoption of an innovation are visible to others, while triability is the degree to which an innovation can be experimented with on a limited basis. These suggest that the attributes e-Procurement technology can constitute either drivers or barriers to its adoption depending on how it is perceived by potential adopters like organizations or individuals.

Further, *Rogers* [16] was also of the view that other factors like the type of innovation adoption decision; how the potential adopters become aware or are informed about the innovation (communication channels); the characteristics of the adopting units; and how the innovators, their representatives or trading partners try to sell the innovation to potential adopters can also affect the diffusion and adoption of an innovation. By implication, factors within and outside organizations can promote or inhibit innovation adoption.

The foregoing submission is consistent with the TOE framework, which indicates that several technological, organizational and environmental factors influence the decision by an organization to adopt an innovation [18]. The technological factors represent the existing and emerging technologies in the organization and may include current practices, equipment and technologies, while the organizational factors include management structure, organizational size, scope of activities and resource base [16]. This means that on the one hand, there is a relationship between the level of awareness of e-Procurement and its adoption by the industry or business organizations. On the other hand, the existing literature indicates that a gamut of factors related to the attributes of e-Procurement technology and factors within and outside the organizations play active roles in inhibiting or promoting its adoption.

2.2. e-Procurement and barriers to its adoption in construction

Although the construction industry is generally regarded as a late adopter of Information Technology (IT) when compared with other industrial and business sectors like manufacturing and retailing [3], a survey of literature reveals that the quantum of literature on e-Procurement use and barriers to its uptake in construction is on the

increase. For examples, *Chege et al.* [19] and *Aranda-Mena* [20] carried out reviews of the published literature on the barriers to e-Procurement adoption in construction in South Africa and Australia and globally, respectively. These two studies identified the key barriers to the adoption of this technology in construction to include, the lack of understanding of how to create an enabling environment to allow small, medium micro-sized enterprises to reap the benefits of e-Commerce; security concern; taxation; legal barriers; accessibility to e-Commerce systems; and the lack of technical standardization of e-Commerce systems. Others were low or lack of awareness of e-Procurement, dearth of requisite skill and evidence-based literature on financial benefits and legal issues in e-Procurement use.

Issa et al. [21] carried out questionnaire survey of 91 contracting firms to determine the level of adoption of e-Business within their project management systems in the USA. The study revealed that around 70% of the respondents used project management software packages, 65% used Extranet/Intranet; 60 % used the Internet, around 80% of them used e-mail and fax in communicating with their partners; and 55% used Electronic Data Interchange (EDI) for communication and exchange of data. In the neighboring Canada, *Rankin et al.* [6] undertook a questionnaire survey involving 226 general and trade contractors, suppliers and their associates on the use of e-Procurement. Around 94% of the participants were found to be engaged in the use of the Internet in searching and finding production information, around 77% of them were responding to bidding opportunities and 70% were transferring bidding information and documents online electronically. The participants identified barriers to e-Procurement adoption to include (i) difficulties in integrating e-procurement systems with the existing work process and procurement system; (ii) information technology investment costs; (iii) resistance to change by people in the industry; (iv) the lack of business relationship with costumers due to low level of personal contact. Others were barriers believed to have been created by vendors or suppliers; the issue of ownership of information used in tender process (copyright), security concern; the unreliability of technologies; negative impact of e-Procurement on the organization and the lack of confidence in the new technology.

Zuo and Seo [5] carried out a survey of 127 contractors, sub-contractors, clients, consulting engineers, suppliers, facility/asset managers and quantity surveyors on the application of e-Commerce technologies in construction supply chain in Australia. All the respondents indicated that they used e-mail, 37% used Intranet and 30% used extranet to support the execution of online search; exchange of CAD drawings; project management; placement of orders; and receiving bid invitation and tender online. The barriers to the use of these applications were identified as the reluctance/inability to adopt computer technologies among sub-contractors and suppliers, the lack of in-house technical expertise and personnel the existence of different organizational culture; the lack of integrated information management system; and fear of implementing a business process change. *Isikdag et al.* [22] investigated the barriers to e-Procurement adoption in the Turkish AEC industry. The authors identified the barriers to e-Procurement adoption to include resistance to change; the lack of upper management support, technical expertise and trust between parties in the electronic commerce and the legality of e-Procurement contracts. Others were the security in the process-data transmission to the wrong person; lack of confidentiality of information-unauthorized viewing and

bodies supporting the shift towards e-Procurement; the lack of best practice studies and pilot projects and training regarding the implementation and use of e-Commerce systems.

In the UK, *Eadie et al.* [7] relied on a web-based survey of 70 contracting firms to investigate the use of fully web-based system and the Compact Disk Read once (CDR) in construction in Northern Ireland. They found the use of these applications to support the exchange of contract documents between clients and contractors. The barriers to the use of the system and CDR were legality of e-Procurement contracts; company culture; the lack of upper management support, access to IT infrastructure; technical expertise and business relationship with suppliers providing e-procurement. Others were high cost of IT systems, security of transactions; and lack of interoperability of e-procurement systems. Again, *Eadie et al.* [8] also investigated the reasons for the low uptake of e-Procurement in construction in the UK from the perspective of Quantity Surveyors (QS). That study revealed that QS perceived the key barriers to e-Procurement use to include (i) investment in compatible systems; (ii) the lack of widely accepted e-Procurement software solution, upper management support, technical expertise and flexibility, lack of pertinent case law in the use of e-Procurement; (iii) other competing initiatives magnitude of change required; (iv) insufficient assessment of systems prior to installation; and (v) different national approaches to e-Procurement. Other barriers identified were related to the issue of clarity of sender and tenderers information; security in the process-data transmission to the wrong person; proof intent- electronic signatures; lack of confidentiality of information resulting from unauthorized viewing; incorrect reassembly of data transmitted in packets; the lack forum to exchange ideas on e-Procurement; and staff turnover. Another study by *Eadie et al.* [9] involved a survey of 483 surveyors, 42 public sector clients, 172 architects, 35 private sector clients and 43 consulting engineers on the use of e-Procurement in the public and private sectors of the UK construction industry. They found that around 53% of those sampled who were mainly contractors in roads service, received between 11% and 30% of documentations electronically. The authors concluded that e-Procurement adoption rate across the UK construction industry was around 27%; and that the private sector lagged behind the public sector in the e-Procurement use in construction.

In South Africa, *Ibem and Laryea* [23] used online questionnaire survey of 603 architects, engineers, quantity surveyors, project managers, contractors, client organizations and procurement officers to investigate e-Procurement adoption in that country's construction industry. They identified the three most widely used e-Procurement technologies to be e-mail, websites, and portals; and that between 11% and 12% of the respondents used these technologies for communication, exchange of bill of quantities, CAD drawings and project specifications. The factors with the most positive influence on the use of these technologies were the speed of transaction, lower transaction cost and ease of use, while unreliable IT infrastructure, established cultures and security concerns were the main barriers to e-Procurement use in that country.

Aduwo et al. [12] examined the barriers to the uptake of e-Procurement in the Nigerian building industry using a questionnaire survey of 213 consulting firms, contractors, client organizations, and government establishments. That study found out that the five significant predictors of e-Procurement adoption by the organizations in this country were (i) the organizations' turnover; (ii) technical, infrastructure, political,

social and cultural issues; (iii) lack of top management support; (iv) the inability of the participants to understand the benefits of using e-Procurement; and (v) the level of awareness on e-Procurement use. That study also identified the barriers to e-Procurement uptake to be related to technical, infrastructure, political, social, and cultural issues; the lack of information technology savvy personnel, interoperability, uniform standards and high cost of e-Procurement technologies; the lack of top management support and understanding of the benefits of using e-Procurement in construction; and delays in the transmission of data and information. *Ibem et al.* [11] also investigated the factors influencing e-Procurement adoption by organizations in the Nigerian building industry based on the data sourced in a questionnaire survey involving 213 participants. That study found that the three most important factors that influenced the adoption of e-Procurement by the respondents in the survey were the benefits of e-Procurement in enhancing efficiency in project delivery, eliminating geographic barrier, and engendering effective communication among project team members.

From the foregoing review, it is obvious that there are variations in the degree of e-Procurement use in the construction industry in the different countries. Notably there appears to be a predominant use of e-mail, websites and portals to support the execution of e-Notification, e-Submission, e-Tendering and e-Sourcing aspects of e-Procurement. The existing studies also show that a whole lot of factors related to infrastructure, technology, and environment (e.g. economic, social, legal and cultural issues) within and outside the adopting organizations are barriers to the uptake of e-Procurement. However, apart from the study by *Eadie et al.* [8] that specifically dwelt on the perspectives of QS on e-Procurement adoption in the UK construction sector, no other study attempted to explore the views of other professionals in the building industry on this subject matter. This is a research gap this study attempted to fill from architects' perspective.

3. Research methods

This is an exploratory research based on a survey of 75 professional architects drawn from architectural and contracting firms, government, and clients organizations in Nigeria. The data collection instrument used was a structured questionnaire designed by the researchers based on findings from the review of literature. It had questions in different sections. Section 1 had questions on the background information of the firms the participants were drawn from. Section 2 had questions on the levels of awareness and the extent of e-Procurement use by the participants' organizations. To identify those whose organizations had used or were using e-Procurement, the question was framed for the participants to indicate whether they have participated in a project that involved the use of e-Procurement by ticking 'Yes' or 'No'. Section 2 of the questionnaire was also used to gather data on the extent of use of the different e-Procurement technologies to support the execution of e-Notification/ e-Announcing/e-Informing, e-Submission, e-Sourcing and e-Payment aspects of construction procurement process.

To achieve this objective, the participants were requested to indicated the frequency of use of each technology, tool or application based on 3-Likert-type scale using

1='Never used', 2 = 'Sometimes' and 3='Always'. The reason for investigating these aspects is that they relate more to the activities of the architect in building construction process (see [1] and [4]). Section 3 of the questionnaire contained a list of 26 barriers identified from the review of literature and the respondents were asked to rate each of the factors in order of their perceived severity in inhibiting the uptake of e-Procurement in the Nigeria building industry based on 5-Likert-type scale of 1='Has No Significant Effect'; 2='Has Very Little Effect'; 3='Undecided'; 4='Has Significant Effect' 5='Has The Most Significant Effect'.

Although data used in this paper were derived from a larger research project designed to investigate e-Procurement use in the Nigerian building industry, only the data derived from architects are presented here. The survey of architects took place between June 8 and 11 during the 2015 Architects' Colloquium in Abuja. This event was chosen as an avenue for data collection from architects because it provided the researchers the opportunity to meet and interact with a large number of practicing architects in Nigeria. In the selection of participants, both purposive and random sampling techniques were used. The former was used in selecting architects at the event (since not all the participants at the colloquium were architects); while the later was used in selecting those the questionnaire was administered to. In order to ensure that only one respondent from an organization was included in the survey, the respondents were asked to indicate the names of the organizations in the completed questionnaires. In addition, copies of the questionnaire were mailed to 30 selected architectural firms whose names and email addresses appeared on the list of registered architectural firms published by the Architects Registration Council of Nigeria (ARCON) in 2013. Although 175 questionnaires were administered and 102 (58.3%) retrieved, 75 representing around 43% of the distributed questionnaires were found to contain valid information and were subsequently used in the analysis.

The data were subjected to descriptive statistics, which helped in the computation of frequencies and percentages of the variables investigated. Another type of analysis carried out was the Pearson product-moment correlation (r), which was used to investigate the relationship between the level of awareness and adoption of e-Procurement by architectural firms in this survey.

4. Results and discussion

4.1. Profiles of the respondents' organizations

Table I shows the profiles of the organizations from where the participants of this research were selected.

From the result in Table I it is evident that a majority of the architects who participated in this research worked in professional consulting firms, followed by those in government ministries/agencies and intuitions and the least from contracting firms. A reasonable proportion of the organizations have their procurement experience in both the public and private sectors and a high majority of them have staff strength of 50 persons and below and are more than 10 years old.

Based on this result, it is obvious that professional architects in Nigeria work in consulting and contracting firms, private sector and government organizations; and a

high majority of the organizations where professional architects work are small-scale enterprises. This result also shows that architects working in the different categories of organizations involved in the procurement of building works and services in Nigeria participated in the survey.

Table I

Profiles of respondents' organizations

Profiles of organizations	N=75	%=100
<i>Type of organization Respondents work for</i>		
Consulting firm	39	52.0
Contractor	8	11.0
Private Sector Client organization	5	7.0
Government Ministry/parasatals/institution	23	31.0
<i>Organizations' procurement experience</i>		
Public sector only	12	16.0
Private sector only	20	27.0
Both public and private	43	57.3
<i>Staff strength of the organization (persons)</i>		
Below 20	42	56.0
20-50	15	20.0
51-100	2	3.0
More than 100	16	21.3
<i>Age of organization</i>		
Below 5 years	16	21.3
6-10 years	21	28.0
More than 10 years	38	51.0
<i>Number of offices the organization has in Nigeria</i>		
One	37	49.3
Two	24	32.0
Three	2	3.0
More than three	12	16.0

4.2. Levels of awareness and use of e-Procurement

The result on the level of awareness of e-Procurement among the participants reveals that a majority (68%) of the 75 respondents claimed that they were aware, while 32% were not aware of e-Procurement in construction. However, the result shows that a majority (68%) of them said their organizations had not participated in building projects that involved the use of e-Procurement, while 32% claimed that their organizations had participated in projects that involved the use of e-Procurement. The result specifically shows that 24 representing around 47% of the 51 respondents who said they were aware of e-Procurement have had their organizations participating in building projects involving the use of e-Procurement. This means that almost one-half of those who were aware of e-Procurement had used the technology suggesting that although there appears to be a high level of awareness of e-Procurement in construction, there is very low usage of this technology among architects in the study area. This finding is also consistent with the previous studies [12] and [13] indicating that the level of awareness

of e-Procurement was one of the factors that influenced its adoption in the Nigerian building industry.

The Pearson product-moment correlation coefficient (r) was used to investigate the relationship between the level of awareness and e-Procurement use. There was a medium, positive correlation between the two variables, $r=0.35$, $n=75$, $p<0.002$. This means that the levels of awareness and e- Procurement use have around 12.3% shared variance, hence there is a positive relationship between the level of awareness and e-Procurement use among the architects sampled in the survey.

4.3. Extent of use of e-Procurement among the respondents

Table II is a display of the result on the extent of use of e-Procurement technologies to support the execution of construction procurement activities and processes related to sending or receiving information on tender opportunities (i.e. e-Notification/e-Announcement/e-Informing).

Table II
Extent of use of e-Notification/e-Announcement/e-Informing

<i>e-Procurement activities</i>	<i>e-Procurement Technologies/Tools</i>	<i>Frequency of use</i>	<i>n =24</i>	<i>%=100</i>
e-Notification/ e-Announcement/ e- Informing	E-mail	Never used	4	17.0
		Sometimes	7	29.2
		Always	13	54.2
	Voice over internet protocol	Never used	8	33.3
		Sometimes	15	63.0
		Always	1	4.2
	Websites	Never used	5	21.0
		Sometimes	8	33.3
		Always	11	46.0
	Internet supported faxing	Never used	11	46.0
		Sometimes	9	37.4
		Always	4	17.0

The result in Table II shows that most (54%) of the organizations that have engaged in e-Notification/e-Announcement/e-Informing mainly used e-mail, 46% used websites always, while very few use Internet-supported faxing and voice over Internet protocol to send or receive information on the availability of tender opportunities.

Table III shows that result on the extent of use of web-based technologies to submit tenders/proposals/ and source for construction materials, equipment and services. It is evident in Table III that more than half (54%) of the users also used e-mails to receive or submit tenders/bids/proposals or expression of interests, while around 46% of the organizations used websites, 29% used project portals, while 25% and 21% claimed to use Internet-supported or software applications and cloud-based systems/applications, respectively. Similarly, a majority (58.3%) of the organizations used e-mails to source and place orders for building materials and equipment, 54.2% used company/vendor/ suppliers websites, while very few used voice over Internet protocol and EDI. These

results imply that there is a predominant use of e-mail in sending or receiving information on tender opportunities; submission of tenders/bids/proposals or expression of interests and sourcing or placing order for materials and equipment by the organizations whose employees participated in the survey.

Table III

Extent of use of e-Submission and e-Sourcing

<i>e-Procurement activities</i>	<i>e-Procurement Technologies/Tools</i>	<i>Frequency of use</i>	<i>n =24</i>	<i>%=100</i>	
e-Submission	E-mail	Never used	3	13.0	
		Sometimes	8	33.3	
		Always	13	54.2	
	Project portals	Never used	8	33.3	
		Sometimes	9	38.0	
		Always	7	29.2	
	Websites	Never used	5	21.0	
		Sometimes	8	33.3	
		Always	11	46.0	
		Cloud-based systems and applications (e.g. Microsoft SharePoint)	Never used	13	54.2
			Sometimes	6	25.0
			Always	5	21.0
	Internet based systems/software application	Never used	8	33.3	
		Sometimes	10	42.0	
		Always	6	25.0	
e -Sourcing	EDI	Never used	17	71.0	
		Sometimes	4	17.0	
		Always	3	13.0	
	E-Market places	Never used	17	71.0	
		Sometimes	7	29.2	
		Always	0	0.0	
	E-mail	Never used	4	17.0	
		Sometimes	6	25.0	
		Always	14	58.3	
		Company/ suppliers website	Never used	5	21.0
			Sometimes	6	25.0
			Always	13	54.2
	Voice over internet protocol	Never used	17	71.0	
		Sometimes	3	13.0	
		Always	4	17.0	

Further, the result in *Table IV* shows the extent of use of e-Payment. The result reveals that a majority (67%) of the organizations sampled used Electronic Fund Transfer (EFT) always, while 33% claimed that they used credit cards always to pay for goods and services.

In all, findings of this study show extensive use of web-based technologies to execute e-Notification, e-Submission, e-Sourcing and e-Payment as reported in the previous study [21]. In addition, there is extensive use of EFT in the payment for goods and services by the organizations that participated in the survey. This suggests that

architects in Nigeria use e-Procurement technologies and applications primarily for the purpose of communication and exchange of building project data and information. However, there is relatively low utilization of cloud-based applications that promote effective collaboration, coordination, and integration of procurement activities.

Table IV

Extent of use of e-Payment

<i>e-Procurement activities</i>	<i>e-Procurement Technologies/Tools</i>	<i>Frequency of use</i>	<i>n =24</i>	<i>%=100</i>
e-Payment	Credit card	Never used	9	38.0
		Sometimes	7	29.2
		Always	8	33.3
	Electronic fund transfer (EFT)	Never used	4	17.0
		Sometimes	4	17.0
		Always	16	67.0

4.4. Barriers to e-Procurement use

Table V shows the findings on the barriers to e-Procurement uptake in the Nigerian building industry as perceived by the architects sampled in the survey. Examination of the mean values, standard deviations and ranks for each of the 26 items investigated will reveal that the factor with the most significant adverse effect on e-Procurement uptake as identified by the architects sampled is the unreliable power supply situation in the country with mean score of 3.96 and ranked number one on Table V. This is followed by the lack of awareness on e-Procurement by people in the industry (3.93); the lack of forum to exchange ideas on the use of e-Procurement (3.91) and the lack of top management support (3.83), respectively.

This result suggests that the top three barriers to e-Procurement use in the Nigerian building industry from the perspective of architects are unreliable power supply; the lack of awareness and forum to exchange knowledge and ideas on the use of e-Procurement in construction. Notably, the emergence of unreliable power supply as factor with the most significant adverse effect on e-Procurement adoption in the Nigerian building industry did not come as a surprise. This is because an earlier study by Oyediran and Akintola [11] also identified this as one of the key challenges militating against e-Tendering use in the Nigerian construction industry. The finding on the lack of awareness of e-Procurement in construction also collaborates that by previous studies [6] and [20] indicating that this constituted a key barrier to the adoption of e-Procurement in the construction industry globally; and thus has contributed to making this industry a late adopter of e-Procurement when compared to sectors.

Related to the challenge of low level of awareness is the lack of forum to exchange ideas on the use of e-Procurement. This finding supports the views of quantity surveyors in the UK on the negative impact this had on e-Procurement adoption in the construction sector of that country as reported in a previous study (see [8]). Similarly, the finding on the lack of top management support as an internal organizational factor

that hinders the adoption of e-Procurement in the survey is also in line with that by previous studies [7]-[9].

Table V

Mean and standard deviation of the perceived barriers to e-Procurement use

Barriers to e-Procurement adoption	Mean	Std. Deviation	Rank
Unreliable power supply situation in Nigeria	3.96	1.13	1
Lack of awareness on e-Procurement in the industry	3.93	1.22	2
Lack of forum to exchange ideas on the use of e-Procurement	3.91	0.90	3
Lack of top management support	3.83	0.89	4
General resistance to change by people in the construction industry	3.83	1.03	5
Lack of a National policy on e-Procurement in Nigeria	3.76	0.97	6
Lack of technical expertise to handle e-Procurement technologies	3.69	1.03	7
Inadequate government support for e-Procurement in construction	3.64	0.10	8
The fear that e-procurement will help curb corruption in the industry	3.63	1.34	9
High cost of investment in e-Procurement technologies and tools	3.61	1.18	10
Lack of widely accepted e-Procurement software solutions in construction	3.55	1.00	11
Lack of confidentiality in e-Procurement transactions	3.53	1.07	12
The complicated nature and process involved in e-Procurement use	3.49	0.96	13
Poor internet and ICT infrastructure in Nigeria	3.49	1.48	13
Safety and security issues in e-Procurement transaction	3.47	1.06	14
Delays in the transmission of data and information	3.45	1.11	15
The concerns over legality of electronic contracts	3.44	1.03	16
Lack of uniform standard in the use of e-Procurement packages	3.43	0.95	17
Inaccurate display of data and information at the receivers' end	3.40	1.17	18
Technical challenges associated with the transition paper based method to e-procurement	3.37	1.04	19
The fear for loss of jobs and staff turnover	3.36	1.25	20
Lack of flexibility in the use of e-Procurement	3.35	1.18	21
Lack of universal format and standard in which construction materials are described, displayed and specified	3.33	1.13	22
Lack of interoperability of e-Procurement software packages	3.30	1.21	23
The benefits of using e-Procurement in construction are not very clear	3.23	1.18	24
Relatively low human- human contact in e-Procurement transactions	3.20	1.14	25

5. Conclusions and recommendations

This study investigated the adoption of e-Procurement in the Nigerian building industry from the perspective of architects. Based on the findings, the following conclusions are drawn. The first conclusion is that although there is a high level of awareness on e-Procurement among architects, there is low utilization of this technology by the employers of architects in Nigeria. The second conclusion is that there is a predominant use of e-mails and websites to support the execution of e-Notification, e-Submission, e-Sourcing, while e-Payment is via EFT among users of e-Procurement in the study area. The last conclusion is that the top three barriers to the uptake of e-Procurement as perceived by the architects sampled are (i) unreliable power supply (ii) the lack of awareness on e-Procurement, and (iii) the absence forum where professionals and other stakeholders in the industry share ideas on e-Procurement use in this country.

From the findings of this study, it can be inferred that in order to achieve a critical mass uptake of e-Procurement and maximize its benefits in the Nigerian building industry, there is a need for a significant improvement of the knowledge base of industry stakeholders on its use. This calls for massive awareness campaigns by vendors of e-Procurement technology, their representatives and sales agents; professional bodies in the building industry; government agencies and the mass media. There is also the need for regular conferences, seminars and training workshops on e-Procurement and its benefits, while the different professional groups in the Nigerian building industry may consider instituting special training programmes on e-Procurement as part of their Continuous Professional Development (CPD) programmes for their members. In addition, academic institutions that run programmes/courses in the built environment and related disciplines should also consider the introduction of e-Procurement as part of their curricula to enable students acquire requisite knowledge and skills on e-Procurement.

Further, government needs to provide the enabling environment to engender e-Procurement adoption in the building industry by further developing the power sector to ensure steady and adequate supply of electricity in this country. This calls for massive investments in alternative sources of electricity generation instead of relying solely on fossil fuel. The foregoing implies that the task of ensuring a critical mass uptake and maximization of the benefits of e-Procurement in the Nigerian building industry is the responsibility of all stakeholders, including professional groups, governments, e-Procurement vendors and their business partners, the mass media as well as academic institutions.

References

- [1] Chigozie, A. C., Jide A. K. The contemporary roles of architect and other building professional panacea to the Menace of Quacks and Quackery in building construction industry, *Civil and Environmental Research*, Vol. 10, 2015, pp. 68–75.
- [2] Bausa P. O., Kourtidis S., Liljemo K., Loozen N., Rodrigues F. J., Snaprud M. *e-Procurement golden book of good practice*, 2013, www.pwc.be, (last visited 15 May 2014).

- [3] Klinc R., Turk Ž., Dolenc M. ICT enabled communication in construction 2.0. *Pollack Periodica*, Vol. 9, No. 3, 2014, pp. 109–120.
- [4] Tepavčević B., Šijakov M., Štulić R. Animation tools in architectural design and education. *Pollack Periodica*, Vol. 7, No. Supplement 1, 2012, pp. 157–162.
- [5] Zou P. X. W., Seo Y. Effective applications of e-Commerce technologies in construction supply chain: current practice and future improvement, *J. Infor. Constr.* Vol. 11, 2006, pp. 127–147.
- [6] Rankin J., Chen Y., Christian A. e-Procurement in the Atlantic Canadian AEC industry, *Journal of Information Technology in Construction*, Vol. 11, 2006, pp. 75–87.
- [7] Eadie R., Perera S., Heaney G., Carlisle J. Drivers and barriers to public sector e-Procurement within Northern Ireland's construction industry, *Journal of Information Technology in Construction*, Vol. 12, 2007, pp. 103–120.
- [8] Eadie R., Perera S., Heaney G. Identification of e-Procurement drivers and barriers for UK construction organizations and ranking of these from the perspective of quantity surveyors, *Journal of Information Technology in Construction*, Vol. 15, 2010, pp. 23–43.
- [9] Eadie R., Perera S., Heaney G. Analysis of the use of e-Procurement in the public and private sectors of the UK construction industry, *Journal of Information Technology in Construction*, Vol. 16, 2011, pp. 669–686.
- [10] Hashim N., Said I., Idris N. H. Exploring e-Procurement value for construction companies in Malaysia, *Procedia Technology*, Vol. 9, 2013, pp. 836–845.
- [11] Oyediran O. S., Akintola A. A. A survey of the state of the art of e-Tendering in Nigeria, *Journal of Information Technology in Construction*, Vol. 16, 2011, pp. 557–576.
- [12] Aduwo E. B., Ibem E. O., Tunji-Olayeni P., Uwakonye O. U., Ayo-Vaughan E. K. Barriers to the uptake of e-Procurement in the Nigerian building industry, *International Journal of Appl. Theo. and Appl. Inf. Techn.*, Vol. 89, No. 1, 2016, pp. 133–147.
- [13] Ibem E. O., Aduwo E. B., Tunji-Olayeni P., Uwakonye O. U., Ayo-Vaughan E. K. Factors affecting e-Procurement adoption in the Nigerian building industry, *Construction Economics and Building*, Vol. 16, No. 4, 2016, pp. 54–67.
- [14] Werner J. Architecture and design, flexible building construction, *Pollack Periodica*, Vol. 11, No. 1, 2016, pp. 163–175.
- [15] Oliveira T., Martins M. F. Firms pattern of e-Business adoption: Evidence from the European Union-27, *The Electronic Journal Information Systems Evaluation*, Vol. 13, No. 1, 2011, pp. 47–56.
- [16] Rogers E. M. *Diffusion of innovations* (5th ed). New York, Free Press, 2003.
- [17] Dinev T., Hu Q. The centrality of awareness in the formation of user behavioral intention toward protective information technologies, *Journal of Association for Information Systems*, Vol. 8, No. 7, 2007, pp. 386–408.
- [18] Tornatzky L., Fleischer M. *The process of technology innovation*, Lexington Books, 1990.
- [19] Chege L. W., Coetzee G., Malachi J. E-Commerce and value chain management - the prospects and challenges for the South African construction industry, *Proc. on Int. Conf. IT in Construction in Africa*, CIB-W78, Pretoria, 29 May-1 June, 2001, pp. 1–11.
- [20] Aranda-Mena G. e-Business adoption in construction: International review on impediments, *Research Report 2003-003-A*, Cooperative Research Centre for Construction Innovation, Brisbane, Australia, 2004.
- [21] Issa R. R. A., Flood I., Caglasin G. Survey of e-Business implementation in the US construction industry, *Journal of Inf. Technology in Construction*, Vol. 8, 2003, pp. 15–28.
- [22] Isikdag U., Underwood J., Ezcan V., Arslan S. Barriers to e-Procurement in Turkish AEC industry, *Proceedings on International Conference of the Chartered Institute of Building*, W78-W102, Sophia Antipolis, France, 26-28 October 2011, pp. 1–10.
- [23] Ibem E. O., Laryea S. e-Procurement use in the South African construction industry, *Journal of Information Technology in Construction*, Vol. 20, 2015, pp. 364–384.