

A SURVEY OF THE STATE OF THE ART OF E-TENDERING IN NIGERIA

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SUMMARY: *E-tendering is a veritable tool for increasing productivity and empowering construction industry professionals to take better control of the tendering process. However, despite the administrative and managerial benefits obtainable by the adoption of e-tendering, the challenges and associated risks are rife. Thus, this study set out to assess the state of the art of e-tendering in the Nigerian construction industry. Using a cross-sectional survey type of research design, data was sought from quantity surveyors, architects, engineers and contractors in the industry. The results of this survey report an elementary level of knowledge about e-tendering among Nigerian construction industry professionals. There is a general lack of basic facilities necessary for the process coupled with a low level of proficiency in its usage. Irregular power supply, financial implications of putting up e-tendering infrastructure and poor telecommunications infrastructure rank highest among factors. Legal backing for electronic transactions in Nigeria is also deficient. Government effort at creation of better exchange portals and improvement of existing e-tendering portals was found to be inadequate. However, despite the ambivalent disposition of industry professionals towards e-tendering, the prospect of its adoption in the Nigerian construction industry by construction industry professionals is still high as evidenced by the results of this research.*

KEYWORDS: *e-tendering, facilities, proficiency, industry professionals.*

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1. INTRODUCTION

Advancements in information and communication technology (ICT) have made possible fundamental changes in the methods of practice of all businesses and industries. It is now a fact that the much-anticipated global village is a reality. The amount of business conducted electronically has reached hundreds of billions of dollars, and there is little doubt that the emergence of the internet is continually revolutionising access to communication and information (Christianson, 2003; Kajewski & Weippert, 2004). The construction industry has been one of the most impacted by these radical changes. Construction industry professionals now aim at paralleling the level of use of ICTs by other industries in the performance of their activities (Ibidapo, 2000).

Tendering is one of the aspects of the procurement process where information technology is useful. Tendering electronically can empower construction industry professionals with the means to take more control over the elements of tendering, providing improved and secure access to tender information to construction industry practitioners (Davila et al, 2002; Henriksen *et al*, 2004). Despite the managerial and administrative benefits e-tendering offers to the procurement process in the Nigerian construction industry, there are still numerous setbacks (Black *et al*, 2005). Awareness about e-tendering is an essential factor in promoting widespread acceptance and usage of e-tendering as a better alternative to the traditional paper-based process. The lack of awareness among other factors has been classified as a specific barrier to the growth of construction collaboration environments (Lou & Ashalwi, 2009).

Furthermore, a serious subject of doubt is that the availability of the facilities necessary for participation in e-tendering by industry practitioners is in question. Most professional practices in Nigeria make use of stand-alone computers running few application packages for word processing and spread sheeting. A moderately high level of proficiency in the use of ICT tools is also a pre-requisite for the use of e-tendering facility by stakeholders. This is necessary since several technicalities are usually involved in forming and managing electronic collaborative relationships between professionals with often-diverse interests and contributions. It is also one of the factors that affect the success or otherwise of an e-tendering system (Lou & Ashalwi, 2009). The necessary requirements in terms of proficiency are far from being met. This is indicative of a gap in skill as mapped out in the work of Oyediran & Kalu (2005).

The use of ICT is usually intended to enable collaboration in construction business processes but it effectively has almost no legal validity even in developed countries. The various forms of contract available for use within the construction industry usually give no indication of the admissibility of electronically exchanged documents in contracts. Hence, the use of ICT remains legally ineffective in current conditions.

Worthy of note is the lack of infrastructure for conducting safe and secure business through the internet. Although several financial institutions have experimented with several e-payment solutions in Nigeria, these have remained available to only a privileged few. Yet there appears to be little knowledge about even the most popular electronic payment media. E-tendering cannot truly be paper free if much emphasis is still being placed on physical cash transactions.

Several research efforts have been concentrated on the implementation of information and technology tools in the Nigerian construction industry. While Oyediran & Odusami (2005) studied the extent of usage of the computer particularly among Nigerian quantity surveyors, (Oladapo, 2006) studied the influence of information and communication technology on professional practice, and Oladapo (2007) investigated the impediments to the use of ICT in the Nigerian construction industry. However, no prior attempt has been made at measuring or quantifying the level of benefits being achieved or the problems being experienced by industry stakeholders who have been using electronic means to perform tendering functions. The uniqueness of the work lies in the Nigerian context. Nigeria is a developing economy in Africa. The level and pace of development has been lethargic in many respects. The adoption of ICT in the construction has nonetheless been found desirable borrowing from its impact in other sectors of the economy, especially the services sector. A roadmap for ICT adoption in the Nigerian construction sector requires a benchmark study to underpin the adoption process in order to measure up to technologically advanced nations. A study of the challenges encountered in the effort to adopt e-tendering as well as an assessment of the level of benefits obtainable at present in the Nigerian construction industry (NCI) is thus essential. This study draws impetus from the need to fill a gap in knowledge in this area of technological innovation in construction as a thorough search of existing literature has shown the dearth of similar work in this area, particularly e-tendering. It is also critical that the factors affecting the art of e-

tendering be examined as prelude to contributing to policy debate on e-tendering for the Nigerian construction industry.

2. THEORETICAL BACKGROUND

2.1 Electronic tendering

Before the advent of the internet, procurement functions were perceived by many to be routine and repetitive processes. This perception has been modified by the expanding capabilities of the World Wide Web in recent years. Most organizations used to have separate procurement offices, or preferred to assign people within the individual departments to specific procurement tasks. These processes have been labour-intensive, dominated by paper, thereby making them costly and inefficient. Various business concerns have found it both appropriate and inevitable to embrace the use of internet facilities to enhance the performance of their tasks.

Electronic procurement has been labelled as a tool that can improve competence and performance while enabling simplicity and automation (Phillips & Piotrowicz, 2006; Henriksen & Mahnke, 2005). Davila *et al* (2002) explained e-procurement as any technology that facilitates the acquisition of goods and services by a private or public organization over the internet, a view that is substantiated by Parida & Parida, (2005). Several researchers have also discussed the challenges involved with public procurement. The most important of these bothers on how best to employ the use of IT in this era of communication revolution to enhance the procurement process (Henriksen & Mahnke, 2005; Lou & Ashalwi, 2009). E-procurement does not however represent a single application but consists of many different tools (Phillips & Piotrowicz, 2006; Kajewski & Weippert, 2004). It encompasses application several ICT tools a major part of which is the internet, to transform the traditional processes of acquisition, purchase or supply of goods and services into the e-processes such as e-tendering, e-awarding, e-auction, e-sourcing, by a private or public organization

E-tendering is basically an expression used to describe the dissemination and receipt of tender information, indication of interest in tendering, receipt of tender documents, submission of tender sum and final selection of successful tender for contracts via the internet (Black *et al*, 2004). In the opinion of Seah (2004) the objective of e-tendering is to specifically increase productivity during the tendering process by decreasing paper handling and speeding up communication and interaction. This represents the ultimate goal of e-tendering, a shift from manual paper methods to fully electronically enabled means of communication. One of the major strengths of arguments for e-tendering is the remote accessibility of the system. Thus making it possible for a tender manager, tenderer, contractor or client to access the facilities of the tender engine from anywhere in the world without being impeded by geographical location constraints (Seah, 2004).

2.2 E-tendering benefits

Economic arguments emphasized in research are those of reduction of workload, and associated cost savings through information technology systems. E-tendering, from an economic stand point, enhances efficiency through transaction cost savings and reduced direct procurement costs. While transparency, accountability, ease of use, speedy exchange of information, including other intangible benefits such as reduced administrative costs are achievable (Davila *et al*, 2002; Henriksen & Mahnke, 2005).

During e-tendering the traditional functions and responsibilities of project team members are maintained throughout the process of e-tendering and do not overlap, rather the efficiency of their activities is greatly enhanced. E-tendering however requires the use of a web collaboration platform through which the project team members make their contributions and queries for information. This must however be done on the platform of an effective electronic data interchange (EDI) format to promote acceptable levels of interoperability (Parida & Parida, 2005).

Cost savings have expectedly been shown to be the primary rationale for investment across all technology platforms (Davila *et al*, 2002). While some cost benefits may accrue from e-tendering, sustainable benefits will only amass from the adoption of a strategic management perspective (Phillips & Piotrowicz, 2006). E-tendering implementations must thus be able to strategically anticipate and manage change in the construction environment, providing ad-hoc solutions whenever necessary. Initial investment required for the system are relatively minimal if the adopting organization uses the facilities of an existing communications network, but is however substantially higher when there is no existing network or the system requires unique features to support

these technologies. These benefits nonetheless depend on the size of the organizations providing the service as the benefits must be weighed against the cost. A significant benefit to cost ratio must be achieved for the use of such technology to be acceptable (Davila et al, 2002). Organizations already using e-tendering technologies report a savings of up to forty two percent in transaction costs; most of this is associated with less paper work, which translates to fewer mistakes and more efficient procurement process.

Administrative benefits (intangible benefits) obtainable from e-tendering are also numerous. However, these benefits may not be as obvious as the tangible forms. These come in form of reduction in workload and improved efficiencies. Government agencies and ministries across the world seeking administrative efficiencies and cost reductions experienced in the private sector have widely embraced e-tendering. This is a trend that has gained prominence in Europe (Coulthard *et al*, 2001). Private organizations or public authorities that implement e-tendering also achieve efficiency gains. Paper work is substituted for new electronically enabled collaboration and integration of tendering data by private consultant/client concerns (Davila *et al*, 2004).

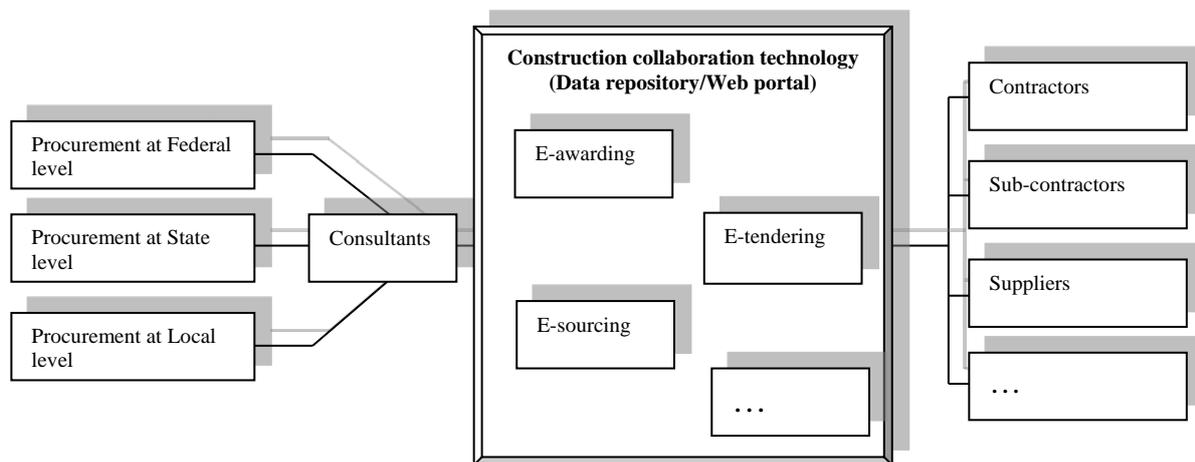


FIG. 1: Public e-procurement portal on the World Wide Web

Undoubtedly, the benefits and advantages inherent in the application of information technology to the process of tendering for both public and private projects are extensive with process efficiency gains through systems such as the one depicted in FIG. 1. It is expected that the early adopters of the e-tendering system would consist of largely public entities; federal, state and local levels of government, ministries and other public agencies and ministries considering the relatively high financial implication of setting up an e-tendering system. This is more so since several authors have shown that the benefits accruable from creating an electronic tendering portal would be more significant for the larger public and private organizations than the small ones.

2.3 Technological requirements for participation in E-tendering

The facilities required for the implementation of a viable e-tendering system may be grouped into three separate categories, hardware, software and internet/network facilities. Basic hardware facilities necessary for participation in e-tendering include computer systems and a dedicated server which manages all client computers on the network, access control and management of data traffic (Seah 2004). There are usually several software requirements. They include the server operating system, the client operating system, and other industry specific software that are used by construction industry professionals in carrying out their functions. Other software facilities required may include a bulk mailing software, electronic signature capture solution and data encryption system.

Connection to the internet is an indispensable requirement. It provides the platform for the operation of the e-tendering web portal, the tool that enables collaboration. It is of paramount importance that the internet connection used for electronic tendering be fast, secure, and reliable. The popular types of connection available in Nigeria include (a) Dial-up networking (b) Radio link (c) and VSAT. The VSAT has proven to be the fastest and costliest of the three alternatives.

2.4 Challenges and risks associated with the adoption of E-tendering

The reasons for the relatively low adoption of e-tendering in developing nations are not farfetched. There are numerous barriers impeding the adoption and implementation of e-tendering. Despite initial optimism about the use of ICT to improve productivity and profitability in the Nigerian construction industry, the benefits have since been localised to minute immediate administrative gains. The far-reaching benefits of e-tendering are yet to be achieved in developing countries. Nonetheless, various studies have suggested reasons for this. Issues relating to the legal ramifications of electronic communications, vague security framework, ownership of intellectual property, and the capture/management of the knowledge generated during the project, as well as issues of trust have been prominent in these postulations (Rezgui *et al*, 2004; Brewer, *et al*, 2005; Pasupathinathan & Pieprzyk, 2008). Challenges local to Nigeria while not differing from these also include the inherent inadequacy or total lack of facilities necessary for participation in e-tendering.

Organizational and human issues have also been highlighted as key factors affecting the use of technologies in the construction sector. This view forms the crux of the study carried out by Lou & Ashalwi (2009). It gives specific recognition to the importance of human resources training and professional development. This is similar to earlier work carried out by Rezgui *et al* (2004). There is also a perception within the construction sector that senior management tend to be lacking in awareness of the available and forthcoming technologies and of the potential benefits of these technologies for process improvement and competitive advantage, (Rezgui *et al*, 2004). This can greatly hamper the adoption of new technologies since most investment decisions are usually taken at the senior management level. There is immense need for trained technical staff with ICT support skills, such as programming, network development and maintenance, website development and maintenance skills, database administrator skills, etc., to support the increased use of and dependency upon ICT both in the workplace and for workers on project sites, (Rezgui *et al*, 2004).

The internet provides access to a vast reservoir of information and it is transforming the nature and methods of perpetrating commerce. It is not surprising that there is some offensive, and even illegal, use of the internet since about 75million users globally make use of the facility (Darlington, 2006; Dara & Gundemoni, 2006). The terms or scope of cyber-laws is not clear in many countries. Laws governing the use of internet can be observed from two different standpoints, one is for the relevant legislations dealing with or regulating telecommunications; the other is for those tackling the emerging cyber related crimes (Edappagath, 2004). The major risks factors relating to electronic transactions on the internet include hacking, viruses, pirating, illegal trading, fraud, money laundry, defamatory libel, among several others (Darlington, 2006). All of these have very destructive impacts on trust and transparency in the process of tendering (Dara & Gundemoni, 2006). They could also lead to the undermining of tendering data.

Organizations must in essence be confident that unauthorized actions would not disrupt the processes when committing to e-tendering technologies. Thus, the challenge to e-tendering technology advocates is to present evidence to non-users that these technologies do not weaken control, security or privacy requirements. Davila *et al*, (2002). Remarkable progress has been made in this area of research. Pasupathinathan & Pieprzyk (2008) generated an e-tendering protocol for the purpose of engendering security and fairness in the process. By combining the techniques of other authors, a system protocol that provides a transparent and verifiable e-tendering system is proposed. Further studies would be necessary to ascertain the efficacy and applicability of these models.

2.5 Legal framework for E-tendering

Information and communications technologies are used extensively for exchange of information in construction. This disposition is however not properly covered by adequate contractual practice and procedures. Poorly defined responsibilities, overlapping communication techniques, possibilities of collusion activities and mistrust of integrity all hamper the full use of electronic data in inter-organisational collaborative processes (Du *et al*, 2004; ICCI, 2001).

While an e-tendering, system may be more efficient and cost effective, it presents its users with several legal impediments, partly because the law that governs electronic transactions is either non-existent or under-developed (Black *et al*, 2004). Thus, one of the primary challenges in developing countries lies in converting the functionality of the traditional paper-based system to an electronic environment while maintaining legal validity

(Betts, et al., 2006). Unreliable communication lines would invariably affect the legal admissibility of electronic documents (Du et al, 2004).

Existing legislations and statutes need to be reviewed to determine whether they can address the issues arising out of the new ICT epoch. Governments and appropriate institutions need to either revise the existing laws or enact new laws to provide individual, corporate and government users with maximum trust and security, (Edappagath, 2004). A situation analogous to research findings in the United Kingdom (Carter, *et al* 2001) is the fact that there is extensive use of the Joint Contracts Tribunal (JCT) forms of contracts in Nigeria. The most common edition being used in Nigeria for traditional procurement is that of 1998, and this makes no express reference to the applicability of electronic documents in construction. However, the edition of the JCT published in 2005 (revised in 2007) recognises the use of electronic documents for exchange of construction information. It only gives allowance for the adaptation of the contract conditions for use in a construction contract where electronic exchange of contract documentation is intended. This is scarcely reliable. In spite of these, parties to a construction contract in Nigeria usually consent to the use and acceptance of electronic communication even without stating it explicitly in signed contract conditions. This may create problems in future if a contractual dispute founded on electronic transaction arises.

According to ICCI (2001) there are basically four types of legal solutions to the challenge of providing the necessary legal structure and security for electronic transactions. These include; National legislation, International legal instruments, such as conventions, treaties, directives or alternative resolution scheme, contractual solutions and self-regulation. Self-regulation has gained recognition as a powerful instrument to manage trust in electronic transactions (UN/CEFACT, 2001). Self-regulation means that organisations collaborating through electronic means voluntarily undertake to comply with certain rules of conduct when dealing electronically with others. Self-regulation can take different forms, such as adopting a code of conduct. A code of conduct is not a contractual solution. A self-regulatory instrument can work in concordance with other means of facilitating e-tendering transactions. The draft Nigerian Electronic Transactions Bill seeks to lay down rules for the admissibility of electronic evidence. Despite the urgent need for the passage of the bill into law by the legislative arm of government, for the protection of on-line business transactions, privacy and security, it is yet to be passed into law (Bregar & Dmitrovic, 2004).

The National Information Technology Policy which was approved by the Federal Executive Council of Nigeria in 2001, had its vision statement articulated as ‘to make Nigeria an IT capable country in Africa and a key player in the information society by the year 2005, using IT as the engine for sustainable development and global competitiveness’ (Bregar & Dmitrovic, 2004; NITDA, 2001). There is clear indication that the implementation of this national IT policy has not met the performance expectations needed to achieve sustainable technological development. Although series of seminars – on projects such as E-Nigeria, E-judiciary, E-governance etc. – have been held, the promises of making technological facilities and resources readily available to all has predictably not materialized (Bregar & Dmitrovic, 2004).

2.6 Parallel studies

In a study of e-tendering as it subsists in the United Kingdom, Tindsley & Stephenson (2008) made a fair attempt at establishing the status, resource effectiveness and practicalities of e-tendering implementation in the locale. The study draws conclusions from both a questionnaire based survey and a case study. The results of the study establish that in the UK, the use of e-tendering brings about substantial resource savings in terms of time and costs. This disposition is also supported in case studies presented in the work of Lou & Ashalwi (2009). Furthermore, Tindsley & Stephenson (2008) affirm that the greatest impediments to the implementation of new technologies such as e-tendering in the UK are scepticism and reluctance to change. Eadie et al (2010) compared rankings for e-procurement drivers and barriers within UK construction organisations. The results of the study show that the level of security of the process (“Prevention of Tampering with Documents – changes to documents” followed by “Confidentiality of Information – unauthorised viewing”) is the most prominent e-procurement barrier within UK construction organisations while cost savings and convenience of archiving information on completed work are the two most important drivers. The findings of Eadie et al (2010) bear semblance to the conclusions drawn of an earlier study carried out in Northern Ireland by Eadie et al (2007) in which legal and security issues were affirmed to be of utmost importance. The similarities in the opinion of contractors and specifically quantity surveyors on the ranking of drivers and barriers is further highlighted in another study by Eadie et al (2010) also in the UK.

2.7 Summary

E-tendering is a veritable tool for the enhancement of the paper-based traditional tender process. The benefits accruable from contract letting and procurement through e-tendering are numerous and immediately obvious. Increased transparency, reduced costs and time, expansion of business horizons and a security level that is at least as adequate as that of the manual methods are some of the strong selling points of tendering through electronic means. Despite these reported benefits, e-tendering is still being impeded by numerous challenges and associated risks. These risks and challenges will have to be weighed against benefits in order to determine e-tendering profitability and the prospects of its adoption and embrace in a developing economy like Nigeria's.

3. RESEARCH METHODOLOGY

A cross sectional survey and a case study type of research design were employed. A questionnaire was used to obtain information from a population comprising all Quantity surveyors, Architects, Engineers and Contractors firms registered to practice in Nigeria. The questionnaire was subjected to content validity by experts in the construction industry and information technology field of practice to ascertain whether the content of the various measures adopted sufficiently covers the domain of the constructs being measured. This resulted in a rigorous process during which the subject area was examined from both construction and information technology perspectives and subsequently making changes to the questionnaire as required. The sampling technique employed was the purposive method. The administration of the research instrument was carried out within 4 months in four states of the country to obtain nationally representative response. Respondents were drawn from Lagos state, representing the commercial nerve centre of the country, Abuja, the political capital of the country, Osun and Ondo states – representing states with low level of economic activities and low presence of consulting firms in the Nigerian construction industry. These states and the FCT put together account for about 64% of registered construction industry consulting firms in Nigeria. The sampling was based on information about the population of registered consulting firms obtained from the respective professional associations and regulatory bodies. Out of 109 questionnaires that were administered, 66 properly completed questionnaires were received. This represents a 65% response rate. This response rate is adjudged acceptable in the opinion of Gordon (2002). A case study was carried out by interviewing a representative of a prominent industry practitioner. This is to provide in-depth inquiry and investigation of the e-tendering phenomenon in a real-life context with a view to providing information for developing hypotheses for future studies on e-tendering.

3.1 Research Instrument

The questionnaire consisted of 7 sections. Section 1 sought background information on the biological age of the respondents, the construction industry work experience, designation and educational background. The purpose was to obtain respondent information that could be used as moderating variables. Section 2 was structured to assess the level of knowledge about e-tendering on a 4-point likert scale ranging from "No knowledge" to "Expert knowledge". Section 3 was designed to determine the availability and state of the basic ICT facilities required for e-tendering on a 5-point likert scale ranging from "Very bad condition" to "Excellent condition". Section 4 asked of the respondents their proficiency in the use of selected ICT facilities at various stages of the tendering process. Section 5 asked the respondents about the knowledge of any constitutional provisions backing electronic transactions in Nigeria. Section 6 assessed the efforts of the Nigerian government at improving the existing e-tendering. Section 7 assessed the prospect of the adoption of e-tendering in the Nigerian construction industry. Respondent perceptions of cost and time savings, level of security and admissibility of electronic documents into evidence were measure on similar Likert type scales. The research instrument was then subjected to content validation by experts in the construction industry, academia and IT experts subsequent upon carrying out a pilot study.

The questionnaires for this survey were entirely hand-delivered and received from the respondents between April and July 2006. Although the postal method of delivery and receipt is adjudged the cheapest by many authors, its use has been precluded from this work because of the unreliable nature of the Nigerian postal service and the culture of "knowing somebody" to give effect to requests, either in terms of following up or obliging the request. Similar to the situation in the UK (Eadie et al, 2010), the response rate of Quantity surveyors outweighs that of other industry stakeholders. This is because tendering and all associated activities are managed and controlled by the Quantity surveyor in the Nigerian construction industry.

3.2 Data Analysis

Mean quantity score (MQS)

Most of the data generated were analysed using Mean Quantity Score (MQS) to generate rating of the variables of interest. This is evaluated using the following expression:

$$\frac{\sum k_i n_i}{\sum n_i}$$

Where

n_i = number of respondents

k_i = rating for the i th response

The variables measured with the index are: the level of knowledge about e-tendering, state of facilities possessed by the professionals, proficiency in the use of facilities necessary for e-tendering, the government effort at improving existing systems and creating new ones, and the prospect. The responses were measured using varying point Likert type scales of measurement. The MQS is a descriptive statistical tool that describes the variables of interests in terms of their central tendency. This was considered adequate as the study is largely descriptive and exploratory in nature.

4. RESULTS AND ANALYSIS

4.1 Case study

The objective of this case study was to assess the barriers to continued use of electronic tendering by industry practitioners that have already tried to make use of e-tendering in the Nigerian construction industry. This case study is based on the experience of a leading (Category A) project cost consultant (Quantity surveyor) in the use of electronic means to accomplish the tendering process. The project under consideration is that of a branch development for a prominent Nigerian bank. The projects estimated cost was about 70 million Naira (about 476, 190.48 US\$). Prior to the commencement of the tendering process, a seminar was organised by the client on the advantages and the need to adopt e-tendering. The seminar had in attendance representatives of all the project stakeholder firms. These included the project quantity surveyor, the architect, the mechanical & electrical services consultant, the structural engineering consultant and the eight (8) contractors that were to be invited to participate in the tendering process. During the seminar however, some of the consultants and especially the contractors expressed early reservations about the feasibility of the process. Data exchange formats were defined at the seminar; all bills of quantities were to be exchanged in Microsoft Excel® format.

4.11 Contract Packaging

The Quantity surveyor produced and packaged all contract documents in electronic form, making use of several of the Microsoft suite applications. This consisted of the contract conditions (JCT 1998), form of tender, articles of agreement, specifications, and bills of quantities. These set of documents were then sent to the client by e-mail for dissemination.

4.12 Tender dissemination

The tender documents were then sent to the contractors through the client's e-tendering portal. All contractors were given a web link through which they downloaded tender documents. A CD copy of the same set of documents was also sent to them. The period allowed for tendering was 2 weeks.

4.13 Tender return

All returned tenders from the contractors were returned via the client's e-tendering portal by uploading the tender documents.

4.14 Tender opening

Returned tenders were opened by the client at the same time. However, there was no opportunity for the consultants involved to be present at the tender opening.

4.15 Tender analysis and reporting

To conclude tendering process, all returned tenders were sent back to the Quantity surveyor for analysis and reporting. This process was also carried out electronically. The quantity surveyor claimed to have experienced

several problems in handling the submissions of the contractor; some of the MS Excel formulas had to be rechecked leading to loss of time. While electronic copies of the report were sent to the client, signed hard copies were also sent by dispatch.

4.16 Overview

While the project quantity surveyor has not ventured into tendering electronically since the first attempt, an interest in participating in e-tendering in future if the technicalities and security of the process were better managed was expressed. The fact that standard forms contracts do not expressly support e-tendering is a source of concern to the quantity surveyor. However, the most significant advantage according to the industry stakeholder is reduced cost. While some time was saved during the process, time was also lost in mitigating the effects of inconsistencies in the tender return and tender analysis phases. This could be a problem emanating from the level of proficiency in computer usage by the contractors.

4.2 Level of awareness about E-tendering

Lack of awareness is one of the major barriers specifically acknowledged as the principal impediment to the adoption of collaborative technology environments (Lou & Ashalwi, 2009). Thus determining the level of awareness about the use of new technology in construction is of utmost necessity as a prelude to assessing the level of problems or benefits encountered in its implementation. FIG. 2 depicts an average awareness about electronically enabled contract letting among project stakeholders. This is similar to the findings of Oyediran & Kalu (2005) in a similar study. About 50.8% of the respondents indicate knowledge of a way of contract letting through the Web, 44.6% indicate unawareness of procurement through the Web while a small fraction of 4.6% are not sure of knowledge about such a method of procurement.

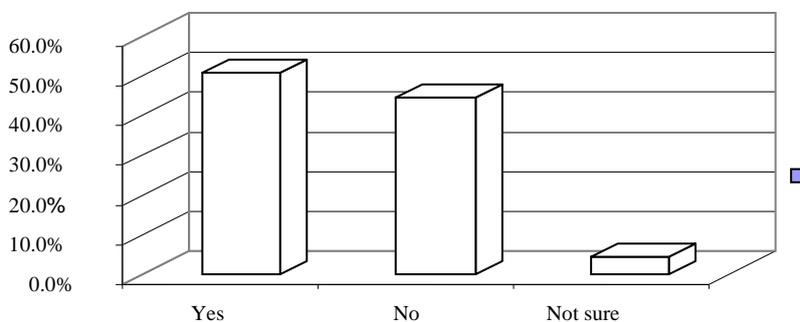


FIG. 2: Knowledge of a way of contract procurement through the World Wide Web

However, despite the evidence available pointing to an average awareness about e-tendering, the level of knowledge is notably elementary as presented in TABLE 1. Respective industry stakeholders have demonstrated just a mere elementary knowledge about tendering electronically. Further, while complete ignorance about e-tendering is not exhibited, the level of knowledge is still at an amateur phase.

TABLE 1: Measures awareness of E-tendering

Professional	Level of knowledge of e-tendering (MQS)*	Participation in e-tendering		Awareness of Nigeria government online e-tendering portal (MQS)**
		Yes (%)	No (%)	
Quantity surveyors	0.96	25.0	75.0	0.65
Architects	0.77	6.7	93.3	0.60
Engineers	0.86	14.3	85.7	0.63
Contractors	0.83	0	100.0	0.29
All	0.86	15.8	84.2	0.54

MQS* in calculated on a sliding scale of on a sliding scale of 0 = No knowledge, 1 = elementary knowledge, 2 = reasonable knowledge and 3 = Expert knowledge.

MQS** calculated on a scale of 0 = Not aware, 1= Partially aware, and 2 = Fully aware

Only about 15.8% of respondents have actually participated in any form of electronic e-tendering, while about 84.2% have not participated in such a process. More professionals in quantity surveying practice than any other professionals have participated in e-tendering with only about 25% haven participated, this is followed by engineers with 14% haven participated, this relatively high number may be attributed to the low number of responses received from the engineers. About 6.7% of architects have actually participated in e-tendering, none of the contracting firms have in any way procured contracts or performed related contract letting activities on the Internet.

Project stakeholders are only partially aware of the Nigerian government's online portal – <http://www.nigeriatenders.net>. When considered separately however, it can be inferred from *TABLE 1* that quantity surveyors, architects and engineers are at least partially aware of the existence of the portal while contractors are not aware of the existence of the portal.

There has been very little use of electronic media in performing tendering related activities. *TABLE 2* shows that only about 4.5% of respondents have distributed contract documents by electronic means, this is in consonance with the level of e-tendered documents as reported by (Eadie et al, 2010). Yet only about 6.1% of the professionals have received contract documents by electronic means, while about 9.1% exchange tendering information with other professionals through electronic media. An almost insignificant 1.5% make and receive e-payment for tendering-related activities. This result is expected since the level of knowledge about e-tendering is still at the elementary stage.

TABLE 2: Usage of specific features of e-tendering

Facility	Percentage
Distribution of contract documents	4.5%
Receipt of contract documents	6.1%
Receipt of tender notification	13.6%
Disseminate tender notification	4.5%
Electronic analysis of tenders	4.5%
Electronic communication of tender information	9.1%
Electronic payment for tendering related activities	1.5%
Receipt of payment electronically for tendering related activities	1.5%

4.3 Facilities necessary to enable participation in E-tendering

About 83.3% of the respondents indicated possession of computer systems; about 69.7% have AutoCAD for electronic design of contract documents. Availability of majority of the facilities is less than 50% (MQS for state of facilities is greater than 3.22 – a state referred to as “good condition”). A significant point to note is that only 13% have a data encryption systems, about 7.6% have a digital signature solution and 10.6% have a digital signature solution. The Architects and Quantity surveyors are evidently better positioned to participate in e-tendering. However on the other hand, the engineers and the contractors have indicated a general lack of these facilities except for computer hardware.

TABLE 3: Availability and state of facilities necessary for e-tendering

Facilities	Proportion of respondents having it					State of facilities (MQS)
	Q.S.	Architect	Contractor	Engineer	All	
Hardware						
Computer systems*	84.4%	88.2%	62.5%	88.8%	83.3%	4.47
Dedicated server	37.5%	35.3%	50.0%	11.1%	34.8%	3.74
Networking/Internet connection						
Local Area Network	40.6%	52.9%	50.0%	11.1%	40.9%	4.11
VSAT	12.5%	29.4%	12.5%	0.0%	15.2%	4.30
Radio link	9.4%	11.8%	12.5%	0.0%	9.1%	4.00
Dial-up Network	25.0%	17.6%	37.5%	11.1%	22.7%	4.07
Network software						
Server operating system	28.1%	35.3%	37.5%	0.0%	27.3%	3.94
Web presence						
Company website/domain	15.6%	29.4%	37.5%	11.1%	30.3%	3.90
Mailing software facility						
Bulk mailing facility	21.9%	29.4%	37.5%	11.1%	24.2%	3.88
Microsoft Exchange 2003 server	15.6%	29.4%	25.0%	0.0%	18.2%	3.83
Security software facility						
Digital signature solution	9.4%	11.8%	0.0%	0.0%	7.6%	3.20
Electronic signature capture solution	15.6%	5.9%	5.9%	0.0%	10.6%	3.43
Data encryption system	15.6%	23.5%	0.0%	0.0%	13.6%	3.22
Specialized application packages						
MasterBill software	46.9%	17.6%	0.0%	0.0%	27.3%	4.06
AutoCAD*	68.8%	88.2%	62.5%	44.4%	69.7%	4.84
ArchiCAD	37.5%	88.2%	25.0%	33.3%	48.5%	4.90
WinQS	28.1%	35.3%	12.5%	0.0%	24.2%	4.06
Client operating systems						
Windows XP Professional*	59.4%	70.6%	44.0%	62.5%	60.6%	4.62
Windows 2003 Professional	25.0%	41.2%	11.0%	37.5%	28.8%	4.42
Average mean of state of facilities score						4.03

MQS calculated on a scale of 5 = Excellent condition, 4 = Very good condition, 3 = Good condition, 2 = Bad condition, and 1 = Very bad condition. * = Facilities >= 50% overall having them.

4.4 Proficiency of practicing professionals in the use of facilities necessary for E-tendering

TABLE 4 presents the mean quantity scores of the proficiency of the respondents in the use of electronic applications for various tendering activities. It is evident that the respondents are most proficient at using MS Word and MS Excel at various stages of tendering. Generally, across all application packages, the respondents have no skill in the use of electronic facilities and packages that enables participation in e-tendering.

TABLE 4 Proficiency of professionals in the use of selected electronic applications for various tendering activities

Applications	BOQ preparation	Invitation to tender	Contractor prequalification	Sending out tenders	Tender submission	Automated economic analysis	Tender analysis reporting	Final selection of successful contractor	Average MQS for applications
Microsoft Excel	4.23		3.26			3.21	3.47	3.07	**3.45
Microsoft Access	1.95	1.73	1.95	1.91	1.91	2.00	1.82	1.82	**1.89
QsCAD	1.90								**1.90
Master Bill	2.03	1.50	1.67	1.57	1.57	1.61	1.65	1.65	**1.66
Microsoft Word	3.94	4.00	3.97	3.64	3.64	3.37	3.82	3.58	**3.75
Electronic mail		3.60		3.63	3.69				**3.64
Web portals on the internet		2.69	2.24	2.39	2.59				**2.48
Visual QSM 2000	1.08	1.21	1.09	1.25	1.09	1.09	1.09	1.09	**1.12
Microsoft Outlook		2.15		2.12	2.04		1.83		**2.03
Microsoft exchange		1.19		1.20	1.20		1.20		**1.20
	*2.52	*2.26	*2.36	*2.21	*2.22	*2.26	*2.13	*2.24	

MQS is calculated on a sliding scale of 5 = High skill, 4 = Average skill, 3 = Low skill, 2 = No skill, 1 = Never used it. * = Average proficiency for each stage of tendering. ** = Average MQS for each of the packages. Overall MQS = 2.31

The bill of quantities preparation is the only tendering activity where the average proficiency of use of software for each state of tendering is about 2.52 – indicating marginal “low skill”. Other activities such as invitation to tender (2.26), contractor prequalification (2.36), sending out tenders (2.21), tender analysis reporting (2.13) and final selection of successful contractor (2.24) showed “no skill” level of proficiency in the selected electronic applications

The extent of use of ICTs by respondents is less than average as depicted in TABLE 5 with a mean extent of usage of about 45.4%. Preparation of tenders and production of contract drawings are the aspects of highest application of ICTs. These are followed closely by tender analysis, contract formulation, and distribution of contract drawings all of which are of about average usage. Evident from the result displayed in TABLE 5 is the relatively low usage of ICTs in making and receiving payments for construction related activities.

TABLE 5: Extent of use of ICTs in aspects of professional practices

Aspect of professional practice	Percentage
Preparation of tenders	56.50%
Production of contract drawings	55.60%
Tender analysis	53.90%
Contract formulation	52.50%
Tendering	51.50%
Distribution of contract drawings	50.10%
Project management	49.70%
Interaction with other professionals	48.20%
Obtaining design brief	45.80%
Consultation with client	43.90%
Submission of tenders	42.10%
Receipt of tender notification	40.50%
Receipt of payments	22.70%
Making payments	22.40%
Mean extent of usage	45.40%

4.5 Existence of the legal framework for E-tendering

There is very little knowledge about any legal backing for electronic transactions. Most respondents do not know of any constitutional backing (58.3% of the respondents). 58.3% of the respondents know of the existence of punishments for involvement in any form of crime on the internet. This is expected, because of the activities of the Economic and Financial Crimes Commission (EFCC) in Nigeria. A minority however have no knowledge of such deterrents.

TABLE 6: Level of knowledge of about legal and penal structure.

	Yes	No	Not sure
Knowledge about the existence of legal provision(s) backing electronic transactions	15.0%	58.3%	26.7%
Knowledge of prescribed penalties for cyber crimes	58.3%	31.7%	10.0%

4.6 Efforts of the Nigerian government towards improving existing portals

In Nigeria, it is common knowledge that there is a dearth of essential infrastructures. Yet several government policies aimed at alleviating this situation are being poorly executed. These perhaps inform the results depicted in TABLE 7 of the perception of the adequacy of the implementation of the Nigerian IT policy. The professionals are close to agreeing that the Nigerian IT policy is being poorly implemented. Nevertheless, there is an agreement on the premise of little or no effort on the part of the government at improving the existing portal – www.nigeriatenders.net.

TABLE 7: Assessment of the government efforts at improving IT uptake

	MQS
Implementation of the Nigerian IT policy	2.44
Efforts of government at improving the existing e-tendering portal	2.62

MQS is calculated on the rating scale of 0 = strongly disagree, 1 = disagree, 2 = indifferent, 3 = agree, 4 = strongly agree.

4.7 E-tendering prospects for the construction industry

The tangible benefits of implementing e-tendering and in fact any new technology is the savings on cost and a reasonably high return on invested funds on such technology (Tindsley & Stephenson, 2008; Lou & Ashalwi 2009). In this Nigerian study, there is an indication of low level of savings on cost when electronic methods are used for tendering activities as opposed to traditional paper – based methods of tendering. This is contrary to the findings of Tindsley & Stephenson (2008) regarding the level of savings on cost in the UK. However, a moderate level of savings in time is being achieved in the Nigerian context, a result that bears semblance to the situation in UK. Savings in time in effect translates to a corresponding savings in cost since the value of time in construction activities cannot be over emphasised.

TABLE 8: Perception of level of savings on cost and time

	MQS
Cost	2.28
Time	3.47

MQS is calculated on a scale of 0 = none, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high

While insecurity is one of the most prominent barriers to e-tendering in the United Kingdom (Eadie et al, 2010), Nigerian construction industry professionals are of the opinion that the security of the e-tendering process is moderately secure; (represents 48.4% of responses). An interesting side to the result is that about 67.7% majority believe e-tendering to be either a moderately or highly secure process, while about 32.3% think it is either minimally secure or not secure.

TABLE 9: Assessment of the level security of e-tendering among professionals in the Nigerian construction industry

Level of security	Percentage	
Not secure	19.4%	} *32.3%
Minimally secure	12.9%	
Moderately secure	48.4%	} *67.7%
Highly secure	19.4%	
Total	100.0%	
MQS	1.68	

* = Group sub-totals MQS is calculated on a scale of 0 = not secure, 1 = minimally secure, 2 = moderately secure, 3 = highly secure.

Industry professionals have indicated their willingness to consider using e-tendering in future. A cumulative majority of about 86.4% indicated either “yes” or “strongly yes”, they will consider using e-tendering in future. This in effect portends a better prospect for the implementation of e-tendering in the Nigerian construction industry. One may further assume that level of security is not one of the reservations expressed by the project stakeholders that participated in the Case study. The situation is notably a converse of the findings of the study conducted in the United Kingdom by Tindsley & Stephenson (2008) which indicates a considerable uncertainty by industry professionals about embracing new technologies.

TABLE 10: Consideration of usage of e-tendering in future

	Percentage	
Strongly yes	18.2%	} *86.4%
Yes	68.2%	
No	13.6%	} *13.6%
Never	0.0%	
Total	100.0%	
MQS	2.05	

* = Group sub-totals, MQS => 0 = never, 1 = no, 2 = yes, 3 = strongly yes.

TABLE 11 depicts the opinion of the industry professionals on the question of whether they would support the admittance of electronic documents into evidence in contractual dispute. As presented in the table, all the professionals except the contractors are willing to support the admittance of electronic documents into evidence. About very few will strongly support the admittance of electronic documents into evidence, and about average number of them will support it. Only a small proportion of the respondents will either not support or never support its admittance.

TABLE 11: Admittance of electronic documents into evidence in contractual dispute

Professionals	MQS
Quantity surveyors	2.57
Architects	2.67
Engineers	3.00
Contractors	2.00
	*2.56

MQS is calculated on a scale of 0 = never, 1 = No, 2 = maybe, 3 = yes, and 4 = strongly yes. * = Average MQS.

The factors listed in TABLE 12 have all except the last two factors (security of e-tendering and ignorance of benefits) have been identified as highly influential to the dismal state of ICT usage by Nigerian construction industry professionals in the performance of their activities. As expected, irregular electric power supply ranks highest on the influence scale followed closely by financial implications of setting up the facilities. These precede poor communications infrastructure, lack of training of professionals, scepticism about the system, reluctance to change, low quality education of graduates and lack of interoperability of software in use by construction industry professionals in that order. This result exhibits the peculiarity of the Nigerian context in the implementation of information technology systems and application in construction (but not peculiar to the construction industry). The immediate worry of majority of business concerns in Nigeria has been power supply for many years. Further current economic situation and lack of government will – power have given rise to the divergence between the rank orders of the barriers when compared with studies carried out by (Eadie, et al 2010) on the subject.

TABLE 12: Influence of selected factors on the dismal history of ICT usage peculiar to the Nigerian construction industry

Factors	MQS	Ranking
Irregular electric power supply	3.32	1
Financial implications	3.31	2
Poor telecommunications infrastructure	3.17	3
Lack of professional training	2.88	4
Scepticism about the system	2.69	5
Reluctance to change	2.64	6
Low quality education of graduates	2.62	7
Lack of interoperability of software in use by construction industry professionals	2.54	8
Lack of security of e-tendering	2.41	9
Ignorance of benefits	2.15	10

MQS is calculated on a scale of 0 = not influential, 1 = slightly influential, 2 = moderately influential, 3 = highly influential, and 4 = very highly influential.

5. DISCUSSION OF FINDINGS

5.1 Level of awareness about E-tendering

It is manifest that awareness of a new or budding, technology is the first step in the course of its adoption. Industry professionals have demonstrated only average knowledge about electronic tendering. This agrees with the research findings of Oyediran & Kalu (2005). This average awareness notwithstanding, in particular, contractors level of knowledge borders on no knowledge at all. This may be explained by the relatively low education of a large number of contractors in the Nigerian construction industry. Further, a large of number of individuals who practice as contractors without the minimum educational and technical background training required for such designation.

Given the foregoing, the fact that only about 15.8% of the professionals have actually participated in tendering through electronic means is expected. Some of the respondents who have tendered electronically claimed to have done so through the web portals of foreign owned oil companies doing business in Nigeria. Nevertheless, very few industry professionals have used electronic methods to distribute contract documents, receive contract documents, receive tender notification, disseminate tender notification, compare bids, interact with other professionals and least of all making and receiving payment for construction related activities.

5.2 Facilities necessary to enable participation in E-tendering

Participation in e-tendering requires certain basic hardware and software facilities. This study has shown that only computer systems, client operating systems and computer aided design software exhibited a high level of availability. The availability of all other identified facilities can be adjudged marginal. This low level of availability of facilities may be because of the financial implications of setting them up, as was found out by this study. However, despite this below average level of availability, the available facilities are in good condition to facilitate participation in e-tendering. It is worthy of note that the facilities necessary for ensuring a secure e-tendering process are not widely available, and it is not clear whether those that have them have been using them to secure exchanged data. Cumulatively only about 47% of the respondents have access to the internet. The most popular type is the dial-up type of connection that depends of phone line communications infrastructure. This is the slowest of the connection types. It also has the narrowest bandwidth.

5.3 Proficiency of practicing professionals in the use of facilities necessary for E-tendering

Availability of necessary facilities for e-tendering cannot on its own ensure a viable e-tendering environment. The proficiency of industry professionals who will use them for tendering must be ensured. Results of this study have shown that construction industry professionals are low skilled at using selected ICT facilities for various tendering activities. The dismal level of proficiency in the use of these ICT tools is linkable to the high influence of the factors identified as financial implications of setting up of the facilities, irregular electric power supply, scepticism about change and reluctance to change of construction industry professionals.

Respondents are averagely skilled at using electronic mail facility and Microsoft Word at various stages of tendering. The respondents have also shown only close to average skill in the use of Microsoft Excel at various stages of the tendering process. In the use of other facilities like Microsoft Outlook, QsCAD, Masterbill, Visual QSM, and Microsoft Access, the respondents have no skill or have never used it as is the case with Microsoft Exchange.

5.4 Existence of the necessary legal framework for E-tendering

The existence of a sound legal framework for electronic transactions on the internet is of paramount importance if the system is to be considered for adoption. The admissibility of an electronic contractual document into evidence in contractual dispute might make the difference between aggressive rate of adoption and indifferent approach towards adoption and implementation.

The results of this survey have shown that most of the industry professionals are not aware of any contractual provisions backing electronic transactions and a considerable number of respondents are not sure of the existence of such a provision. This notwithstanding, most of the industry professionals have knowledge of prescribed punishment by law of crimes committed on the internet. This is very much expected as the orientation of the people towards commission of fraudulent acts on the internet are being affected by the advent of the Economic and Financial Crimes Commission (EFCC).

Respondents of this survey except contractors would agree to the admittance of electronic documents into evidence. The differing stand taken by the contractors may be as a result of reluctance to change or scepticism about the system.

5.5 Efforts of the Nigerian government towards improving existing portals

Majority of the high – level benefits of e-tendering for public procurement are largely dependent on government efforts in the direction of creating the required communication backbone and the improvement of the existing e-tendering portals. Evidence provided by the findings of this research show that, respondents are almost in agreement with the premise that the Nigerian IT policy is being poorly implemented. This corroborates the findings of Bregar & Dmitrovic (2004). The respondents are however in agreement with the premise that the Nigerian government's online portal – <http://www.nigeriatenders.net> – is not being maintained.

5.6 Prospects of the adoption of e-tendering

Cost and time savings have been identified as the tangible benefits of e-tendering. The results of this study indicate low level of savings in cost. However, industry professionals who have been carrying out their tendering activities in electronic form have experienced a moderate level of savings in time. This is anticipated since the activities carried out through electronic means the most are receipt of tender notification and receipt of contract documents. The results of this survey are indicative of a reasonably high prospect for e-tendering in the Nigerian construction industry.

Yet, project stakeholders are of the opinion that e-tendering is a moderately secure process. This opinion may have a backing from the fact that the process (as it is being practiced currently) is at least as secure as the traditional paper – based process. The more convincing the state of the security of contract letting on the internet, the more acceptable it would be for would be adopters of the technology.

A little more than half of the respondents of this survey have the intention to consider the use of e-tendering in future. This at least is indicative of a lack of total apathy for e-tendering among construction professionals. Impediments to increased usage of such as irregular power supply, financial implications, poor communications infrastructure, poor training, scepticism about the process and lack of security of e-tendering have been rated as highly influential on the use of electronic media for communication of construction information.

6. CONCLUSION

The results of this research have established that the awareness about e-tendering among industry professionals is average. However, the level of knowledge about contract procurement on the internet is still elementary. The few professionals who have participated in e-tendering have experienced low level of savings in costs and moderate level of savings in time has been achieved.

The basic facilities necessary for tendering electronically are for the most part, not available. Apart from computer systems, design software and client operating systems, all other basic facilities are short of average level of availability. Availability of facilities necessary for participation in e-tendering is not all that is required of prospective adopters of the technology. A fairly high level of skill and proficiency in the use of such facilities is also required. This study is a pointer to the fact that industry professionals have little or no skill in the use of facilities necessary for participation in e-tendering. However, industry professionals are only averagely skilled at using word processing and spread sheet applications at various stages of tendering. Yet, the extent of usage of ICTs by industry professionals in their respective practices stands at a little below average.

Legal backing for e-tendering and indeed e-commerce generally is almost non-existent. Most of the professionals are not aware of any constitutional provisions that lend legal validity to electronic transactions, although the knowledge of prescribed punishment for committing crimes on the internet is rife among industry professionals. Interestingly, there has been an indication of the will to support the admittance of electronic documents into evidence. One of the greatest impediments to e-tendering in Nigeria nonetheless remains the lack of constant power supply. This remains a long standing infrastructural problem in the country that is showing little signs of abating.

The Nigerian government is evidently not putting any effort into the creation of new e-tendering portals. While some of the existing portals have become dysfunctional. The Nigerian IT policy being championed by the National Information and Technology Development Agency is being poorly implemented.

The problems impeding the adoption of e-tendering in the Nigerian construction industry are rife. Slight level of knowledge about the process, lack of necessary facilities, minimal level of proficiency in its use, non-existence of a sound legal backing and low support from government are enormous challenge to the adoption and successful implementation of e-tendering in the Nigerian construction industry. In spite of the enormous challenges that have been identified, the prospect of e-tendering in the industry is high. This is especially true since potential obstacles such as lack of trust of the security of e-tendering and admissibility of electronic documents into evidence may not pose serious problems for the implementation of the system.

Against the background of low level of awareness, there is need to develop a capacity building knowledge backbone to drive the adoption of e-tendering. The extent of e-tendering basic and applied knowledge being shared in training construction industry professionals in tertiary institutions has not been fully determined.

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