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Barriers and prospects of e-Procurement in the South African construction industry

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ABSTRACT

Purpose of this paper

The use of electronic procurement in construction is increasing with the associated barriers and prospects in the different countries. However, the extent of barriers to, and prospects of e-procurement uptake in the South African construction industry is not well articulated in the literature. Therefore, the purpose of this paper is to report findings of a study conducted to investigate the barriers to e-procurement adoption in the South African construction industry. This is with a view to suggesting ways to mitigating the barriers and enhancing the prospects of e-procurement in the South African construction industry.

Design/methodology/approach

The study was exploratory in nature and the data used were derived from online questionnaire survey involving 603 respondents comprising architects, clients, construction/project managers, contractors, engineers, quantity surveyors, procurement and supply chain officials in the construction industry conducted between March and June 2014 in South Africa. The data were analyzed using descriptive statistical and content analyses.

Findings.

The main barriers to e-procurement uptake in the construction sector are related to unreliable ICT infrastructure, cultural issues, concern over security and data protection, unequal access to IT infrastructure by all categories of firms, inadequate knowledge on e-procurement systems and legal issues.

Practical Implications

The study indicates that there is a possibility of future success in the use and maximization of the benefits of e-procurement in the South African construction industry. However, these depend on the availability of reliable ICT infrastructure and knowledgeable construction professionals; improved access to ICT infrastructure across the country and supportive legal environment.

What is original/value of paper

The paper provides insight into the current barriers to e-procurement use and suggests how the identified barriers can be mitigated to maximise the benefits of e-procurement in the South African construction industry

Keywords: e-procurement, Construction sector, online survey; Barriers; South Africa

1. INTRODUCTION

Since the 1960s when electronic systems such as the electronic data interchange (EDI) was first used to support the exchange of construction project information and data, the use of electronic procurement in construction has been on the increase with the associated barriers and prospects in the different countries. The e-procurement golden book defines electronic procurement (e-procurement) as the use of electronic communications and transaction processes to buy supplies and services or conduct tendering for works (see Bausa *et al.*, 2013:5). Construction procurement in this context refers to the process involved in the creation, management and fulfilment of contracts relating to the provision of goods, services, engineering and construction works or disposal, or any combination thereof as defined by the International Standard Organization's document on procurement ISO 10845 (2010). Therefore, e-procurement in construction can be described as the use of electronic communications or systems to announce /notify/inform stakeholders about tender opportunities (soliciting for tender offers); exchange project information and data; conduct tendering; evaluate tender offers; award and manage construction contracts (see Bausa *et al.*, 2013 for the basic component activities of e-procurement).

From the existing literature we understand that in many developed and developing countries, the use of electronic procurement in construction is fast growing, but this has been constrained by several factors as the following studies help to amplify: (i) a survey of 226 stakeholders drawn from general and trade contractors, suppliers and associates on e-procurement use in the Atlantic Canadian AEC industry by Rankin *et al.*(2006) (ii) a survey of 70 contractors on drivers and barriers to public sector e-procurement within Northern Ireland's construction sector by Eadie *et al* (2007) (iii) a study of the use of e-procurement in the public and private sectors of the UK construction by Eadie *et al* (2010); and (iv) a survey of 330 quantity surveyors in 29 UK construction organizations on e-procurement drivers and barriers. Consequently, in their study on barriers to e-procurement in Turkish AEC industry, Isikdag *et al.* (2011) noted that the AEC industry needs to overcome various barriers in order to fully utilize this new approach to procurement. This implies that among other benefits, investigating and understanding the barriers to e-procurement use will help in mitigating the existing challenges; promoting critical mass uptake and identifying ways to harnessing the full benefits and prospects of e-procurement in the construction sector locally and globally.

According to Isikdag (2011), a limited number of empirical studies have been done on the barriers to e-procurement in the AEC industry. For instance, in the South African construction industry, the extent of barriers to e-procurement uptake has not been investigated and properly articulated in the literature; resulting in a lack of understanding of the factors that inhibit the uptake of e-procurement in the construction sector of this country. As the construction sector in South Africa seeks to develop further, e-procurement is set to become a major enabler of that development. Hence, it is imperative to identify the factors or situations militating against a critical mass uptake of e-procurement in the in South African construction industry. Therefore, the aim of this study was to investigate the barriers and prospects of e-procurement in the South African construction industry. The study sought to address two key research questions. These are:

- What are the barriers to the uptake of e-procurement in the South African construction industry?

- How can these barriers be mitigated to harness the prospects of e-procurement in construction in South Africa?

2. LITERATURE REVIEW

The purpose of this section is to identify the key barriers to e-procurement use in construction as reported in international literature. The survey of literature reveals that studies on the adoption of e-procurement in the construction industry emerged in the early 2000s (see Isikdag *et al.*, 2011). Among the existing studies are those on the benefits of e-procurement (see for examples Issa *et al.*, 2003; Aranda-Mena, 2004; Rankin *et al.*, 2006; Hashim *et al*, 2013). Aggregate findings of these studies indicate that the benefits of e-procurement in construction are multi-faceted and related to costs and time savings; improved quality of construction products and services, client and user satisfaction, efficiency and effectiveness in the management of construction projects. Specifically, in a study on web-based technology in support of construction supply chain, Mohamed (2003) summarized the benefits of e-procurement by noting that (i) e-procurement is an effective communication channel for organizing and communicating information, and improving interactivity among project participants (ii) it is also a transaction channel for streamlining transaction process, thereby reducing the complexity of task, paperwork and transaction cost; and (iii) a distribution channel for reducing delivery and operating cost and time.

Other studies have examined factors that affect the adoption of e-procurement in the construction sector. Farzin and Nezhad (2010: 519) explained that factors that determine whether or not the implementation of e-procurement will be successful are divided into two groups. The first group are the drivers, which promote e-procurement use and produce positive results. The second are the barriers that inhibit e-procurement use and produce negative results. Eadie *et al* (2007) described the drivers as those processes or items which produce benefits through e-procurement use, while barriers represent those factors or circumstances that prevent the implementation of an e-procurement system. Corroborating this description in multiple case studies of five major e-procurement projects in UK-based public sector agencies, Doherty *et al* (2013) made it clear that barriers/ inhibitors are obstacles that must be mitigated if a successful implementation of e-procurement must be achieved.

In countries like Australia, Canada, Ireland, Nigeria, Turkey and the UK, a number of studies investigated the barriers to e-procurement in the construction sector. For examples, in a review of 200 articles on the impediments to the uptake of e-Business in construction in Australia and globally, Aranda-Mena (2004) identified the general impediments to the adoption of e-procurement across the globe as related to low or lack of awareness of e-procurement, dearth of requisite skill and legal and security issues. The author further explained that uncertainty in financial returns from investment due to lack of evidence-based literature on financial benefits of e-procurement use was responsible for the slow uptake of e-procurement in the construction industry. Similarly, the CRC Construction Innovation team (2003; 2006) investigated e-tendering in Australia and other countries and found that some of the barriers to e-tendering were related to security issues, including violations of data integrity and confidentiality.

Rankin *et al* (2006) investigated e-procurement in the Atlantic Canadian AE industry and linked the key barriers to e-procurement in that country to technical and organizational issues. They explained that on the one hand the technical issues deal with the integration of e-procurement systems with the existing work process and procurement systems; standardization of procurement documents and procedures; security of automated procurement process and authentication- status of digital document and electronic signatures. The organizational issues on the other hand are concerned with cost appropriation; ownership of information used in tender process (copyright issues); roles and responsibilities of participants during tender process and the capacity of the entire bidding community to adopt and use e-procurement (e.g. connectivity of bidders, accessibility to documents unhindered , download time). The authors concluded that the obstacles to a critical mass uptake of e-procurement were directly linked to unreliability of technologies, barriers created by vendors or buyers; the negative impact of e-procurement on the organization- in shifting peoples' mind set; and the long term effect of e-procurement use on relationships with customers due to lack of personal contact.

In Europe, Eadie *et al*. (2007) studied the drivers of and barriers to e-procurement in the construction industry in Northern Ireland. Three years after another study by Eadie *et al* (2010) examined the reasons for the uptake of e-procurement in construction in the UK from the perspective of quantity surveyors. These two studies came up with the findings that the barriers to e-procurement uptake can be classified under five categories: compatibility (interoperability), cultural; infrastructure, legal and security. Lavelle and Bardon (2009) also investigated the perception of e-tending in construction among 57 quantity surveyors in north east England. That study identified six barriers to e-tendering in order of importance to include the: (i) legal issues (ii) difficulty in sharing information (iii) security concerns (iv) poor systems (v) high complexity of e-tendering process, and (vi) poor reliability of e-tendering systems. Similarly, in the Turkish AEC industry, Isikdag *et al*. (2011) found that the barriers to e-procurement use were related to technology, strategy, marketing, people and process.

Elsewhere in Nigeria, Oyediran and Akintola (2011) examined the state of e-tendering among 66 architects, contractors, engineers and quantity surveyors. That study found out that general lack of basic e-tendering infrastructure, low proficiency in the use of e-tendering technologies, irregular power supply, cost of e-tendering technologies and absence of legal backing for electronic transactions were the key barriers to the uptake of e-tendering in Nigeria. Further, a recent comparative analysis of barriers to e-procurement among quantity surveyors in the UK and Nigeria was conducted by Bello and Iyagba (2013). That study was based on the findings of an earlier research conducted by Eadie *et al* (2010) as previously highlighted. The result reveals that there was no significant difference in the barriers to e-procurement as seen from the lens of quantity surveyors in the two countries; suggesting that despite the technological, socio-cultural and economic differences between the UK and Nigeria, the barriers to e-procurement use in the two countries are similar in nature

In South Africa, one of the earliest works on the challenges and prospects e-procurement in construction was by Chege *et al*. (2001). That theoretical paper examined the prospects and challenges of the applications of e-Commerce in value chain management in the South African construction industry. The authors explained that e-Commerce is valuable in facilitating the exchange

of information on construction projects, electronic buying and selling of goods and services used in construction process and in conducting tendering. They however noted that in the context of South Africa, the challenges of e-Commerce adoption in construction were related to how to create an enabling environment to allow SMMEs to reap the benefits of e-Commerce, security concern, taxation, legal barriers, accessibility and lack of technical standardization of e-Commerce systems

From the reviewed of the existing literature in the preceding paragraphs, a number of barriers to e-procurement use in construction were identified and summarized in Table 1.

Table 1: Barriers to e-Procurement use in Construction

Barriers	References
Compatibility (interoperability)	
Integration of e-procurement systems with the existing work process and procurement system	Rankin et al (2006)
Interoperability of e-procurement software and systems	Eadie et al. (2007);
Investment in compatible systems	Eadie et al. (2010)
Lack of widely accepted e-procurement software solution	Eadie et al (2010)
Cost Issue	
Information technology investment costs	Rankin et al (2006); Eadie et al. (2007); Oyediran and Akintola (2011)
Other competing Initiatives	Eadie et al (2010)
Cultural Issues	
Resistance to Change	Pires and Stanton(2005); Rankin et al. 2006; Isikdag et al (2011)
Lack of confidence in the new technology	Rankin et al (2006)
Low or lack of awareness of e-procurement	Aranda-Mena (2004), Oyediran and Akintola (2011)
Perception of no business benefit realized	Eadie et al. (2007); Eadie et al. (2010)
Lack of business relationship with costumers due to low level of personal contact	Rankin et al (2006),Eadie et al. (2007)
Lack of upper management support/Lack of Leadership	Eadie et al. (2007); Eadie et al. (2010); Isikdag et al (2011)
Barriers created by vendors or suppliers	Rankin et al (2006),
Organizational culture	Eadie et al. (2007)
Lack of technical expertise	Eadie et al. (2010); Isikdag et al (2011)
Lack of Flexibility in the use of e-procurement	Eadie et al. (2010)
Complicated procedures and extended relationships	Eadie et al. (2010)
Staff turnover	CRC Construction Innovation (2006); Eadie et al. (2010)
Magnitude of Change	Eadie et al. (2010)
Lack of trust between parties in the electronic commerce	Isikdag et al (2011)
Infrastructure	
Access to Internet and ICT Infrastructure	Eadie et al. (2007); Chege et al. (2001).
Insufficient assessment of systems prior to installation	Eadie et al. (2010)
Legal Issues	
The legality of e-procurement contracts	Kajewski and Weippert (2004); Eadie et al. (2007); Oyediran and Akintola (2011); Isikdag et al (2011); Chege et al. (2001).
Ownership of information used in tender process (copyright);	Rankin et al 2006
Lack of or poor implementation of IT policy relating to e-procurement issues	Oyediran and Akintola (2011)
Lack of pertinent case law	Eadie et al. (2010)
Different national approaches to e-procurement	Eadie et al. (2010)
Clarity of sender and tenderer information	Eadie et al. (2010)
Security	
Security in the process-data transmission to the wrong person	Eadie et al. (2010); Isikdag et al (2011); Chege et al. (2001).
Proof intent- electronic signatures	Eadie et al. (2007); Eadie et al. (2010)
Confidentiality of information-unauthorized viewing	CRC Construction Innovation (2006) Eadie et al. (2010); Isikdag et al (2011);
Integrity of data(changes to data making it inaccurate, incomplete and corrupted)	Kajewski and Weippert (2004);Rankin et al (2006); CRC Construction Innovation (2003; 2006); Eadie et al. (2007)
Data transmission reassembly-incorrect reassembly of data transmitted in packets	Eadie et al. (2010)
Authentication of user identities	CRC Construction Innovation (2006)

General

Lack forum to exchange ideas on e-procurement	Eadie et al (2010)
Lack of bodies supporting the shift towards e-procurement	Isikdag et al (2011)
Lack of best practice studies and pilot projects	Isikdag et al (2011)
Lack of training regarding the implementation and use of e-commerce systems	Isikdag et al (2011)

From the review of the existing works presented here, it is obvious that there is a paucity of published empirical literature on the barriers and prospects of e-procurement in the South African construction industry. It is also evident from Table 1 that in the different countries where e-procurement has been adopted, at least 39 different factors related to cultural, legal, security, infrastructure and cost issues as well as the interoperability of e-procurement systems constitute barriers to e-procurement use in construction. Data in Table 1 also indicates that a majority of the barriers reported in the literature in the different countries are culturally and technologically related.

3. RESEARCH METHOD

This paper reports part of the findings of a larger study designed to investigate the state of e-procurement use in the South African construction industry. Due to the nature of the research questions, which required unbiased and specific information on the current barriers to e-procurement use be obtained from key industry stakeholders; the survey research design was considered appropriate for this research. According to Creswell (2009), the survey research design has an advantage of providing quantitative data that describe the trends, attitudes or opinion of a population on specific issues by studying a sample of that population.

The survey was conducted to provide a clearer picture of the current state of e-procurement use and users experience with e-procurement systems and tools in three main areas of construction procurement. These are the use of electronic communication systems to (i) announce/notify/inform consultants and/or contractors about construction services or works (i.e. e-announcing/ notification/informing/) (ii) support exchange of project information (e.g. project briefs, drawings, specifications, bill of quantities) by clients, professional consultants and contractors (i.e. e- exchange of project information and data); and (iii) conduct tendering and submission of proposals, tenders or bids (i.e. e-tendering).

The data collection instrument was questionnaire comprising both close and open-ended questions. This instrument was designed based on findings from the review of literature, and had five sections of 16 questions. The first section contained questions on the professional background of the respondents, followed by question on their level of awareness of e-procurement in construction. The next section had questions on the extent to which the respondents use electronic notification; electronic exchange of project information; and electronic tendering, respectively. The last section contained questions on the respondents' experience with the use of e-procurement systems and applications.

Although in most of the existing studies cited in Table 1, respondents were asked to rate the barriers to e-procurement based on findings from the existing studies; the current study adopted a different approach by asking the respondents one open-ended question: "*Based on your experience, please describe the main issues of concern when it comes to using electronic communication systems and tools in the procurement of construction services and works*". This was a deliberate attempt to ensure that the respondents have the opportunity to freely bare their minds on the barriers to e-procurement use based on their experiences. Most importantly, this approach was intended to investigate the extent to which the perspective of industry players in South Africa is similar or different from those of other countries (e.g. Australia, Canada, Ireland, Nigeria, Turkey and UK) on the issue under investigated.

The questionnaire was self-administered through qualitrics online survey software. The link to the survey was sent by e-mail to 20,000 contractors registered in the Construction Industry Development Board (CIDB) database; 618 architectural firms; 1,740 members registered with the South African Council for the Project and Construction management Professions (SACPCMP) and 878 quantity firms of surveyors listed in 2013 Professions and Projects Registers published by the Times Media Limited as well as 12,000 registered members of the South African Institution of Civil Engineering (SAICE). The survey lasted between March 7 and June 13, 2014. Although 686 persons started the online survey, the data extracted show that 669 completed it. This represents around 2 percent of the total number of those the link to the online survey was sent to.

The data were subjected to two types of analyses. The first was descriptive statistical analysis, which was used to compute the frequency and percentages of the different categories of respondents in

terms of their roles in the construction industry; categories of the organizations they work for and their levels of awareness of the use of e-procurement in construction. This was also used to compute the frequency of respondents on each of the factors identified as a barrier to e-procurement in construction. The second type of analysis conducted was content analysis. This was used to analyse the open-ended responses on the barriers to e-procurement. Specifically, the content analysis helped in identifying common factors as provided by the respondents and grouping them into themes as found in the existing literature and shown in Table 1.

4. RESULT

4.1. Professional profile of Respondents in the survey
The result in Table 2 shows the distribution of the respondents of the survey according to their roles in the construction industry.

Table 2: Role of Respondents in the construction industry

Respondents	Frequency (N=603)	Percentage (%)
Architects	12	2
Clients	20	3
Construction/Project Managers	42	8
Contractors	331	55
Engineers	97	16
Quantity Surveyors	19	3
Procurement / Supply Chain Official	26	4
Others	56	9

From Table 2 it is evident that of the 669 who completed the questionnaire, 603 of them provided information on their specific roles in the construction industry. The result specifically shows that the majority of the respondents were contractors, followed by engineers, while the least number of respondents were architects. This result was to be expected as the survey was sent to over 20,000 contractors of the different categories registered with the CIDB in South Africa.
Figure 1 show the distribution of those who participated in the survey according to the categories of organizations they worked for.
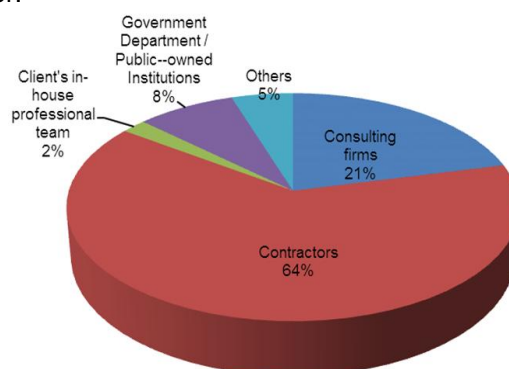

Figure 1: Categorization of respondents' organization

As would be expected Figure 2 also reveals that a majority of the respondents were employed in contracting firms, followed by 21 percent who were employed in consulting firms, while only 2 percent were members of client's in-house professional team. The 5 percent respondents classified as others included professionals in the banking and insurance sector, mining, academics and self-employed.
On the level of awareness of e-procurement use in construction, the result also shows that around 44 percent of the respondents indicated that they were aware of the use of e-procurement in construction, while 56 percent claimed that they were not aware of this new method of construction procurement. The foregoing result shows that the participants in the survey were indeed professionals in contracting and consulting firms and client organizations in the South African construction industry; and that a majority of them were not aware of e-procurement in construction.

4.2. Barriers to e-procurement in construction

The result also shows that 66 representing around 11 percent of the respondents provided responses on the barriers to the e-procurement use in the South African construction industry. The number of respondents is relatively low because the question on barriers was meant for the users of e-procurement only. The result is a displayed in Table 3.

Table 3: Barriers to e-procurement in construction

Respondents	Barriers	Frequency N=66	Percentage (%)
	Reliability of IT Infrastructure	30	45.5
R3	E-mail sent does not necessarily mean received		
R5	Network infrastructure issues in some areas and delays due to down time.		
R9	If there is power cuts that mean procurement of goods stops.		
R6	Delay in network response		
R11	The project information is not all included or is missing important information.		
R14	No proof that the intended recipient has received the documents.		
R15	The telecommunications can crash for a few hours and for that time you have no access to electronic communications		
R23	The information sent not getting to the other side due to network errors.		
R24	Sending large documents or if the receiver's domain is congested due to too many mail.		
R26	Lack of network reception		
R27	When the server is off line no procedures can be processed		
R30	When systems are down one can easily miss the deadline		
R37	It becomes very complicated when electronic system is down.		
R39	If you have a power failure or load shedding, could compromise your tender reaching your client on time		
R40	Network issues affect the functionality of the system		
R41	Electronic copies are often formatted to the users/receivers operating system and data often gets formatted incorrectly.		
R42	The automated system does not have time and date stamp on receipt of the submission		
R43	System not being able to accept submissions, or being off line		
R46	System failure		
R46	Documents not reaching the person intended to		
R46	E-mail get delayed and not meeting the deadline		
R46	Power failure on crunch times when the has to be sent or on its way to the other server		
R50	Electronic system is not reliable.		
R52	If you can't access the web pages for one reason or the other, e.g. server being down for a prolonged period you cannot participate in tendering		
R54	Not sure whether the recipient actually downloads the sent docs on time		
R55	Should their system be down and the deadline is close by, what do you do then.		
R55	System malfunctioning		
R58	Feedback and ensuring that the submission was successful		
R59	Reliability of information systems not certain		
R60	Unfiled documents flowing through the project while other project team members remain with the perception that documents are still not existing.		
R61	Delayed responses due to connection problems. Most departments are always offline.		
R62	The government and business sectors do not have a well-designed system in place whereby the contactors can be able to fill up the forms needed for the bids advertised.		
R63	Sometimes you will find that the computer system of municipality is down		
R64	Sometime there are noise and also problem of clearing in teams of telephone communication and also when the internet is slow.		
		18	27.3

Cultural issues

R3	Some of the systems are cumbersome and not user friendly
R4	Lack of personal interaction means queries are not promptly responded to and resolved
R5	It is an opportunity for corruption
R14	Difficult in getting original documents more especial signed contractual documents
R16	The process used to download these documents is not user friendly
R17	No response of receipt of your mail etc. and you need to follow up
R25	Big reluctance to change in the industry as a whole
R25	Lack of understanding of the benefits by all parties
R28	Tax-clearance, they always want the original not e-copy
R32	Sometime the companies slowly responding to e-mails
R33	People who don't check their e-mail
R34	For as long as it is not transparent, there will be some problems.
R41	Some systems are not user friendly as a result users have problems using them.
R41	Bids might be sent to opposition for re-pricing.
R54	Might forward your information to a competitor in view of wide spread corrupt business practices and failed business ethics.
R53	Those contractors who were marginalized in the past because most of them are illiterate let alone being computer illiterate.
R56	It imposes restriction on users
R57	There is no direct communication with procurement officers in case where clarification/s are/is needed.
R63	The employees don't check it on time
R65	One has to create hard-copy because electronic copy is not reliable

Security issues   12   18.2

R3	User rights are not maintained and updated
R3	Lack of confidentiality
R14	Certain confidential documents can easily get "stolen" using the last computer scam
R15	Also privacy is an issue because someone can hack into your accounts
R19	The security of the information getting to the other side without interference of the 3rd party.
R22	The online scams
R22	System hacking
R23	During circulation of documents, some recipients of the information can corrupt/virally infect the document before the next user gets the information.
R26	System hacking
R31	Submission safety
R36	Viruses in computer and hacking of systems
R39	It is impersonal
R39	Lack of surety that the system can be misused and confidentiality issues violated
R46	System Crash
R40	Lack of surety about the Information security.

Accessibility to IT infrastructure   12   18.2

R4	Certain groups may feel discriminated against as - e procurement is seen as not accessible contrary to the principles in the constitution that require fair, transparent, accessible, cost effective procurement
R10	It may exclude other upcoming bidder
R13	Little reach to the emerging sector - majority may not have access to e-com facilities
R21	Applications are only computer based, which are as useful on an iPad or iPhone for example.
R28	Poor network services in the remote areas

R29	Not accessibility to every one		
R35	Accessibility to everyone is a problem		
R36	Internet is not accessible every where		
R38	Some bidders may not have invested much on IT infrastructure, and thus tends to favour well-resourced contractors.		
R44	Some small BEE companies do not have access to such facilities		
R53	The ordinary people cannot have access to this so called electronic equipment.		
R66	The failure of client departments to afford opportunity to newly registered Companies		
	Knowledge of e-procurement systems	8	12.1
R1	Limited people understand how the system functions, so auditing the fairness of the approach is difficult		
R5	Staff involved with some companies especially SMME's lack e-procurement skill		
R7	Some service providers who are old as I am are not computer literate.		
R45	Lack of properly trained people to use the system		
R46	Lack of proper trained personnel to use the system with the government		
R49	More training to be able to use the application or system/program.		
R53	There is a need to train these people how to use a computer and latest technology e.g. internet		
R56	Low Knowledge of users of e-procurement		
	Legal Issues	4	6.1
R12	May be difficult to e-sign document legally acceptably		
R13	Documents not being legitimate and tamperproof especially e.g. Tax clearances and electronic signatures.		
R20	Lack of aggressive legal control system to report and handle frauds in electronic communication systems.		
R48	The authenticity of documents submitted whether the client will approve them or will still need original copies		
	Cost Issues	2	3.0
R10	Fees of the system are high		
R36	Internet is expensive		

The data in Table 3 shows that the four most critical barriers to e-procurement use in construction as identified by the respondents are related to the reliability of IT infrastructure (46 percent of the respondents), security issues that surround the use of e-procurement (27 percent of the respondents), accessibility to IT infrastructure (18 percent of the respondents) and culturally related issues (18 percent of the respondents). This result goes to suggest that in South Africa, unreliable IT infrastructure is the critical challenge militating against the use of e-procurement in construction.

5. DISCUSSION

From the result presented in the previous section, it is evident that the participants of the survey cut across all professional groups and client organizations in both the public and private sectors of the construction industry in South Africa. Hence, the respondents were deemed qualified to provide reliable data for the current research. The result indicates that the majority of the respondents were not aware of e-procurement use in construction. This was to be expected for two reasons. The first is that e-procurement is relatively new and has not yet developed sufficiently across the country; and as such many people in the construction industry may not have been aware of it. The second reason is that a majority of respondents are contractors who may not have come across or participated in projects that involved the use of e-procurement systems. Relating this result to findings of previous studies, it will appear that this result is not consistent with that by Oyediran and Akintola (2011) indicating that around 51 percent of the respondents were aware, while 45 percent claimed that they were unaware e-tendering in the Nigerian construction industry. Therefore, if the assertion by Oyediran and Akintola (2011:572) that "*awareness of a new or budding technology is the first step in the course of its adoption*" is anything to by, then this result may be an indication of the extent of e-procurement use in the South Africa construction industry.

Despite the above result, there are convincing evidence suggesting that around 44 percent of the respondents were currently engaged in the communication and exchange of construction project

information and data using electronic means like e-mail and other web-based applications. It was on the basis of their experience in the use of these electronic communication systems that they were able to identify a number of barriers to the use of these and other e-procurement systems (see Table 3). From the data in Table 3, it is evident that 66 respondents in the survey identified a total of 96 factors as barriers to e-procurement use. A closer examination of these factors will reveal that some of them are similar or related to each other in meaning. From these factors, the key barriers were identified and grouped into six main areas: (i) infrastructure (ii) security (iii) cultural (iv) knowledge base of users (v) legal; and (vi) cost implication in e-procurement use. Although, interoperability issues were not identified as barriers in the current study, our classification of the barriers as shown in Table 3 appears to be consistent with that identified in the literature (see Table 2). This goes to suggest that broadly speaking; the barriers to e-procurement in construction in South Africa are similar and related to those in other countries such as Turkey, Nigeria and the UK as previously highlighted in the reviews of literature.

However, the specific factors that constitute the key barriers to e-procurement use in the context of South Africa as shown by our survey data deserve critical examination. For instance, the result indicates that the two barriers to e-procurement related to infrastructure are unreliable IT infrastructure and uneven access to ICT infrastructure across all nooks and crannies and by all categories of firms in the country. Similar result was observed by Oyediran and Akintola (2011) in Nigeria. The specific issues associated with unreliable IT infrastructure are system failure, system malfunction and delays in the transmission of information and data. This situation is understandable because, telecommunication infrastructure that supports the operation of e-procurement systems and tools are not sufficiently developed to handle current demands of electronic commerce in many developing countries. Hence, there is seemingly lack of confidence in the existing IT infrastructure among the respondents. The lack of access to IT infrastructure as identified in the survey is in respect to emerging and previously disadvantaged firms, as well as those in remote areas of South Africa. In the current situation, it is generally believed that the adoption of e-procurement will result in the exclusion of these classes firms from participating in construction projects, which is against the principle of fairness and equity in procurement process as enshrined in the South African constitution. In support of the findings by Eadie *et al.* (2007) as previously highlighted, a lack of access to IT infrastructure therefore emerged as a barrier to e-procurement use in the country.

Cultural issues also emerged as another key barrier to e-procurement in the survey. This obviously supports previous studies (see Pires and Stanton, 2005; Rankin et al. 2006; Eadie *et al.*, 2010; Isikdag *et al.*, 2011). Amongst the factors identified under cultural issues are the perception that e-procurement systems are complex, not user friendly and do not allow for flexibility in their uses. Others are peoples' reluctance to change; lack of understanding of the benefits of e-procurement by all parties; lack of confidence in the new technology; people's attitude to e-mail messages; and the misconception by some of the respondents that e-procurement can perpetuate corrupt practices in the award of construction contracts . As interesting as these issues may appear to be, it is noteworthy that some of these cultural issues may be linked to a lack of adequate understanding by the people on e-procurement systems works. Our survey data indicate that this was indeed another barrier to e-procurement use in the country. As some of the respondents indicated, this is as a result of a lack of adequate training and skill on the e-procurement systems and applications. This can also be related to the finding on the level of awareness of e-procurement among the respondents as previously discussed. Following Lou and Ashalwi's (2009) argument in their study on critical success factors for e-tendering implementation in construction collaborative environments that some of the specific barriers to adoption of e-tendering in construction are due to lack of awareness and limited skilled workers, it can be inferred from the evidence in this study that the current level of knowledge on e-procurement in South Africa constitutes a key barrier to e-procurement use in the construction sector.

In addition, security concerns and legal issues were also identified as barriers to e-procurement use in the survey. Among the key factors associated with security are lack of confidentiality, unauthorized persons gaining access to vital information and the integrity of data. Notably, previous studies(including, Rankin *et al.*, 2006; CRC Construction Innovation,2003; 2006; Eadie *et al.*, 2007; Eadie *et al.*, 2010; Isikdag *et al.*, 2011) have also identified these issues in the other countries. Similarly, factors linked to legal barriers are related to authentication of e-documents and inadequate legal system to deal with issues emanating from e-contracts. These are also similar to the factors identified by previous studies (see for example Kajewski and Weippert, 2004; Eadie *et al.*, 2007; Oyediran and Akintola, 2011; Isikdag *et al.*, 2011).

6. CONCLUSIONS AND RECOMMENDATIONS

In this paper, we have examined and analysed the current barriers to e-procurement in the South African construction industry using data derived from an industry-wide survey. From the result it is

evident that the key barriers to e-procurement use in construction are related to infrastructure, culture, security, inadequate knowledge of e-procurement and legal issues. These are no doubt similar to the barriers identified in the existing literature. The implication of this is that several factors related to the basic infrastructure that facilitates e-procurement uptake, security and legal issues and the knowledge level and perception of the people on e-procurement systems and applications constitute barriers to effective use of e-procurement in the South African construction industry. Therefore, the good prospects of e-procurement use in the construction sector of the country can only manifest if these barriers are effectively mitigated.

In order to enhance the good prospects and maximise the benefits of e-procurement use in construction, the following recommendations have been put forward. First, there is a need to improve the availability of and access to relaible ICT infrastructure across the country. This calls for further development and expansion of the existing stock of ICT infrastructure to enhance its capacity to accommodate the rapidly evolving e-procurement systems and applications.This means that substantial investment is required from both the public and private sectors to improve the quality, reliability and coverage of ICT infrastructure in the country. On the one hand,these will build peoples' confidence in the use of e-procurement systems; and on the other and improve access to such facilities across the country.

Second, adequate knowledge of e-procurement systems and applications is required to engender their critical mass uptake in the counstruction sector. This may require among other stratgies aggressive awareness campaigns, trainings, skill acquisition and development on e-procurement technologies within the industry. The main focus should be getting people in the construction industry to understand how e-procurement systems work, the benefits of using them and the need to buy into the systems. Specifically, education of clients on these issues is very vital as they have a lot of influence on the choice of procurement methods; and thus can play key roles in the diffusion and uptake of e-procurement. Among other benefits, adequate knowledge on e-procurement systems can help to change peoples' attitude to the use of electronic means to communicate and exchange project information, correct some of the misconceptions and skeptisms about e-procurement and by so doing encourage the uptake of e-procurement in the industry. To this end, government agencies such as the Construction Industry Development Board (CIDB), the Council for the Built Environment (CBE), professional associations in the industry, firms and the academia have roles to play in this regard.

Third, although some of the security issues raised by the respondents may appear real, evidence from other industrial sectors that have embraced e-commerce technologies indicate that e-procurement transactions are very safe and secure. In fact, the use of technologies such as digital certificates, data and system encryption, secure sockets layer (SSL) to protect data during transmission, secure electronic transactions (SET) and cookies; hyper text transfer protocol (HTTP) to exchange data that are not encrypted; password and electronic signatures; firewalls, proxy servers and virtual private networking has shown that in practical terms, the concerns over confidentiality, security and integraity of data in e-procurement platforms are no longer critical issues. Therefore, what is required by construction firms is adequate investment in, and the use of approparite IT infrastructure that is secured and guarantees users' confidence and trust.

Finally, legal issues associated with e-procurement use need to be addressed through appropraite legislations by goverenment in conjunction with industry stakeholders. This is important in eliminating fears on the legality of e-procurement contracts and related issues. Also the enforcement of the existing pro e-commerce legisltions such as the Electronic Communications and Transactions Act No. 25 of 2002 as it relates to the acceptance of electronic copies of documents (e.g. certificates, contract papers) in business transactions should be figourously pursued in the construction sector.

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