KEY FACTORS INFLUENCING INFORMATION AND COMMUNICATION TECHNOLOGY FACILITIES DEPLOYMENT ON QUANTITY SURVEYING PRACTICES IN NIGERIA

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Abstract

The world today has become a global village with information being passed on within seconds and jobs made easier through the use of electronic devices. Information and communication (ICT) is in the forefront of championing this course. Most quantity surveying firms face one challenge or the other in adopting ICT in their daily operations. The purpose of this study is to assess the factors influencing ICT facilities deployment on quantity surveying practices in Abuja. The study adopted a survey approach, in which quantitative data were gathered from quantity surveying firms (QSFs) within the study area, through the use of structured questionnaire. Percentage, mean item score, factor analysis and PCA were used in analysing the data gathered. The study reveals that the factors influencing the deployment of ICT in quantity surveying practices are majorly ICT related issues. This is an indication that items of this factor: rapid changes in ICT technology, software and hardware reliability problems, security concerns/privacy fears, missing link in the educational training, inadequate knowledge about returns on ICT investment and virus attack, security breach and fear of accuracy are the key factors influencing ICT facilities deployment in quantity surveying practice in Nigeria and should be given due consideration for effective implementation of ICT facilities deployment in quantity surveying practices within the QSFs. Thus, the findings of this study would serves as mechanism for effective implementation of measures that could aids deployment of ICT facilities in QS practices within the QSFs in Nigeria.

Keywords: *ICT Deployment, Information and Communication Technology, Quantity Surveying Practice, Factors, Abuja, Nigeria.*

INTRODUCTION

Across the world, new technology is developed daily which is transforming and revolutionizing all, from the basic to the intricate functions of life, and the construction industry is no exception. Halim (2010) postulated that no profession can effectively succeed in solving its 21st century development challenges unless the professional visions, aspiration, mission and strategies are fundamentally anchored in the realm of knowledge creation and strategically driven by technology. Technology is seen as the catalysts for change; changing working conditions, handling and exchanging information, teaching methods, learning approaches, scientific research, and in accessing information (Mikre, 2011; Onyegiri, Nwachukwu and Onyegiri, 2011). Information and Communication Technology (ICT), a crucial aspect of technology has been described as an aspect that covers any product that will store, retrieve, manipulate, transmit or receive information electronically (Alaghbandrad, Nobakht, Hosseinalipour and Asnaashari, 2011). In construction, Maqsood, Walker and Finegan (2004), opined that a major construction process demands heavy exchange of data and

information between project participants on a daily basis. This is made easy through the adoption of ICT.

One of the major participants in the construction industry, whose role is crucial in the delivery of construction projects, are the Quantity Surveyors (QS). Ashworth, Hogg and Higgs (2013) described QS as those responsible for the costing of construction designs and production of procurement and construction documents. Ojo (2011), further stated that QS estimate and manage the cost of construction projects. Practicing QS is mostly found in Quantity Surveying Firms (QSFs) which are service based firms providing consultancy, financial and allied management services to their clients (Abidin, Adros and Hassan, 2014). Oyediran and Akintola (2011) view QSFs as knowledge based firm because QS sells knowledge and not physical product when in operation. It is noteworthy that this knowledge is transformed into service that gets delivered to clients eventually. It has therefore become a tactical necessity for these QSFs to integrate ICT into their service delivery in order to improve the flow of information between them, and also enhance the effectiveness of decision-making and service delivery (Najam, Kamran, Qamar and Irfanullah, 2014).

Tan and Yeoh (2011), highlighted a major benefit of ICT in the delivery of QS service. The study suggested that the use of measurement software applications can help QS to speed up the measurement of designs and also the preparation of the bill of quantities. However, it was further stated that QS ability to avail themselves of these emerging opportunities provided by the advent of ICT, depends on the adoption of new technologies since its impact on professional practice has been mainly in making jobs easier for the professions, facilitating decision-making and savings in operating costs, among others. Sekou (2012), stated that there is a reasonable level of awareness about the potential benefits of ICT within the construction industry, however, current ICT usage in most firms was found to be unsophisticated, with more advanced applications of ICT lacking. UsmanSaid and Yahaya (2012), revealed that QS in Nigeria are not taking serious action towards advanced adoption of ICT as QSFs appears to make sluggish progress towards effective ICT implementation for its unique features which distinguish it from other firms within the industry. In addition, most software packages used for estimating and tender analysis by QS, still rely on manual data input (Oyediran and Akintola, 2011). This tends to lead to low productivity of QS and increases the risks of errors which eventually give wrong budget estimate (Akinnagbe and Adelakun, 2014). Consequently, pertinent issue such as the level of ICT facilities deployment among QSFs requires answers if the use of ICT among these firms is to improve.

Ibironke, Ekundayo and Awodele (2011), revealed that although there is the increasing awareness of the importance of information technology in improving service delivery and productivity, QS in Nigeria are still reluctant in using these technologies. Reason for this reluctance was attributed to the high initial cost of acquisition, lack of infrastructures to support its use, and security concerns such as the susceptibility of the system. Similarly, Akinnagbe and Adelakun (2014), assessed the risk associated with using quantity surveying software in QSFs in Lagos. The study revealed that not all QSFs have fully braced up to the acceptance and usage of ICT modalities. It was also discovered that changing trends in technology is the major factor that necessitates the usage of software in QSFs. According to Halim (2010), ICT has not yet gained wide

range acceptability within the assessed organisations. Musa, Oyebisi and Babalola (2010), affirmed that ICT is a suitable tool for improving the quality of quantity surveying services in the country.

It is evident from the above studies that significant literature abounds in the aspect of ICT in the Nigerian construction industry. Despite the fact that several studies have been conducted on factors influencing ICT deployment among quantity surveying practices in the study area, yet empirical studies of the key factors affecting ICT deployment in Nigeria have not received detailed research. Bearing in mind that the socio-economic and physical environment have significant influence on the delivery of professional service within the construction industry (Kazaz and Ulubeyli, 2009, Pamuku and Bhuta, 2004), assessing the factors influencing the deployment of ICT facilities among QSFs specifically in Abuja was deemed necessary. Therefore, the aim of this research is to assess the key factors influencing ICT facilities deployment in quantity surveying practices in Abuja, with a view to proffering possible measures towards increasing its deployment in QSFs. The specific objectives are to determine the factors influencing the deployment of ICT in Quantity Surveying Practices and to assess the possible measures for increasing ICT deployment in Quantity Surveying firms in Nigeria.

LITERATURE REVIEW

Evolution of Technology in Quantity Surveying Practice

Musa *et al.* (2010), opined that Quantity Surveying Practice the world-over and in Nigeria in particular is experiencing dramatic but significant changes in scope and service delivery. Researchers in the early twenties attributed these changes to the changing industry's and clients' demands, advances in Information and Communications Technology, increased level of competition both locally and internationally and globalization. Major among these changes is the paradigm shift from paper-based to computer based (digital) cost information production and exchange through the adoption and use of the Information and Communications Technology (ICT). Mores so, the advent of technology has also enhanced quantity surveying practice in Nigeria (Halim, 2010).

Corroborating further, a simple example is the use of mobile phones for communication via text messages which has helped to improve communication in the course of everyday assignments. Field staff can make immediate contact with their office of the principal partner when issues arise while out in the field in the past, such staff would have had to return to base to deal with such issues. The use of computers and the internet has also made it possible for firms to operate several branches apart from their Head offices with more ease than previously was the case. Professional reports may be vetted online and the exchange of documented information has been greatly enhanced. ICT are perfect tools for working with information and can handle and process large amounts of information for various purposes which would otherwise be difficult to manage manually (Halim, 2010).

Quantity surveying practitioners in Nigeria do not seem to be operating at par with their professional counterparts in the industry. As field reconnaissance revealed that some practitioners have traditionally lagged behind others, when it comes to applying the latest ICT application in quantity surveying practice. Thus, a greater part of the production difficulties in the construction industry has strong relation to the

communication and information exchange between the parties involved in the construction project (Oyetunji, Ojo and Oyetunji-Olakunmi, 2018)

ICT Deployment Tools

According to Oladapo (2007), the basic modes of acquisition of computer literacy available to construction professionals are through private lessons, self-taught, in service training given by employer and continuous professional development training by professional bodies were the major modes, and lastly learning at school. The use of self-taught is most common and this is a reflection of the very low ICT contents of construction education in Nigeria (Oladapo, 2006). The essential tools for ICT deployment are hardware and softwares. While the hardware comprises majorly of the different types of computerised gadgets, the softwares ranges from word processing softwares to design softwares. The common types of software used in construction include: Word processing; Spreadsheet; CAD (Revit, AutoCAD, ArchiCAD); Internet software; BIM (Building Information Model); RFID (Radio Frequency Identification); Project extranet; Microsoft project etc. These softwares are used for administration, marketing, desktop publishing, presentation and project management (Doherty, 1997, Arif and Karam, 2001). While architects, engineers and contractors use CAD mostly for design, drawing and presentation, quantity surveyors use it for measurement, preparation of bills of quantities (BOQ), estimating, and presentation.

The Quantity Surveying Firm in Nigeria

Ojo (2011) opines that the responsibilities of QS begin at the planning stage and continue through the construction period. Nigerian quantity surveying firms (QSFs) usually have more than one registered quantity surveyors that have been licensed to practice under the bye-laws of the Nigerian Institute of quantity surveyors, NIQS (Anyadike, 2001). QSF may consist of unlicensed individuals also, but they only work as assistants to the licensed QS in the firm for the purpose of gaining experience and getting licensed. Quantity Surveying Firms like any other firm/company must be registered with Corporate Affairs Commission (CAC) and given certificate of incorporate to operate legally (OdediranAdeyinkaOpatunji and Morakinyo, 2012). Also, the firm have to register with Quantity Surveyors Registration Board of Nigeria (QSRBN) and the Nigerian Institute of Quantity Surveyors (NIQS), to be recognised as quantity surveying firm (Odediran *et al.*, 2012).

Factors Influencing ICT Deployment

Oladapo (2007), noted that there is significant positive correlation between the level of ICT use and business of the firm (contracting, consulting or academics), years of computer literacy of the CEO/senior managers, and the attitude of the CEO/senior managers to ICT (whether they see the need for ICT or not). Oyediran and Odusami (2005), identified the following factors as those that are responsible for the slow acceptance of ICT by quantity surveyors. They are: Operational inhibitors - Rate of virus attack leading to loss of data, and associated problem, the rate at which software becomes outdated and require up dating, the durability of clones (locally assembled computers), and branded computers are not replaceable; Educational problems - QS training institutions are not equipped\positioned to give computer education to their students, there is no tailor-made QS training by private computer school trainers, management of organizations rarely give in-service training to QS staff, software education is poor, capacity of QS educators are low; Return on investment - Inadequate job order to encourage investment in computer, the cost engaging computer literate is high, fees are not paid to justify computerization of PCMS; Management attitude -

management is not willing to computerize PCMS, management does not see the need to computerize; Myth factors - It makes other professionals to encroach on QS jobs. QS believes computer training and usage is for the coming generation, and it is capable of creating unemployment for QS.

According to Oladapo (2007), the factors that constraints the acceptance of ICT devices include insufficient/erratic power supply; job sizes and fees not enough for ICT; high cost of hardware/software; fear of virus attack; high rate of obsolescence of software/hardware; inadequate ICT content in construction; scarcity of professional software; high cost of engaging computer staff; lack of management desire and appreciation of ICT; Security; Low return on investment in ICT; personnel abuse; and fear of ICT making professionals redundant. Ibironke *et al.* (2011) reported that the major factors that could influence the use of ICT by QSFs include; rate of virus attack leading to loss of data and associated problems, high initial cost of acquisition, fear of ICT making professionals redundant, irregular power supply, few professional software to choose from, inadequate job order to encourage investment in computer, security/privacy fears, the cost of engaging computer literate staff is high/training on use of software, fear of personal abuse, the rate at which software becomes outdated and requires updating. Oyediran and Akintola (2011), asserted that the reasons for the relatively low adoption of ICT are: issues relating to the legal ramifications of electronic communications, vague security framework, and issue of trust. Also, organizational and human issues were highlighted as the key factors affected the use of technologies in the construction sector. However, empirical studies on key factors influencing the deployment of ICT facilities in QS practices within the QSFs in Nigeria have not received detailed research attention. This is gap this study intends to bridge.

Measures for Improving ICT Deployment

Mutesi and Kyakula (2009), carried out a research on the possible solutions to the use of ICT. The top three possible solutions to the use of ICT in their organizations are; loans from Government for ICT development in the private sector, Improving and employing professionals with ICT skills and Staff training on job in the use of ICT for work. The ICT sector must be strengthened since it affects operations of all other sectors of the economy (Oladimeji and Folayan, 2018, Oyetunji *et al.*, 2018, Kundishora, 2006). Some of the points that were further stressed upon which helps to strengthen ICT are: loans from government, adequate power supply, lowering cost of PC's by rationalizing ICT's tariff structure, ensure that every department develops and manages a computerized information system, promote awareness and use of ICT and Promote local research and development. These factors can only be implemented by the government and so are to be considered under the roles of the government in improving the use of ICT.

RESEARCH METHOD

This study covered the assessment of the factors influencing ICT facilities deployment in quantity surveying firms (QSFs) in Abuja. The choice of selecting QSFs in Abuja for the study is based on the premise that Abuja is the administrative centre of the country with lots of construction projects being executed on a daily basis. Thus, most construction related firms (QSFs inclusive) have their head office or branches there (Aje, Makanjuola and Olatunji, 2015).

According to Kothari (2004), population is a collection of elements being studied and about which conclusions are to be drawn. Since this research sets out to assess the key factors of ICT deployment on quantity surveying practices in Nigeria, the population for this research is therefore quantity surveying firms (QSFs) in Abuja. There are 82 registered quantity surveying firms in Abuja as at December, 2016. Since the population is defined and fall under a manageable and reachable size, the whole population was considered for the research (Morenikeji, 2006). However, during sampling it was observed that some of the quantity surveying firms have either moved without a forwarding address or could not be accessed as at the time of visit, thus reducing the number of QSFs accessible to 64. This study adopted census method of sampling, a non-probability sampling since the population for the research falls within a manageable and accessible size; and the researcher is not concern about the representativeness of the sample, and the probability of an element being stated is unknown. This sampling method is suitable for this study since it involved an extensive field work. Furthermore, the study adopted a well-structured questionnaire administered personally to quantity surveying firms in Abuja. One quantity surveyor was assigned to attend to the questionnaire in each of the QSFs assessed. According to Sekaran and Bougie (2009), questionnaire is one of the most used technique for conducting social research, and it involves the formulation of precise written questions for the respondents, whose opinion is being sort. The questionnaire used was designed in sections with multiple-choice.

The questionnaire for this study was designed in two sections using the identified factors emanated from related literatures reviewed. Section A of the questionnaire was used to harness data on the background respondent. This was done in order to provide quality check to the data gotten from the other sections of the research instrument. Section B was divided into parts and it addressed the objective. Part A and B assessed the factors influencing the deployment of ICT and the possible measures of increasing ICT deployment in QSFs. After administering the questionnaire, the respondents were given considerable amount of time to reflect and facilitate giving of valid responses to the items on the questionnaire.

A total of 59 questionnaires were retrieved out of the 64 questionnaires administered to available QSFs. This represent a response rate of 92% which is far above the usual response rate of 20-30% for questionnaire surveys in construction management studies, as suggested by (Akintoye, 2000). Reason for this high response rate can be attributed to the sampling technique adopted for the study, out of which 59 were retrieved and ascertained fit for analysis. The study employed Percentile, Mean Item Score (MIS), and principal component analysis (PCA) in the data analysis. Percentile was employed in analysing the background information of the respondents, Mean Item Score was used in assessing the factors influencing ICT deployment and in determining the possible measures for increasing ICT deployment is QSFs, and factor analysis was adopted in order to get a relatively manageable number of factors influencing ICT deployment in quantity surveying practices. This study employed the use of PCA with varimax rotation for factor extraction. PCA is concerned mostly with establishing which linear components exist within the data and how a particular variable might contribute to that component (Field, 2005, Pallant, 2011). Data analysis was conducted using statistical package for social science (SPSS 17.0).

RESULTS AND DISCUSSION

The analysis of data gathered on the background of respondents is showed that majority of these respondents (42.4%) have worked between 6 to 10 years in their

respective QSFs. The average number of years the respondents have spent at their present firm is put at 7.3 years. This implies that these respondents have spent considerable number of years in their present organisations and therefore can give a reasonable insight to the happenings within their firms. In terms of highest amount of construction project handled, 44.1% of them have handled projects worth of 51 to 100 million naira. Result further shows that on the average these assessed firms have handle projects worth of 204 million naira. Also majority of the respondents (44.1%) have between 6 to 10 years working experience. The average years of working experience of these respondents is calculated to be 10.7 years, while their highest academic qualification is Bachelor of Science/Technology with (42.4%), Higher National Diploma stood at (25.4%) and Masters of Science/Technology had (15.3%). This result suggests that the respondents are not only equipped in terms of number of years working in these firms, but in terms of years of experience in the built environment and also academically. Most of these respondents are Senior QS (35.6%) and Assistant QS (33.9%) in their respective firms, while most of them are corporate (37.3%) and probationer (33.9%) members of the Nigerian Institute of Quantity Surveyors. Findings from the background information of the respondents for this study shows that response gotten from them can be relied upon in making valid conclusion of the subject of the study.

Factors Influencing the Deployment of ICT in Quantity Surveying Practices

The seventeen factors identified from literature were assessed based on the level of significance as the influence the deployment of ICT in Quantity Surveying practices. The ranking of these factors is shown in **Table 1**. The analysis revealed that the top ranked factor is the high cost of hardware and software needed for ICT deployment (mean = 4.17), next is satisfaction with existing method of working, lack of legal support for use of ICT and high cost of training ICT professionals with a mean value of 3.93, 3.88 and 3.68 respectively. The least significant factor is virus attack, security breach and fear of accuracy with a mean value of 3.07. With an average mean score of above average of 3.0., these factors can be said to exert a considerable influence on the deployment of ICT in quantity surveying practices.

Table 1: Factors influencing the deployment of ICT in quantity surveying practices

Factors	Mean	Std. Deviation	Rank
High cost of hardware and software	4.17	1.248	1
Satisfaction with existing method of working	3.93	1.065	2
Lack of legal support for use of ICT	3.88	1.247	3
High cost of training ICT professionals	3.68	1.432	4
Inadequate knowledge about return on ICT investment	3.58	1.429	5
Inadequate financial resources	3.56	1.263	6
Software and hardware reliability problems	3.56	1.236	6
Inadequate trained ICT professionals	3.53	1.419	8
Fear of job losses /making professionals redundant	3.49	1.165	9
Missing link in the educational training	3.46	1.194	10
Rapid changes in ICT technologies	3.46	1.343	10
Inability to quantify process improvements and uncertainty of benefits of ICT	3.41	1.219	12
Lack of information by professionals on areas of adoption	3.39	1.313	13
Little return on investment	3.37	1.272	14
Security concerns/privacy fears	3.22	1.233	15
Insufficient/Erratic power supply	3.20	1.141	16
Virus attack, security breach and fear of accuracy	3.07	1.701	17

Source: Researcher's analysis, 2017

In order to group the identified factors influencing ICT deployment in quantity surveying practices into more manageable and significant size, factor analysis was employed. This was deemed necessary to reduce these factors into a smaller number of coherent subscales. The suitability of the data gathered for factor analysis was determined firstly by considering the sample size and number of variables under study. Pallant (2011), stated that there had been little agreement amongst authors concerning the size of a sample for factor analysis, but recommended the use of a larger sample. However, studies of factor analysis conducted for smaller sample size has evolved in over the years. Akintoye (2000) conducted factor analysis for a sample size of 84 in a comparative study on UK contractors, Takim and Adnan (2008) also employed factor analysis on 93 respondents in analysing the effectiveness measures of construction project success in Malaysia. Thus, it can arguably be stated that a sample size of 59 adopted in this study is suitable for this analysis. Regarding the number of variables, (Hair, Black, Babin, Anderson and Tatham, 2006) suggested that factor analysis is suitable for 20–50 variables, as the extraction of common factors becomes inaccurate if the number of variables exceeds this range. However, study has shown that less number of variables can be used (AhadzieProverbs and Olomolaiye, 2008). Hence the 17 factors coupled with the sample size are considered adequate for factor analysis.

Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity were adopted in testing the factorability of the data gathered. According to Pallant (2011) KMO is a measure of homogeneity of variables and has become a popular measure used in testing whether the partial correlations among variables are small. Tabachnick and Fidell (2007) stated that the KMO index ranges from 0 to 1, with 0.6 suggested as the minimum value for a good factor analysis. However, Hair *et al.* (2006) and Stern (2010) suggested that KMO value should be greater than 0.7 if the sample size is adequate for factor analysis. Sample with a KMO value between 0.5 and 0.7 is marginal while lower than 0.5 is considered to be unsuitable for factor analysis. Also Pallant (2011) submitted that Bartlett's test of sphericity shows whether the correlation matrix is an identity matrix. It was further suggested that the Bartlett's test of sphericity should be significant ($p < 0.05$) for the factor analysis to be considered appropriate. Result in **Table 2** shows a KMO value of 0.738 and a significant level of 0.000 for the Bartlett's test. This result coupled with the 0.860 result obtained from the reliability test carried out through the use Cronbach's alpha test, shows that the use of factor analysis for the data gathered is appropriate.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.738
Bartlett's Test of Sphericity	Approx. Chi-Square	391.951
	Df	136
	Sig.	0.000

Source: Researcher's analysis, 2017

Having confirmed the suitability of the data, principal component analysis (PCA) with varimax rotation was conducted. Result in **Table 3** shows that 5 components with eigenvalues greater than 1 were extracted using the factor loading of 0.50 as the cut-off point. The total variance explained by each component extracted is as follows; component 1 with 33.64%, component 2 with 10.28%, component 3 with 7.84%,

component 4 with 7.28%, and component 5 with 6.54%. Thus, the final statistics of the PCA and the components extracted accounted for approximately 65.59% of the total cumulative variance. This fulfils the criterion of factors explaining at least 50% of the variation as stated by (Stern, 2010).

Table 3: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	5.719	33.641	33.641	5.719	33.641	33.641	2.953	17.369	17.369
2	1.749	10.289	43.931	1.749	10.289	43.931	2.789	16.407	33.775
3	1.333	7.840	51.771	1.333	7.840	51.771	2.467	14.509	48.285
4	1.238	7.283	59.054	1.238	7.283	59.054	1.686	9.918	58.203
5	1.112	6.544	65.598	1.112	6.544	65.598	1.257	7.395	65.598
6	0.918	5.402	71.000						
7	0.877	5.160	76.160						
8	0.767	4.510	80.671						
9	0.612	3.601	84.272						
10	0.599	3.524	87.795						
11	0.447	2.630	90.425						
12	0.435	2.561	92.986						
13	0.339	1.995	94.982						
14	0.269	1.583	96.565						
15	0.243	1.432	97.997						
16	0.209	1.228	99.225						
17	0.132	0.775	100.000						

Source: Researcher's analysis, 2017

Further to the factor extraction with eigenvalues greater than 1, Pallant (2011) suggested a critical look at the scree plot in other to determine which components (factors) to extract or retain. In analysing the scree plot, a change in the shape of the plot is identified and only components above this point are retained. A look at the fig. 1 shows that from the fifth component, the plots tend to flattened; hence only components from this point above are retained. This further confirms the result in **Table 3** which shows only 5 components with eigenvalues greater than 1. Result in **Table 4** shows each of the 5 extracted components and their variables. Spector (1992) stated that a clear component structure is present when a variable has significant factor loading (loading > 0.50) on one component only. Hence, only elements with 0.5 and above are considered under each component.

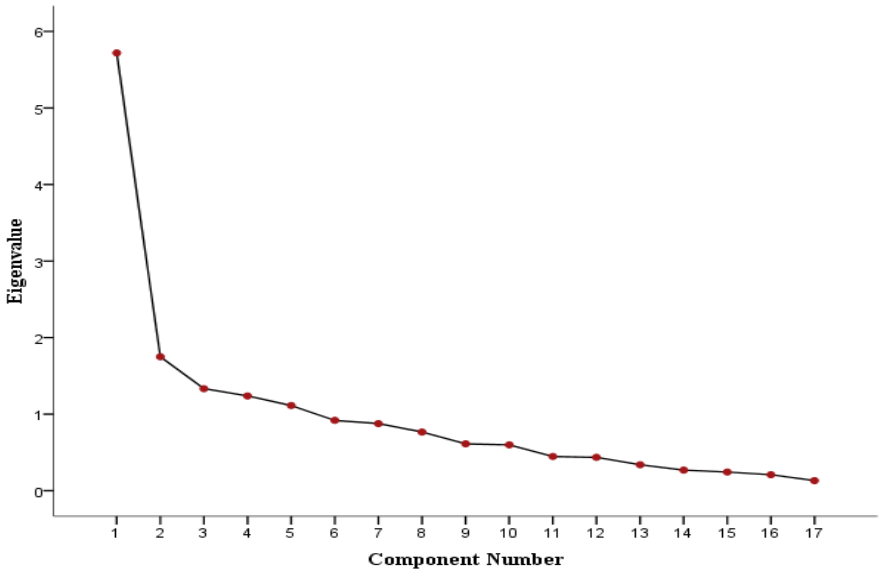

Figure 1: Scree Plot

Table 4: Rotated Components Matrix

	Component				
	1	**2**	**3**	**4**	**5**
Rapid changes in ICT technologies	0.730				
Software and hardware reliability problems	0.728				
Security concerns/privacy fears	0.625				
Missing link in the educational training	0.612				
Inadequate knowledge about return on ICT investment	0.571				
Virus attack, security breach and fear of accuracy	0.568				
Insufficient/Erratic power supply		0.751			
Inadequate financial resources		0.571			
Little return on investment		0.569			
Inability to quantify process improvements and uncertainty of benefits of ICT		0.472			
Fear of job losses /making professionals redundant			0.827		
Lack of information by professionals on areas of adoption			0.723		
Inadequate trained ICT professionals			0.564		
Lack of legal support for use of ICT				0.831	
Satisfaction with existing method of working				0.645	
High cost of hardware and software					0.895
High cost of training ICT professionals					0.572

Source: Researcher's analysis, 2017

Explanation of the Extracted Factors

(i) ICT Related Issues

Result in Table 4 shows that the first principal component has high factor loadings for a group of 6 variables. These variables include; rapid changes in ICT technologies, software and hardware reliability problems, security concerns/privacy fears, missing link in the educational training, inadequate knowledge about return on ICT investment, and virus attack, security breach and fear of accuracy. These factors accounts for 33.6% of the variance explained. After a critical examination of the characteristics of these factors, it was observed that these factors have to do with issues that tend to emanate from ICT usage. Hence, this component was named "ICT related issues".

(ii) External Related Issues

Result also shows that the second principal component accounts for 10.3% of the total variance explained. Factors loading on this component are; insufficient/erratic power supply, inadequate financial resources, and little return on investment. These factors are associated with external environment of the QSFs. Based on this knowing, this component was named "external related issues"

(iii) Human Related Issues

The third principal component accounts for 7.8% of the total variance explained. Three factors are loaded on this component and they include; fear of job losses /making professionals redundant, lack of information by professionals on areas of adoption, and inadequate trained ICT professionals. These factors tend to emanate from the individuals within the industry. Based on this, the component is named "human related issues".

(iv) Legal and Change Issues

Result reveals that the fourth principal component have only two factors loading on it and it accounts for 7.3% of the total variance explained. These two factors are; lack of legal support for use of ICT and satisfaction with existing method of working. Based on the characteristics of these two factors, the component was subsequently named "legal and change issues".

In the adoption of ICT in quantity surveying practices, the absence of legal backing cum implication can go a long way in affecting the deployment of same within QSFs. In similar vein, the inability of the construction industry in general to adapt to changes and adopt innovative ideas tends to impact negatively on the delivery of the services of the industry. Thus, instead of adopting the use of ICT in its holistic form, QSFs tend to rather stick to their old practices base on the fact that appreciable satisfaction is still being derived from the old ways.

(v) Cost Related Issues

The fifth principal component also has two factors loading on it and it accounts for 6.5% of the total variance explained. These factors are; high cost of hardware and software, and high cost of training ICT professionals. Since these factors are cost related, this component was subsequently named "cost related issues". The huge cost of acquiring most of quantity surveying softwares has been a major issue that deters most QSFs from acquiring them. This invariable has its share of influence in the choice of adopting ICT by these firms. In similar vein, training QS on the use of ICT can prove to be expensive, thus, delimiting the use of these softwares within QSFs.

These findings regarding the factor Influencing the Deployment of ICT in Quantity Surveying Practices are in line with Oyediran and Odusami (2005) who stated that factors relating to the ICT operations tend to have huge influence in the choice of the

adoption of ICT by firms. Findings of this research is also in tandem with Ibironke *et al.* (2011) findings which shows that the high initial cost of acquisition; lack of infrastructures to support its use and security concerns such as the susceptibility of ICT system are some of the major factors influencing the use of this system. However, contrary to Ibironke *et al.* (2011) findings that the rate of virus attack leading to loss of data and associated problems is the major factor affecting the adoption of ICT in QSFs, this study discovered that this factor is actually the least influencing factor. The top factor according to this research is the high cost of hardware and software. This further confirms the result from the crosstab conducted, which shows that QSFs involved in higher budget projects tend to deploy ICT more than those with smaller budget projects. This further corroborates Oladapo (2006) submission that the increased cost of acquiring hardware and softwares for the deployment of ICT in the dwindled economic condition of Nigeria, has made it almost impossible for construction professions to adopt ICT in their daily activities. Usman *et al.* (2012) categorised the factors influencing the deployment of ICT in QSFs in Nigeria in two; human factors which has to do with individuals, and the organisational culture factors. Findings of this study is in tandem with this submission as it was discovered that human related issues are among the crucial factors influencing the deployment of ICT facilities in QSFs in Abuja, Nigeria.

Table 5: Monte Carlo PCA for Parallel Analysis

Eigenvalue No	Random Eigenvalue	Standard Dev
1	2.0710	0.1377
2	1.8406	0.1018
3	1.6483	0.0729
4	1.4851	0.0689
5	1.3497	0.0597
6	1.2326	0.0566
7	1.1201	0.0518
8	1.0147	0.0543
9	0.9149	0.0436
10	0.8219	0.0414
11	0.7384	0.0426
12	0.6583	0.0439
13	0.5739	0.0377
14	0.4929	0.0373
15	0.4214	0.0392
16	0.3499	0.0417
17	0.2662	0.0382

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Number of variables: 17
Number of subjects: 59
Number of replications: 100

Table 6: Comparison of eigenvalues from PCA and criterion values from parallel analysis

Component no	Actual eigenvalue from PCA	Criterion value from parallel analysis	Decision
1	5.719	2.0710	Accept
2	1.749	1.8406	Not Accept
3	1.333	1.6483	Not Accept
4	1.238	1.4851	Not Accept
5	1.112	1.3497	Not Accept

Figure 1 present the Scree Plot of the data. An examination of the chart revealed a sudden and constant change after the third component. As a result, components just above this point are retained. These were additionally upheld by the outcomes of the parallel analysis **Table 5**, which indicated just one component with eigenvalues surpassing the comparing benchmark values for an arbitrarily produced data matrix of the same size (17 variables * 59 respondents) as shown in **Table 6**. The Monte Carlo principal component analysis for parallel analysis presented in Table 5 also indicates that only items (1) has the highest random eigenvalues in the parallel analysis, as it is compared inTable 6 with the actual eigenvalues from principal component analysis. The criterion values from the parallel analysis is less than the initial eigenvalue which make it acceptable.

Measures for Increasing ICT Deployment in Quantity Surveying firms in Abuja
Result in T**able 5** showed the ranking of the possible measures to increase deployment of ICT among QSFs, identified from literature. The result revealed that the most significant measures are; creating avenues for proper education and trainings on ICT, promoting awareness and use of ICT, implementing measures to develop and retain skilled human resources in the ICTs sector, ensuring easy access to loans from financial institutions to finance ICT development, and top management supports within the organisation, with a mean value of 4.22, 4.17, 4.02, 3.98 and 3.97 respectively. Also, the least ranked measure is promoting local production of ICTs products to ensure relevance of content and use of appropriate technologies that meet international standards with a mean value of 3.07. It is evident that all the identified measures can increase the deployment of ICT with QSFs if considered as they all have a mean value of above average of 3.0. This finding further affirms (Mutesi and Kyakula, 2009) submission that the top three possible solutions to the use of ICT are; loans from Government for ICT development in the private sector, improving and employing professionals with ICT skills and Staff training on job in the use of ICT for work. The finding is also in line with that of (Akinnagbe and Adelakun, 2014) who observed that for increased ICT deployment, QS should be trained and given technical and financial support so that they can become first hand software experts. The study observed that ensuring easy access to loans is crucial if ICT deployment is to increase in QSFs. This is in line with (Eze, Ayigbe, Eberechi and Jordan, 2015) submission that Government should extend the hand of assistance to firms in the country, particularly with a view to improving their funding and financing capacity.

Table 5: Measures for Increasing ICT Deployment in QSFs

Measures	Mean	Std. Deviation	Rank
Creating avenues for proper education and training on ICT	4.22	0.892	1
Promoting awareness and use of ICT	4.17	0.931	2
Implementing measures to develop and retain skilled human resources in the ICTs sector	4.02	1.196	3
Ensuring easy access to loans from financial institutions to finance ICT development	3.98	1.106	4
Top management supports within the organisation	3.97	0.830	5
Rationalise the ICTs tariff structure to make ICTs more affordable and accessible	3.64	1.256	6
Promoting local research and development	3.56	1.134	7

Creating a conducive environment for investment in the ICTs sector	3.46	1.104	8
Adequate /Improving power supply by the government	3.46	1.194	9
Promoting local production of ICTs products to ensure relevance of content and use of appropriate technologies that meet international standards	3.07	1.285	10

Source: Researcher's analysis, 2017

CONCLUSION

This study assessed the key factors influencing information and communication technology (ICT) facilities deployment in quantity surveying practice in Abuja, Nigeria with a view to providing possible measures that will ensure the increase in the use of ICT among in the delivery of quantity surveying services within the country. Using a survey design approach, the study has been able to ascertain the factors influencing the deployment of ICT in quantity surveying practices, and possible measures for increasing ICT deployment have been identified.

Based on the findings of the research, the study concludes that the factors influencing the deployment of ICT in quantity surveying practices are major ICT related issues, external related issues, human related issues, legal and change issues, and cost related issues. Crucial factors among them are; high cost of hardware and software needed for ICT deployment, satisfaction with existing method of working, lack of legal support for use of ICT, and high cost of training ICT professionals. It was further concluded that the most significant measures that can aid ICT deployment in quantity surveying practices are proper education and trainings on ICT, promoting awareness and use of ICT, and implementing measures to develop and retain skilled human resources in the ICTs sector.

However, the comparison of eigenvalues from PCA and criterion values from parallel analysis revealed ICT related issues had the highest random eigenvalues in the parallel analysis. This is an indication that items of this factor: rapid changes in ICT technology, software and hardware reliability problems, security concerns/privacy fears, missing link in the educational training, inadequate knowledge about returns on ICT investment and virus attack, security breach and fear of accuracy are the key factors influencing ICT facilities deployment in quantity surveying practice in Nigeria and should be given due consideration for effective implementation of ICT facilities deployment in quantity surveying practices within the QSFs. Thus, the findings of this study would serves as mechanism for effective implementation of measures that could aids deployment of ICT facilities in QS practices within the QSFs in Nigeria.

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