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Overview of ICT Usage in Construction Industry: A Case Study of Lagos State, Nigeria

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ABSTRACT

Information and computer technology (ICT) are found to accumulate, salvage, broadcast or receive information through the electronic way. Construction industry engages the services of builders, engineers, surveyors, architects, Geographic Information System (GIS), clients, consultants, contractors, workers and suppliers, all with conflicting interests in the project which demands an intense exchange of data and information. Consequently, the construction industry is one of the most information demanding industries and requires close coordination of a large number of specialized mutually dependent organizations to achieve cost, time and quality goals of a particular project. The industry is described by incorrect and ill-timed communications that often result in costly delays. As a result, ICT could be of tremendous help in this regard. This study explains the usage level of ICT and its impact on the construction industry in Nigeria. Relevant data were obtained from the Nigerian Bureau of statistics in Abuja and a survey was done in the industry comprising professionals, academia and the general public. The study produced limitations, benefits and possible solutions to how ICT can become better in its usage in the construction industry.

Keywords: ICT, Construction, Industry, Professionals.

1.0 INTRODUCTION

Information and Communications Technology (ICT) is a specialized application of information technology that has some aspect of communication [1]. It includes areas such as; software development, mobile devices, cloud computing, data centers, cyber security, research networks, support [2] and so on. Industry in general has seen many technological developments in recent decades. However, the construction industry has not kept pace particularly within the area of information and communication technologies (ICTs). This could be for many reasons notably including the fragmented structure of the industry. Many studies regard the construction industry's failure to keep pace with ICTs as a major problem affecting its performance. Hence, they have tried to diagnose the problem in this regard [16]. Many drivers have seen the successful adoption of new ICTs within other industries with this trend now emerging within the construction industry. Because of the increasing awareness among practitioners of the benefits of utilizing ICTs within construction, the recent decade has seen many construction projects harnessing ICTs methods and strategies in construction [17]

The starting point for the use of computers in the construction industry was structural calculations. Civil engineer Konrad Zuse is considered to be one of the major pioneers in computer technologies [3]. In 1941 he developed the world's first functional programme-controlled Turing-complete computer, the Z3. Structural calculations were followed by drawing tools and geographic information systems. The origins of Computer Aided Design (CAD) lie in the aircraft industry in the 1960s [4]. In the 1980s, these systems also made their break-through in architecture. Specialized Computer Aided Architectural Design (CAAD) software programs started to improve the drawing process in 2D. In the 1990s, tools emerged which provided the possibility of 3D drawing and subsequently, object-oriented design systems were developed [4].

Design data produced by specific software tools is used throughout the life-cycle of a building from project development through to refurbishment and, in addition to architects and engineers, it is used by building owners, statutory authorities and contractors [18]. Essential input for the design phase is provided by location-related data, which is processed by Geographical Information Systems (GIS) tools. Design ideas are investigated with computer aided architecture tools (CAAD) and informed by calculation

and simulation tools [5]. This interdependence means that both data production and data communication are enormously important. GIS systems support the design process through the preparation of information about the site and geography. Collected data can be summarized and is available for the designers in real-time. Direct interfaces of the applied GIS systems ensure that corresponding design tools are given access to this database. Design documents can be created by CAD tools in 2D, 2½D and 3D. 2D and 2½D designs can be used for standard building designs. 3D-software is needed for polyaxial curvatures, varying curves and dynamic structures [6]. Drawing elements are vector-based such as points, lines, poly-lines, circles, etc. Textures simulate materials and depth. Complete building elements exist in specific libraries for the creation of models [7]. These elements can be specified by various parameters. Linking single elements of this database forms a connected model with interdependent parts, which means that changes to one part of the model can influence other parts if necessary. Elevation drawings, sectional views and 3D views can be generated as construction drawings [8]. The design data from these software tools can be exported and imported using various exchange formats for further use.

2.0 AIM AND OBJECTIVES

This study considers the level of ICT saturation in the construction industry in Nigeria and its impacts in construction industry while specific objectives are:

- To obtain data from relevant agency in Nigeria
- To get information from professionals and academia in the industry
- To perform analysis based on the information gathered

3.0 METHODOLOGY

This study was carried out through a survey by professionals, academia in the construction industry in Nigeria. Also relevant data was obtained from Nigerian bureau of statistics for comparison to ascertain the level of ICT usage in Nigeria and its impact on the economy.. Areas considered in this research are level of computer usage in the construction industry, importance index, communication systems used, benefits of using ICT, constraints and suggestions.

4.0 RESULTS AND ANALYSIS

4.1 Rate of response from the professionals in the industry

Table 1: RESPONSE RATE OF RESPONDENTS.

Questionnaire administered	**540**
Questionnaire received	**390**
Percentage rate of response	**72.2%**

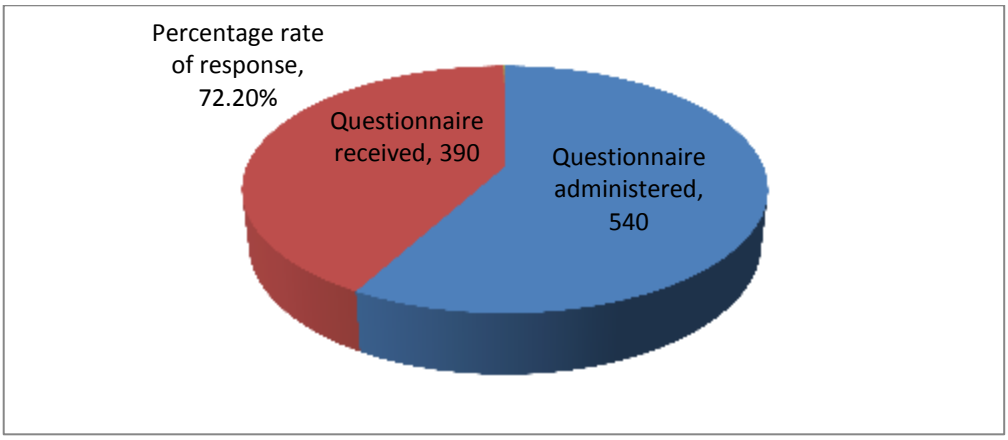

Figure 1.0 Graph showing rate of respondent

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Table 1 and figure 1.0 show that 540 questionnaires were administered and 390 were recovered. This represents a response rate of 72.2%. It is an indication of good response from respondents.

4.2 Working Experiences of the professionals in the industry

Table 2: WORKING EXPERIENCES OF RESPONDENTS

Working experience	Frequency	Percentage
Less than 10 years	41	10.5%
10 – 19 years	60	15.4%
20 – 29 years	101	25.9%
30 – 39 years	188	48.2%
TOTAL	390	100%

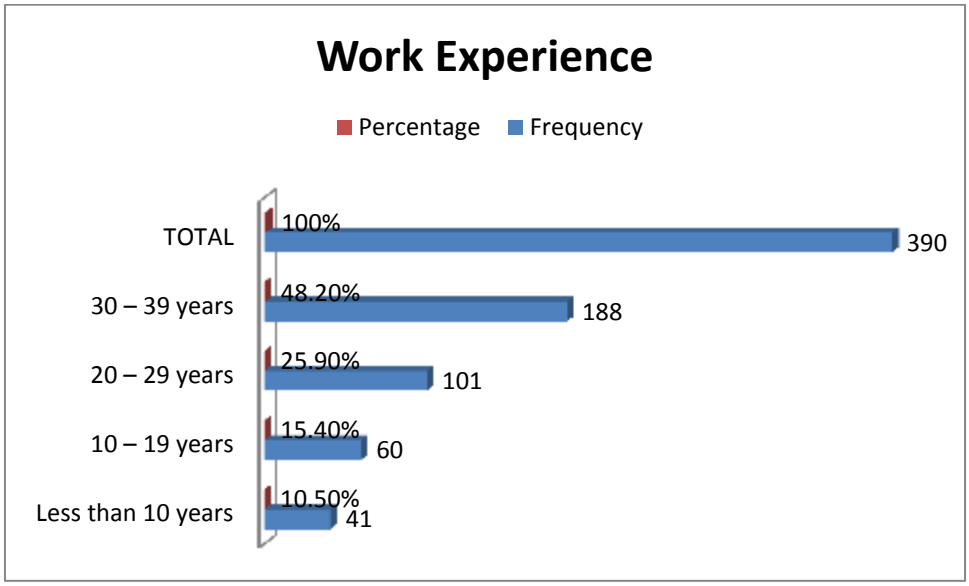

Figure 1.1 Graph showing work experience

Table 2 and figure 1.1 show that 10.5% of the Respondents, most of who are professionals in the built environment have less than 10 years work experience and 15.4% have 10 to 19 years experience. Furthermore, 25.9% of the Respondents have 20- 29 years of work experience, while 48.2% has 30- 39 years of experience. This shows that 89.5% of the respondents who are mainly professionals in the built environment have more than 10 years of experience; meaning that they possess adequate years of cognate experience for this study.

4.3 Various professionals in the industry

Table 3: RESPONSE RATE OF PROFESSIONALS

Professionals	Frequency	Percentage
Architects	25	16.7%
Builders	47	31.1%
Elect. Engineer	10	6.7%
Civil. Engineer	17	11.1%
Mech. Engineer	4`	4.4%
Quantity surveyor	28	18.9%
Town planner	12	7.8%
Others	7	3.3%
TOTAL	150	100%

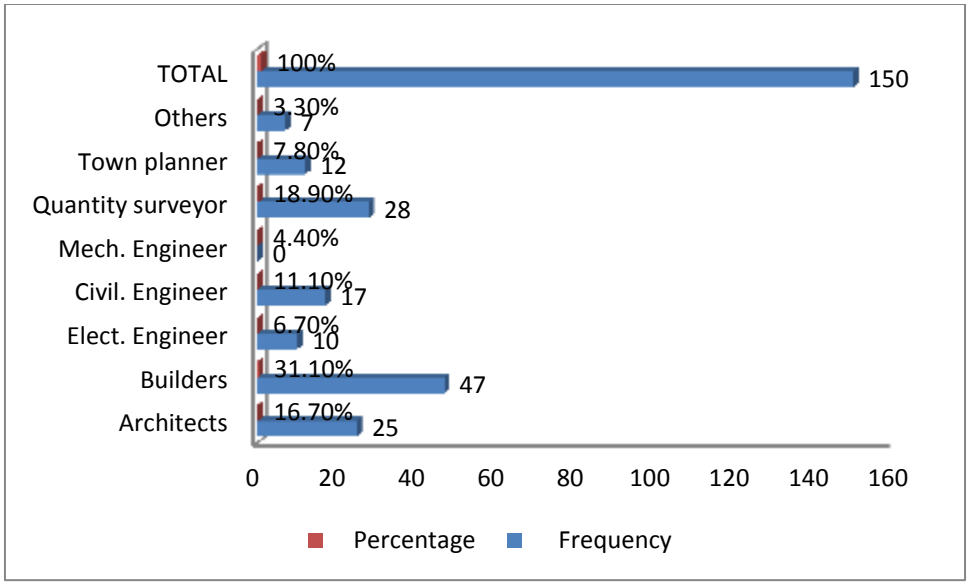

Figure 1.2 Graph showing professionals response

Table 3 and figure 1.2 show that 16.7% of the Respondents were Architects, 6.7% were Electrical engineers, 31.1% were builders, 4.4% were Mechanical engineers, 11.1% were Civil engineers, 18.9% were Quantity surveyors, 7.8% were town planners and 3.3% were other profession related to the built environment. Thus, the respondents are capable of providing information for this study based on professional point of view in the construction industry.

4.4 Qualifications of professionals in the industry

Table 4: RESPONSE RATE OF QUALIFICATION FOR PROFESSIONALS AND ACADEMIA

Qualification	Frequency	Percentage
MNIA	19	18.4%
MNIQS	19	18.4%
MNIB	34	32.0%
MNSE	24	22.4%
Others	9	8.8%
Total	105	100%

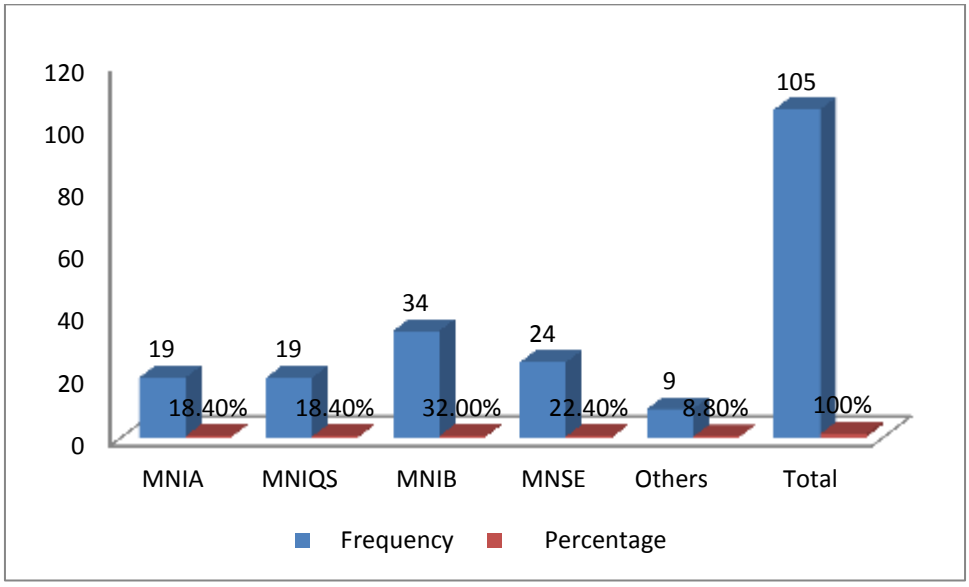

Figure 1.3 Graph showing qualification of professionals and academia

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Table 4 and figure 1.3 show that 18.4% of the Respondents were registered architects, 18.4% were registered quantity surveyors, 32.0% were registered builders, 22.4% were registered engineers and 8.8% were other professionals related to the construction industry. This is an indication that the response centers primarily on registered professionals and academia who are expected to be better informed on ICT in construction industry.

4.5 Reactions due to gender

Table 5: GENDER RATE OF RESPONSE

Gender	Frequency	Percentage
Male	278	71.1%
Female	112	28.9%
TOTAL	390	100%

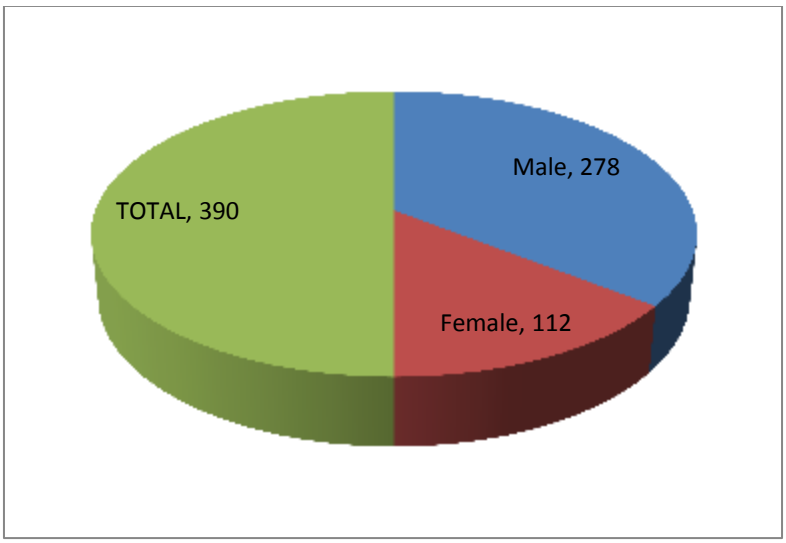

Figure 1.4 Graph showing gender rate

Table 5 and figure 1.4 indicate that 71% of the respondents were male, while 29% of the respondents were female. This shows that the male respondents are about two and a half times the female respondents to provide the necessary information for this study.

4.6 Reactions from Geo political zones in Nigeria

Table 6: Response Rate From Geo-Political Zones

Geo-political zones	Frequency	Percentage
North - East	15	7.9%
North – Central	40	21.1%
North – West	15	7.9%
South – West	50	26.3%
South – South	20	10.5%
South – East	50	26.3%
Total	190	100%

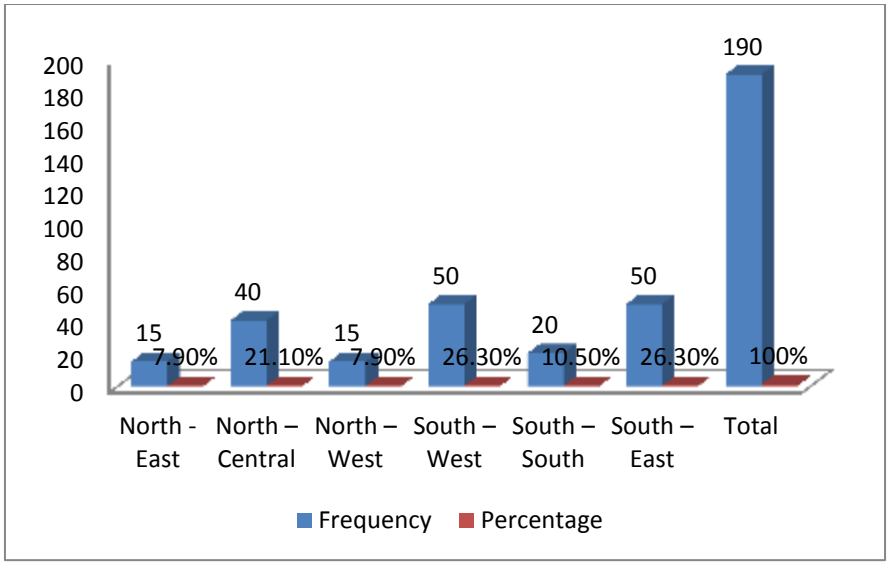

Figure 1.5 Graph showing rate of respondent from geo political zones

Table 6 and figure 1.5 shows that the respondents from North- East were 8%, North- Central were 21%, North- West were 8%, South- West were 26%, South- South were 11% and South- East were 26%. This shows that north- central, south- west and south-south have more respondents as shown in the Table 6.

4.7 Distribution of questionnaire

Table 7: DISTRIBUTION OF QUESTIONNAIRE

Respondents	Frequency	Percentage
Professionals	184	47.4%
Academia	123	31.6%
Public	83	21.1%
Total	390	100%

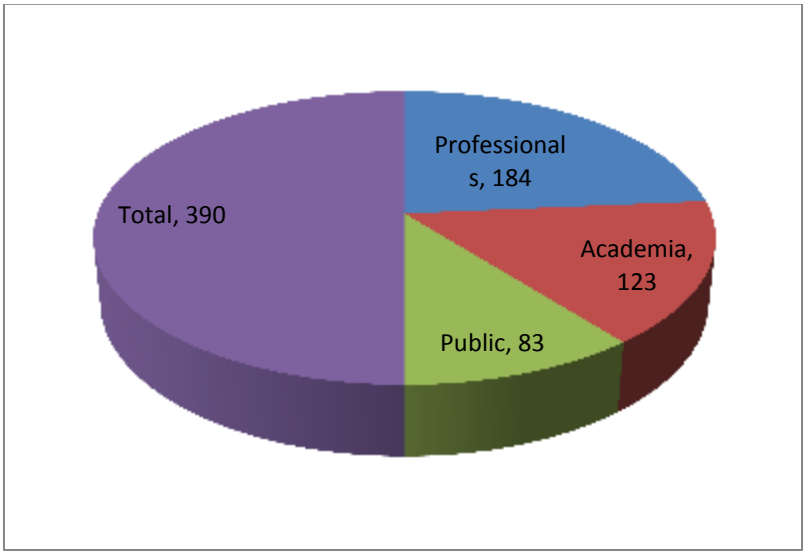

Figure 1.6 Graph showing distribution of questionnaires

Table 7 and figure 1.6 show questionnaires were distributed more to the Professionals and Academia. The distribution shows that the professionals and academia have greater contributions in this study than the public.

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Table 8: Software and percentage used in the industry obtained from Nigerian bureau of statistics [10]

Software	Percentage using it
Word processing and accounting software	
Ms word	89.2
Ms excel	85.7
Presentation software	
Ms power point	60.8
Ms outlook	8.6
Adobe image maker	6.9
Architectural and engineering design software	
Corel draw	11.9
Archicad	54.8
Prokon	18.6
Staad pro	15.8
Mx road	25.7
Hdm 4 model	17.9
Ukdcp	11.3
Electrical engineering	
Matlab	30.6
Fortran	35.9
Electronic work bench	28.5
Quantity surveying measurement and estimating	
Winqs	29.8
Cata pro	8.6
Master bill	28.9
Qs elite	13.5
Snape vector	9.6
Project planning	
Ms project	67.9
Path maker	49.5
GIS	
ILWIS	58.5
ArGIS	49.3
ArcMap	45.8
BIOCHEMICAL	
COOT	55.9
DIGITAL MICROGRAPH	60.3
FASTQC	48.2

4.8 Computer Utilization level

Percentage Level of Computer Utilization is shown in Figure 1.7

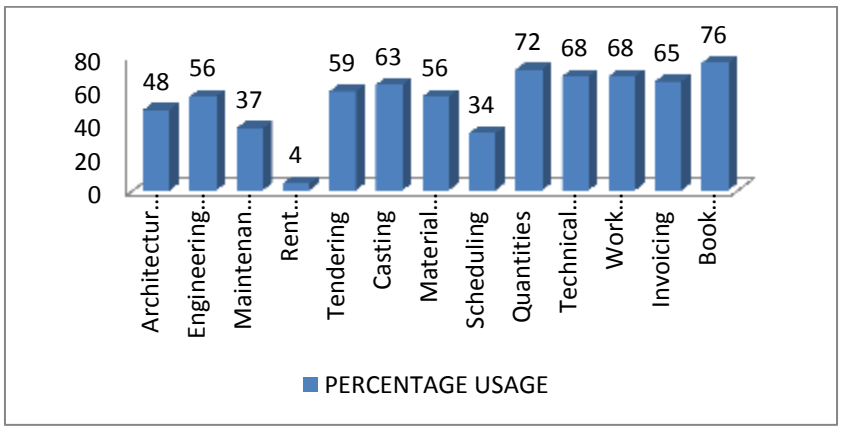

Figure 1.7: Level of ICT usage among professionals in the construction industry

The major use of the computer is book keeping at 76% as compared with other sections in the industry as shown in Figure 1.7. This shows that the use of ICT in construction industry cannot be overemphasize as it will bring eventual growth in the GDP within the country [11].

4.9 Communication System Usage

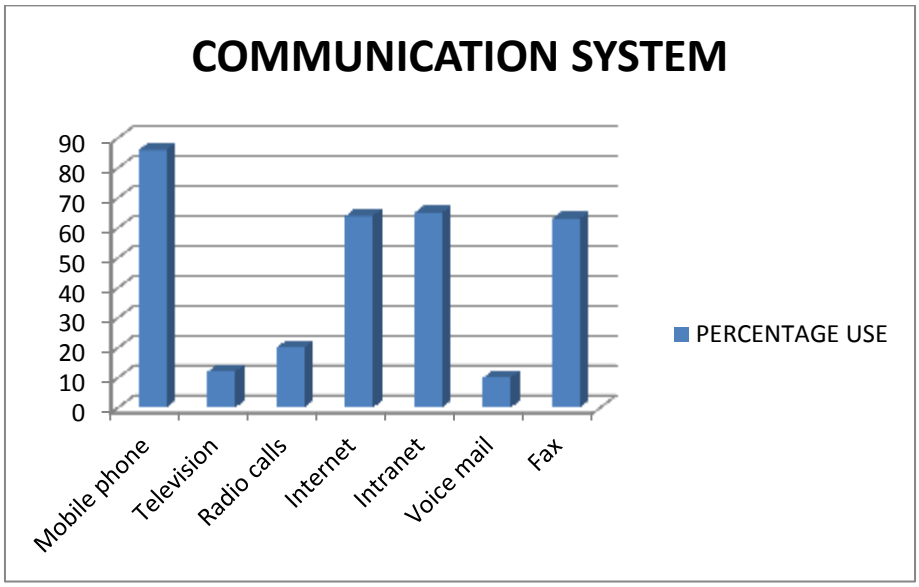

Figure 1.8 Percentage of the internet usage

Figure 1.8 shows that a high percentage of 64% of the firms are connected to internet which they use mostly for e-mail. 87% use mobile phones. Firms find it more suitable and resourceful to communicate using mobile phones especially when it is a one-on-one communication [12]. Intranet (68%) is commonly used within the firms and Fax (64%) are also fairly used by firms to communicate with their employees and clients [19]

4.1.0 IMPORTANCE INDEX AND RANKING

Importance index=$\frac{W}{5*N}$*F*100 [13]

Where w is the weight given to each response

F is the frequency of response

N is the number of responses

Table8: Benefits and Importance Index

Benefits	Importance index	Rank
Error minimization in documents	**92.5**	**1**
Ease of doing complex tasks	**88.6**	**2**
Time saving	**73.8**	**3**
Increased productivity	**70.9**	**4**
Reduction of degree of difficulty	**69.5**	**5**
Increase in speed of work	**67.5**	**6**
Increase in quality of document	**60.3**	**7**
Reduction in construction mistakes	**55.8**	**8**

Table 8 shows the ranking of the benefits which shows that ICT provides the highest benefits in error minimization in documents compared to others [19]

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Table 9: LIMITATION TO ICT USAGE

Constraints	Importance index	Rank
High cost of investment	87.9	1
System and computer malfunction and virus attacks	85.2	2
Poor security and privacy	79.2	3
Continual need to upgrade	72.5	4
Inefficiency from ICT	70.5	5
High cost of professionals to employ	68.5	6
Mass of losses in the industry	50.5	7
Incompatibility in software packages	40.5	8
Management commitment to ICT	39.8	9
Personal abuse	29.8	10
Poor return on investment	25.5	11
ICT making professionals redundant	22.6	12
Inadequate power supply	16.5	13

Table 9 shows that high cost of investment, system and computer malfunction, virus attacks Poor security, privacy, continual need to upgrade inefficiency from ICT and high cost of professionals to employ are the leading limitations faced by professionals using ICT [14]

Table 10: Proffered Solutions to ICT USAGE

Solution	Importance index	Rank
Loans from Government for continuous development	80.4	1
Improving and employing professionals	79.4	2
Staff training on job	77.4	3
Relevant ICT courses in schools at early stages	75.5	4
Increase the development of internet in workplace	52.5	5
Seminars on ICT to refresh skills	45.5	6
Remove ICT investment obstacles	42.5	7
Incompatibility in software packages	40.5	8

For ICT to be more relevant in Lagos State and Nigerian as a whole the proffered solutions obtained are loans from government for continuous development, improving and employing professionals, staff training on job and relevant ICT courses in schools at early stages [15,20]

5. CONCLUSION

This study has dealt with the issue of ICT in the construction industry as it affects the economy of Lagos State. It has employed data obtained from professionals in the industry to determine benefits, limitation and possible solutions on how the use ICT in

Lagos State could be enhanced especially when it comes to everyday construction work. The data obtained Nigerian bureau of statistics show that the computer is mainly used as a word processor. ArchiCAD is mainly accepted at (54.8%) for Architectural/ Engineering design and drawing, WinQs (29.8%) for quantity surveying, Microsoft Project (67.9%) for project planning. Also, 76% of the companies use computers for bookkeeping. Mobile phones (87%), intranet (68%) and internet (64.2%) are used for employer employee communication. The major benefits of ICT were lessening of mistakes in document, making complex tasks easier to perform and saving time. The major limitations for ICT in the construction industry are; soaring cost of investment, system and computer malfunction and virus attacks, and high cost of professionals to employ. The possible solutions leading to development in the use of ICT in construction industry are; Loans from Government for ICT development in the private sector (80.4%), Improving and employing professionals with ICT skills (79.4%) and Staff training on job in the use of ICT for work (77.4%).

REFERENCES

[1] Adenuga O.A. (1999) Building Maintenance in Nigeria: Structural Deterioration, ignition and Diagnosis of causes and Remedies. Shelter watch, Vol. 001.No June-July pp 5-25.

[2] Agele Alufohai J.(2012) The challenges of building collapse in Nigeria. NBRRI news letter. Vol. 1, No.7, June, pp13

[3] Akeju, T.A. (1984): "Lessons from recent structural failures". The Nigerian Engineer. 1984. Vol. 19. No. 2.

[4] Akinpelu, J.A. (2002): The need for code of conduct, building regulations and by-laws for the building industry in Nigeria. The Professional Builder, Nigeria Institute of Building, pp 11-14.

[5]Adebayo A. O., (2007), an investigation into the use of ICT in the Nigerian Construction industry http://itcon.org/2007/18/.

[6]Amor. R, Betts.M, Coetzee. G and Sexton. M, (2002), Information technology for construction: recent work and future direction, Journal of Information Technology in construction, 7: 245 – 258 Http://WWW.itcon.org/cgi - bin/works/show 2002-16 (12 Sept 2007).

[7]Arif A. A and Karam A.H. (2001) Architectural practices and their use of IT in the Western Cape Province, South Africa, Journal of Information Technology in Construction, 6, 17-34, at http://www.itcon.org/2001/2

[8]Boyd, C. and Paulson, J.R. (1995), Computer Applications in Construction.

[9]McGraw-. Hill, Inc, Singapore Doherty J.M. (1997). A survey of computer use in the New Zealand building and construction industry, Journal of Information Technology in Construction 2:45-57

[10]El-Haram, M. A. and Homer, M. W. (2002) Factors affecting housing maintenance cost. Journal of Quality in Maintenance Engineering, 8(2), p. 115-123

[11] Knight, P. and Boostrom, E. (1995),"Increasing Internet Connectivity in Sub-Saharan Africa: Issues, Options, and World Bank Group Role", Online World Bank Publications

[12] Augustine C.I (2012) Case histories of building collapse in Nigeria. NBRRI news letter. Vol. 1, No.7, June, pp10

[13] Ayinuola, G.M and Olalusi, O.O, (2004), "Assessment of building failure in Nigeria" African journal of science and technology, science and engineering series, Vol. 5, No 1.

[14] Chinwokwu, (2000). The role of professionals in averting building collapse, the Nigerian institute of building publication, may 3rd and 4th, pg 12-27.

[15] Danladi Matawal S.(2012) The challenges of building collapse in Nigeria. NBRRI newsletter. Vol. 1, No.7, June, pp8

[16] Felix A.(2012) Causative factors of building collapses in Nigeria. NBRRI news letter. Vol. 1, No.7, June, pp11

[17] Hall, G.T. (1984): Revision Notes on Building Maintenance and Adaptation, Butterworth and Co., England.

[18] Iyagba, R. O. A. (2005): The menace of sick buildings – a challenge to all for its prevention and treatment. An Inaugural lecture delivered at University of Lagos, Lagos.

[19] lyagba, R (1989): "Lesson for the construction Industry from Building Disaster and Failures" (1989).

[20] Kingsley .O. Dimuna(2010). Incessant Incidents of Building Collapse in Nigeria: A Challenge to Stakeholders. Global Journal of Researches in Engineering Vol.10 Issue 4 (Version 1.0)

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