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ASSESSMENT OF THE CHALLENGES AND BENEFITS OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) ON CONSTRUCTION INDUSTRY IN OYO STATE NIGERIA

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ABSTRACT: A major construction process demands both heavy usage of data and data communication between project participants on a daily basis, to meet client requirements. This paper presents the results of investigation conducted to examine the usage, benefits, challenges and the effect of Information Communication Technology (ICT) on project delivery in Oyo State Nigeria. Primary and secondary sources of data collection were used during the investigation. For the primary data, well-structured questionnaire were administered to the professionals in the construction industry in Oyo State using random sampling. The returned questionnaires were analyzed using descriptive data analysis and inferential. The finding revealed the major benefit of ICT as substitute for other more expensive means of communication, improved productivity and channel information and enriches knowledge. The major challenges to the use of ICT were found to include high cost of employing computer professionals, inadequate power supply and inadequate training. Effect of ICT on project delivery was more on project cost and information management. The paper concluded that researching into the benefits of ICT usage and how to overcome the challenges facing the adoption of ICT in construction industry in the area considered will assist the stakeholders in improving construction processes and project delivery.
Keywords: challenges, communication technology, construction industry, information

1. INTRODUCTION

One of the fallout of the recent computer age is the fact that Information and Communication Technology (ICT) is gradually taking over the construction processes. Information is being generated, transmitted and interpreted to enable the project to be built, maintained, reused and eventually recycled through ICT. A major construction process demands heavy exchange of data and information between project participants on a daily basis (Maqsood, Walker and Finegan 2004). This makes the construction industry one of the most information-intensive industries, and requires close coordination among a large number of specialized but interdependent organizations and individuals to achieve the cost, time and quality goals of a construction project (Toole, 2003).

In construction, ICT can be broken down into different segments of information, communication and technology, for better understanding and role in construction. For example, Adriaanse and Voordijk, (2005) gives explanation of ICT within the perspective of a neutral provider of input for decision making. In this point of view communication is no more than distribution of information. ICT may be adopted by specific groups of users within an organization. For example, use of Computer Aided Drafting (CAD) by architects or estimating software used by engineers or project managers. Emmitt and Gorse (2003) identified the reality that, communication between construction industry participants and organizations are concerned with information exchange, dealings with drawings, specifications; cost data, programs plus other design and management information. According to Day et al. (1986), ICT can be the interaction of meaning to reach a mutual understanding between a sender and a receiver via technology. The fact that each project

is unique in terms of site positioning, design requirements, materials selection, budget constraints and the availability of specialized skills makes even the acquisition of ICT know-how relevant (Balogun, , 2007). More importantly, the construction industry is confronted with highly fragmented and competitive environment, addition to the fact that majority of construction projects are hardly treated without traditional communication means, such as face-to-face meetings and the exchange of paper documents. Nevertheless, due to potentially increase in volume, speed, and quality of information transfer, it is possible to improve communication, increase client satisfaction, reduce coordination errors in construction, provide a greater understanding between project participants, create fewer ambiguities and discrepancies in documentation and generally increase awareness and recognition of issues and requirements by all project participants (Murray, et al., 2001). There is also the issue of construction project chain which is lengthy being driven by the client. According Murray et al. (2001), the chain may involve large numbers of skilled professionals and companies with, quite often, much repetition of activities and accumulation of paperwork. They further averred that the main project participants in a typical construction project namely (i) the client and his/her team of professional advisers (consultants) and (ii) the main contractor, subcontractors and suppliers require access to the project information at one time or another. This has necessitated a gradual paradigm shift from traditional paper-based to digitally based information exchange, which other industries such as aircraft manufacturing and banking have adopted and benefited from long time ago (Rivard, et al,. 2004). As more and more computers are connected through the Internet to form the worldwide web, thus allowing firms located on different streets or in different cities, provinces, countries, or even continents to readily exchange information, it has impacted on the traditional processes of organization in construction and result in change in organizational processes, working methods and culture (Ruikar et al., 2005). Some of the benefits of increasing use of ICT in construction industry are: reduction in the time for data processing and communicating information, (ii) improved communications for effective decision-making and coordination among construction participants (Peansupap and Walker, 2005). Enhanced construction productivity was also listed by Liston et al. (2000) as amongst the benefits. According to De Lapp, et al., (2004) and Agyekumet al. (2015), the observed benefits are due to access to Internet-based tools of ICT allow communication between even remote users and enables them to share files, comment on changes and post requests for information.It has been reported that construction deliveries to time, within the projected cost and quality specifications are yet to be fully achieved as there are still evidences of project time and cost overrun and poor project quality, which in many instances, have resulted in project abandonment, dispute, extensive maintenance work etc. The construction industry is faced with the ongoing challenge of changing and improving current work practices in order to become more client-orientated; more competitive as well as productive through adoption of ICT as an integral part of the construction process (Weippert, Kajewski and Tilley 2003). ICT has been shown to be a vital tool in assisting the construction industry to cope with the increasing complexity of its products, increase the demands of its clients and regulators (Betts, 1999), and enhance construction productivity (Liston, Fischerand Kunz 2000). Much effort has been directed toward improving construction productivity and the use of Information and Communication Technology (ICT) in construction, because of its potential to decrease the time for data processing, communicating information and increase overall productivity.

Modern structural design software applications, such as 3D modeling and Building Information Modelling (BIM), provide an example where the design of complex structures and organization of its sub-sections – electrical, mechanical, site, structural and quantifying of a project - can be achieved in minimum time and increased efficiency all within the context of one data framework. In the past, this was almost impossible (Peansupap and Walker, 2005). Therefore the understanding of ICT and its role is important for the realization of improved communications between participating organizations in construction projects. However, the 2002 global ICT rankings by the International Telecommunications Union (ITU) rankedNigeria 27th among 51 African countries and 153rd among 178 countries in the world. (Adebayo, 2007). Investigations conducted later to assess the state of ICT utilization in the construction industry by Ugwuanyi, (2012) indicate that Nigerian Construction Industry has not fully appreciated the value of ICT and the impact of its use on the productivity value chain management. They further averred that the delay in ICT uptake in Nigerian construction industry is limiting advances in construction

quality, cost efficiencies and competitiveness of local firms. This seeming slow pace of ICT application in construction industry also applied to the professional in the industry. According to Oyewobi (2015), many of the professionals in the Nigerian construction industry are still lagging behind in the adoption of ICT compare with their counterpart in other developing nations of the world despite the globalization in technological advancement

The aim of this paper is to examine the challenges and benefits of ICT usage in construction industry and the effect of ICT on project delivery in Oyo State Nigeria, with a view to enhancing effective project delivery to time within cost and of good qualityin Oyo State Nigeria.

Oyo State is an inland state in south-western Nigeria with it capital at Ibadan being a commercial nerve centre. Oyo state covers approximately an area of 28,454 Square Kilometers with over 5,591,589 populations. There are many reputable Construction Companies operating in Oyo State with numerous construction projects executed by both the private and public sector to meet the housing and infrastructure requirements of the state. The choice of Oyo State is very relevant to this study because it allows representative sampling of a large population of construction professionals.

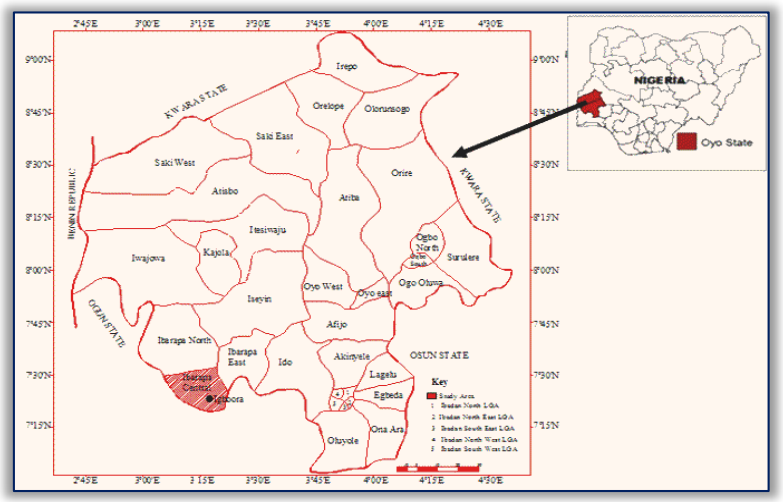

Figure 1: Map of Oyo State (ibpulse .com)

To achieve this aim the study sought to assess the usage and benefits of ICT in the construction industry in Oyo State Nigeria, examine the challenges of adoption and evaluate the effect of ICT on project delivery in Construction Industry in Oyo state Nigeria.

2. METHODOLOGY

The research investigated the use, benefit and the challenges of adoption of ICT and the effect in the construction industry in Oyo state Nigeria. The survey approach was used and the professionals in the construction industry in Oyo State were targeted. The professionals include: Architects, Builders, Civil Engineers, Structural Engineers, and Quantity surveyors working in three categories (large, medium and small) of companies used for this study. The large companies have workers in excess of 500, while medium companies have employees between 50 and 499, and the small companies are companies with workers less 49. The data used emanated from both the primary and secondary sources. For the secondary data, relevant literature were review in the journals and internet to identify various ICT used in construction industry , the benefits were numerous but the most important was selected for the analysis and the challenges facing the use of ICT and its effect on project in the construction industry were identified. For the primary data, well-structured questionnaire in which questions were asked on a five point Likert type scale format where the respondents were to rate their opinion on the use, challenges, benefit and effect of ICT on Construction Industry in Oyo State. A total number of 50 as determined with the use of Nigeria Business Directory and sampling table were administered to the professionals in the construction industry in Oyo State using random sampling. A total number of 38 questionnaires were returned and analyzed using percentile and mean score ranking method with the aid of Statistical Package for the Social Sciences (SPSS).

3. RESULTS, DATA ANALYSIS AND DISCUSSIONS

The results of the survey have been group under four for the purpose of analysis and discussions, and are shown in Tables 1 – 4.

3.1. The professionals distribution of respondents

For compatibility of responses which will subsequently make the result credible and reliable, demography analysis of the respondent is essential. Table 1 shows professional constitution of the respondents. From the Table, it can be seen that all the professionals in the construction industry are well-represented.

Though the Architects, with 23.7%, has the highest number of respondents, and Town planner had the least number of respondent at 10.5%, the fact that the respondents cut across the professionals who are active participant in the construction industry, and who are expected to possess the require knowledge about the subject under survey cannot be disputed. The results of assessment of the computer literacy and competency, measured within the context of the number of years of exposure to ICT, as obtained from the survey is shown in Figure 1.From the figure, about 18.4 % has exposure to ICT for about up to 5 years, 26.3 % has exposure to ICT spanning between 6 and 10 years, and 55.3 % has been exposed to ICT for over 10 years. It can thus be deducted that the respondent sampled have relevant experience in ICT in relation to the construction industry that is necessary for reasonable response to the questionnaire asked in the survey.

Table 1: Respondents Professional Background

Professional	Frequency	Percentage (%)	Ranking
Architect	9	23.7	1
Builder	8	21.1	2
Engineer	6	15.8	3
Quantity surveyor	6	15.8	3
Estate Manager	5	13.2	5
Town Planner	4	10.5	6
Total	38	100.0	

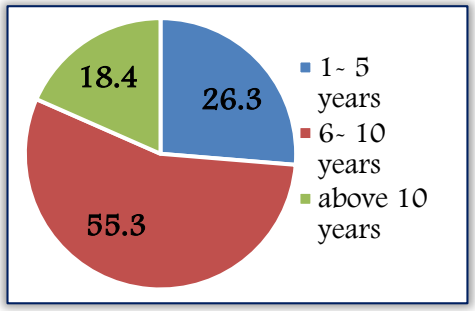

Figure 1: Computer Literacy of the Respondents

3.2. Assessment of benefits of ICT to respondents

The responses of the respondents to the considered benefits of ICT utilization in construction industry, according to the author are presented in the order of ranking in Table 2. From the Table, it can be seen that all the benefits are almost given equal prominence from the response of the professionals involved in the survey are diverse. From the table, the first top five in ranking among the benefits of ICT: (i) were substitute for other more expensive means of communication, (ii) improve productivity, (iii) channel information and enrich knowledge, (iv) facilitate decision making and (v) time saving respectively with the mean score of 4.2368, 4.2105, 4.1053, 4.0789 and 4.0789 respectively.

Table 2: Evaluation of the benefits of ICT

Benefit	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Substitute for other more expensive means of communication	38	3.00	5.00	4.2368	.75101	1
Improve productivity	38	3.00	5.00	4.2105	.74100	2
Channel information and enrich knowledge	38	3.00	5.00	4.1053	.68928	3
Facilitate decision making	38	2.00	5.00	4.0789	.88169	4
Time saving	38	3.00	5.00	4.0789	.71212	4
Reduction in transaction cost	38	3.00	5.00	3.9737	.82156	6
Offer immediate connectivity	38	2.00	5.00	3.9474	.89887	7
Improve quality of work	38	2.00	5.00	3.9211	.91183	8
Provision of access to unavailable goods and services	38	2.00	5.00	3.7105	.86705	9
Improve task efficiency	38	1.00	5.00	3.1579	1.19744	10

Other variables also had above 3 points; this indicated that using ICT on construction site has various diverse benefits. The findings from this study agree with those identified in the literature. Agyekum et al., (2015), Liston et al., (2000), Matipa (2009) identified increase productivity as one of the major benefit of ICT usage in construction industry while Mutesi and Kyakula(2015) result indicated improve productivity and time savingas benefit of ICTin construction industry in Kampala.

3.3. Evaluation of challenges of ICT usage to respondents

The responses of the respondents to the question as to want constitutes serious challenge and threat to the adoption of ICT in the construction industry are presented in Table 3.

Table 3 indicated that high cost of employing computer professionals and inadequate power supply has the highest rank of the challenges to the use of ICT in construction industry with the same mean score of 4.2368. That inadequate power supply ranked amongst the highest by the respondent as the major challenge to ICT usage is characteristic of developing nations had been earlier observed researchers (Goh, 2003, Oladapo, 2006 and Akinnagbe and Adelakun, 2014).

Table 3: Evaluation of the challenges in the use of ICT in construction industry

Challenges variable	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
High cost of employing computer professionals	38	3.00	5.00	4.2368	.75101	1
Inadequate power supply	38	3.00	5.00	4.2368	.71411	1
Inadequate training on ICT content of construction process	38	3.00	5.00	4.0789	.78436	3
High cost of hardware and software	38	3.00	5.00	4.1800	.71200	4
Lack of sufficient jobs	38	2.00	5.00	3.9211	.91183	5
Low return on investment	38	2.00	5.00	3.6842	.96157	6
Fear of virus attacks	38	1.00	5.00	3.3421	1.34116	8
Privacy/security fear	38	1.00	5.00	3.2895	1.06309	9
Fear of professional redundancy	38	1.00	5.00	3.1842	1.22707	10
Fear of mass job loses in the industry	38	1.00	5.00	3.0526	1.33452	11

Inadequacy of power is manifested in frequent and consistent power outages, inadequate/erratic power, and unreliable power supply. Also considered as key challenges by the respondents along with inadequate power supply are whose mean score is 4 and above: that high cost of employing professionals, inadequate ICT content of construction education, high cost of hardware and software. The fact that other challenges on the list obtained a mean score of 3 and above is an indication that the use of ICT on construction projects is faced with numerous challenges which may have hindered many projects delivery appropriately and inhibit the full realization of the benefits that come with use of ICT. For example, lack of sufficient jobs, low return on investment, and fear of mass job losses in the construction industry are some of the credible challenges that needs be overcome if the full benefits of ICT are to be realized.

3.4. Evaluation of effects of ICT on project delivery

The perceptions of the respondents on the effects of ICT on some variables of project delivery as captured through their responses are presented in Table 4.

Table 4: Evaluation of effect of ICT on project delivery Variables

Project delivery variables	Frequency	Minimum	Maximum	Mean	Std. Deviation	Ranking
Project Cost	38	3.00	5.00	4.2368	.75101	1
Information management	38	3.00	5.00	4.2368	.71411	1
Delivery Time	38	3.00	5.00	4.1053	.68928	3
Productivity	38	3.00	5.00	4.0789	.78436	4
Project Quality	38	2.00	5.00	3.7105	.86705	5

From Table 4, it can be seen that project cost and information management rated first among the respondents with mean score of 4.2368 as being affected by ICT. This was followed by delivery time, productivity, and project quality whose mean score are respectively 4.1053, 4.0789 and 3.7105. This information is very instructive in the sense that the respondents considered the effects of ICT to be more on cost than on quality. This is in agreement with Table 3 in which cost of employing professionals, cost of training and hardware cost rank amongst the major challenges of using ICT in construction industry.

4. CONCLUSION AND RECOMMENDATIONS

From the results of analysis conducted based on data obtained from this investigation, the following conclusions can be made.

- Substitutes for other more expensive means of communication, improve productivity, channel information and enrich knowledge were the threetop ranked benefit of ICT usage in the construction firm in Oyo State.
- High cost of employing computer professionals, inadequate power supply, inadequate training on ICT content of construction process and high cost of hardware and software were the topmost challenges facing the used of ICT in the construction firm in Oyo State.
- It was also revealed that the effect of ICT is high on project Cost, information management, project delivery time and productivity while project quality was moderately affected by ICT in construction industry in Oyo State; this may be due to fact that the respondents sampled were strictly professionals who may put other quality determinant in construction Industry into consideration.

From the results of this investigation, it is obvious that, poor power supply, inadequate training of professionals and high cost of computer software and hardware cumulatively account for slow pace of ICT in the Nigeria's construction industry. Improvement in all these areas will no doubt bring about significant advancement of ICT utilization in the construction industry with its

attendant benefits. It is thus recommended, all the stakeholders in this area should come up with policy initiatives that will improve power supply, result in affordable cost of computer facilities and bring about an environment that encourages training and re-training for professionals in the construction industry.

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