

IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY ON BUILDERS' PRACTICES IN CONSTRUCTION INDUSTRIES IN FEDERAL CAPITAL TERRITORY, ABUJA

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Abstract

This study determined the impact of ICT on Professional Builders Practices in the Construction Industries in the Federal Capital Territory, Abuja. Three research questions guided the study. A descriptive survey research design was employed for the study. A purposive sampling technique was employed to select 8 functional construction industries with 58 subjects comprising of 18 Registered Builders and 40 Non-Registered Builders. A questionnaire containing 41 items developed by the researcher and validated by three experts was used for the data collected for the study. The data collected from the pilot testing exercise was analyzed to establish a reliability coefficient of 0.82 for the instrument using Cronbach Alpha statistics. Statistical mean and standard deviation were employed to analyze the data for the study. The findings among others revealed that: ICT enhances the modernization drive of the construction industry, service delivery and increases organizational productivity. It was concluded that ICT improves work plan and help in monitoring and facilitating stages of the construction process. Based on these findings, it was recommended that construction industries should organize regular workshops and seminars for the construction workers due to the day-to-day improvement on the emergence of new application of ICT software in building construction project and also the construction industries should engage construction workers on training and retraining on effective use of ICT tools during each stage of the construction process to enhance data processing in the industry.

Keywords: Impact, Information and Communication Technology, Builders Practices, Construction Industry.

Introduction

The benefit of technological age in various sectors of the economy cannot be over-emphasized and construction industries are not left out. Information and Communication Technology (ICT) plays vital role in generating, transmitting and interpreting information to enable some of the human day-to-day activities to be easily carried out, maintained, reused and eventually recycled. The everyday life of individuals is increasingly reliant to ICT. ICT refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT), but focuses primarily on communication technology. These include the internet, wireless networks, cell phones and other communication mediums. This has totally transformed individuals and organizations to its wide spread use. According to Sun and Howard (2004), "the importance of Information Technology (IT) on modern society is profound", and its growing speed has enabled globalization especially through the introduction of a global system of interconnected computer networks known as the 'INTERNET', use for communication between individuals, companies and institutions sharing and exchanging information and data which the construction industries is not left out.

Construction industries encompasses all construction activities either building houses and offices or highways and bridges, as well as those who specialized work of electricians, plumbers and masons, who are typically involved in the construction of all kinds of structures. The construction industries faced with challenge of changing and improving current work practices in order to become more client-oriented; more competitive as well as productive through the adoption of ICT as an integral part of the construction process (Weippert, 2003). Much effort has been directed toward improving construction productivity through the use of ICT in construction industries. This is an area worth concentrating upon because it can reduce the time for data processing, communicating information and increase overall productivity. Modern structural design software applications, such as 3D modelling and Building Information Modelling (BIM), provide an example where designing complex structures and organizing the electrical, mechanical, site, structural and quantifying of a project can be achieved in minimum time and increase efficiency, all these in one data framework, which in the

past, was almost impossible (Peansupap and Walker, 2005). The understanding of ICT and its role is important for the realization of improved utilization for builders' practices in construction industries which include residential building, office building, recreational facilities, school building to mentioned a few.

However, the professional builders practices is currently experiencing a paradigm shift from traditional paper-based to digitally based information exchange, which other professions such as the engineers and technologists adopted and benefited from long ago (Rivard, Froese, Waugh, El-Diraby, Mora, Torres, Gill, and O'Reilly, 2004). Rivard et al further explained that the shift has been aided to a large extent by the drastic reduction in computer hardware and software prices and the increased power, usefulness and popularity of computers over the last few years. Computers are connected through the Internet to form the Worldwide web, thus allowing professionals located on different streets or in different cities, provinces, countries, or even continents to readily exchange information, the benefits of ICT to industries and organizations have indeed become global. Hence, the study is designed to determine the impact of ICT on the builders' practices in the construction industries in Federal Capital Territory, Abuja.

Purpose of the study

The main purpose of the study was to determine the impact of ICT on builders' practices in construction industries in Federal Capital Territory, Abuja. Specifically the study sought to:

1. Find out the areas where ICT facilitate work in the construction industry.
2. Determine the benefits of ICT on builder's practices in the construction industry and
3. Assess the constraints to the use of ICT in the construction industry

Research Questions

1. What are the areas where ICT facilitate work in the construction industry?
2. What are the benefits of ICT on builder's practices in the construction industry?
3. What are the constraints to the use of ICT in the construction industry?

Methodology

A descriptive survey research design was used for the study. A structured questionnaire instrument was used to collect the required information from the respondents. The study was conducted in Federal Capital Territory, Abuja. Owing to the high number of construction industries in Federal Capital Territory, Abuja, a purposive sampling technique was employed for the study. Uzoagulu (2011) described purposive sampling as a sampling technique arising from a situation whereby a special characteristic possessed by a subject grant the subject the qualification of being included in the sample. Hence the used of 8 functional construction industries for the study. The 8 functional construction industries comprising of 58 subjects, 18 Registered Builders (those with the satisfactory certificate of building work operation from Nigerian Institute of Builder) and 40 Non-Registered Builders (those without the satisfactory certificate of building work operation from Nigerian Institute of Builder). The instrument was pilot tested in Niger State which does not form part of the study area. The data collected from the pilot testing exercise was analyzed to establish a reliability coefficient of 0.82 for the instrument using Cronbach Alpha statistics. The data collected by the researcher was analyzed using mean and standard deviation. The questionnaire was assigned five point rating scale with response options of: Strongly Agreed (SA) 5 points, Agreed (A) 4 points, Disagreed (D) 3 points, Strongly Disagreed (SD) 2 points and Undecided 1 point. The decisions on the items were based on the acceptance level of above 3.00 for the five point scale used for this study.

Results

Table 1: Mean Responses of Registered and Non-Registered Builders on Areas where ICT Facilitate Work in the Construction Industries.

S/N	Items	N ₁ = 18,		N ₂ = 40.		\bar{x}_A	SD _A	Decision
		\bar{x}_1	SD ₁	\bar{x}_2	SD ₂			
1	Administrative management	2.16	0.80	2.04	0.93	2.10	0.87	Disagreed
2	Data collection	3.16	0.99	3.24	0.66	3.20	0.83	Agreed
3	Information dissemination	3.04	0.91	3.76	0.75	3.40	0.83	Agreed
4	Service delivery	3.44	0.87	3.28	0.84	3.36	0.86	Agreed
5	Design	3.52	0.65	3.28	0.76	3.40	0.71	Agreed
6	Enhance modernization drive of the industry structural aspect	3.40	0.82	3.04	0.89	3.22	0.86	Agreed
7	Organizational productivity	2.95	0.99	3.96	0.84	3.46	0.92	Agreed
8	Time management	3.12	0.97	3.24	0.93	3.18	0.95	Agreed
9	Working drawings	3.16	0.75	3.2	0.87	3.19	0.81	Agreed
10	Construction management	3.08	0.91	3.04	0.88	3.06	0.90	Agreed

KEYS: N₁ = Numbers of Registered Builders, N₂ = Numbers of Non-Registered Builders, \bar{x}_1 = Means response of Registered Builders, \bar{x}_2 = Means response of Non-Registered Builders, \bar{x}_A = Average mean of both groups of respondent, SD₁= Standard Deviation of Registered Builders, SD₂= Standard Deviation of Non-Registered Builders, SD_A= Standard Deviation of both groups of respondents.

Table 1 reveals that both groups of respondents agreed with item 2, 3, 4, 5, 6, 7, 8, 9 and 10 with average mean scores from 3.06 – 3.46. The decision on the items was based on the acceptance level of above 3.00 stated for agreement to an item for the five point scale used for this study. This indicates that those are the areas where ICT can facilitate work in the construction industry while both groups of respondent disagreed with item 1 with mean scores below 3.00. Also the Table revealed that the standard deviation of the items ranged from 0.71 – 0.95 whose difference is less than 1.00. This implies that the respondents were not far from the mean and were close to one another in their responses.

Table 2: Mean Response of Registered and Non-Registered Builders on the Benefits of ICT in the Construction Industries.

S/N	Items	N ₁ = 18,		N ₂ = 40.		\bar{x}_A	SD _A	Decision
		\bar{x}_1	SD ₁	\bar{x}_2	SD ₂			
1	There is creativity benefit amongst the construction industry	3.88	0.79	3.92	0.90	3.90	0.85	Agreed
2	Work improvement benefit exist in the use of ICT materials	3.32	0.98	3.12	0.88	3.22	0.93	Agreed
3	Ease of designing modern building structure	3.04	0.97	3.2	0.74	3.12	0.86	Agreed
4	Improvement of productive activities in the construction industry	3.44	0.93	3.26	0.95	3.35	0.94	Agreed
5	Aid in the exchange of documented material	2.2	0.78	2.12	0.25	2.16	0.52	Disagreed
6	Provide adequate supervision of construction work	3.36	0.86	2.85	0.88	3.11	0.87	Agreed

7	Help personnel in detecting fault and correct it immediately	2.2	0.93	1.48	0.76	1.84	0.85	Disagreed
8	It brings about level of commitment in the construction industry	3.24	0.97	3.44	0.19	3.34	0.58	Agreed
9	Aid in monitoring each stage of the construction process	2.92	0.99	3.76	0.99	3.34	0.99	Agreed
10	Easy understanding of the work plan	3.04	0.88	3.44	0.69	3.24	0.79	Agreed
11	Reduce degree of difficulty in each stage of the construction process	3.08	0.81	3.76	0.27	3.42	0.54	Agreed
12	Saves considerable time and cost for document transfer	3.16	0.84	3.6	0.89	3.38	0.87	Agreed
13	Help in administrative work	3.84	0.99	3.68	0.59	3.76	0.79	Agreed
14	Help in quantity take off and reuse	3.40	0.91	2.84	0.95	3.12	0.48	Agreed

KEYS: N_1 = Numbers of Registered Builders, N_2 = Numbers of Non-Registered Builders, \bar{x}_1 = Means response of Registered Builders, \bar{x}_2 = Means response of Non-Registered Builders, \bar{x}_A = Average mean of both groups of respondent, SD_1 = Standard Deviation of Registered Builders, SD_2 = Standard Deviation of Non-Registered Builders, SD_A = Standard Deviation of both groups of respondents.

Table 2 shows that both groups of respondents agreed with item 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13 and 14 as reflected by the average mean scores from 3.11 – 3.90. The decision on the items was based on the acceptance level of above 3.00 stated for agreement to an item for the five point scale used for this study. This indicates that those are the areas where construction industry can benefit with the aid of the use of ICT while they disagree with item 5 and 7 with mean scores below 3.00. Also the Table revealed that the standard deviation of the items ranged from 0.48 – 0.99 whose difference is less than 1.00. This implies that the respondents were not far from the mean and were close to one another in their responses.

Table 3: Mean Response of Registered Builders and Non-Registered Builders on the Constraints to the use of ICT in the Construction Industries.

		N_1 = 18	N_2 = 40.						
S/N	Items	\bar{x}_1	SD_1	\bar{x}_2	SD_2	\bar{x}_A	SD_A	Decision	
1	Cost of acquisition of both hardware and software	3.16	0.75	3.20	0.87	3.18	0.81	Agreed	
2	Inadequate ICT expert in the building sector	2.92	0.86	2.20	1.01	2.56	0.94	Disagreed	
3	Lack of proper planning for acquiring ICT materials among the construction industry	3.24	0.87	3.00	0.86	3.12	0.87	Agreed	
4	Inadequate communication among the staff through different means of ICT materials	2.04	0.93	2.12	0.97	2.08	0.95	Disagreed	
5	ICT manuals are not provided to staff	3.32	0.85	3.2	0.96	3.26	0.91	Agreed	
6	Security and privacy fear	3.08	0.76	2.92	1.04	3.00	0.90	Agreed	
7	Inadequate staff training and retraining to be updated with new technology	3.16	1.03	3.26	0.76	3.21	0.90	Agreed	

8	Inadequate supervision or monitoring by management of staff to encourage the use of ICT materials	3.32	0.80	3.36	0.81	3.34	0.81	Agreed
9	Lack of interoperability between many ICT tool	3.92	0.99	3.04	0.88	3.48	0.94	Agreed
10	Fear of mass job losses in the construction industry	3.12	0.6	3.26	0.69	3.19	0.65	Agreed
11	Use of non-standard application of ICT tools	3.36	0.81	3.08	0.81	3.22	0.81	Agreed
12	Inadequate power supply	3.20	0.92	3.32	1.03	3.26	0.98	Agreed

KEYS: N_1 = Numbers of Registered Builders, N_2 = Numbers of Non-Registered Builders, \bar{x}_1 = Means response of Registered Builders, \bar{x}_2 = Means response of Non-Registered Builders, \bar{x}_A = Average mean of both groups of respondent, SD_1 = Standard Deviation of Registered Builders, SD_2 = Standard Deviation of Non-Registered Builders, SD_A = Standard Deviation of both groups of respondents.

Table 3 revealed that both groups of respondents agreed with item 1, 3, 5, 6, 7, 8, 9, 10, 11 and 12 as reflected by the average mean scores from 3.00 – 3.48. The decision on the items was based on the acceptance level of above 3.00 stated for agreement to an item for the five point scale used for this study. This indicates that those are the constraints to the use of ICT in the construction industry while both groups of respondents disagree with item 2 and 4 with average mean scores below 3.00. Also the Table revealed that the standard deviation of the items ranged from 0.65 – 0.98 whose difference is less than 1.00. This implies that the respondents were not far from the mean and were close to one another in their responses.

Discussion of Findings

The findings on research question 1 revealed some of the areas where ICT facilitate the builders practices in the construction industry such as enhance work improvement, ease designing of modern structure of building, ease preparation of working drawings, improve construction management, monitoring each stage of the construction process and others. The finding is in agreement with the opinion of Goh (2005) who explained that word processing, spreadsheet, Computer Aided Drafting (CAD) and Internet were common software used for administration, communication, marketing, desktop publishing, presentation and project management. This was also corroborated by Rivard (2000) and Arif and Karam (2001) who were of the view that the architects, engineers and contractors use CAD mostly for design, drawing and presentation and also professional builders use it for measurement, preparation of bills of quantities, estimating and presentation. Also in support of the finding Liston (2000) and Björk (2002) were of the viewed that ICT is a vital tool use in construction industry assist to cope with the increasing complexity of its activities as well as the increasing demands of its clients and enhancement of the construction of building project. Communication technology, also commonly known as (IT) have been radically transforming the way we live, learn, work and play (Capron, 2000). Also Paulson (1995) pointed out that site operation simulation programs can emulate what happen in a real construction site by representing workers, machines, materials and computing the cycle of each step taking into consideration.

The findings on research question 2 revealed the benefits of ICT in the construction industry to include creativity, enhance work improvement, aid in monitoring each stage of the construction process, saves considerable time and cost for document transfer and help in quantity take off. This finding is in support of Gann (2000) who pointed out that development of an Electronic Document Management (EDM) system for project management can save considerable time and cost for document transfer while e-business provides an efficient infrastructure for remote consulting services to consultants and contractors who desire to provide their services through the Internet. In support of this finding Peansupap and Walker (2005) were of the view that some benefits of ICT in the construction industry are to reduce the time for data processing, communicating information, improve communications for effective decision-making and coordination among construction participants and enhance construction productivity. This is possible because the 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 (De Lapp, 2004).

The findings on research question 3 revealed the constraints to the use of ICT in the construction industry to include among others cost of acquisition of both hardware and software, fear of mass job losses in the construction industry, inadequate staff training and retraining to be updated with new trend in ICT. This finding is in support of Svidt and Christiansson (2006) they pointed out that the users of new technology in the construction industry are experiencing difficulties with equipment because of insufficient knowledge they have to perform properly in the demanding environment of a construction site. They further said effective use of ICT requires training and retraining of staff in order to achieve maximum benefit in the use of the tool. Also in support of this finding Bowden (2002) who pointed out that ICT improve human endeavour drastically in the recent time but the high cost of hardware and software make it impossible for some sectors to purchase adopt it for their use. Bowden further explained that when ICT materials were fully adopted for use in any sector of the economic it create a huge vacuum of redundancy in side of human workforce.

Conclusion

Based on the findings of the study, it was concluded that ICT has significant impact on the professional builders' practices in the following areas: easy understanding of the work plan, reduce degree of difficulty in each stage of the construction process, help in administrative work, aid in monitoring each stage of the construction process, time management, ease in effective and efficient design and productive organizational improvement.

However, there some constraints to the use of ICT in the construction industry such as inadequate power supply, since most ICT gadget are electronically operated, use of non-standard application, wherever standard application are used it brings out the best of any construction work, ICT manuals are not provided to staff, lack of funds ICT personnel are not involved in the purchase of ICT equipment, inadequate staff training and retraining to be updated with new technology.

Recommendations

Based on the findings of the study it was recommendations that;

1. The construction industries should engage construction workers on training and retraining on how to effectively use ICT tools during each stage of the construction process because of it speed in data processing.
2. The construction industries should always ensure that ICT tools are readily available since it facilitates wide areas of construction activities in the construction industry.
3. The construction industries should ensure that ICT manual and supply of electricity are always available for staff use.
4. The construction industries should also discourage the use of non-standard application of ICT tools.
5. Nigeria Institute of Builders should develop a practical test instrument on the use of ICT as part of requirements for the registration of professional builder.

References

- Arif, A. A & 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
<http://www.itcon.org/2001/2>. Retrieved 12/04/2017
- Björk, B. C. (2002) The Impact of Electronic Document Management on Construction Information Management, Proceeding of the International Council for Research and Innovation in Building and Construction, *CIB W78 Conference 2002, Aarhus, 12–14June*.
- Bowden, S. (2002). "Good gadget guide – appropriate technology." *CIRIA Report*
<http://www.ciria.org.uk/>. Retrieved 10/12/2016

- Capron, P. (2000) "Experiences from implementation of ICT for resource management in small construction companies." *Proceedings of the World Conference on IT in Design and Construction INCITE/ITCSED 2006, New Delhi, India, November 2006.*
- De Lapp, J. A., Ford, D. N., Bryant, J.A. & Horlen, J. (2004). Impacts of CAD on Design Realization, *Engineering, Construction and Architectural Management*, 11 (4), 284-291.
- Egbu, C.O. & Botterill, C. (2002). Information technologies for knowledge management their usage and effectiveness, *Journal of Information Technology in Construction*, 7,125-137,<http://www.itcon.org/2002/8>. Retrieved 11/10/2016
- Gann, D.M. (2000) *Building Innovation: Complex Constructs in a Changing World*. London: Thomas Telford Publishing,
- Goh, B.H. (2005) IT Barometer 2003: Survey of the Singapore Construction Industry and a Comparison of Results, *Journal of Information Technology in Construction*, 10, 1-13 <http://www.itcon.org/2005/1/> Retrieved 11/12/2016
- Liston, K.M., Fischer, M.A. & Kunz, J.C. (2000) Designing and Evaluating Visualization Techniques for Constructional Planning, Presented at the 8th International Conference on Computing in Civil and Building Engineering (ICCCBE-VIII), Stanford University, Stanford, CA, 1293-300.
- Peansupap, V. & Walker, D. H. T. (2005). "Factors enabling information and communication technology diffusion and actual implementation in construction organizations," *IT-con Vol. 10, 193-218*, <http://www.itcon.org/2005/14> Retrieved 16/10/2016
- Paulson, O. (1995) "The IT-barometer – a decade's development of IT use in the Swedish construction sector." *ITcon 13*, pg. 1-19, <http://www.itcon.org/2008/1>. Retrieved 10/12/2016
- Rivard, H. (2000) A Survey on the Impact of Information Technology in the Canadian Architectural, Engineering and Construction Industry, *Journal of Information Technology in Construction*5, 37-56, <http://www.itcon.org/2000/3> Retrieved 19/10/2016
- Rivard, H., Froese, T., Waugh, L. M., El-Diraby, T., Mora, R., Torres, H., Gill, S. M. & O'Reilly, T. (2004). Case Studies on the Use of Information Technology in the Canadian Construction Industry, *Journal of Information Technology in Construction* 9, 19-34, <http://www.itcon.org/2004/2>. Retrieved 11/11/2016
- Sun, R & Howard, J. J. (2004). *Total transformation of individuals and organizations: impact of ICT towards globalization*. Illiones: De Gyy Publisher
- Svidt, K. & Christiansson, P. (2006) "Experiences from implementation of ICT for resource management in small construction companies." *Proceedings of the World Conference on IT in Design and Construction INCITE/ITCSED 2006, New Delhi, India, November 2006.*
- Uzoagulu, A. E. (2011). Practical guide to writing research project in tertiary institution. Enugu: Jacob's Classic Publishers Ltd.
- Weippert T. J. (2003). End -user Perspectives on Use of Project Extranets in Construction Organizations, *Engineering, Construction and Architectural Management*. 3 (2), 23-36.