

CONSTRUCTION PROFESSIONALS' PERCEPTION ON PROFICIENCY AND USE OF PLANNING SOFTWARE FOR CONSTRUCTION PROJECT DELIVERY IN ABUJA, NIGERIA

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Abstract

Failures of many projects in the construction industry have been caused by improper and ineffective systems for project planning. The use of planning software and its associated processes not only minimizes such problems but also helps improve project planning. The purpose of this paper is to investigate the construction professionals' perception of proficiency and use of planning software for construction project delivery in Abuja. The study focused on the factors affecting the use of planning software, its extent of use for construction project delivery and an assessment of level of proficiency of construction professionals in the use of planning software. Data were drawn from an empirical study of construction professionals that yielded 156 respondents from 240 questionnaires that were distributed. The study reveals that proficiency of use and knowledge of the software, cost of mounting of software and training as well as cost related factors are the factors with the highest effect on the use of planning software in construction project delivery. The study concludes that proficiency of construction professionals and use of planning software for project delivery is relatively low as many professionals are not susceptible to change and still employ traditional method of carrying out their duties. It is recommended that construction organizations should invest in planning software for project delivery while construction professionals should make efforts to improve proficiency in the use of planning software through personal training and constant practice with the use of such software.

Keywords: Construction Professionals, Construction Project Delivery, Proficiency, Project Planning, Planning Software.

INTRODUCTION

Design and engineering phases of a typical construction project produces considerable amount of details and specifications (Khosravi and Kalikonen, 2015). Hence, the planning and management of construction, like most other industries, requires accurate generation of planning information and subsequent sharing of generated plans between professionals in the built environment. The need to increase the efficiency of information management by exchanging massive volumes of information at high speed and at relatively low cost has been long recognised by the industry (Deng *et al.*, 2001; Chan and Kamara, 2011; Ahmad *et al.*, 2017). Planning software can be employed in the planning and management of projects from inception to completion. However, the complexities of new projects provide challenges for project planning and management (Khosravi and Kalikonen, 2015). The use of software and associated ICT processes not only minimizes such challenges like client's increased demands and technological advancement, but also helps improve project planning, scheduling and cost control (Sriprasert and Dawood, 2002;). There are different types of software that enhance the various aspects of planning process. Project planning software has a capacity to help plan, organize, and manage resource pools and develop resource estimates (Schwalbe, 2007). Depending on the sophistication of the software the processes of design, estimation, scheduling, cost control, budget management, resource allocation, process collaboration, communication, decision-

making, quality management and documentation or administration systems are enhanced

Construction firms are quite attached to their conventional methods instead of the use of new technologies (Ahmad *et al.*, 2017). This tendency can be observed easily in the realm of web-based technologies where the rate of adoption of various systems is far from the desired level (Acar *et al.*, 2005). According to Chen and Kamara (2008), the majority of construction processes are heavily based upon traditional method of carrying out the construction. The attachment of firms to conventional means limits professionals to paper-based files for on-site information communication. This scenario has remained a major constraint in on-site information communication and exchange (Ahmad *et al.*, 2017). This is why the construction industry has for many years suffered from difficult -to-access, out-of-date and incomplete information (Oladapo, 2006).

Naoum, Fong and Walker (2004) describe planning as one of the key tools that stakeholders use to ensure that construction projects are successful. Idoro (2009) argue that the measure of the effectiveness of project planning is directly related with project outcome. Kerzner (2017) posited that project planning is a vital management activity and it has a high and significant relationship with project performance for successful projects. The failure on the part of construction professionals to use software to carry out the planning process leaves much to be desired. The use of modern techniques and wide range of planning software solutions cannot be over emphasized in the planning and management of construction work to enhance project performance.

This paper aim to investigate the construction professional's perception on proficiency and use of planning software in the processes of project delivery with specific objectives of identifying factors affecting the use of planning software; proficiency of construction professionals in the use of planning software and the extent to which planning software are used in the construction delivery process.

LITERATURE REVIEW

Construction Planning and Process:

Planning can be described as a process of developing predetermined course of action to be executed on projects. Gido & Clement (2009) describes planning as a process that determines what needs to be done, who will do it, how long it will take, and how much it will cost. Akindoyeni (1999) in his own definition stated that planning is the process of organizing all resources and activities in such a logical sequence as to achieve measurable achievement of stated policy objectives. Construction planning can then be described to mean the planning of construction works which involves the articulation of construction activities, organizing available resources and developing alternate course of actions in sequences with a view to achieving measurable construction objectives. All these components are supported in the definition of planning by various authors (Zwikael, 2008; Oxford, 2011; Chitkara, 2011; Idoro, 2012; and Farflex, 2014,).

Several studies have reiterated the importance of planning to the delivery process. In a study of critical success factors for project management carried out in Pakistan, Planning and Programming techniques was ranked as one of the most important factors affecting project management success factors (Arian *et al.*, 2004). This notion is supported by Ohiri (2010) that firms who use formal planning approaches are generally more profitable and successful in project delivery than those that do not. Similarly

Khosravi and Kalikonen, (2015) illustrated the importance of adequate management and planning over whole construction process of metro projects. For the projects to be delivered on time and on budget with high quality and efficiency proper planning and management is important. The literature therefore suggests that project planning has significant impact on project success (Globerson and Zwikael, 2002; Zwikael and Sadeh, 2007; Idoro 2012; Kerzner, 2017).

In order to develop a project plan, several managerial processes should be executed. Possible lists of planning processes are found in different sources. For example, Russell and Taylor (2003) identified seven planning processes; Kerzner (2006) identifies nine major components of the planning process while The PMBOK identified 21 as planning processes (PMI Standards Committee, 2004). Although the relevant planning processes have been recognized, Zwikael and Globerson (2006) identified the following six planning processes as the ones that highly contribute to project success: definition of activities to be performed in the project; schedule development; organizational planning; staff acquisition; communications planning; and development of a project plan.

Planning Software Selection:

Schwalbe (2007), identified factors affecting the selection of software for planning; the factors also are similar with factors affecting the adoption of ICT technology in Nigeria (Oyerinde and Odusami, 2005). They include: proficiency and knowledge on software, capacity (ability of the software to handle complexity), documentation and on-line help facility, ease of use, features available, installation requirements, integration with other systems and software, internet features, reporting capacity, security, vendor support, accuracy of results and affordability of procuring software. Hence a critical factor for software selection includes proficiency of the professional that intends to use it. This indicates that using planning software depends largely on the construction professional and the ability to use the software for the purposes intended.

Level of use of Planning Software:

Nitithamyong and Skibniewski (2006) in their study of success/failure factors of web-based project management systems identified the effects some factors have on the level of use of software available for planning. Similarly, Chitkara (2011) outlined Sixteen (16) sub factors which are: Complexity of the software application, Integration with project team's internal system, Rate of virus attack on programmes loss of data, Investment by employers on infrastructure, Proper knowledge of the project delivery process, Encouragement & compulsion for using planning software, Proficiency and knowledge on software, Cost of personal training on software, Hierarchical training of personnel, Cost of mounting infrastructure to support software, Cost of individual software, Type of project planned, Project size, Complexity of the project planned, Project profitability, and Project cost. The study generally concluded that software underutilization reduces the efficiency of the system. These sub factors however are organized into contingent factors of; operational, management, training, cost, and project factors. The position adopted is based on the integration of the two studies on the level of use of planning software.

Proficiency of Construction Professionals in the use of Software:

To a large extent software application in the project delivery system has attained high prominence in the Nigerian construction industry. However, the appropriate or optimum usage may not be adequately employed by the construction professionals. This has led to several training and retraining efforts to bring construction professionals up to date with many software applicable to their areas of expertise (Ibrahim, 2012).

Some of the available software used in the industry today includes software for design (architectural; structural, civil, electrical and mechanical); estimating and budgeting; scheduling and planning; and general project management (resource planning, monitoring and control). In addition to the above communication management and planning has been enhanced through the use of web-based project management systems (WPMS) in recent times. These are one of the latest Internet-based applications in the construction industry. Although the current rate of WPMS implementations is still lower than the projected trend, the systems hold a great promise and are expected to replace traditional project management methods (Becerik, 2004; Zou and Roslan, 2005). Several reasons supporting this promise include increased competitive pressures, expectations of revenue growth, ability to compete globally, and the desire to reengineer the business to respond to market challenges (Nitithamyong and Skibniewski, 2006).

Planning Software

Design Software:

One of the prominent vendors of design software is Autodesk makers of the popular AutoCAD. They have produced many software applicable today in the industry by designers. AutoCad was first released in December 1982 (Autodesk, 2016) with multi user interfaces and it is currently across a range of industries, including architects, project managers, and engineers among other professionals. Heesom, (2003) explored the use of AutoCAD software to go beyond 2D, 3D and 4D designs. The use of AutoCAD by built environment professionals for many planning activities outside the conventional production of drawings is considered low. The available Autodesk software in use in the industry today are: Autodesk Revit, Civil CAD, AutoCAD and QS-CAD (Autodesk, 2016). Other design software also employed in the Nigerian Construction industry aside the Autodesk software includes: Sketch up and ArchiCAD.

Special Purpose Software:

There are few software that are designed for specific professions. Examples are the Orion Software; established in 1984, is a leading software in house developing accounting and financial software products for the global market. STAAD or (STAAD.Pro) is a structural analysis and design computer programme originally developed by Research Engineers International at Yorba Linda, CA in year 1997 (REI, 1997), STAAD. Pro is one of the most widely used structural analysis and design software. It supports several steel, concrete and timber design codes. Dolphin Community Builder; created by the Boonex company; is a universal, free and open source software that allows any person to build any kind of community page with the huge variety of features and options that the Dolphin software provides and without any programming experience. Dolphin imaging (2016), explains that the package relies on a language system that is controlled via an Administrator. This is useful in the production of on line environment for project monitoring and evaluation of construction projects. A Web-Based Project Management System (WPMS) mostly depend on such platform to function (Dolphin-Software, 2016). Power systems analysis and simulation

software are ubiquitous in electrical engineering practice. Initially, they were used to quickly solve the non-linear load flow problem and calculate short circuit currents, but their use has been extended to other areas such as power system stability, protection and coordination, contingency / reliability, economic modelling, etc. Other design software applicable used but made by other vendors include microsoft visio and 3-D Max

Estimating and Budgeting Software:

In a study of the use of ICT by quantity surveyors, Oyerinde and Odusami (2005) have discovered that Quantity Surveying (QS) appears to be one of the few professions that have not been profoundly transformed by the application of the technological advancement offered by digital revolution especially in a developing economy like Nigeria. Only a handful of the professionals use this technology to provide services. Those that do have relied primarily on Microsoft excel and word. However several applications are available for the primary function of Quantity Surveyors with some of the software having advance function to use in project monitoring and evaluation. Common software in use in the industry now includes: Master Bill (MB-3 and MB lite), Workmate 5.0, Pro-Estimate, Estimator and Cost Planner.

Project Management Software:

A project can be described as a sequence of unique, complex, and connected activities, having one goal or purpose which must be completed by a specific time, within budget, and according to specification. This always requires management skills to deliver. Chitkara (2011) explained that software is the tool that computer hardware needs to give it proper instructions in order to perform specialized operations. The use of project management software for planning, monitoring and controlling projects has attained prominence globally. However in a study of the application of project management software in the Nigerian Construction Industry, Akale, *et al.*, (2015) posited that there is a poor use of web-based project management software packages in the construction industry and there is a misplaced emphasis on the cost of software and software graphic displays during selection.

The project Management function in any organization is accorded very high regard. This contributed to the high prominence in management software available (Schwalbe, 2007). Three of the software commonly used in Nigeria includes: work plan Enterprise, Microsoft project and Oracle primavera EPPM (Primavera P6)

RESEARCH METHOD

The data for this study was obtained from construction professionals with relevant construction experience in the FCT, Abuja. The research was conducted by an examination of relevant literature followed by the administration of a structured questionnaire on selected professionals. The population comprises of professionals in contracting and consulting firms registered with Abuja Municipal Area Council (AMAC). The contracting and consulting firms who have office addresses in Abuja were further extracted from the list giving eighty - four (84) firms. The target populations were construction professionals such as Architects, Structural Engineers, Civil Engineers, Service Engineers, Quantity Surveyors and Builders. Convenience sampling technique was used for selecting two hundred and forty (240) construction professionals from the firms earlier extracted. Convenience sampling is a quantitative sampling procedure in which the researcher selects participants because they are willing and available to be studied (Creswell, 2012). From the 240 questionnaires distributed

156 was retrieved. This represents a response of rate of 65%. Questionnaires were distributed by hand, via Google forms to listed phone numbers and via email to construction professionals employed by the organizations selected. Data for the study was processed and analysed with the aid of Statistical Packages for Social Science (SPSS 20.0). Data measured on nominal scale were analysed using descriptive statistics such as frequency distribution, percentages and mean scores. The levels of significance of identified factors were determined by the magnitude of their mean scores, with the greatest mean representing the most significant factor.

The questionnaire used was constructed to elicit responses to determine the important factors that affect the use of planning software in construction project delivery. A total of Sixteen (16) factors were identified and grouped under five (5) categories. Twenty (20) planning software were used to elicit responses on the proficiency of construction professionals in the built environment while respondents were required to rate the use of the software analysed against individual process in construction delivery. The survey instrument consists of four (4) sections. Section A sought information on the personal profile of the respondents and also evaluates the organizational characteristics of the respondents. Section B elicited information on the factors that affect the use of planning software in construction project delivery while section C measures the proficiency of construction professionals in the use of planning software. The last section D elicited information on the extent that the software was employed in the process of construction delivery. Respondents were requested to measure the level of the effect of highlighted factors on a five-point scale. The reliability test for the research instrument adopted for the study was the test-retest method, which allowed the research instrument to be administered at two different times. Joppe (2000) defines reliability as the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

The Federal Capital Territory (FCT), Abuja, Nigeria was selected as the study area because it is the Federal Capital and has a high volume of construction activities as well as a large concentration of construction professionals employed by private Firms. The high demands for residential, commercial and institutional buildings, civil and heavy engineering works have necessitated the selection of the study area.

DATA ANALYSIS

The results from the data collected are presented in two forms. The demography of the professionals and organizational characteristics sampled was analysed in percentages and are narrated. The decisions on the results of the factors relating to the objectives are presented in tabular form and measured based on mean scores.

Response Rate from Professionals:

Table 1: Response rate of professionals sampled

Respondent's Profession	Questionnaires Distributed		Questionnaires returned	
	No	%	No	%
Civil/ Structural Engineers	50	20.8%	45	28.8%
Quantity Surveyors	50	20.8%	42	26.9%
Architects	50	20.8%	33	21.2%
Builders	40	16.7%	12	7.7%
Mechanical Services Engineers	25	10.4%	9	5.8%
Electrical Services Engineers	25	10.4%	15	9.6%
Total	240	100.0%	156	100.0%

(Source: Authors' Field Survey 2017)

General Information of Respondents:

The demographic information of the respondents was first investigated, for this purpose, six characteristics namely, sex of the respondents, age, professional background, educational qualification, construction experience and professional qualification were selected. The results show that 75% of the respondents are male and the other 25% are female. This indicates a considerable good female representation among the sample. The distribution also selected a good percentage of matured professionals judging from the age distribution. It was revealed that 17.3% of the respondents are between 25 – 35 years of age; 53.8% are between 36 – 45 years of age; and 28.8% are above 46 years of age. This confirms that majority (83%) of the respondents are above 35 years of age. A large percentage of the distribution also have additional degrees as the response revealed that 11.5% of the respondents possess Higher National Diplomas; 21.15% of the respondents have a Bachelor of Technology, Science or Engineering degree; 13.4% have a Post Graduate Diploma degree; while 51.9% have a Masters of Technology, Science or Engineering degree; and only 1.9% has PHD. This indicates adequately trained personnel in the distribution as a total of 67.2% of the distribution have post graduate degrees. Also 9.6% of the respondents have construction experience of 1 – 5 years; 17.3% has experiences ranging from 6 – 10 years; while the 73.1% of the total respondents has over 10 years. This confirms that majority of the respondents have requisite experience to provide information for the study. Finally 23.1% of the total respondents are graduate / probationer members of their professional bodies; 3.8% are associate members; 59.6% are full Professional practitioners in their institutes; and 13.5% are professional fellows. This shows that a total of 73.1% are members of their professional bodies in the country.

Thirty seven percent (37%) of the respondents' organization engage in civil engineering and building construction, 24% are specialist contractors, while 37% are consultants who specialize in either building/engineering or services (mechanical and electrical) services within the construction industry. The study also revealed the frequency distribution of the years of existence of responding firms in the construction industry. Majority (60%) of the responding organizations has existed for more than 10 years, while 35% of the respondents have existed for 6-10 years with the remaining 5% existing for less than 5 years in the construction industry. Results also show that 48% of the responding organizations have more than 5 projects undertaken each year, while

the remaining 52% have less than five (5) construction projects they were involved in during the period of the survey.

Factors Affecting the Use of Planning Software in Construction Project Delivery:

The effect of selected factors on the use of planning software in construction project delivery was measured using sixteen factors identified from previous literature. The factors were further classified into five (5) categories namely; operational factors, management factors, training factors, cost factors and project factors. The effect of the factors was measured on a 5 point Likert scale; nil, low, moderate, high and very high. The scales were weighted as follows: nil=1, low=2, moderate=3, high=4 and very high=5. The mean scores of the effect of the factors on the use of planning software in construction project delivery are presented in Table 2, below:

Table 2: Respondents perception of the effect of factors on the use of planning software in construction project delivery

Factors and Sub-Factors	1	2	3	4	5	N	Mean	Rank
Training Factors								
Proficiency and knowledge on software.	6	9	57	12	72	156	3.87	1
Cost of personal training on software.	3	27	36	18	72	156	3.83	2
Hierarchical training of personnel	21	18	15	33	69	156	3.71	3
Average Mean & Rank							3.80	1
Cost Factors								
Cost of mounting infrastructure to support software.	15	12	15	66	48	156	3.77	1
Cost of individual software.	18	9	18	69	42	156	3.69	2
Average Mean & Rank							3.73	2
Operational Factors								
Complexity of the software application.	60	24	21	24	27	156	2.58	1
Integration with project teams internal system.	57	36	21	9	33	156	2.52	2
Rate of virus attack on programs loss of data.	60	24	33	15	24	156	2.48	3
Average Mean & Rank							2.53	3
Management Factors								
Investment by employers on infrastructure.	54	21	39	24	18	156	2.56	1
Proper knowledge of the project delivery process.	60	42	15	18	21	156	2.35	2
Encouragement & compulsion for using planning software.	57	36	36	9	18	156	2.33	3
Average Mean & Rank							2.41	4
Project Factors								
Type of project planned.	48	21	54	24	9	156	2.52	1
Project size.	33	45	75	0	3	156	2.33	2
Complexity of the project planned.	72	36	30	12	6	156	2.00	3
Project profitability.	78	45	15	12	6	156	1.87	4
Project cost.	87	39	9	21	0	156	1.77	5
Average Mean & Rank							2.10	5

(Source: Authors' Field Survey 2017)

Proficiency of Construction Professionals in the use of Planning Software:

In determining the proficiency of construction professionals in the use of planning software in construction project delivery, twenty (20) planning software were identified from literature and industry. The proficiency of construction professionals is assessed by measuring responses on a 5 point Likert scale; poor, low, average, good and excellent. The scales were weighted as follows: poor=1, low=2, average=3, good=4 and excellent=5. The mean scores of the proficiency of professionals is presented in Table 3,

Table 3: Respondents proficiency in the use of planning software

Software	1	2	3	4	5	N	Mean	Rank
Microsoft Project	6	9	15	30	96	156	4.29	1
AutoCAD (Autodesk)	3	0	42	21	90	156	4.25	2
ArchiCAD	3	9	36	27	81	156	4.12	3
STAAD pro	18	15	27	24	66	156	3.75	4
CivilCAD (Autodesk)	18	24	33	15	66	156	3.56	5
Workmate 0.5	27	9	33	30	57	156	3.52	6
Oracle Primavera (Primavera P6)	18	15	42	27	54	156	3.54	7
Microsoft Visio	39	9	27	33	48	156	3.27	8
Revit	39	18	33	27	39	156	3.06	9
Master Bill (MB-3 & MB Lite)	54	9	30	30	33	156	2.87	10
Orion	42	30	30	24	30	156	2.81	11
Easy Power System Analysis	42	30	36	21	27	156	2.75	12
3-D MAX	48	36	30	18	24	156	2.58	13
Estimator	54	33	36	9	24	156	2.46	14
Qs-CAD	66	24	36	9	21	156	2.33	15
WorkPLAN Enterprise	69	39	24	6	18	156	2.13	16
Pro-Estimate	69	30	36	9	12	156	2.13	16
Volts Enterprise (Dolphins Software)	81	12	42	12	9	156	2.08	18
Sketch-Up	69	33	39	9	6	156	2.04	19
Cost Planner	99	36	24	9	0	156	1.56	20

(Source: Authors' Field Survey 2017)

Extent of use of Planning Software in Construction Project Delivery:

To determine the level of use of planning software in construction project delivery, twenty (20) planning software applications were measured against the activities of construction project delivery. Respondents were required to identify and weigh the software that is applicable to the different project delivery activities. Activities were drawn from RIBA work stage comprising: project initiation; project appraisal; project design; budgeting; project procurement; project construction; and commissioning. The weighting is measured on a five (5) point Likert scale; never, rarely, occasionally, frequently, and always. The scales were weighted as follows: never = 1, rarely = 2, occasionally = 3, frequently = 4 and always = 5. The total calculated weights derived for individual software is the total scores for the software.

The mean scores derived from total identified levels of use of planning software in construction project delivery is presented in Table 4.

Table 4: Respondents Mean scores of the level of use of planning software in construction project delivery.

Software	1	2	3	4	5	N	Total Score	Mean Score	Rank
Microsoft Project	30	117	531	207	474	156	1359	8.71	1
AutoCAD	897	108	51	225	48	156	1329	8.52	2
Oracle Primavera	6	96	444	198	315	156	1059	6.79	3
Workmate 0.5	405	9	477	21	105	156	1017	6.52	4
Microsoft Visio	606	126	93	12	39	156	876	5.62	5
WorkPLAN Enterprise	612	99	42	27	84	156	864	5.54	6
Volts Enterprise	9	105	492	195	33	156	834	5.35	7
Cost Planner	276	21	450	12	51	156	810	5.19	8
Easy Power System Analysis	0	0	525	27	54	156	606	3.88	9
Pro-Estimate	3	21	513	24	27	156	588	3.77	10
Orion	6	9	12	207	78	156	312	2.00	11
Estimator	129	9	36	24	69	156	267	1.71	12
CivilCAD (Autodesk)	27	15	36	57	84	156	219	1.40	13
Qs-CAD	24	15	48	3	105	156	195	1.25	14
Sketch-Up	15	24	39	42	63	156	183	1.17	15
ArchiCAD	12	3	48	30	72	156	165	1.06	16
Revit	75	18	6	30	45	156	174	1.12	17
STAAD pro	75	12	30	18	27	156	162	1.04	18
3-D MAX	18	9	3	6	66	156	102	0.65	19
Master Bill	27	15	15	6	12	156	75	0.48	20

(Source: Authors' Field Survey 2017)

DISCUSSION OF RESULTS

The construction professionals who participated in the survey cut across the following professional background: architects, civil engineers, service engineers, builders and quantity surveyors. They are adequately trained and have requisite experience in the construction industry.

Results indicates that proficiency and knowledge of the software coupled with cost of personal training on software are the sub-factors with the highest effect on the use of planning software in construction project delivery with mean scores of 3.87 and 3.83. It further highlighted that training associated factors are very important factors because the failure to know how to use the planning software will affect the adoption for use of such software in the first place. This can be a fundamental reason why firms remain attached to conventional means of using paper-based files for information communication. This has been recognised as a limitation for information communication exchange (Ahmad *et al.*, 2017). Other factors with relatively higher effect on the use of software are cost of individual software, hierarchical training of personnel and the cost of mounting enabling infrastructure to support the software with mean scores of 3.77, 3.71 and 3.69 respectively. Project planning challenges faced by professionals due to complexities in new projects (Khosravi and Kalikonen, 2015) is not yet seen as an important reason to use planning software in the industry. This is deduced because complexity of the project planned, project profitability and project cost are the sub-factors that exert the least effect on the use of planning software in construction project delivery with mean scores of 2.0, 1.87 and 1.77 respectively. This can be attributed to the reason client's according to Takim and Akintoye (2002) are dissatisfied with the outcome of most construction projects, which is somewhat linked

to inadequate planning and implementation amongst other factors. The study however suggests that project planning has significant impact on project success (Globerson and Zwikaël, 2002; Zwikaël and Sadeh, 2007; Idoro 2012; Khosravi and Kalikonen, 2015; Kerzner, 2017). Hence, it is important for project factors to be taken more seriously. In summary it is evident that training factors and cost related factors are categories with the highest effect on the use as compared with management and project factors. Operational factors such as: complexity of the software application; integration with project teams' internal system; and rate of virus attack on programmes loss of data still exert average impact on the use of planning software in construction project delivery.

The ability of staff to use software when mounted by firms is another critical factor considered. Results revealed that construction professionals are very proficient in Microsoft project (MS project) as planning software in construction project delivery with mean score of 4.29. The activity that earned this software a very high score is the use of the software to prepare the programme schedule of work as part of contract documents at the planning stage of construction project delivery. Significant use of the software for extensive resource schedule and other monitoring activity such as work progress and resource monitoring were not identified as factors contributing to its high use. This may be related to the reason for several training and retraining efforts to bring construction professionals up to date with many software applicable to their areas of expertise (Ibrahim, 2012). Other planning software that construction professionals are proficient in include: AutoCad, ArchiCad and CivilCad with mean score of 4.25, 4.12 and 3.75 respectively. They are used more to design architectural and/or structural element of construction projects. However, Pro-Estimate, Volts Enterprise, Sketch-up and Cost Planner are the software that professionals are least proficient with mean scores of 2.13, 2.08, 2.04 and 1.56 respectively

Finally the survey also revealed that Microsoft Project was used more than any other planning software in construction project delivery with a mean score of 8.71. This could be as a result of its use to prepare contract programme of work and resource schedules as well as evaluation, monitoring and control of work activities. Closely following is AutoCAD and Primavera with mean scores of 8.52 and 6.79 respectively. AutoCad software is used to design in order to show the clients brief on paper. Primavera like MS Project is used in the preparation and review of contract programme. The software however has a broader application as it is more sophisticated than the MS Project. Also its web application properties are comprehensive. This survey thereby agrees with Akale, *et al.*, (2015) that there is a poor use of web-based project management software packages in the construction industry and there is a misplaced emphasis on the cost of software and software graphic displays during selection. Other planning software used by construction professionals to ensure project objectives are achieved includes Workmate 0.5, a budgeting and estimating software indigenous to Nigeria. It is used for the derivation of project budgets and equally in evaluation with a mean score of 6.52. Microsoft Visio and WorkPlan Enterprise are equally of high prominence in construction project delivery with mean scores of 5.62 and 5.54 respectively. Revit, Staad.Pro and 3-D Max are rarely used with means of 1.12, 1.04 and 0.65 respectively. This could be associated with the fact that majority of the respondents are matured and have been in the industry for a considerable amount of time. The respondents have not shown the motivation to learn the use of the software and hence are rarely used. MasterBill is the planning software with the least amount of use in the construction industry with 0.48 mean score. Though it is present in the industry, professionals rarely use this software. This can be attributed to the training and cost factors as suggested by

this study and also agreeing with Oyerinde and Odusami (2005) position that Quantity Surveying appears to be one of the few professions that have not been profoundly transformed by the application of the technological advancement offered by digital revolution especially in a developing economy like Nigeria.

CONCLUSION

The findings of this study serve as a basis for making the following conclusions: Construction organizations and practitioners consider the huge capital outlay in buying related software, associated training and related support infrastructure because of the uncertain nature of incorporating such software in the discharge of their services. These factors are primary reasons construction practitioners shy from using planning software in the construction delivery process. Adoption of the use of planning software for project delivery could help bridge the gap in paper-based files and help improve on-site information communication.

Proficiency of construction professionals in the use of software in construction project delivery is relatively low as many professionals are not susceptible to change and still employ traditional method of carrying out their duties. Improving the proficiency level will help organizations to improve their processes and enhance design, estimation, scheduling, cost control, budget management, resource allocation, process collaboration, communication, decision-making, quality management and documentation or administration systems.

Construction professionals find it difficult to embrace modern use of software in preparing the construction deliverables. Design software such as AutoCAD, CivilCAD and other related software are essential in the planning process as it produces the desire and brief of the client for the project to kick off. It must be said that the planning process starts with the initial or sketch design with the highlighted software used for the purpose. Workmate is budgeting and evaluation software and its prominence is shown by a relatively high mean score in this study. MS project and Primavera are planning software used for producing workable plan for construction activities and are employed for ensuring appropriate monitoring, evaluation and control. The study revealed that the more predominantly utilized software include those employed for design, scheduling and budgeting. However adoption of the more productive scheduling and budgeting software is low. Employing the more productive software for scheduling and budgeting activities will help to solve the problems associated with client's increased demand and technological advancement, together with helping to improve project planning, scheduling and cost control activities.

It is recommended that management of construction organizations should be aware of the latest software available in the construction market and carry out due diligence on effect of introducing such software into its operations. Professionals should also increase their reputation in the construction industry by acquiring technical competencies and capabilities with the use of modern software as these qualities have become important considerations in assessing competitiveness and key indicators of increased productivity on construction projects. Clients and employers should insist on the maximal use of relevant software on all aspects of project planning, development, monitoring, evaluation and control. Construction professionals should make concerted efforts to improve proficiency in the use of planning software through personal training and constant practice in the use of such software.

This study was carried out in the Abuja municipal area and employed only descriptive statistics in the analysis of its results as such caution should be exercised in the use of the data as a general inference on the entire population of professionals in Nigeria. It is recommended that a broader survey of construction professionals should be carried out to further substantiate the results of this study.

REFERENCES

- Acar, E., I. Kocak, Y. Sey, and D. Arditi, D. (2005). Use of information and communication technologies by small and medium-sized enterprises (SMEs) in building construction, *Construction Management and Economics*, 23: 713–722
- Ahmad, H. S., Bazlamit, I. M., and Ayoush, M. D (2017). Investigation of document management systems in small size construction companies in Jordan, *Procedia Engineering* 182 (2017), 3 - 9.
- Akale, J., Amade, B., Akpan, E., Okebugwu, O., and Omajeh, E. (2015). Project Management Software Application in the Nigerian Construction Industry. *Serbian Project Management Journal*, 5 (2). 3 - 10
- Akindoyeni, A. (1999). The Role of Quantity Surveyors in Strategic Planning and Budgeting for Government Projects with a View to Avoiding Abandonment. *Paper presented at the 5th Annual Conference of Heads of Quantity Surveying Departments*, Abeokuta, Ogun, Nigeria.
- Araín, F.M., Assaf, S.A. & Low, S.P. (2004) Causes of discrepancies between design and construction. *Architectural Science Review*, 47(3), 237-249
- Autodesk (2005). Building Information Modeling for Sustainable Design. http://www.kelarpacific.com/resources/Documents/bim_for_sustainable_design_jun05.pdf
- Becerik, B. (2004). A Review on Past Present & Future of Web-Based Project Management Collaboration Tools & their Adoption by US AEC Industry; *International Journal of IT in Architecture, Engineering & Construction*, Vol.2, Issue 3, 233 - 248
- Chen, Y. & Kamara, J.M. (2008). Using mobile computing for construction site information management. *Engineering, Construction and Architectural Management*, 15(1), 7 - 20
- Chen, Y. & Kamara, J.M. (2011). A framework for using mobile computing for information management on construction sites. *Automation in Construction*, 20(7), 776 - 788
- Chitkara, K.K. (2011). *Construction Project Management Planning, Scheduling and Controlling*, 2nd Edition, Tata McGraw Hills
- Deng, Z.M., Li, H., Tam, C.M., Shen, Q.P. & Love, P.E.D. (2001). An application of the Internet-based project management system, *Automation in Construction*, 10 (2), 236-246.
- Dolphinimaging, (2016). Online support framework for Dolphin Systems. Retrieved on September 20, 2016 from <http://www.dolphinimaging.com>
- Farflex (2014) - The Free Online Dictionary, Retrieved on September 24, 2015 from <http://www.thefreedictionary.com>.

- Gido, J. & Clement, J. P. (2009). *Successful Project Management-Fourth Edition*. Oxford, South Western CENGAGE Learning.
- Globerson, S. & Zwikael, O. (2002). The impact of the Project Manager on Project Management Planning Process, *Project Management Journal*, 33(3), 58 - 65.
- Ibrahim, YM (2012). Computer Based Project Planning & Scheduling Using Microsoft Project (1). Workshop Paper at the Nigerian Institute of Quantity Surveyors National Workshop 2012,
- Idoro, G. I. (2012). Influence of Project plans on the outcome of construction projects procured by Design-Build in Nigeria. *Journal of Construction in Developing Countries*, 17 (2), 77-99.
- Idoro, G. (2009). Comparing levels of use of project plans and performance of traditional contract and design-build construction projects in Nigeria. *Journal of Engineering, Design and Technology*, 45-67.
- Joppe, M. (2000) The Research Process, available at <http://www.ryerson.ca/~mjoppe/rp.htm> (accessed on 25 February 2015).
- Kerzner, H. (2006). *Applied Project Management: Best Practices on Implementation*. New York: John Wiley & Sons Inc.
- Kerzner, H. (2017). *Project Management: A systems Approach to Planning, Scheduling and Controlling*. 12th Edition. New Jersey: John Wiley & Sons Inc.
- Khosravi, M and Kalikonen, K., (2015). Management and planning under complexities of metro construction. *Procedia Economics & Finance*. 21 (2015), 415 - 421.
- Naoum, S.G. (1991). Procurement and project performance. Occasional paper no. 45, *The Chartered Institute of Building*, Ascot.
- Naoum, S., Fong, D. & Walker, G. (2004). Critical success factors in project management, in *Proc. of the International Symposium on Globalization and Construction*. CIB 2004. W107, TG23, 17-19 September, 2004, School of Civil Engineering, Asian Institute of Technology, Thailand, 2004.
- Nitithamyong P. & Skibniewski M. (2006). Success/failure factors and performance measures of web-based construction project management systems: professionals' viewpoint. *ASCE Journal of Construction Engineering and Management*, 132(1), 80-87.
- Oladapo, A. A. (2006). The Impact of I.C.T. on Professional Practice in the Nigerian Construction Industry. *Electrical Journal of Information Systems in Developing Countries*, 24 (2), 1-19.
- Oxford Living Dictionaries (2011). *Advanced Learners Dictionary - Eight Edition*. Oxford University Press.
- Oyediran, O. S. & Odusami, K.T. (2004). Whither the Nigerian Quantity Surveyors in the Information Technology Age. *An International Journal of Information and Communication Technology (ICT)*, 1 (2), 1-16.
- Oyediran, O.S & Odusami, K. T. (2005). A Study of Computer Usage by Nigerian Quantity Surveyors. Retrieved on September 24, 2016 from <http://www.ITcon.org/2005/20/Vol.10> p291-301.
- Project Management Institute. (2004). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*. Newtown Square, PA: Project Management Institute.

- Russell, L. (2003), "Conference Highlights Growing Importance of Knowledge Management", Construction News, e-Commerce News, Published on February 14, http://www.cnplus.co.uk/News/News_Article/?ChannelID=4&pid=3&aid=27763
- Schwalbe, K. (2007). *Information Technology Project Management-Fifth Edition*. Thomson Course Technology PM-Book.
- Senaratne, S. & Sexton, M.G. (2009). Role of knowledge in managing construction project change. *Engineering, Construction and Architectural Management*, 16(2), 186 – 200
- Sheba, P. (2009), Lecture Notes for Construction Planning and Scheduling, Department of Civil Engineering, Noorul Islam College of Engineering.
- Sohail, M. and Baldwin, A.N (January 2004). Performance Indicators for Micro Projects in Developing Countries. *Construction Management and Economics*, 22, 11 - 23.
- Sripraset, E. & Dawood, N. (2002). Requirements identification for 4D constraint-based construction planning and control system. *Paper presented at Proceedings of CIB w78 Conference*, Istanbul, Turkey, 177-184.
- Takim, R, & Akintoye, A (2002) Performance indicators for successful construction project performance. In: Greenwood, D (Ed.), *18th Annual ARCOM Conference*, 2-4 September 2002, University of Northumbria. Association of Researchers in Construction Management, 2, 545-55.
- Zou P.X.W. & Roslan B. A. (2005). Different Perspectives towards using Web-based Project Management Systems in Construction: Large-Sized Enterprises Versus Small- and Medium-Sized Enterprises, *Architectural Engineering and Design Management Special Issue: Working in an nD Environment*, 1 (2), 127-143.
- Zwikael, O (2009), Critical planning processes in construction projects, *Construction Innovation*, Vol. 9 Issue: 4, pp.372-387,
- Zwikael, O & Globerson, S 2006, 'From Critical Success Factors to Critical Success Processes', *International Journal of Production Research*, vol. 44, no. 17, 3433 - 3449.
- Zwikael, O., Sadeh, A. (2007), Planning effort as an effective risk management tool. *Journal of Operations Management*, Vol. 25 No 4, pp. 755-767