DOI: https://doi.org/10.68128/jocrebe.2024.4xm6n194

Journal of Contemporary Research in the Built Environment ISSN: 2636-4468

Volume 8, Number 2, September 2024 © Department of Building, University of Uyo

EVALUATION OF THE IMPACT OF PLANNING TECHNIQUES ON CONSTRUCTION PROJECT PERFORMANCE IN NIGERIA

Dele S. Kadiri[1], Obiora K. Uroko[2], Babajide O. Onabanjo[3] and Elijah O. Oyewole[2]

[1, 2] Department of Quantity Surveying, Obafemi Awolowo University, Ile-Ife, Nigeria.

[3]Department of Architecture, Obafemi Awolowo University, Ile-Ife, Nigeria

ABSTRACT

Purpose: Time and cost overruns are two of the major criticisms against the Nigerian construction industry. Extant literature indicates that the planning technique used for the execution of construction project will determine its performance. However, there seems to be scanty empirical evidence on the impact of planning techniques on project performance in the literature. This study hence evaluated impact of planning techniques on construction project performance in Nigeria.

Design/methodology/approach: A descriptive survey using structured questionnaire was conducted on medium and large scale contracting firms in Lagos State, Nigeria using random sampling technique. One hundred and twenty (120) respondents were sampled out of a sampling frame of 159 contracting firms in these categories in the study area. Primary data were collected on the usage of the techniques while archival data were collected on the time and cost performances of the planning techniques used in the study area. The data collected were analysed using mean score, mean and percentage.

Findings: The results from the study indicated that Gantt/bar chart is the planning technique mostly used in the study area. Moreover, critical path method and PERT out-performed the other planning techniques in completion time and cost, respectively while bar chart performed least in both completion time and cost.

Research limitations/Implications: The paper presents project managers the insight that construction projects perform low in cost and time because innovative techniques are not used in their execution.

Originality/value: This paper complements existing literature on the planning techniques used for project execution in the Nigerian construction industry by providing information on cost and time performances.

Keywords: Construction; Evaluation; Performance; Planning; Techniques.

1. INTRODUCTION

Increasing complexity of construction projects requires proper planning to achieve success (Olateju *et al.*, 2011). Lines *et al.* (2014) defined planning as the procedure of determining what to do and how to do it before it is done. Anyanwu (2013) opined that planning involves making decisions now with the purpose of influencing the future. It sets a roadmap that should be followed to reach a destination. Patankul *et al*. (2010) defined planning techniques as tools used by project managers to orchestrate the activities

[1]Email: deleskadiri@oauife.edu.ng

required in a project life cycle. Idoro (2012) described construction planning techniques as crucial tools which stakeholders use to ensure that projects are successful. Tesfaye *et al.* (2017) explained that project planning defines the activities required in a project as well as the resources needed for their accomplishment. Ayodele *et al.* (2015) claimed that planning techniques are needed to effectively implement project activities. Kerzner (2009), Patanakul *et al.* (2010) and Tesfaye *et al.* (2017) observed that there are several planning techniques in use in the construction industry worldwide. Olateju *et al.* (2011), Inuwa *et al.* (2014a), Ayodele *et al.* (2015), Ahmed and Namala (2015) and Ugwu and Attah (2016) have identified the planning techniques mostly used in Nigeria to include Gantt/bar-chart (BC), line of balance (LOB), project evaluation and review technique (PERT), critical path method (CPM), linked bar charts (LBC).

The construction industry worldwide has for long been criticised for being inefficient with regard to cost, time and quality outcomes of its outputs. In Nigeria, for instance, Ogedengbe and Adesopo (2003) and Zuofa and Ochieng (2014) reported that most projects don't deliver on schedule and budget allocated. However, there is a close nexus between planning and construction projects performance. Ogunde and Fagbenle (2013) posited that proper planning is vital to successful project execution. Omotayo and Kaushal (2014) opined that the level of success of any project executed depends on the planning technique adopted. Ahmad and Namala (2015) affirmed that planning ensures that projects are completed within specified duration, cost, and quality. In other words, successfully completed projects are as a result of careful planning and execution using established techniques.

Similarly, Idoro (2009) claimed that poor project control and planning are major contributors to project delay in Nigeria. Saidu and Shakanta (2017) opined that inadequate project planning and control are major challenges to efficient project performance in both developed and developing nations of the world. Daniel and Ibrahim (2019) also found that inadequate planning was a major cause of project failure in Nigeria. Thus, research efforts towards enhancing project efficiency via proper planning should not be underestimated. However, empirical studies on the performance of planning techniques seem scanty in construction literature. Patanakul *et al.* (2010) reported that research on project management tools and techniques has not been adequately investigated with regard to their impact on project outcomes. Being a developing country, Nigeria is faced with a lot of infrastructure deficit which will need the deployment of efficient planning techniques in their execution. The foregoing necessitates an evaluation of the performance of the construction planning techniques used in Nigeria, hence this study. The aim of this study is to evaluate the impact of planning techniques on the cost of construction projects in Nigeria with a view to enhancing project delivery. The specific objectives of this study are to assess the usage of planning techniques in Nigeria and their impact on cost and time performances of construction projects in the study area.

1.1. Objectives of the Study

Given the background above, the specific objectives are to:

i. Assess the usage of planning techniques for the execution of building projects in the study area.

ii. Determine the cost and time performance of planning techniques in the execution of building projects in the study area.

The outcome of the study is expected to create awareness on the cost and time performances of planning techniques when used for the execution of building projects, thereby enabling construction stakeholders to pay attention to these planning techniques so as to reduce the cost and time overruns in building projects.

2. LITERATURE REVIEW

A number of empirical studies have been conducted around the world on the usage of planning techniques. Agumba and Fester (2011) investigated construction projects executed by small and medium enterprises in South Africa and reported that bar-chart and networks were used for managing time and cash flow. Deacon and Vander-Lingen (2015) examined the use of critical path and critical chain methods in South Africa with a view to determining which construction sector apply the methods and their level of usage. The study concluded that the methods were mostly used by the building sector and that critical path was more used than critical chain method.

In Mexico, Carcano *et al.* (2015) investigated the performance of the processes of managing 14 public school projects and concluded that the more the schedule management of projects, the more likely timely completion of projects will be. Similarly in Sweden, Al Nesseri (2015) inquired into the application of project planning and scheduling in construction projects with a view to creating an awareness of its understanding. The study however found that there is insufficient attention to effective management and definition of project planning. In Ethiopia, Tasfaye *et al.* (2017) assessed the impact of planning on project using four input factors which affect planning quality namely: human, organizational, management and technical factors. The study concluded that project success depended on time, cost and risk. Haron *et al.* (2017) studied the project management practice and its effects on project success in the Malaysian construction industry using interviews and questionnaire administration. The study reported that customer satisfaction, competency of project teams and performance of subcontractors and suppliers are becoming critical success factors of projects in addition to the classic iron triangle's view of cost, time and quality.

Similarly, in Nigeria, a number of researches have been undertaken in the area of construction project planning. Olateju *et al.* (2011) studied the management practices adopted for public sector projects in Nigeria using 23 public institutions in the study area. The study found that there is inadequate knowledge of project planning techniques in public institutions in the study area due to the high cost of application. Adebowale and Oluboyede (2011) investigated the cost and minimum expected time required to complete building projects using network analysis with a view to reducing the menace of building collapse in Nigeria. In a related study, Inuwa *et al.* (2014) assessed the project planning techniques used by indigenous contractors in Nigeria using questionnaire survey and a case study to probe the responses from the questionnaire. The study concluded that majority of Nigerian indigenous contractors do not apply project planning techniques because of their personnel's incompetence. Ahmad and Namala (2015) investigated the practical application of essential planning tools in construction process in Nigeria. The study reported that few contractors use planning tools in the study area and that GC is the planning tool mostly used because of its simplicity. The study concluded that the cost of application inhibited the usage of other planning tools. Training on application was hence recommended for enhanced adoption of planning tools and management of construction projects. Ayodele *et al.* (2015) studied the techniques used for project planning in Nigeria. Umar (2016) appraised construction project planning in Nigerian indigenous construction companies in Northwest Nigeria with a view to ascertaining the level of adoption and efficiency of the techniques in use. The study found that the adoption of project planning techniques in the study area was low.

The foregoing reviews have chronicled extant literature on construction project planning tools and techniques in country contexts. It is however pertinent to note that regarding the offshore studies, the emphasis has mostly been on the use of planning tools or techniques with little emphasis on their impact on project performance. Similarly, most of the studies in Nigeria have been based on the usage of one or two planning techniques with limited coverage of their impact on project cost, time and quality. This study was hence undertaken to bridge the knowledge gaps in construction project

planning techniques in the literature. This study hence investigated the level of usage of planning techniques and their impacts on cost and time performances of construction projects in Nigeria. The planning techniques investigated are Gantt/bar chart, linked bar chart, line of balance, critical path method and project evaluation and review technique. These planning techniques have been reported in the literature to be the dominant techniques used in Nigeria.

3. METHODOLOGY

This study assessed the usage of construction project planning techniques in the Nigerian construction industry, which is reported to be under-researched. The study was conducted in Lagos State because Ameh and Daniel (2017) claimed that Lagos state is the commercial nerve centre of Nigeria and hosts a large number of construction firms due to the volume of construction activities in the State. This ensured access to robust data for the study. Building projects were use because their data are better documented than Civil Engineering projects. The objectives of this study are to assess the usage of planning techniques and their impact on the cost and time performances of construction projects in the study area. Cost and time performances are selected because they have been reported to be the measurable indicators of project success (Xiao and Proverbs, 2003). The population for this study comprised the medium and large scale construction firms in Lagos State. The sampling frame of these categories of firms registered with the State is 159 as listed in the Public Procurement Agency of Lagos State (PPA, 2018). These categories of companies are deemed to take the issue of project planning more seriously than the small scale companies. A sample size of 110 construction firms representing 69.2% of the sampling frame was randomly selected for this study.

Both primary and secondary data were used for the study. A structured questionnaire was used to elicit primary data from the respondents on respondents' profiles and the usage of planning techniques in the study area. Respondents were asked to tick their level of usage of the planning techniques aggregated from literature on a scale of '0' to '4' (0 for never and 4 for always). From the 110 copies of questionnaires administered, 98 were retrieved while 44 (representing 36.7%) were properly completed and used for analysis. Archival data on the completion cost and time of the building projects executed by the respondents were also collected. Respondents were required to indicate the planning techniques used to execute the projects. Data collected on respondents' profiles were analysed using frequency counts and percentage. Data on the usage of planning techniques were analysed using mean score while data on the impact of planning techniques on project performance were analysed using percentage and mean to determine cost and time overruns or savings.

4. PRESENTATION AND DISCUSSION OF RESULTS

4.1. Response Rate

The response rate (36.7%) for this study is considered adequate going by the norm in construction management researches (Takim *et al.*, 2004). Chinowsky and Meredith (2000) reported 26.5% response rate while Tam (2007) reported a response rate of 31.2%. indicating that this study outcomes can be used to generalise the study population with regard to the usage of planning techniques and impacts on project completion cost and time in the study area.

4.2. Respondents' Profile

Before presenting the results of the data analysis on the basis of the study objectives, it is necessary to report the respondents' characteristics. Table 1 indicates that 90.9% and 88.6% of the respondents possessed requisite academic and professional qualifications, respectively. Similarly, regarding industry experience, none of the respondents has worked less than seven years. The Table also shows that none of the respondents has

handled less than nine projects using planning tools. Thus, the respondents possess sufficient qualifications and experience to be able to provide reliable information upon which valid inferences from this study can be drawn.

Table 1: General Information on Respondents

Category	Frequency	% of Total	Cumulative %
Academic Qualification			
HND	11	25.00	25.00
B.Sc.	20	45.45	70.45
M.Sc.	9	20.45	90.91
Ph.D.	0	0.00	90.91
Others	4	9.09	100.00
Total	44	100.00	
Professional Qualification			
MNIQS	23	52.27	52.27
MNIA	9	20.46	72.73
MNSE	4	6.82	81.82
Probationer	3		88.64
Others	5	11.36	100.00
Total	44	100.00	
Work Experience			
0-5	8	18.18	18.18
5-10	25	56.82	75.00
10-15	6	13.64	88.64
15-20	3	6.82	95.45
>20	0	0.00	95.45
Unspecified	2	4.55	100.00
Total	44	100.00	
Projects Handled			
1-5	8	18.18	18.18
6-10	21	47.73	65.91
11-15	7	15.91	81.82
16-20	2	4.55	86.36
>20	1	2.27	88.64
Unspecified	5	11.36	100.00
Total	44	100.00	

Mean = 7 years (Experience), Mean = 9 (Project Handled)

4.3. Usage of Planning Techniques

The first objective of this study is to assess the usage of planning techniques for the execution of building projects. Analysis of the data on this objective indicate that Gantt/Bar Chart with mean score (MS) of 2.84 is the lead planning technique (Table 2) used in the study area. It is closely followed by PERT (MS=2.65) and CPM (MS=2.61). The least used planning technique is LOB (MS=1.34) followed by LBC (MS=1.74). Overall, the usage of BC, PERT and CPM in the study area is high (3.0) on a Likert-like scale of zero to 4. Similarly, the usage of LBC is low (2.0) while the usage of LOB is very low (1.0).

Table 2: Usage of Planning Techniques

Planning Techniques	N	TWV	MS	R
Gantt chart/Bar chart	43	122.00	2.84	1
Programme Evaluation and Review Technique	43	114.00	2.65	2
Critical Path Method	43	112.00	2.61	3
Linked Bar chart	42	73.00	1.74	4
Line of Balance	41	55.00	1.34	5
Average			**2.24**	

Key: N = Frequency of Responses, TWV = Total Weighted Value, MS = Mean Score, R = Rank

The findings of this study on the usage of planning techniques totally align with Agumba and Festers (2011) and Ahmad and Namala (2015). Agumba and Fester (2011) reported that Gantt/bar chart was the planning technique mostly used in Ghana. Similarly, Ahmad and Namala (2015) concluded that bar chart and networks were mostly used in Nigeria. The findings however agree in part with Deacon and Van der Linger (2015) who reported that critical paths were mostly used in South African. Overall, Table 2 shows that the usage of GC, PERT and CPM is high, respectively. This finding does not align with Ahmad and Namala (2015) and Inuwa *et al.* (2014), Al Nesseri (2015) and Umar (2016). Inuwa *et al.* (2014) affirmed that there was inadequate experience and application by Nigerian indigenous contractors of project planning techniques. This study however reveals otherwise – that the usage of planning techniques is high on the average. Moreover, Ahmad and Namala (2015) found that few Nigerian contractors use planning tools contrary to the finding of this study that the usage of planning techniques is high, overall.

However, a case can be made for the high usage of planning techniques by medium and large scale contractors in Nigeria. Probably, the scope of that study included small scale contractors which may not pay much premium on project planning. In the case of Al Nesseri (2015), the claim that there was inadequate understanding and application of project planning and scheduling in construction projects in Sweden is also not in agreement with the outcome of this study. The fact that this study shows high level of usage of planning techniques in Nigeria contrasts with that study. However, this explanation should not be over emphasized because of the deferring levels of development of the construction industry in the two countries.

Generally, the usage of planning techniques in Nigeria seems to be on the increase going by the outcome of this study. This is because their moderate usage suggests that more competent personnel are now being engaged by Nigerian indigenous contractors, contrary to the findings about a decade ago by Olateju *et al.* (2011) and Inuwa *et al.* (2014). Both researchers reported that the low application of planning techniques was due to incompetence of personnel and high cost. However, findings from this study indicate that three out of the five techniques investigated are scored 3.0 on a Likert-scale of 0 to 4. These techniques are Gantt/Bar Chart, Programme Evaluation and Review Technique and Critical Path Method, indicated in Table 2. However, on overall, the usage of the planning techniques is moderate with a score of 2.24 on a Likert scale of 0-4.

4.4. Cost and Time Performance of Planning Techniques

The impact of the usage of planning techniques on project performance is presented in Table 3. The Table is a summary of Appendices A (1 to 4), attached to this study which are percentage time and cost overruns of projects executed using the techniques, respectively. They are the archival time and cost data collected on the second objective of this study. Ojo (2009) described project performance as the measurement of achievement against intention. Alqahtani *et al.* (2015) identified cost, time and quality to be the

veritable indicators used to measure project performance in the construction industry. Moreover, Atkinson (1999) affirmed that cost, time and quality are the iron triangle of project performance. However, cost and time were used to evaluate project performance in this study because of the ease to collect data on them (Xiao and Proverbs, 2003). In all, 16 time and cost data were collected on projects executed using BC, eight on LBC, 10 on CPM and eight on PERT.

Table 3: Time and Cost Performances of Planning Techniques

Planning Techniques	N	Time Performance	Cost Performance
		Mean (%)	Mean (%)
Critical path method	10	10.58	16.03
Programme Evaluation and Review Technique	8	17.61	12.93
Linked Bar chart	8	21.78	14.19
Gantt/Bar chart	16	29.11	16.63
Mean		**19.77**	**14.95**

If other factors are held constant, the Table shows that CPM is the most efficient technique for planning the duration of construction projects in the study area with average time overrun (TO) of 10.58%. It is followed by PERT (TO=17.61%) and LBC (TO=21.78%). Gantt/bar chart is the least efficient technique for planning project duration in the study area with time overrun of 29.11%. Similarly, PERT outperformed the others in terms of completion cost with average cost overrun (CO) of 12.93%. It is followed by LBC (CO=14.19%) and CPM (CO=16.03%). Moreover, BC performed least in terms of projects completion cost in the study area with average cost overrun of 16.63%. Generally, the above performances of the planning techniques investigated can be said to be within acceptable limits when compared with previous studies on project time and cost performances.

The findings of this study however align in part with Agumba and Fester (2011) and Deacon and Van der Linger (2015). Agumba and Fester (2011) reported that bar chart and networks are efficient planning techniques for managing time in Ghana. Similarly, Deacon and Vander Linger (2015) also found that CPM was time and cost efficient in South Africa. The findings from this study that CPM outperformed the others in terms of completion cost and time is not surprising. This is because CPM establishes the critical activities of a project which give the shortest duration of a project. Similarly, the shortest duration will invariably lead to increase in the cost of a project. Adebowale and Oluboyede (2011) concluded that time reduction increases building cost. This means that as project duration decreases, project cost increases and vice versa, all other things being equal**.**

5. CONCLUSION AND RECOMMENDATIONS

This study evaluated the impact of planning techniques on construction project performance in Nigeria. Five planning techniques reported by extant literature to be the mostly used in the study area were investigated. The usage of the techniques and their project cost and time performances were investigated using medium and large scale contractors registered with the agency in charge of procurement in the study area. The study concludes that, overall, the usage of construction planning techniques is moderate (with overall score of 2.24 on a Likert-scale of 0 to 4) in the study area. The usage is however limited to simple techniques. Similarly, their overall completion time and cost performances appear fair with average time and cost overrun of 19.77% and 14.95%, respectively. Although findings from this study may have limited generalizations due to the limited number of techniques investigated, the study nevertheless has implications for enhancing the usage and cost and time performances of construction planning techniques in the study area. It is recommended that more sophisticated planning techniques should

be used in the study area for the execution of building projects so as to enhance project cost and time performances.

6. LIMITATION OF THE STUDY

This study is limited to the usage of five construction planning techniques and the impact on two project success performance criteria. Therefore, further studies on more planning techniques and performance criteria could improve the results and generalisations of the study.

REFERENCES

Adebowale, S. A. and Oluboyede, E. D. (2011). Network analysis and building construction: Implications for timing and costing of activities, *Journal of Civil Engineering and Construction Technology.* 2(5), 90-100.

Agumba, J. N. and Fester, F. C. (2011). Identifying tools and techniques for managing construction project delivery in small and medium enterprises in South African construction industry, *Journal of Social and Development Sciences*, 2(4), 204-213.

Ahmad, X. U. B. and Namala, K. A. (2015). Overview of the practical application of essential planning tools in Nigerian construction process, *International Journal of Emerging Research and Technology*, 3(7), 108-113.

Al Nasseri, H. A. (2015). Understanding Application of Project Planning and Scheduling in Construction Projects. Doctoral Thesis, Lund University, Sweden. Department of Construction Sciences, Faculty of Engineering.

Alqahtani, F., Chinyio, E., Mushatat, S. and Oloke, D. (2015). Factors effecting performance of projects: A Conceptual Framework. *International Journal of Scientific and Engineering Research*, 6(4), 670-676.

Ameh, O. J. and Daniel, E. I. Human Resource Management in Nigerian Construction Firms: Practices and Challenges, *Journal of Construction Business and Management*, 2(1), 46-53.

Anyanwu, C. I. (2013, October). Project Management and the Project Manager: A Strategy for Addressing the Problem of Building and Infrastructural Collapse in Nigeria, *Scientific Research Journal*, I(III), *59-67.*

Atkinson, R. (1999). Project Management: Cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria, 17(6), 337-342.

Ayodele, V. M., Olatunji, S.O., Oke, A. E. and Akanni, P. O. (2015). In: Ogunsemi, D.R., Awodele, O. A. and Oke, A. E. (Eds). Proceedings of confluence of Research, Theory and Practice in Quantity Surveying Profession for a sustainable Built Environment. 2nd Research Conference (RECON2) of the Nigerian Institute of Quantity Surveyors, 1st to 3rd September, 2015, Akure, 164-177.

Carcano, R. G., Corona-Suarez, G. A. and Garcia-Ibarra, A. J. (2015). The use of Project Time Management Processes and the Schedule performance of Construction Projects in Mexico, *Journal of Construction Engineering*, 2015, 1-10.

Chinowsky, P. S.; Meredith, J. E. Strategic management in construction, *Journal of Construction Engineering and Management*, 2000, 126, 1-9.

Daniel, C. O. and Ibrahim, A. U. (2019). Project failure and its influence on the performance of construction firms in Nigeria, *International Journal of Research in Business, Economics and Management*, 3(2), 86-95.

Deacon, H. and Van der Lingen, E. (2015). The use of the critical path and critical chain methods in the South African Construction Industry, *Acta structilia*, 22(1), 73-95.

Haron, N. A., Devi, P., Hssim, S., Alias, A. H. and Tahir, M. M. (2017). Project management practice and its effects on project success in Malaysian construction industry, *International conference on Architecture and Civil Engineering,* 291(2017), 1-7.

Idoro, G. I. (2009). Clients' perception of construction project leaders in the Nigerian banking industry, *Journal of Engineering, Design and Technology*, 7(3), 264-281.

Idoro, G. I. (2012). Influence of project plans on the outcome of construction projects procured by design and build in Nigeria, *Journal of Construction in D eveloping Countries, 17(2), 77-99.*

Inuwa, I. I., Wanyana, G, and Dianga, S. (2014). Application of Project Planning Techniques in Construction Procurement: The Case of Nigerian Indigenous contractors, *International Journal of Economic Development Research and Investment*, 5(1), 31-47.

Kerzner, H. (2009). A Systems Approach to Planning, Scheduling and Controlling. In H. KERZNER, *Project Management (pp. 411-535). John Wiley & Sons, Inc.*

Krishnamurthy, K. G. and Ravindra, S. V. (2010). *Construction and Project Management for Engineers, Planners and Builders*, New Delhi: Satish Kumar J.

Lagos State Public Procurement Agency (2018). List of Registered Contractors, *Procurement Journal*, 2018, 29-39.

Lines, B. C., Sullivan, K. T., Hurtado, K. C. and Savicky, J. (2014). Planning in Construction: Longitudinal Study of Pre-contract Planning Model, *International Journal of Construction Education and Research*, 11(1), 21-39.

Ogedengbe, P. S. and Adesopo, A. A. (2003). Problems of financing real Estate development in Nigeria, *Journal of Human Ecology*, 14(6), 425-431.

Ogunde, A. O. and Fagenle, O. I. (2013). Assessment of effectiveness of planning techniques and tools on construction projects in Lagos State, Nigeria, *ASCE*, AEI 2013, 396-407.

Ojo, S. O. (2009). Benchmarking the performance of construction procurement methods against selection criteria in Nigeria, *Civil Engineering Dimension*, 11(2), 106-112.

Olateju, O. I., Abdul-Azeez, I. A. and Alamutu, S. A. (2011). Project management practice in Nigerian public sector – An empirical study, *Australian Journal of Business and Management Research*, 1(8), 1.

Omotayo, T. and Keraminiyage, K. (2014). The widening knowledge gap in the built environment of a developed and developing nation: lean and offsite construction in Nigeria and the UK. https://www.researchgate.net/publication/271841903.

Patanakul, P., Lewwongcharoen, B. and Milosevic, D. (2010). An empirical study on the use of project management tools and techniques across project lifecycle and their impact on project success, *Journal of General Management*, 35(3), 41-65.

Takim, R.; Akintoye, A.; Kelly, J. Analysis of performance measurement in the Malaysian construction industry. In Proceedings of the Globalization and Construction, AIT Conference Centre, Bangkok, Thailand, 17-19, November 2004.

Tam, V. W. (2007). The effectiveness of the green building evaluation and labelling system, *Architectural Science Review*, 50, 323-330.

Tesfaye, E., Lemma, T., Berhan, E. and Bashah, B. (2017). Key project planning Processes Affecting Project Success, *International Journal for Quality Research*, 11(1), 159-172.

Ugwu, O. O. and Attah, I. C. (2016). An appraisal of construction management practice in Nigeria, *Nigerian Journal of Technology*, 35(4), 754-760.

Umar, B. (2016). An appraisal of construction project planning in Nigerian Indigenous construction companies. M.Sc. Thesis, Department of Building, Faculty of Environmental Design, Ahmadu Bello University, Zaria.

Xiao, H. and Proverbs, D. (2003). Factors influencing Contractors Performance: An International investigation, *Engineering Construction and Architectural Management*, 10, 322-333.

Zuofa, T. and Ochieng, E. G. (2014). Project failure: The way forward and panacea for development, *International Journal of Business and Management*, 9(11), 59-71.

APPENDIX A

Impact of Planning Techniques on Cost and Time Performances of Building Projects

Table A1. Impact of Gantt chart/Bar chart

S/N	TIME				COST			
	INITIAL (month)	COMPLETION (month)	OVERRUN (month)	% OVERRUN	INITIAL (₦m)	COMPLETION (₦m)	OVERRUN (₦m)	% OVERRUN
1	6	8	2	33.33	50.00	52.00	2.00	4.00
2	9	10	1	11.11	45.25	43.69	(1.56)	-3.45
3	9	10	1	11.11	800.00	950.00	150.00	18.75
4	9	14	5	55.56	1,350.00	1,700.00	350.00	25.93
5	12	16	4	33.33	439.00	452.00	13.00	2.96
6	11	12	1	9.09	230.00	238.46	8.46	3.68
7	12	15	3	25.00	54.63	57.37	2.73	5.01
8	12	13	1	8.33	52.63	56.35	3.72	7.07
9	12	17	5	41.67	678.00	694.00	16.00	2.36
10	30	32	2	6.67	725.00	1,200.00	475.00	65.52
11	6	7	1	16.67	36.00	38.00	2.00	5.56
12	12	18	6	50.00	360.00	390.00	30.00	8.33
13	12	15	3	25.00	320.00	345.00	25.00	7.81
14	18	36	18	100.00	500.00	870.00	370.00	74.00
15	18	24	6	33.33	114.30	123.00	8.70	7.61
16	36	38	2	5.56	1,260.00	1,650.00	390.00	30.95

Time overrun	% Time overrun	Cost overrun	% Cost overrun
Mean	Mean	Mean	Mean
3.81	29.11	115.31	16.63

Table A2. Impact of Linked Bar chart

S/N	TIME				COST			
	INITIAL (month)	COMPLETION (month)	OVERRUN (month)	% OVERRUN	INITIAL (₦m)	COMPLETION (₦m)	OVERRUN (₦m)	% OVERRUN
1	30	36	6	20.00	1,142.00	1,242.60	100.60	8.81
2	20	26	6	30.00	672.08	671.52	(0.56)	-0.08
3	20	26	6	30.00	632.08	684.52	52.44	8.30
4	13	15	2	15.38	436.27	439.33	3.06	0.70
5	13	18	5	38.46	78.00	85.00	7.00	8.97
6	9	10	1	11.11	756.00	1,200.00	444.00	58.73
7	14	17	3	21.43	370.00	400.00	30.00	8.11
8	38	41	3	7.89	1,500.00	1,800.00	300.00	20.00

Time overrun	% Time overrun	Cost overrun	% Cost overrun
Mean	Mean	Mean	Mean
4.00	21.63	117.00	14.18

Table A3. Impact of Critical Path Method (CPM)

S/N	TIME				COST			
	INITIAL (month)	COMPLETION (month)	OVERRUN (month)	% OVERRUN	INITIAL (₦m)	COMPLETION (₦m)	OVERRUN (₦m)	% OVERRUN
1	13	13	0	0.00	3,700.00	3,730.00	30.00	0.81
2	12	13	1	8.33	457.24	461.75	4.51	0.99
3	14	15	1	7.14	468.24	466.76	(1.48)	-0.32
4	18	20	2	11.11	21.85	20.80	(1.05)	-4.79
5	21	23	2	9.52	24.38	26.80	2.43	9.96
6	14	17	3	21.43	156.00	168.00	12.00	7.69
7	28	30	2	7.14	250.00	283.00	33.00	13.20
8	36	42	6	16.67	2,000.00	3,500.00	1,500.00	75.00
9	25	28	3	12.00	1,700.00	2,800.00	1,100.00	64.71
10	16	18	2	12.50	38.58	35.90	(2.68)	-6.96

Time overrun	% Time overrun	Cost overrun	% Cost overrun
Mean	Mean	Mean	Mean
2.20	10.58	267.67	16.03

Figure A4. Impact of Programme Evaluation and Review Technique (PERT)

S/N	TIME				COST			
	INITIAL (month)	COMPLETION (month)	OVERRUN (month)	% OVERRUN	INITIAL (₦m)	COMPLETION (₦m)	OVERRUN (₦m)	% OVERRUN
1	13	18	5	38.46	1,785.38	2,230.45	445.07	24.93
2	14	16	2	14.29	584.38	640.45	56.07	9.60
3	11	12	1	9.09	245.00	255.00	10.00	4.08
4	11	13	2	18.18	325.00	335.00	10.00	3.08
5	24	30	6	25.00	1,942.00	2,500.00	558.00	28.73
6	32	36	4	12.50	2,470.00	3,000.00	530.00	21.46
7	45	48	3	6.67	1,986.45	2,271.11	284.65	14.33
8	12	14	2	16.67	36.00	35.00	(1.00)	-2.78

Time overrun	% Time overrun	Cost overrun	% Cost overrun
Mean	Mean	Mean	Mean
3.13	17.61	236.60	12.93