

An Evaluation of Planning Techniques Impacting Construction Project Performance in Nigeria

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Abstract:

It has been observed that the planning technique used for project execution determines its performance. Extant literature shows that the five planning techniques mostly used in Nigeria are Gantt/bar chart, linked bar chart, critical path method, project evaluation and review technique and line of balance. However, there are scanty studies on the impact of planning techniques on project cost performance. This study evaluated the usage of these planning techniques in Nigeria to determine their impacts on project cost and duration. A descriptive survey using a structured questionnaire was conducted of medium and large scale contracting firms in Lagos State, Nigeria, using a random sampling technique. One hundred and twenty (120) respondents were sampled out of a population of 159 contracting firms in these categories. The data collected were analysed using mean score and percentage. The results from the study indicated that Gantt/bar chart is the planning technique mostly used in the study area. Moreover, the critical path method and PERT outperformed the other planning techniques in time and cost performance, respectively, while the bar chart performed least in both time and cost. The study concluded that although planning techniques are low in the study area, their time and cost performances are fair. It is recommended that more sophisticated techniques should be used in the study area for enhanced project performance.

Keywords: Construction, evaluation, performance, planning, techniques

1 Introduction

The increasing complexity of construction projects requires proper planning to achieve success (Olateju *et al.*, 2014). 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 to influence 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 required in a project life cycle. Idoro (2012) described construction planning techniques as crucial tools that stakeholders use to ensure successful projects. Tesfaye *et al.* (2017) explained that project planning defines the activities required in a project and the resources needed for their accomplishment. Ayodele *et al.* (2015) claimed that planning techniques are needed to implement project activities effectively. 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 has been criticised for being inefficient in its outputs' cost, time, and quality outcomes. In Nigeria, for instance, Ogedengbe and Adesopo (2003) and Zuofa and Ochieng (2014) reported that most projects do not 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 the specified duration, cost, and quality. In other words, completed projects are 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 developed and developing nations. 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 had not been adequately investigated regarding 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 preceding necessitates an evaluation of the performance of the construction planning techniques used in Nigeria, hence this study. This study aims to evaluate the impact of planning techniques on the cost of construction projects in Nigeria to enhance project delivery. The specific objectives of this study are to assess the usage of planning techniques in Nigeria and their impact on the cost and time performances of construction projects in the study area.

2 Literature Review

Several 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 to determine which construction sector applies the methods and their usage level. The study concluded that the methods were used mainly by the building sector and that the critical path was more used than the critical chain method.

In Mexico, Carcano *et al.* (2015) investigated the performance of managing 14 public school projects and concluded that the more the schedule management of projects, the more likely timely completion of projects would be. Similarly, in Sweden, Al Nesser (2015) inquired into the application of project planning and scheduling in construction projects to create 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 a project using four input factors that affect planning quality: human, organisational, management, and technical factors. The study concluded that project success depended on time, cost and risk. Harun *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, several types of research 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 to reduce 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 a questionnaire survey and a case study to probe the responses from the questionnaire. The study concluded that most 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 the 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 the 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 to ascertain 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 preceding reviews have chronicled extant literature on construction project planning tools and techniques in country contexts. However, it is pertinent to note that regarding the offshore studies, the emphasis has mostly been on the usage 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 undertaken to bridge the knowledge gaps in construction project planning techniques in the literature. This study 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 Research Methodology

This study assessed construction project planning in the Nigerian construction industry, which is reported to be under-researched. The study was conducted in Lagos State, Nigeria, because it is the commercial nerve centre and its former capital. Moreover, about 70% of construction firms in Nigeria have their offices in Lagos (NIOB, 2005). 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 were selected because they have been reported to be the measurable indicators of project success (Xiao and Proverbs, 2003). The population for this study comprised all the 159 medium and large contracting companies registered with the Public Procurement Agency of Lagos State (PPA, 2018). These categories of companies were deemed to take project planning more seriously than the small-scale companies. A sample size of 110 contracting firms representing 69.2% of the population was randomly selected for this study. From the 120 copies of questionnaires administered, 98 were retrieved, while 44 (representing 36.7%) were completed correctly and used for analysis. Data collected on respondents' profiles were analysed using frequency counts and percentage, the data on usage of planning techniques were analysed using mean score, while data on the impact of planning techniques on the project performance were analysed using percentage cost and time overruns or savings.

4 Findings and Discussion

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 a 26.5% response rate, while Tam (2007) reported a response rate of 31.2%, indicating that these study outcomes can be used to generalise the study population concerning the usage and impacts of planning techniques on project performance.

4.2 Respondents' Profile

Before presenting the results of the data analysis based on 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 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

PhD.	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		81.82
Probationer	3	6.82	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

Data analysis show that Gantt/bar chart with a mean score (MS) of 2.84 is the lead planning technique (Table 2) used in Nigeria. It is closely followed by PERT (MS=2.65) and CPM (MS=2.61), in that order. The least used planning technique is LOB (MS=1.34) followed by LBC (MS=1.74). Overall, BC, PERT, and CPM usage in the study area is high on a Likert-like scale of zero to 4. Similarly, the usage of LBC is low, while the usage of LOB is very low.

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

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 Nessleri (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 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. The scope of that study probably included small scale contractors who may not pay much premium on project planning. In Al Nessleri (2015) case, 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. This study shows a high level of usage of planning techniques in Nigeria contrasts with that study. However, this explanation should not be overemphasised because of the development industry's deferring levels 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 high usage suggests that more competent personnel are now being engaged by Nigerian indigenous contractors contrary to the status quo about a decade ago Olateju *et al.* (2011) and Inuwa *et al.* (2014).

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 presents summaries of appendices 1 to 4 attached to this study, which are percentage time and cost overruns of projects executed using the techniques. 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 as 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 its ease of collecting data (Xiao and Proverbs, 2003).

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

Sixteen time and cost data were collected on projects executed using BC, eight on LBC, ten on CPM, and eight on PERT. 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 an 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 on project duration in the study area. Similarly, PERT outperformed the others in terms of cost with an average cost overrun (CO) of 12.93%. It is followed by LBC (CO=14.19%) and CPM (CO=16.03%).

Moreover, BC performed least on projects cost in the study area with an average cost overrun of 16.63%. Generally, the above performances of the planning techniques investigated can be within acceptable limits compared with previous studies on project time and cost performances. However, the findings of this study 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 is not surprising. This is because CPM establishes a project's critical activities, which give the shortest duration of a project. Similarly, the shortest duration will invariably lead to an 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 planning techniques impacting construction project performance in Nigeria. Five planning techniques reported by extant literature to be mostly used in the study area were investigated. 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. Overall, the study concludes that the usage of construction planning techniques is low in the study area, although their time and cost performances appear fair. Moreover, the usage is limited to simple techniques. It is recommended that more sophisticated planning techniques should be used in the study area for enhanced project cost and time performance.

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