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Impact of Construction Planning Techniques on Contractors' Profit in Ondo State, Nigeria

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***Abstract*: Construction planning techniques in the construction industry are not only crucial to the attainment of project objectives but also necessary if project failure must be avoided and profitability enhanced by the Contractor. Improper application of these techniques in monitoring and planning the progress of construction work has resulted in cost and time overrun. The study aimed at assessing the construction planning techniques used by contractors in Ondo State, Nigeria; and further to objectively unearth the impact of these construction planning techniques on cost and time performance, as well as their effect on Contractor's profit. The study utilized a quantitative research approach with a review of existing literature. Questionnaires were administered to construction professionals; that is the consulting and contracting practitioners who are handling projects within the state. The data collected was analyzed using Mean Item Score, Relative Importance Index, Regression and Percentile. The results shows that bar chat were mostly used followed by method statement. The main challenge facing the implementation of these techniques was discovered to be personnel training. The study recommends appropriate usage of construction planning techniques by contractors in order to facilitate profitability and good performance on construction projects in the state.**

Keywords: Construction planning techniques, Profitability, Cost overrun, Time overrun and Contractors profit

1.0 INTRODUCTION

Planning is a fundamental tool in construction project used in meeting project scope, time and cost (Igwe & Ude, 2018; O Passenheim, 2009). Ubani, Nwachukwu, and Nwokonkwo (2010) define planning as activities and performance milestones that relate to actions, time and cost targets which will result in successful project objectives. Inuwa, Wanyona, and Diang'a (2014) opined that contractors have embraced project planning in developed countries which resulted in a well-planned and controlled contract that impacted positively on performance and profitability of such contractors but (Ubani et al., 2010) observed that contractors in a developing country like Nigeria are vulnerable to losses because of the inability to plan or having defective plans and inefficient management. El-Sayegh and Mansour (2015) also opine that most developing countries in Africa do not utilize project planning techniques in the delivery of construction projects. Oladimeji and Ojo (2012) buttressed this fact that Nigeria is experiencing poor project outcome due to non-adoption of project management techniques, management incapacity and the inability to plan projects adequately according to contractual requirements. Frimpong, Oluwoye, and Crawford (2003) observed that most contractors are in the business of making money at the expense of good management and consequently, they pay low wages, submit very low bids and have very little ability to plan and coordinate contracts. Kartam and Kartam (2001) however attributed the low usage of planning techniques to subjective judgment and contractor's reliance on their experience and intuition. Over-reliance on traditional management approach has resulted in poor project planning and low productivity (Ekundayo, Jewell, & Awodele, 2013; Inuwa et al., 2014) and these have compounded the inability of contractors to deliver projects within the time frame and at the estimated cost which leads to loss of profit as a result of inadequate project planning. This has made the underperformance of the industry to remain unresolved (Dosumu, Idoro, & Onukwube, 2017) which calls for continuous improvement. Thus, this study aimed at appraising contract planning practices used by contractors with a view to unearthing the relationship between planning and the profit made in a contract executed within Ondo State, Nigeria.

2.0 LITERATURE REVIEW

2.1 Construction Industry in Nigeria: The Nigerian construction industry contributes between 3.05% and 3.12% to the GDP (Khosa, 2001; Ogunsemi, 2015). This makes the construction industry as a vital element of the economy. It also has a significant effect on the efficiency and productivity of other industrial sectors (Bala, Randhawa, Kaur, Saili, & Chitkara, 2018). The Nigerian construction industry is largely dominated by international firms (Arijeloye, 2017), therefore, the local content bill for construction services was passed in April 2014 in order to give indigenous construction companies a level playing field as their international counterparts, as well as, making it easier for local businesses to thrive in the industry (Ogunsemi, 2015).

2.2 Planning in construction projects

Planning seeks to calculate what risks that may occur in the project and how to deal with them during the project lifetime. Idoro (2010) opined that planning is a process that is continuous throughout the delivery of a project which can be classified according to the project delivery stage. According to Inuwa et al. (2014), there are four variables that should be taken into consideration when managing a project: time, cost, quality and scope. Even if a project is on schedule the costs can be higher than expected. In the construction industry planning is a complex and challenging task and there is an increasing need for a more comprehensive view in the projects (Abbas, Din, & Farooqui, 2016).

2.3 Level of Planning

There are two main levels of planning associated with construction projects which are; strategic and operational planning (Inuwa et al., 2014). Strategic Planning is associated with establishing organizational context, determining a desired future state

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and mechanisms by which the organizational objectives may be reached. There is considerable evidence to suggest that engaging in strategic planning improves firm profit level (Al-Khrabsheh, 2018), hence it is crucial to the success of firms operating in a competitive environment. Strategic planning is multi-dimensional and complex process wherein the potential to incorporate related fields of strategic management dimensions such as strategic decision making, organizational type as well as characteristics of the strategic planning process which include formality, participation, flow and time horizon (Cassol, Lorandi, Carvalho, Cintra, & Ribeiro, 2019; Mintzberg & Laasch, 2020; Shimada, Ang Soo-Keng, & Ee, 2019). The Operational Planning is at the post-contract stage of a project and refers to any activities or tasks a contractor is expected to accomplish in his contractual obligation using any type of construction planning techniques (Bansal & Gupta, 2019).

2.4 Construction Planning Techniques

The common project planning techniques are Bar Charts, Line of Balance (LOB), Critical Path Method (CPM), Resource planning, Programme Evaluation & Review Techniques (PERT) and Precedence network method (Bala et al., 2018; Ekundayo et al., 2013; Idoro, 2010; Inuwa et al., 2014). The Critical Path Method (CPM) was developed in 1960 by the DuPont Corporation in order to allow the program of maintenance work during a chemical plant shut-down (Ray, Craven, Wallace, & Roberts, 2019). The CPM calculates the minimum completion time for a project, along with the possible start and finish times for the project activities. The method was originally developed for computer-aided planning, and an advantage is that changes in duration or costs are obtainable in real-time (Umoh, 2016). Resource Planning is mainly about making the most out of what is disposable (Simon, 2018). Resources may refer to human labour, but also to machinery, tools, materials, equipment etc. If the rate of production is proportional to the use of resources, the costs for an activity will be the same, no matter if an activity is finished in less time with more resources or in a long time with fewer resources which all have an impact on the profit level of a contractor. Handigund and Bhavikatti (2019) opine that the Bar chart is very easy to understand and were first developed by Henry Gannt which concentrates on the position of identification of sequence. The technique is suitable for strict operational sequencing and permits a high degree of control (Handigund & Bhavikatti, 2019; Krishnamurthy & Ravindra, 2010).

Program Evaluation and Review Technique (PERT) was developed by the US Navy in 1960 as a way to put boundaries around overall project durations (Sackey & Kim, 2019). Unlike the Critical Path Method (CPM) model, which uses deterministic durations, the PERT approach uses a three-point time estimate, which considers the uncertainties of the activity durations. Aribisala, Otenaike, Balogun, and Ofusori (2017) observed that the objective of the PERT model was to assist a project manager to identify bottlenecks and overruns in the project before they happen so that corrective actions can be taken before it is too late to effect any change while network diagram (also called as a network topology) is used for allowing a user to grasp a configuration of a system that individual information processing devices are connected to each other by a network (Okano, Iizawa, & Morimoto, 2019). Specifically, in the network diagram, the overall image of a network is expressed by rendering devices as nodes and networks as links. The network diagram is generally regarded as an excellent diagram, because the network diagram can visualize individual connections between nodes.

2.5 The Role of Planning in Increasing Contractors Profit

There is a difference between project management from a contractor's perspective compared to what it is from a client's perspective (Koops, Bosch-Rekveldt, Coman, Hertogh, & Bakker, 2016), the contractor is in business to make a profit while client perspective is to get value for their money. Hosking and Anderson (2018) opined that a well-planned project is going to be profitable and that it is the project manager's task is to ensure that the project reaches its objectives and profit(s) maximized. Site manager's tasks consist of managing, coordinating, and supervising the construction process, starting from the initial phases throughout the whole project. Therefore it is logical that the competence of the site manager to use planning techniques is a contributing factor to whether the project will be successful and the maximum profit will be achieved or not (Inuwa et al., 2014).

2.5.1 Factors Contributing to Profit Maximization or Loss in Contracting Firms

Akinradewo and Aigbavboa (2019) observed that some certain factors impacted directly or indirectly on contractors profit in the construction industry; factors such as; reduction of waste on construction site, reduction in expenditures and cost, reduction on time spent on construction projects, efficiency of labours on-site, getting retention on time thereby attracting another job which will bring more profit. However, Hosseini, Windimu, Klakegg, Andersen, and Laedre (2018) opined that managing relationship among the contracting parties is a key ingredient to the successful project delivery that will invariably impact on organization profits. Abebe (2017) identified factors such as effective management of resources; availability of personnel with interpersonal skill as well as project management skills; proper records keeping whether paper-based or electronic should be captured in an entity's recordkeeping system(s) in accordance with the entity's general recordkeeping policies and procedures as factors that impact profit maximization in any organization.

3.0 METHODOLOGY

Data for the study were collected through the administration of the survey questionnaire and through the extensive review of Literatures. A total number of eighty-four (84) questionnaires were self-administered with the help of field assistants to selected respondents in both consulting and contracting organizations that registered with the ministry of works and housing in Ondo State with an updated record for the year 2018 but records show that there are 524 professionals in these organizations. The samples were reduced to 84 using Yamane (1967) formulae because of time constraints of the researchers in collecting data for a period of four weeks. The questionnaire was a multiple choice type of different table and checkboxes with five different

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sections. Section A of the instrument elicited demographic information about the respondents, such as official designation, gender, age, academic qualification, years of working experience, membership of professional bodies and number of projects executed. Section B elicited information about the ratings and the level of awareness and usage of construction planning techniques. Section C elicits information on the impact of the construction planning techniques on contractors' profit. The question was rated on a 5-point Likert scale. A total of sixty-four (64) were retrieved and sixty (60) were suited for the analysis which makes up 71% of the sample size. Frequency distribution, Percentile, Mean Score and Spearman Correlation were the tools employed in analysing the data collected.

3.1 Result and Discussion

Table 1: Level of Usage of Construction Planning Techniques

Construction Planning Techniques	MIS	Rank
Bar chart	4.23	1
Link bar chart	3.80	2
Critical path method (CPM)	3.58	3
Project evaluation and review techniques (PERT)	3.52	4
Cost breakdown scheduling	3.43	5
Critical path scheduling	3.38	6
Resource planning	3.20	7
Milestone chart	3.18	8
Network diagram	3.18	8
Work break-down Structure	3.13	10
Resource leveling	3.05	11
Precedence Network diagram	2.98	12
Schedule Acceleration	2.98	12
Task line	2.95	14
Discounted cash flow	2.92	15
2-Dimensional task list	2.85	16
Critical chain	2.77	17
Lester diagram	2.73	18
line of balance	2.58	19

Table 1 shows the level of usage of construction planning techniques. The bar chart has the highest means score of 4.23 of all the techniques; this highlighted the simplicity and visual clarity of the Bar chart that makes it a very valuable medium for displaying job schedule information. Link bar chart with mean score 3.80 is rated as the second-highest of the techniques; the likely reason is that it provides an easy and convenient way to monitor job progress, schedule equipment and crews, and record project advancement. The critical part method with a means score of 3.58 is rated as the third highest with the likely reason of identifying the critical activities so that more resource may be employed appropriately. Lester diagram with a mean score of 2.73 is rated as the second-lowest of the level of usage of the techniques; the reason might be due to the difficulty in preparing the diagram. Line of balance techniques with a mean score of 2.58 is the least rated techniques; this might also be due to the difficulty in preparing the diagram.

Table 2 present the emerging construction planning techniques adopted by contractor in the study area. Statement of work/method statement with a mean score of 4.12 is ranked the highest and the likely reason for this is due to the fact that method statement details the work to be executed with the labour and plant required and the time required in completing a particular task. Work breakdown structure with a mean score of 3.98 is ranked the second-highest and this might due to ease of communicating the work and processes involved to execute the project. Milestone chart with a mean score of 3.57 is ranked the third highest with likely reason of giving a project timeline i.e. a particular time that a task must be completed and it aided the preparation of valuation. 2-Dimensional Task List with a mean score of 2.85 is rated as the second-lowest with likely reason that the technique is used occasionally. Lester diagram with a mean score of 2.82 as the lowest and the likely reason is the difficulty in preparing it.

Table 2: Emerging Construction Planning Techniques and Level of Adopted by Contractor

Techniques	MIS	Rank
Statement of work/Method statement	4.12	1
Work breakdown structure	3.98	2
Milestone Chart	3.57	3
Site Man-hour and Cost (SMAC)	3.55	4
Cost breakdown structure	3.52	5
Time scale network	3.38	6
Schedule Acceleration	3.35	7
Task List	3.33	8
Precedence Network	3.28	9

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Resource Leveling	3.17	10
Float	3.05	11
Critical Chain	3.00	12
Arrow diagram	2.98	13
2-Dimensional Task List	2.85	14
Lester diagram	2.82	15

Table 3: Factors contributing to Profit Maximization in Construction Firms

Factors	MIS	S.Dev	Rank
Good interpersonal and Project Management Skill	3.63	0.504	1
Reduction of waste on Construction Sites	3.63	0.809	2
Reduction in Time spent on Construction Projects	3.55	0.522	3
Good Record Keeping	3.55	0.688	4
Good Relationship	3.54	0.82	5
Getting Retention on time	3.45	0.934	6
Efficient Labour on Site	3.36	0.504	7
Reduction in Expenditure and Cost	3.27	0.647	8
Effective Management of Resources	3.18	0.751	9

Table 3 shows the factors contributing to Contractors profit in construction organizations. Good interpersonal and Project Management Skill and Reduction of waste on Construction Sites was ranked highest with a mean score of 3.63 but with different standard deviation figure of 0.504 and 0.809 respectively, reduction in time spent on construction projects and good record keeping were ranked next to the first two factors with a mean score of 3.55 but with different standard deviation of 0.522 and 0.688 respectively while reduction in expenditure and cost as well as effective management of resources were ranked the least with a mean score of 3.27 and 3.18 respectively. It is to be noted that all the factors ranked a little bit above the moderately impact level of 5-point likert scacle which denotes that all the factors are important in improving profit maximization in construction organizations.

Table 4: Impacts of Construction planning techniques on Contractor's profit using Spearman Correlation

		Good Interpersonal and Pm skill	Reduction of Wastes on Construction sites	Reduction in Time spent on Construction sites	Good Record Keeping	Good Relationship	Getting Retention on Time	Efficient Labour on Site	Reduction in Expenditure and Cost	Effective management of resources
Spearman's rho	**Statement of work/Method statement**	0.150	-0.278	-0.247	0.064	0.103	-0.314	-0.234	-0.064	.205
	Correlation co-efficient	0.03	.024	.232	0.04	0.381	.173	0.090	0.426	.272
	Sig. (1-tailed)									
	Work breakdown structure									
	Correlation co-efficient	0.150	-0.298	-0.247	0.071	0.329	0.231	0.456	0.345	.116
	Sig. (1-tailed)	0.33	.007	.232	0.04	0.111	0.020	0.156	0.026	.097
	Milestone Chart	-0.212	-0.213	-0.367	0.158	0.092	0.238	0.403	-0.158	0.147
	Correlation co-efficient	0.265	0.264	0.13	0.321	0.394	0.240	0.110	0.321	0.003
	Sig. (1-tailed)									
	Site Man-hour and Cost (SMAC)	0.166	-0.17	0.096	0.462	0.072	0.349	0.426	-0.198	-1.165
	Correlation co-efficient	0.313	0.480	0.390	0.076	0.417	0.147	0.096	0.280	0.314
	Sig. (1-tailed)									
	Cost breakdown structure									
	Correlation co-efficient	0.029	0.269	0.068	0.561	-0.487	-0.570	-0.293	0.420	0.350
	Sig. (1-tailed)	0.466	0.212	0.422	0.036	0.064	0.403	1.191	0.09	0.06
	Time scale network	-0.121	-0.380	0.189	0.386	-0.475	0.375	-0.528	0.247	-0.085
	Correlation co-efficient	0.370	0.139	0.301	0.135	0.083	0.142	0.058	0.245	0.07
	Sig. (1-tailed)									
	Schedule Acceleration	-0.33	-0.125	0.383	0.363	0.710	0.035	-0.312	0.198	-0.100
	Correlation co-efficient	0.161	0.001	0.136	0.136	0.007	0.459	0.175	0.280	0.385
	Sig. (1-tailed)									
	Task List	0.406	0.466	-0.127	0.461	0.498	0.264	-0.230	0.362	0.071
	Correlation co-efficient	0.008	0.74	0.355	0.07	0.06	0.216	0.248	0.137	0.018
	Sig. (1-tailed)									
	Precedence Network	0.622	-0.153	-0.153	0.247	0.000	-0.227	-0.147	0.768	0.456
	Correlation co-efficient	0.02	0.327	0.327	0.232	0.500	0.251	0.333	0.003	0.079
	Sig. (1-tailed)									
	Resource Leveling	-0.101	-0.224	-0.247	0.320	-0.98	0.157	-	0.384	0.194
	Correlation co-efficient	0.05	0.254	0.002	0.169	0.387	0.022	0.215	0.001	0.284
	Sig. (1-tailed)							0.023		

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Float	0.404	-0.213	-0.367	0.158	0.059	0.075	0.530	0.095	0.096
Correlation co-efficient	0.109	0.264	0.133	0.021	0.432	0.413	0.047	0.391	0.089
Sig. (1-tailed)									
Critical Chain	0.157	0.201	-0.467	0.484	0.026	-0.230	-0.442	0.032	0.060
Correlation co-efficient	0.003	0.007	0.074	0.006	0.470	0.247	0.087	0.063	0.04
Sig. (1-tailed)									
Arrow diagram	0.216	0.000	0.466	0.626	-0.402	0.195	-0.392	-0.099	-0.123
Correlation co-efficient	0.233	0.005	0.074	0.053	0.110	0.283	0.117	0.386	0.059
Sig. (1-tailed)									
2-Dimensional Task List	-1.78	-0.112	0.000	0.129	-0.286	0.183	-0.520	0.354	0.487
Correlation co-efficient	0.03	0.071	0.005	0.353	0.197	0.295	0.051	0.142	0.11
Sig. (1-tailed)									
Lester diagram	-0.441	-0.269	0.068	0.210	-0.143	0.459	-0.052	0.070	-0.275
Correlation co-efficient	0.087	0.212	0.422	0.006	0.042	0.078	0.039	0.419	0.027
Sig. (1-tailed)									

Table 4 above depicts the correlational relationship between the variables (construction planning techniques) and the other set of variables (factors contributing to profit maximization). The correlation co-efficient is normally within a range of -1.00 to +1.00; hence the basic idea is that once a positive value i.e. greater than 0.00 exists between any two tested variables, that construction technique will lead to profit maximization eventually. In the table above, the highest positive value of Correlation co-efficient for example is "0.768"; this value signals that "Precedence Network" has a very huge impact on the "Reduction of cost and Expenditure". In lieu of this, once a functional Precedence Network diagram is in place to guide the proper scheduling of the construction activities, there is bound to be reduction in cost and expenditure in the construction sites; hence the contractor can maximize their profit. The negative values on the table depict a negative relationship; it simply means that such planning technique is in no way leading to profit maximization. Another significant correlation co-efficient is "0.622" which signals the precedence network has a big positive effect on interpersonal and project management skills.

4.0 DISCUSSIONS OF FINDINGS

The result indicates the level of awareness and level of usage of construction planning techniques in the study area; the findings show that bar chart and project evaluation review techniques (PERT) are the most used tools by the professionals in the construction industry to manage their project for adequate profit and this is in corroboration with the study of O. Passenheim (2009) which depicted that tracking, trending schedule, breaking down of various activities and crashing of activities can be used to maintain minimum duration and maximize contractual profit. This study also investigated the emerging construction planning techniques adopted by contractors. The findings showed that Statement of work/Method statement, work break down structure and milestone was most construction techniques adopted by the professionals. This means that professionals who are involved in one developmental project or the other must work out the methods to be employed in carrying out the project and the materials, labour needed and known and understand a particular activity to be carried out for maximum profit (Spedding & Chan, 2000). Furthermore, Personnel training were recognized as the most challenges faced by site managers to use this technique, the inability of the management to train personnel to involve. Technical and managerial know-how the inability of the management to employed competent managers who know all these techniques and understand the appreciate one to use on a particular activity. Choice of appropriate techniques the stress and the choice of appreciating techniques is one the challenges what techniques will be used and how to apply them to the real-life situation that happens on-site, not paperwork (Toor & Ogunlana, 2008). Furthermore, there are lots of positive values on the correlation co-efficient table, and this means that generally, there is usually a positive relationship between construction planning techniques and contractor's profit. It could be inferred that if more attention is paid to these construction planning techniques by the contractors, then there would be a positive ripples effect on their profit margin as corroborated by Ubani et al. (2010) and Ogunsemi (2015).

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusively, this study has been able to establish that construction planning techniques have huge impacts on the profit realized by contractors in the construction context. It also established that professionals in the construction industry use more of the techniques that have been in existence for long (work breakdown structure, Cost breakdown structure). Seemingly modern techniques like "Precedence Network", "Critical Chain" and "Arrow Chain" are seeing less usage by the construction professionals. However, these newer techniques or tools have shown to have the biggest impact on contractor's profit.

It is highly recommended that contractors imbibe the usage of these newer techniques; there are even other techniques not covered in this study such as "Earn Value Management". Contractors are implored to evolve with the emerging trends.

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