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RESEARCH ARTICLE

EVALUATING IMPACTS OF CONSTRUCTION PLANTS AND EQUIPMENT'S HIRING ON PROJECT TIME DELIVERY IN ONDO STATE.

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Abstract

Diverse measures have been proposed to arrest the problem of time overrun in large construction projects that involve the use of plants and equipments. In the quest for the best possible solution to this problem in a developing country like Nigeria, this research assesses the impacts of plants and equipment's hiring on project time delivery. It proffers measures for enhancing construction time performance in large construction projects reflecting the peculiarity of the Nigerian construction environments. The aim was achieved by finding the major source of hiring equipment in the state and establishing the relationship between equipment usage and project delivery time. The population for the study consisted of 75 identified equipment hiring firms and registered contractors in Ondo State. Data collection was through the use of well-structured questionnaires. The data were analyzed using statistical tools such as correlation, ANOVA and regression analysis. Kendall coefficient established a significant relationship between plants/equipment's hiring and project delivery time with the asymptotic significant probability of 0.034 less than the 0.05 level of significance. Thus the work submits that usage of equipment enhances productivity but when hired, it should be efficient ones within well planned time to ensure effective project delivery.

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Introduction:-

The construction industry is one area of project management that has very much been plagued with project failures and inability to meet completion time. It has been contended that the diverse and multifaceted nature of construction projects make it more difficult to plan for, forecast, manage and control (Sawacha et al., 1999), such that decisions taken in the preliminary stages of project management process are critical to project success (Mas, 2008). For example, some researchers have argued that decisions made in the initial phases of a project's life cycle such as the type of equipment to hire for a specific work, site preparation stage planning and even the choice of firm of hiring equipment have a much greater influence on a project's outcome than decisions made in later phases (Kartam and Kartam, 2001). It has also been established that project success varies from different perspectives and can be looked at from multiple dimensions such as achieving project objectives, user satisfaction, operational performance, meeting up with scheduled time of completion and functionality (Alzahrani and Emsley, 2013).

Equipment" refers to different types of construction related aided device that makes work done easier and faster and machines like bulldozer, excavator, static cranes, concrete pokers, hand-held tools and specialist equipment such as

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floor polishers. On the other hand, usually the terms plant and equipment could be used interchangeably (Edwards and Holt, 2009). It is very essential to use better construction facilities and equipment in the construction sites (Halpin, 2010). The efficiency of equipment determines the product of the work been carried out and ability to meet completion time. Furthermore the level of competence of operators, familiarity to the type of work, incentives among others also affects the quality of job output and the time at which a scheduled task is completed. Consequently, most equipment's used seems to be a very essential factor to improve the ability of the contractors during the project time (Day and Benjamin, 1991). In view of this, plant and equipment hiring is a major contributing factor to the success of any construction activities; most importantly projects of complexity in its operation. Project delivery time could be affected therefore by the choice of plants and equipment's hired. This research is aimed at assessing the impact of plants and equipment hiring on time performance in construction activities in Ondo State. This was achieved by assessing the different source of plants and equipment for hiring and the effect of hiring of plant and equipment on the construction time.

Plant and equipment utilization:-

Good project management must vigorously pursue the efficient utilization of labour, material and equipment. The use of new equipment and innovative methods has made possible huge changes in construction technologies in recent times. The selection of the appropriate type and size of construction equipment often affects the required amount of time and the productivity of a project. It is therefore important for site managers and construction planners to be familiar with the characteristics of the major types of equipment most commonly used in construction (Edwards and Holt, 2009). Plant includes any appliance, equipment (including scaffolding), machinery, implement or tool or any associated component, fitting or accessory that aid work execution. Equipment on the other hand is heavy-duty vehicles specially designed for executing construction tasks. Construction plants and equipment are used in order to increase the rate of output through work progress with the best effective and efficient methods and to reduce the overall cost of construction especially in large contracts. The use of plant and equipment also leads to improvement in the quality of work, economics and much faster option. It eliminates the heavy manual work by humans thus reducing fatigue and eliminates various other hazards and maintains the planned rate of production where there is a shortage of skilled or unskilled labour. It becomes probable to maintain the high quality standards often required by present day design and specifications.

Nonetheless, the following factors must be considered in the selection of the plant and equipment to hire or use for construction works.

Economic specific factors:-

The economic consideration such as owning cost, operating labour cost and operating fuel costs of equipment are most important in selection of equipment's. Besides, the resale value, the replacement costs of existing equipment and the salvage value associated with the equipment are also important.

Company specific factors:-

The selection of equipment's by a company may be governed by its policy on owning or renting. While, emphasis on owning may result in purchase of equipment keeping in mind the future requirement of projects, the emphasis on renting may lead to putting too much focus on short term benefits.

Site specific factors:-

Site conditions both ground conditions as well as climate conditions may affect the equipment selection decision. For example, the soil and profile of a site may indicate whether to go for crawler-mounted equipment or a wheel mounted equipment. If there is power line at or near site, one may go for a fixed base kind of equipment rather than a mobile kind of equipment.

Equipment specific factors:-

Construction equipment's comes with high price tags. While it may be tempting to go for the equipment with low initial price, it is preferable to opt for standard equipment. Such equipment is manufactured in large numbers by the manufactures, and their spare parts are easily available, which would ensure minimum downtime, besides; they can also fetch good salvage money at the time of their disposal.

Client and project specific factors:-

The owner/client in a certain project may have certain preferences that are not in line with the construction company's preferred policies as far as equipment procurement is concerned. The schedule, quality and safety requirements demanded of a particular project may in some cases force the company to view to the demand of the client.

Manufacturer specific factors:-

A construction company may prefer to buy equipment from the same manufacturer again and again and that too from a specific dealer. This may be to bring in uniformity in the equipment's fleet possessed by the company or because the company is familiar with the working style of the manufacturer and the dealer.

Labour specific factors:-

Shortage of manpower in some situations may lead to a decision in favour of procuring equipment that is highly automated. Furthermore, the selection of equipment may be governed by the availability or non-availability of trained manpower. Equipment vendors range from private firms to local government and other non-governmental equipment owning organizations. Other sources of ownership of equipment are the contractors who have plants and equipment to run their construction projects. There are two main sources for plants and equipment hiring. These are private owned equipment hiring firms which can either be sole proprietorship or partnership business. The public owned equipment hiring firms on the other hand include local governments, ministries of works etc.

Methodology:-

The research is a survey of plant and equipment hiring firms in Ondo state. The qualitative nature of this research demands primary data. The population for the study consists of plants and equipment's hiring firms (private and public hiring vendors) in Ondo state and selected contractors of some construction projects. The Sampling frame for this research consisted of the works section of the 18 local governments in the state, 38 equipment's hiring firms and 19 contractors handling large projects that involve the use of plants and equipment's in the state. These numbers are chosen from the figures gotten from the association of equipment's hiring vendor, Ondo State Headquarter in Akure. Due to the manageable size of the population, case study was employed for the process of data collection. The research instrument which is a survey questionnaire was personally administered on the respondents with 93% response rate. The questionnaire employed had two sections. The first section of the questionnaire dealt with the respondent's general information. While the second section of the questionnaire required the respondent view on the subject matter using five-point Likert scale viz-a-viz: strongly disagree = 1; disagree = 2; neutral = 3; agree = 4 and strongly agree = 5. Likert scale rating system has been successfully utilized by several researchers in their studies. The types of equipment used by contractors for their construction projects in Ondo State, effects of plants and equipment's hiring on project time delivery was tabulated in a questionnaire for easy ranking. The data were analysed using tools such as; frequencies and percentages; correlation and regression and the relative importance index (RII) and Kendall's coefficient of concordance. The validity of the instrument was carried out by two experts in the field while reliability of the instrument was established by applying split-half method.

Data analysis and discussion:-

The findings from the field were analyzed and subsequently discussed as follows.

Table 1:- Summary of Background Information of Respondents

Background Information		Govt/Hiring Firms		Contractors	
Category	Classification	No.	%	No.	%
Level of respondents	Managing Director	9	16.1	6	31.6
	Project manager	-	-	9	47.4
	Head of Department	8	14.3	4	21.0
	Selected consultants	21	37.5	-	-
	Director of works	18	32.1	-	-
	Total	56	100.0	19	100.0
Years of experience	6-10years	8	14.3	3	15.8
	11-15years	11	19.6	4	21.1
	16-20years	15	26.8	7	36.8
	Above 20 years	22	39.3	5	26.3

	Total	56	100.0	19	100.0
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Source: Analysis of field data, (2017)

Table 1 indicates the status and the years of experience of the respondents. Based on the above analysis, it can be concluded that the data provided by the respondents can be relied upon for the purpose of the analysis.

Effect of Plant and Equipment's hiring on Project Time Delivery:-

The objective was to determine the effect of plants and equipment hiring on project time delivery. To achieve this objective, multiple regression analysis was used to test the selected plants and equipment's (independent variables) on the dependent variable (project delivery). The result is shown in tables 2-5.

Table 2:- Regression Coefficient for the effect Plants and Equipment's hiring on project delivery

S/N	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	(Constant)	8.116	2.813		2.886	0.063
1	Bulldozer	-1.198	0.684	-1.101	-1.752	0.170
2	Excavator	0.280	0.309	0.277	0.907	0.234
3	Grader	-0.264	0.284	-0.319	-0.928	0.431
4	Crane	0.047	0.083	0.434	0.569	0.422
5	Low Bed	0.772	0.438	0.775	1.762	0.609
6	Vibratory	-1.374	0.588	-1.466	-2.335	0.176
7	Asphalt Conc Plant	-0.062	0.902	-0.069	-0.068	0.102
8	Road Paver	-1.325	0.473	-1.556	-2.798	0.950
9	Concrete Mixing Machine	0.183	0.587	0.207	0.312	0.068
10	Dumper	0.156	0.409	0.162	0.381	0.813

Source: Analysis of field data, 2017.

Table 2 shows the regression coefficient for Plants and Equipment's hiring. Variables like excavator having 0.28, crane 0.05, low bed 0.77, concrete mixing machine 0.183, and dumper 0.156 were tested. This means that these variables are having positive effect on dependent variable (project delivery). Thus, an increase in the use of these plants and equipment will lead to a corresponding improvement in project delivery. The regression coefficient for bulldozer -1.198, grader -0.264, vibratory -1.374, asphalt conc. plant -0.062 and road paver -1.325 is negative. This implies that an increase in the hiring of these plants and equipment will negatively affect project delivery.

Table 3:- Correlation and Regression Analysis for Plants and Equipment's hiring

S/N	Plants	Correlation (R)	Regression Coefficient(R ²)	P-Value	P-Value%
a	Bulldozer	0.547	0.299	0.001*	0.1
b	Excavator	0.606	0.367	0.467	46.7
c	Grader	0.565	0.319	0.081	8.1
d	Crane	0.499	0.249	0.049*	4.9
e	Vibratory Compactor/Roller	0.426	0.182	0.424	42.4
f	Asphalt Conc Plant	0.524	0.157	0.008*	0.05
g	Road Paver	0.433	0.658	0.658	65.8
h	Concrete Mixing Machine	0.455	0.207	0.036*	3.60
j	Dumper	0.426	0.182	0.014*	1.4

Source: Analysis of field data, 2017

Table 3 shows the effect of plant and equipment hiring on project time delivery. The analyses were based on a P-value % less than 5% or p-value less than 0.005. Factors with P-values less than 0.005 have significant effect on project performance while factors with P-values more than 0.005 are statistically not a significant factor on project time delivery. Hence, findings revealed that bulldozer, crane, asphalt concrete plant, concrete mixing machine, dumper and excavator have a P-value less than 0.005 and thus have a very significant effect on the time performance of construction projects. Other Equipment such as Pavement Breaker, Road Paver, Vibratory Compactor/Roller,

Grader and excavator have a P-value higher than 0.005 and thus they do not have significant effect on the project time delivery.

Table 4:- Analysis of variance for equipment hiring

Model	Sum of squares	Df	Mean square	F	Sig
Regression	27.332	15	1.822	1.711	.036 ^b
Correlation	3.194	3	1.065		
Total	30.526	18			
R = .985					
R ² = .189					
Adj. R ² = 0.37					
Std. Error =1.032					

Source: Analysis of field data, 2017.

Table 4 shows a significant variation in the effect of plant and equipment hiring on construction projects time performance. The coefficient of determination (R square) is 0.189 which indicates that plant and equipment hiring accounted for 18.9% of not meeting up with project time delivery. The correlation coefficient of 30.53% indicates that the combined influence of all the plants and equipment has a positive correlation with project delivery. Thus, the effect of hiring the effect of plants and equipment's hiring is statistically significant in influencing project time delivery.

Table 5:- Kendall's Coefficient of Concordance on the Effect of Equipment hiring on Projects Time Delivery

N	4
Kendall's W ^a	.247
Chi-Square	3.817
Df	14
Asymp. Sig.	.034

Source: Analysis of field data, (2017)

Table 5 indicates that there is significant relationship between plants/equipment's hiring and project delivery determinants (Time) since the asymptotic significant probability of 0.034 less than the 0.05 level of significant.

Discussion of Findings:-

From the results obtained from the survey, the equipment's were correlated against their effect on time of project delivery as shown in Table 3. The equipment that has the highest effect on time overrun of construction projects are; bulldozer, concrete mixing machine, crane, asphalt plant, dumper and excavator. Grader, pavement breaker, road paver and vibratory compactor/roller has little or no effect on project time delivery. This finding is in concordance with previous work by Akintan (2016) which concluded that hiring equipment has huge role to play in execution of construction projects. So also, Nnadi (2015) has previously submitted that poor equipment usage is a risk factor to successful project delivery resulting into delay, poor work output and sometimes rework.

Conclusion:-

The assessed impact of construction plants and equipment hiring on time performance of construction projects reveals that the private equipment hiring firms are the commonest source of equipment hiring in Ondo state and these firms are majorly located in Akure, Ondo and Ore. The study revealed that plant and equipment has a significant impact on the delivery of construction project with machine inefficiency as the major challenge. Furthermore, concrete mixing machine, asphalt concrete plant, and bulldozer and vibratory compactor/roller are identified to be the equipment that has major effect on construction projects time delivery.

Recommendations:-

Recommendation on how to keep the pace of plant's efficiency on project was drawn from the conclusions of the study. Contractors should make proper evaluation and assess the equipment's hiring firms to know which of the firms meets up with their targets. Contractors should make adequate plans before mobilization to ensure that lapses of time of equipment's supply to site are properly catered for. Finally, proper monitoring of equipment's (operators)

on site to ensure that work is being done to desire output, quality and to time is of great essence to avoid time overrun of construction projects.

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