

Assessing the Use of Construction Plant and Equipment by Construction Companies in Awka Anambra State, Nigeria

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Abstract

The research assessed the Use of Construction Plant and equipment by construction Companies in Awka. The researcher used survey research method through questionnaires to collect data. The target population was construction companies in Awka metropolis from which a sample of eighty (80) was drawn. The relevant literature was reviewed for the study. The data collected were presented, analyzed and hypothesis tested. Among other things the results of the study revealed the following: That there is inadequate or under - utilization of plant for construction works in Awka metropolis and this has resulted in delays. That there is ignorance of the knowledge of hiring and owning criteria as well as factors to be considered before applying plant on jobs for better works and economy. The following recommendations were made: Firstly, construction companies should procure some plant to reduce the percentage of work done manually. Secondly, to be an economic proposition, large items of plant need to be continuously employed and not left idle for considerable period of time. Owners of mechanical plant must have sufficient work for the plant either through firm's owned contract or through public line business. Thirdly, advice of quantity surveyors should be sought when decisions are to be taken whether to hire or purchase plant items for some specified work.

Key Words: *Company; Construction; Economical; Plant.*

1.0 Introduction

The amount of plant and equipment in use on construction sites continues to grow at a tremendous rate. This is as a result of the need to build faster and keep down labor costs and the development of prefabrication. Because of these factors, new types of machineries are constantly being produced and full use must be made of them as well as plant and equipment already commonly available. This can only be done if site engineers and construction planners are fully aware of the capabilities and limitations of the various types of construction plant they will have to deal with. According to Ade-Ojo, Nnadi and Akintan (2018), the economic use of construction plant is one of the most important branches of engineering economy Ade-Ojo *et al* (2018) states that these are the days of machines in construction

works. With the help of plant and equipment, many complicated and laborious work have been simplified with maximum times saved. With the continued rise in labour costs both direct and indirect, many contractors are now making great use of plant for construction work. The work in question include construction of roads, excavation of basements, digging of trenches for foundations and for most other building work. However here in Awka, construction plant are not widely used and where used, they are only for big projects as the labour rates for other smaller jobs are cheap.

It is a common experience in Awka to find that most of the concreting work (mixing and placing), which should, be done using concrete mixers are done manually by men and women. Also work like site clearing, excavation of small drainages and the likes are being done manually. Yusuf M. I., Owoyala O. S., Keftin N. A. & Dzasu W. E. (2011)

One can visit more than twenty sites without seeing the simplest plant items such as mixers and vibrators and compacting plant being put into use. In most of the cases, the use of plant can be better in terms of economy, quality of work produced and even for the growth of the construction industry.

The present level of plant usage is very low in Awka. Even when some plant items are available on sites, they are not usually utilized to carry out the work which they procured or hired to work. The situation is further aggravated by palpable ignorance of both criteria for hiring or owning plant items by many people in construction companies.

1.1 Research Aim and Objectives

The research is aimed at establishing how construction plant and equipment will be economically used by Nigerian Construction Companies in Awka.

1.2 Research Questions

- What are the consequences of inadequate or underutilization of plant items in construction works in Awka Metropolis?
- What are the criteria for hiring or owning of plant for construction works?

1.3 Research Hypotheses

Hypothesis One

Ho: Inadequate or under utilization of plant for construction works in Awka metropolis result in delays.

H₁: Inadequate or under utilization of plant for construction works in Awka metropolis does not result in delays.

Hypothesis Two

Ho: There are some criteria for preferring hiring of plant to owning of plant.

H₁: The criteria for preferring hiring of plant to owing of plant is insignificant.

2.0 Methods

The data were based on questionnaires distributed to people in relevant construction companies and plant-hiring companies in Awka metropolis, and physical inspection of some construction plant throughout Awka.

The literature review findings informed the survey components of this research work, and this includes extensive search for both published and unpublished materials from text books, journals, past research thesis, seminar and conference papers, to have some insight on the particulars of mechanical plant.

The population size under study comprises 100 respondents. The sample size of eighty (80) was selected through the use of systematic sampling. This is given by the use of Taro Yamane method of sample size determination. Descriptive statistics such as tables, frequencies, charts, and graphs were employed in the analysis. Hypotheses were tested using

inferential statistics: the chi-square

3.0 Results

Table 1: Consequences of inadequate or underutilization of plant items

Item	Response				Total
	Strongly Agree	Agree	Disagree	Strongly Disagree	
High Constr. Cost	7	4	3	4	18
Delay	10	5	3	6	24
Low quality Work	13	7	5	7	32
TOTAL	30	16	11	17	74

Table 2: The Criteria or yardstick for hiring or owning plant items for construction works in Awka Metropolis.

Item	Response				Total
	Strongly Agree	Agree	Disagree	Strongly Disagree	
Owning Cost	10	6	5	8	29
Operating Cost	6	8	5	4	23
Residual Value	4	5	6	7	22
TOTAL	20	19	16	19	74

Table 3: Contingency Table on consequences of inadequate or under utilization of plant items for construction works in Awka metropolis.

Item	Response				TOTAL
	Strongly Agree	Agree	Disagree	Strongly Disagree	
High Const. Cost	7 (7.30)	4(3.90)	3 (2.676)	4(4.135)	18
Delays	10(9.30)	5(5.189)	3 (3.568)	6(5.514)	24
Low Quality Work	13(12.973)	7(6.919)	5 (4.757)	7(7.351)	32
TOTAL	30	16	11	17	74

Determination of expected frequencies

$$\text{Row 1 Cell 1 (E)} = \frac{8 \times 30}{74} = 7.30$$

$$\text{Row 1 Cell 2 (E)} = \frac{8 \times 16}{74} = 3.900$$

$$\text{Row 1 Cell 3 (E)} = \frac{8 \times 11}{74} = 2.676$$

$$\text{Row 1 Cell 4 (E)} = \frac{8 \times 17}{74} = 4.135$$

$$\text{Row 2 Cell 1 (E)} = \frac{24 \times 30}{74} = 9.300$$

$$\text{Row 2 Cell 2 (E)} = \frac{24 \times 16}{74} = 5.189$$

$$\text{Row 2 Cell 3 (E)} = \frac{24 \times 11}{74} = 3.568$$

$$\text{Row 2 Cell 4 (E)} = \frac{24 \times 17}{74} = 5.514$$

$$\text{Row 3 Cell 1 (E)} = \frac{32 \times 30}{74} = 12.973$$

$$\text{Row 3 Cell 2 (E)} = \frac{32 \times 16}{74} = 6.919$$

$$\text{Row 3 Cell 3 (E)} = \frac{32 \times 11}{74} = 4.757$$

$$\text{Row 3 Cell 4 (E)} = \frac{32 \times 17}{74} = 7.351$$

Computation of chi-square

$$x^2 = \frac{(O - E)^2}{E}$$

$$\frac{(7 - 7.30)^2}{7.30} + \frac{(4 - 3.90)^2}{3.90} + \frac{(3 - 2.676)^2}{2.676} + \frac{(4 - 4.135)^2}{4.135}$$

$$\begin{aligned}
 &+ \frac{(10-9.30)^2}{9.30} + \frac{(5-5.189)^2}{5.189} + \frac{(3-3.568)^2}{3.568} + \frac{(6-5.514)^2}{5.514} \\
 &+ \frac{(13-12.973)^2}{12.973} + \frac{(7-6.919)^2}{6.919} + \frac{(5-4.757)^2}{4.757} + \frac{(7-7.351)^2}{7.351} \\
 &= 0.012 + 0.003 + 0.039 + 0.004 \\
 &+ 0.053 + 0.007 + 0.090 + 0.043 \\
 &+ 0.000 + 0.000 + 0.012 + 0.016 \\
 &= 0.279
 \end{aligned}$$

Computed Value of $X^2 = 0.279$

Critical Value of X^2 for 6 df at 0.05 = 12.59

$12.59 > 0.279$

Decision Rule:

The decision rule is set as follows:

For a one tail test

Accept H_0 if $|Z| < Z_{1-\alpha}$ or $|Z| < Z_{\alpha}$

Reject H_0 if $|Z| > Z_{1-\alpha}$ or $|Z| > Z_{\alpha}$

For a two-tail test

Accept H_0 if $|Z| < Z_{1-\frac{\alpha}{2}}$ or $|Z| < Z_{\frac{\alpha}{2}}$

Accept H_0 if $|Z| > Z_1$ or $|Z| > Z_{\frac{\alpha}{2}}$

Where $|Z| =$ Calculated Value of Chi-Square

$Z_{1-\alpha} =$ Table Value of Chi-Square

Decision: Since the calculated value of X^2 is less than the table value, the alternative hypothesis is rejected while the null hypothesis is accepted. The researcher therefore concludes that inadequate or underutilization of plant for construction works results in delays.

Contingency Table on the criteria for hiring or owning plant items for construction works in Awka metropolis.

Item	Response				TOTAL
	Strongly Agree	Agree	Disagree	Strongly Disagree	
Owing Cost	10(7.84)	6(7.45)	5 (6.27)	8(7.45)	29
Operating cost	6(6.21)	8(5.91)	5(4.97)	4(5.91)	23
Residual Value	4(5.96)	5(5.65)	6(5.65)	7(5.65)	22
TOTAL	20	19	16	19	74

Determination of expected frequencies

$$\text{Row 1 Cell 1 (E)} = \frac{29 \times 20}{74} = 7.84$$

$$\text{Row 1 Cell 2 (E)} = \frac{29 \times 19}{74} = 7.45$$

$$\text{Row 1 Cell 3 (E)} = \frac{29 \times 16}{74} = 6.27$$

$$\text{Row 1 Cell 4 (E)} = \frac{29 \times 19}{74} = 7.45$$

$$\text{Row 2 Cell 1 (E)} = \frac{23 \times 20}{74} = 6.21$$

$$\text{Row 2 Cell 2 (E)} = \frac{23 \times 19}{74} = 5.91$$

$$\text{Row 2 Cell 3 (E)} = \frac{23 \times 16}{74} = 4.97$$

$$\text{Row 2 Cell 4 (E)} = \frac{23 \times 19}{74} = 5.91$$

$$\text{Row 3 Cell 1 (E)} = \frac{22 \times 20}{74} = 5.65$$

$$\text{Row 3 Cell 2 (E)} = \frac{22 \times 19}{74} = 5.65$$

$$\text{Row 3 Cell 3 (E)} = \frac{22 \times 16}{74} = 4.76$$

$$\text{Row 3 Cell 4 (E)} = \frac{22 \times 19}{74} = 5.65$$

Computation of chi-square

$$x^2 = \frac{(O - E)^2}{E}$$

$$\frac{(10 - 7.84)^2}{7.84} + \frac{(7 - 7.45)^2}{7.45} + \frac{(5 - 6.27)^2}{6.27} + \frac{(8 - 7.45)^2}{7.45}$$

$$\begin{aligned}
 &+ \frac{(6-6.21)^2}{6.21} + \frac{(8-5.91)^2}{5.91} + \frac{(5-4.97)^2}{4.97} + \frac{(4-5.91)^2}{5.91} \\
 &+ \frac{(4-9.96)^2}{5.96} + \frac{(5-5.65)^2}{5.65} + \frac{(6-4.76)^2}{4.76} + \frac{(7-5.65)^2}{7.56} \\
 &= 0.595 + 0.282 + 0.257 + 0.041 \\
 &+ 0.007 + 0.739 + 0.000 + 0.617 \\
 &+ 0.645 + 0.075 + 0.323 + 0.241 \\
 &= 3.822
 \end{aligned}$$

Computed Value of $X^2 = 3.822$

Critical Value of X^2 for 6 df at 0.05 = 12.59

$12.59 > 3.822$

Decision Rule:

The decision rule is set as follows:

For a one tail test

Accept H_0 if $|Z| < Z_{1-\alpha}$ or $|Z| < Z_{\alpha}$

Reject H_0 if $|Z| > Z_{1-\alpha}$ or $|Z| > Z_{\alpha}$

For a two-tail test

Accept H_0 if $|Z| < Z_{1-\frac{\alpha}{2}}$ or $|Z| < Z_{\frac{\alpha}{2}}$

Accept H_0 if $|Z| > Z_1$ or $|Z| > Z_{\frac{\alpha}{2}}$

Where $|Z| =$ Calculated Value of Chi-Square

$Z_{1-\alpha} =$ Table Value of Chi-Square

Decision: Since the calculated value of X^2 is less than the table value, the alternative hypothesis is rejected while the null hypothesis is accepted. The researcher therefore concludes that there are some criteria for preferring hiring of plant to owing of plant for construction works in Awka Metropolis.

4.0 Discussion

The level of usage of plant is very low in Awka Metropolis and is still decreasing. One can visit more than twenty sites without seeing the Simplest plant items such as concrete mixers and vibrators being put into use. From the study, it was found out that even when some plant items are available on the site, they are not usually used to carry out work half to two thirds of the year. The rest of the time, they are at the depot either under repairs or awaiting a site to need them. Even so the plants are not necessarily productive for the whole of the recording working time. The analysis reveals that: -

Inadequate or underutilization of plant items for construction works in Awka Metropolis

results in delays. Some factors shall be considered before applying plant on jobs for better works and economy in Awka Metropolis.

There are some criteria for preferring hiring of plant to owning of plant for construction works in Awka Metropolis.

There is gross under utilization of plant items in construction works in Awka metropolis.

Conclusions

This study has revealed that there is low level of usage of construction plant in Awka Metropolis. There is high use of manual labour which has direct advantage to considerably large number of people by way of employment which helps in social and economic development. Even when some items of plant are available on sites, they are usually idle or in state of disrepair. Idle plant means financial loss to the owner because it depreciates in value everyday and owning cost which includes initial capital, depreciation on average life condition, interest, taxes, insurance, repairs and maintenance costs are tied up.

- Since most of the works are done manually, construction companies should try to procure some plant to reduce the percentage of work done manually. Plants are invaluable when tough works which cannot be handled by manual labour are involved. Plants are cheaper when quantum of work is more and material is required to be transported for long distances. Plant usage helps in the development of the technical know how, skill and industrial growth of the country. These will result in better quality of works and economy.
- To be an economic proposition, large items of plant need to be continuously employed and not left idle for considerable period of time. Owners of mechanical plant must have sufficient work for the plant either through firm's owned contract or through public line business.
- Advice of quantity surveyors should be sought when decisions are to be taken whether to hire or purchase plant items for some specified works. Quantity surveyors are trained to match productivity with economy when carrying out construction projects.
- Big construction companies should own big plant because they can handle big projects which they "will like to be completed within a short period while at the same time achieving efficiency.

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