International Journal of Pure and Applied Science, Volume 3, Number 3, 2010

DEVELOPING PLANT AND EQUIPMENT POLICY FOR INDIGENOUS CONSTRUCTION FIRMS IN NIGERIA

[1]Fagbenle, Olabosipo I. and [2]Oluwunmi, Adedamola O.
[1]Department of Building Technology [2]Department of Estate Management
Covenant University, Ota, Ogun State, Nigeria

ABSTRACT

Plant and equipment play an increasing role in building/engineering operations in such a way that both time and money can be saved by their efficient use. The paper therefore discussed the general plant policy in the construction industry and went further to develop a plant/equipment policy for indigenous construction firms in Nigeria. Using a stratified sampling technique, the opinions of ninety indigenous contractors were randomly sampled from three commercial nerve centres of the country (Lagos, Abuja and Port Harcourt). The paper revealed that the indigenous construction firms invest little or nothing on plant/equipment purchase and therefore have no policy in place. It then concluded that for the plant policy to be efficiently executed, it is desirable to install a recording and costing system which should include, among other things, an asset register comprising an inventory of each plant item in the fleet with information on the date of purchase, registration/code number, location and the hours operated.

Keywords: Construction; Developing; Equipment; Indigenous; Nigeria; Plant; Policy.

INTRODUCTION

The primary aim of any business enterprise is among others, to continue in existence. In other words, to survive or maintain growth and development as well as make profit. According to Adeyemi (2004), clearly established objectives provide direction, allow synergy, assist in evaluation, establish priorities, reduce risk and uncertainty, minimise conflicts and also aid in the allocation of resources and the design strategies. Asserting further, the common objective of construction contracting firms is to deliver the project at the right time, at the appropriate price and at determined profit without sacrificing quality standard. Plant/equipment therefore plays an increasingly important role in building as well as civil engineering operations. Both time and money can be saved by the efficient use and better management of plant item (Fagbenle, 2005). However, mechanical plants have not received the attention they merit and indeed, they are often left to develop haphazardly. Studies by Adeyemi (2000), Oyewande (1990) and Douglas (1975) have pointed to the fact that mechanical plants and equipment are not optimally utilised on sites to justify the huge amount of money being invested on them. Also, proper records and plant inventory as well as other relevant records which would have facilitated maintenance works and reduce cost of maintenance and repair are not kept. Studied of plants and equipment management have engaged the attention of many researchers in recent times. For example, Babalola (2005) studied the plant and equipment policies of indigenous, foreign and hiring companies in the Nigerian construction industry and noted that the foreign companies have laid-down policies guiding them in the choice, purchase and maintenance of plant/equipment while their indigenous counterparts pay little or no attention to these factors. This assertion was further buttressed by Douglas (1975). the management of plant and equipment was studied by Olatunji (1997) and concluded that careful consideration and investigation are necessary before the acquisition of the most suitable plants and equipment are made. Adeyemi (2000) investigated the equipment policy of construction contractors and concluded that contractors are yet to fully imbibe the use of mechanical plants and equipment in their construction operations. The maintenance management of mechanical plants in building industry was studied by Adu (1983) and noted that the use of mechanical plants in the tropical region is not as widespread as in Europe and other developed countries. According to him, this is as a result of high cost of mechanical plant and lack of maintenance facilities. In his study, Oyewande (1990) investigated the effectiveness of technical and commercial management of a construction company's plant fleet and posited that a company is expected to pay for plant purchased at the end of the day. Rather, plant must be able to pay for itself and earn for the company more money than it costs. A suggestion was then given that before any decision can be made to purchase a plant, the company must ascertain that such plant will pay for itself either on the company's project or by hiring it out if the company desires. In their studies, Douglas (1996) and Adu (1983) highlighted the need for mechanical plants on the construction sites as follows:

- to reduce the rate of output;
- to reduce overall project cost;

- to supplement human efforts on site;
- to maintain heavy manual works, thus reducing fatigue and increasing productivity of manual operatives;
- to maintain a planned rate of production where there is a shortage of skilled and/or unskilled labour; and
- to maintain the high standards often required by current designs and specifications, especially the structural engineering works.

Arising from these submissions, important questions are: do the indigenous contractors have enough awareness on the need for mechanical plant policy in place for indigenous construction firms in Nigeria?; is there any plant policy in place for Indigenous construction firms in Nigeria?; what is the appropriated plant and equipment policy for indigenous construction firms in Nigeria?. This paper therefore sets to provide answers to these posers.

Classification of Mechanical Plants

Mechanical plants can be classified according to mobility and function. According to mobility, mechanical plants can be divided into three classes (Chudley, 1977). They are fixed, portable and mobile. Fixed plants refer to machines which are static or statutory and fixed in position while in operation e.g. tower crane, concrete mixer. Portable plants refer to machines and powered tools which can be moved about by pulling, pushing or carrying by hand. e.g. compressor, wheel barrows, rockdril. Mobility plants refer to machine that are moved under their own system and could still work while moving e.g. dumpers. According to the classification by function, mechanical plants can be grouped as; excavating; hoisting; transporting; mixing; and compacting. Otherwise, it can be grouped according to the following headings; (1) Foundation and excavation equipment; (2) Transportation equipment; (3) Pneumatic, electric and general plant: (4) Concreting machinery.

General Plant Policy in the Construction Industry

Plant/equipment policy has become an essential one in view of the competitive nature of construction contracting business which consequently improves management techniques. Adeyemi (2000) also highlighted other factors necessitating plant policy as the need to control the size of plant fleet in order to minimize the idled time and whether to own or lease a plant on one hand and repair or replace on the other hand. He stressed further that sound plant policy most contain all elements that affect the ownership and operational of plants. Foreign construction companies have the following plant and equipment policies (Babalola, 2005 and Chudley, 1977): choice of plant and equipment; planning on construction plan; plant maintenance (planned preventive maintenance, planned corrective maintenance); and, monitoring of maintenance. Generally, a construction company has two options in acquiring plant: it may either own its plants and equipment or hire it. Therefore, it is highly essential to carry out some engineering, technical and commercial appraisals of a particular plant before a choice to purchase it is made. The engineering and technical appraisals should include among other things, the technical specifications, the performance, safety report, mechanical report services, spares, etc. According to Oyewande (1990), some basic questions must be asked the manufacturers like how many of this particular model have they sold?; which major user one can go to for a reference?; can one visit and inspect the manufacturing and services facilities?; is it possible to have a machine on site for trail?. These basic questions must be answered satisfactorily before a decision is made to purchase such a plant, most especially a new plant in the market. As posited by chuddley (1977) and Oyewande (1990), the firm, having made the decision to procure rather than hire a piece of plant, needs to forecast a cash flow and cash requirements for the company for acquisition of plant after the general appraisal. The forecast should include the methods of acquisition and purchasing of plant as well as prediction of the disposal proceeds. Also, the forecast method of acquisition should include the expenditure of the firm. That is, the repayment of acquisition money. The acquisition method may be an outright purchase, a hire purchase, a credit purchase or a lease.

RESEARCH METHODOLOGY

The population for the study is the indigenous construction firms that are found within the three commercial nerve centres of the country, namely Lagos, Abuja and Port-Harcourt. Study by Fagbenle et al. (2004) revealed that over 75% of the construction activities take place in this area. Moreover, more than 70% of the construction contractors in the register of the Federal Registration Board of Nigeria have the addresses of these commercial nerve centres . Therefore, the population is expected to have a fair representation of the study area (Nigeria). According to Ogunlana and Olomolaiye (1990), most of the indigenous construction companies fall within small sized firms while a few of these companies can be considered as medium size in

their operations. In view of this assertion and preliminary investigation of the study area, 90 main contractors were randomly sampled from small and medium sized firms within the study area. The distribution was done in a manner that 30 questionnaires were distributed to the indigenous construction contractors in each of the three states that were sampled. This classification was based on their registration categorisation by the Federal Registration Board of Nigeria. Out of this distribution, 65 questionnaires representating 72.20% were duly filled and returned by the respondents in the study area. Table 1 further shows the questionnaire distribution across the study area and the response rates in this regard.

Table 1: Questionnaire Distribution to Indigenous Contractors and the Response Rates

Questionnaire Distribution					Response Rates				
S/N	Commercial Nerve Centre	Medium Sized	Small Sized	Total	Commercial Nerve Centre	Medium Sized	Small Sized	Total	Percentage Response (%)
1	Lagos	15	15	30	Lagos	11	12	23	76.60%
2	Abuja	15	15	30	Abuja	12	10	22	73.30%
3	PortHarcourt	15	15	30	PortHarcourt	8	12	20	66.60%
		45	45	90		31	34	65	72.20%

Source: Field Survey (2009)

The likert scaling techniques was adopted and applied to some of the questions asked for ease and uniformity of response in this regard. The analysis of data was based on a scoring system and in this scoring, for each of the four response categories (High level, Average level, Low level, No level of awareness at all), a score of 0-3 was assigned. The highest score of 3 was assigned to "High Level", 2 to "Average Level", 1 to "Low Level" and a score of 0 to "No level of awareness at all". Having scored the response to each item for each respondent, an overall average score for each organisational categorisation was then calculated by finding the cumulative score of all the respondents from the organisation and dividing this by the number of respondents from the firm. This score provided an indication of the level of awareness of the contractors with response to each of the indices listed in Table 2. This process resulted in a distribution of scores of organisations from which sample means and standard deviations were calculated for the two samples of small and medium sized firms as follows (Spiegel, 1972; cited in Ankrah and Langford, 2005).

$$x = \frac{\sum x}{n} \quad \text{and} \quad s = \left[\frac{\sum x^2 - \frac{\left(\sum x\right)^2}{n}}{(n-1)}\right]$$

Where x = mean, x = score, n = sample size, s = standard deviation

RESULTS AND DISCUSSIONS

The respondent contractors in the small and medium sized construction firms were asked to rate the level of their awareness in relation to the use of some certain categories of construction equipment, which are classified according to their functions. They are ; earthmoving and excavation; piling; mining and tunneling; pumping; crushing and screening; lifting; conveying and pulling; compacting; asphalting; concreting; air compressing and miscellaneous (petrol, diesel and steam engines, generators, hand electric tools, saw benches, space heaters, concrete breakers, etc). The ranking criteria are as earlier stated. The results of the mean scores and standard deviations in Table 2 indicated that the indigenous contractors in the medium sized firms have more awareness in the use of mechanical equipment for construction projects than their counterparts in the small sized firms. This might not be unconnected with their level of exposure, the contract values and their geographical spread, in terms of contract handling, when compared with their small sized firms. The results in the table (Table 2) further shows that apart from the use of pumping equipment (s = 0.518), compacting equipment (s = 0.526) and the concreting equipment (s = 0.629) for the medium firms, the standard deviations of the use of other equipment classifications fall below 0.500, which is regarded as an average. The same trends were also observed for all the firms when pooled together. The results of the means and standard deviations obtained in Table 2 below further justified the need to know if there is a policy in place for these indigenous contractors. To achieve this aim, hypotheses were set up and levels of significance of 0.05 were assumed, representing 95% ccnfidence level. The hypotheses were as follows:

Ho: The indigenous contractors have plant policy in place for their construction operations. Hi: The indigenous contractors have no plant policy in place for their construction operations. From Spiegel (1972), the critical values of the standardized variable (or z score) at 5% level of significance for a two-tailed test are -1.96 and 1.96. Therefore, the null hypothesis will be rejected if the z score of the difference of means lies outside the range -1.96 to 1.96, and accepted otherwise. The z score was calculated from the following formula (Spiegel, 1972; cited by Ankrah and Langford, 2005).

$$z = \frac{\overline{x_1} - \overline{x_2}}{\sigma_{x_1 - x_2}} = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

The results obtained are as shown in Table 3

Table 2: Mean Scores and Standard Deviations of the Level of Awareness of indigenous contractors

S/N	Equipment Classification by Function	Awareness Level					
		Small Firms		Medium Firms		All Firms	
		x	s	x	s	x	s
1	Earth moving and Excavating	1.880	0.115	2.525	0.365	2.203	0.240
2	Piling	1.690	0.163	2.975	0.472	2.333	0.318
3	Mining and Tunneling	1.721	0.118	2.868	0.373	2.295	0.246
4	Pumping	2.321	0.210	2.657	0.518	2.489	0.364
5	Crushing and Screening	1.672	0.119	2.605	0.445	2.139	0.282
6	Lifting, Conveying and Pulling	1.614	0.124	2.315	0.492	1.965	0.308
7	Compacting	1.756	0.116	2.118	0.526	1.937	0.321
8	Asphalting	1.819	0.112	2.113	0.425	1.966	0.269
9	Concreting	1.917	0.210	2.621	0.629	2.269	0.420
10	Air Compressing	1.964	0.212	1.779	0.451	1.872	0.332
11	Miscellaneous	2.413	0.232	2.526	0.485	2.470	0.359

Source: Field Analysis (2009)

Table 3: z Scores for Difference of Means

S/N	Equipment Classifications by Function	$x_1 - x_2$	$\sqrt{s_1^2/n_1 + s_2^2/n_2}$	z
1	Earth moving and Excavating	-0.65	0.12	-5.42
2	Piling	-1.29	0.15	-8.60
3	Mining and Tunneling	-1.15	0.11	-10.46
4	Pumping	-0.34	0.17	-2.00
5	Crushing and Screening	-0.93	0.14	-6.64
6	Lifting, Conveying and Pulling	-0.70	0.15	-4.67
7	Compacting	-0.36	0.16	-2.25
8	Asphalting	-0.29	0.13	-2.23
9	Concreting	-0.70	0.20	-3.50
10	Air Compressing	-0.19	0.15	1.27
11	Miscellaneous	-0.11	0.16	-0.69

Source: Field Analysis (2009)

From the results of Table 3, the null hypothesis is rejected and the alternative hypothesis accepted instead. That is, the indigenous contractors have no policy in place for their construction operations. The result supports the assertions of Babalola (2005), Adeyemi (2000), Adu (1983) and Douglas (1975) that the indigenous construction contractors in Nigeria have no laid down policies guiding them in the choice, purchase and maintenance of plants and equipment. The fact (from the results) that the Nigerian indigenous contractors have no policy guiding them in the use of equipment therefore justified the need to propose a plant policy for their operation and this is presented thus:

Developing Appropriate Plant Policy for Indigenous Construction Contractors

The elements which must be included in formulating a sound policy should include among other things, the following: economic life of various machines; timing of machines for replacement; degree of maintenance; rating; leasing/owning; equipment selection; equipment analysis for cost and production; inventory management; storage and security; spare parts and stock levels; and organisation for administering equipment.When examining the need to own a plant, the following must be taken into consideration:

i. will the item of plant generate sufficient turnover to provide an adequate rate of return on the capital employed?
ii. Is ownership of the plant rather than obtaining it by some other method(s) absolutely necessary for the business?
iii. Is outright purchase the only way of acquiring the plant?

If the answers to the questions are not positive ones, then there should be some other sound commercial reasons for taking a contrary decision. The firm, having made the decision to purchase rather than hire a piece of plant, need to forecast a cash flow and cash requirements for the company for acquisition of plant after the general appraisal. The forecast should include the methods of acquisition and purchasing of plant, prediction of the disposal proceeds. As soon as the plant and equipment have been chosen, their physical location on the site can then be planned and such plans must be dimension immediately. After acquisition, the contractor must prepare to provide maintenance and servicing of the equipment if economic levels of utilisation are to be obtained. Effective plant maintenance must include the following: planned preventive maintenance (daily servicing and superficial inspection, regular full maintenance and inspection as well repair or replacement of component parts within a working period); planned corrective maintenance (running, shut-down and breakdown maintenance facilities); and monitoring of maintenance.

In the null shell, the following guidelines (figure 1) may be followed while taking a decision on equipment purchase, lease or hire by the indigenous contractor(s).

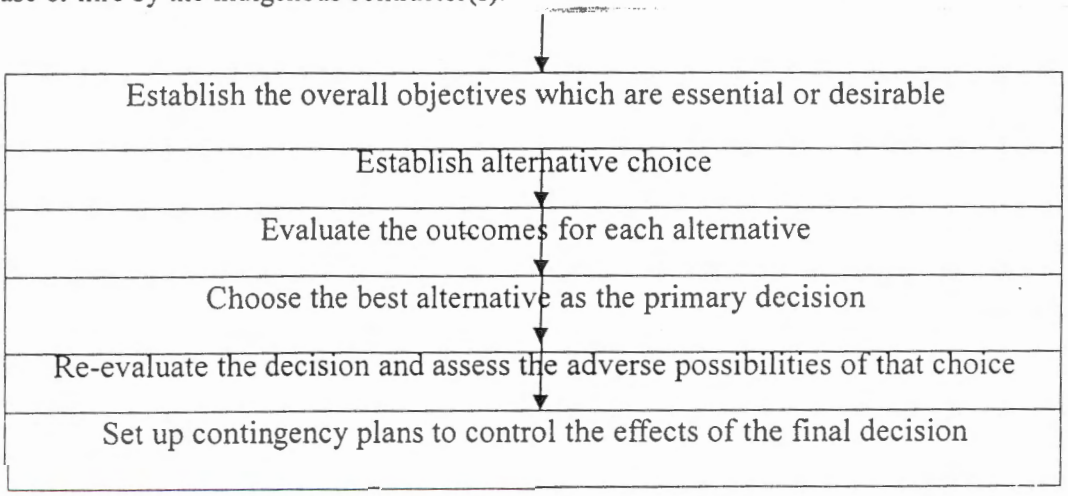

Figure 1: Charts for Decision Making on Plant Policy
Source: Adapted from Babalola (2005) and Fagbenle (2005)

CONCLUSION

Based on the aforementioned and in order that the maintenance policy may be executed efficiently, it is necessary to install a recording and costing system. This should include the following:

1. An asset register comprising an inventory of each plant item in the fleet with information on the date of purchase, registration or code number, purchase price, current value, location, hours operated, etc.
2. A maintenance schedule indicating the type of maintenance and servicing required on each plant item

together with the time intervals between each plant maintenance.

3. Specialised equipment and general plant should be thoroughly serviced and maintained. In addition, the workers must have the ability and capability to handle the day-day service challenges.
4. There should be freelance fitters/mechanics to be carrying out day-to-day repair on site and on yard-old machines that are still functioning can be hired out at a cheaper rate instead of disposing them off immediately.
5. Job cards are to be introduced and filled by the fitter each time maintenance work is performed. This should include a description of the work done, materials used, time taken, recurring defects, etc.
6. There should be history record cards. The information on the job card is transferred for each individual machine to its history card normally a computer file, together with the hours operated and fuel used.

Conclusively, indigenous contractors are advised to consider the option of hiring if the plant required is for short period of time and there is no likelihood of any repetitive work.

REFERENCES

Adeyemi, A. Y (2000): "Equipment Policy of Construction Contractor", **Journal of the Federation of Construction Industry**, Vol. 5, No 1, Jan-April.

Adeyemi, A. Y. (2004); "Financial Performance of Construction Contractors in Nigeria", Unpublished Ph.D Thesis, Department of Building, Obafemi Awolowo University, Ile Ife, Nigeria.

Adu, C. G (1983); "Management and Maintenance of Mechanical Plant in Building Industry", Unpublished Ph.D Thesis, Department of Building, Obafemi Awolowo University, Ile Ife, Nigeria.

Ankrah, N. A. and Langford, D. A. (2005); "Architects and Contractors: A Comparative Study of Organisational Cultures", **Construction Management and Economics**, Vol. 23, July, pp 595-607.

Babalola, O. (2005); "Plant and Equipment Polices of Indigenous. Foreign and Hiring Companies in Construction Industry", Unpublished Ph.D Thesis, Department of Building, Obafemi Awolowo University, Ile Ife, Nigeria.

Chudley, R. (1977); "**Construction Technology**", Vol. iv Longman Group Ltd, UK.

Douglas, J. (1975); **Construction Equipment Policy**, McGrawHill, Inc., New York.

Fagbenle, O. I. Adeymi, A. Y. and Adesanya, D. A. (2004); "The Impact of Non-Financial Incentives on Bricklayers' Productivity In Nigeria", **Construction Management and Economics**, Vol. 22, pp 890-911.

Fagbenle, O. I. (2005); "Modelling a Plant Policy for a Typical Indigenous Construction Company", Unpublished Ph.D Seminar Paper, Department of Building, Obafemi Awolowo University, Ile Ife, Nigeria, pp 1-31.

Ogunlana, S. O. and Olowolaiye, P. O. (1990); "Improving Contract Planning Practice in the Nigerian Engineer", **A Publication of the Nigerian Society of Engineers**, Vol. 25, No. 4, pp 25-47.

Olatunji, S. O (1997); "The Management of Plants and Equipment", Unpublished M.Sc Seminar Paper, Department of Building, Obafemi Awolowo University, Ile Ife, Nigeria, pp 1-21

Oyewande, B. (1990); "The Effectiveness of Technical and Commercial Management of a Construction Company's Fleet", **The Builders' Journal**, A Publication of the Nigerian Institute of Building, Vol.1, No 2 pp 16-28.

Spiegel, M. R. (1972), **Schaum's Ouline of Theory and Problems of Statistics**, 1st Edition, McGraw-Hill, New York.