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EQUIPMENT MAINTENANCE AND PRODUCTION OPTIMIZATION OF ROAD CONSTRUCTION FIRMS IN RIVERS STATE

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Abstract

Organizations are in the pursuit to increasing productivity in the maximization of its goals and objectives, thus it is partly tied to the efficient utilization of operational equipment. This study carefully examined maintenance options and how it contributed to production optimization in the four (4) road construction firms in Rivers State, Nigeria. The study adopted a correlational statistical tool to test hypotheses stated by means of questionnaires derived from two hundred and eighty five (285) sample size. Findings revealed that, there was a positive significant correlation on both predictor and criteria variables of the study at the least measure of 0.58 - 0.73 strong. Recommendations was advance that the production unit of the firm should at regular period effect cost efficiency measures through equipment maintenance structure; and the study was concluded as seeing maintenance as a reliable technique for ensuring and deriving optimal utile among studied firms.

Introduction

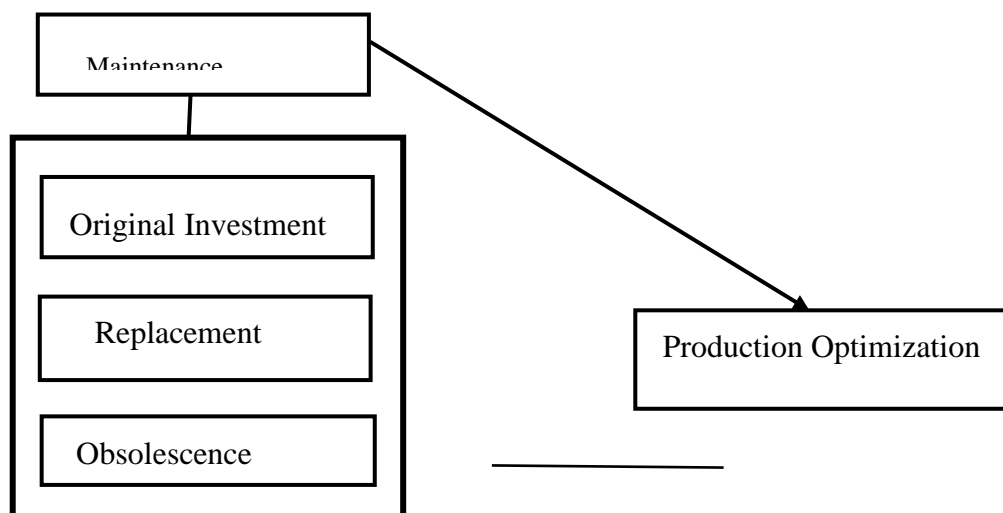
In our recent world, it has become observable that productive activities of firms are increasingly gaining concern in the approach to which work is performed. Bellchartte, (2021); Hammer, & Moore, (2022) alluded that, this concern was necessitated by means of competitive desire to gain higher dominance among competitive firms within a particular industrial section. One of the major push in the competitive space was identified to be the rate at which high technological innovations in the equipment use for productive activities are adopted (Madu, 2020). Osama, (2021) asserted that, in deriving utility is associated with the use of equipment both for immediate and future need would require a degree of maintenance that would sustained optimality in the utility gained from the use of the equipment. Tiepreye, et al., (2022) maintained that, maintenance as it is communicated in this study implies to cost associated in acquiring new equipment (original or initial investment), either for both

individual and group replacement, and the scrap value for an obsolete or idol equipment. Wariboko, & Akomas, (2021) identified that, these variables are functional determinant for a flow or intermittent operation in the road construction sector, as well as, its sudden failure would increase cost factor for production. Hence, Opuwari, (2022) noted that, it is contingent that adequate determination of equipment useful life within a finite horizon is ascertained in order to ensure operations utility optimization and holding cost effective among four (4) road construction firms namely; Monier Construction Company (MCC), Julius Berger Construction Company (JBCC), Lubricks Construction Company (LCC), Reynold Construction Company (RCC) studied.

Statement of the Problem

Optimal use of equipment have much influence on productive capacity of an organization, as its optimal or minimal effectiveness contributes to viability and competitive potentiality of the organization, even in construction sector (especially road construction). Loola, et al., (2021); Godwin, et al., (2022) avowed that, among road construction firm, their operations are majorly in the delivery or rendering of tangible service that its utilization would span or be classified as long-term product, hence the determination of its quality is also tied to the finite horizon in the utilization of such service or product. The observed problem among the road construction firms is the inability to sustain delivery date and quality product as a result of low equipment acquisition and maintenance schedule. Thus, the dependability on efficient operative structure or system largely depends on cost capability of the firm, which is associated with the level of material and equipment utilization in the productive processes of the firm Loveday, & Besinoye, (2022). However, some other researcher has written on the subject, but it seems to be insufficient or inexhaustible; hence these equipment is subject to maintenance, which cost forms a major budgetary provision in among firms studied as a result increasing the cost components of operation in the firms as against the utility optimization. This is a problem that necessitated this study.

Conceptual Framework



Source: Researcher's Conceptualization, (2023)

Objectives of the Study

1. To determine how original investment correlates with production optimization in the road

- construction firms in Rivers State
2. To determine how replacement correlates with production optimization in the road construction firms in Rivers State
 3. To determine how obsolescence correlates with production optimization in the road construction firms in Rivers State

Research Questions

1. What is the relationship between original investment and production optimization in the road construction firms in Rivers State?
2. What is the relationship between replacement and production optimization in the road construction firms in Rivers State?
3. What is the relationship between obsolescence and production optimization in the road construction firms in Rivers State?

Statement of Hypotheses

The hypotheses were stated in the null form

H₀₁: There is no significant relationship between original investment and production optimization in the road construction firms in Rivers State.

H₀₂: There is no significant relationship between replacement and production optimization in the road construction firms in Rivers State.

H₀₃: There is no significant relationship between obsolescence and production optimization in the road construction firms in Rivers State.

Conceptual Review

Maintenance is aimed at ensuring that equipment or machinery is at its operating state or condition by regular servicing or repairing or replacing some of its components. Mark et al., (2021) opined that, the perception of maintenance is to set up a routine plan of action regarding the procedures to be followed while carrying out a particular maintenance activity. Newton, et al., (2022); Onyeaba, & Ika, (2021) asserted that, based on history of equipment designed for road construction purposes, and feedback received from road construction firms enables the users to formulate implementable and step-by-step plan for maintenance areaways, which is known to be maintenance policies; such policy would even require effective manufacturer-user interaction when such maintenance need is envisaged. Ralto, & George, (2021) observed that, as a result, the manufacturer may redesign the equipment as maintenance requirements of the user. The essence of Maintaining Equipment, Timipri & Theophilus, (2022) as also seen in Faniel, et al., (2021) identify that: i. To minimize the rate of interruption in the productive process by means of equipment breakdown; ii. To optimize the productive capacity of a given equipment; iii. To enhance and promote safety measures of the utilizing work force (Amiejoko, et al., 2021); iv. To adequately ensure that service reliability of the equipment is guaranteed; v. to ensure that the quality of product or service is achieved; vi. To maximize the useful life of the equipment (Baggi, et al., 2021); vii. To minimize the rate of equipment repair or breakdown (Faltoile, & Niaki, 2020).

In construction operations, Chinedu & Fidelis, (2021) orated that, it is obvious that system interruptions resulting from equipment failure is necessitated by poor maintenance culture. The equipment, whose efficiency gradually decreases according to their age, requires paying out more money towards running cost, and scrap (Ernest, et al., 2022). Abu, & Odumayor, (2022) orated that, the only alternative way to prevent such increased expenses is the replacement of old equipment with new one. Replacement problems fall into the following

categories depending upon the useful life pattern of the equipment involved.

Maintenance Culture: Organizational activities as it relates to road construction are mainly based on the use of heavy physical equipment (Asset), and this equipment is subjected to regular maintenance for it to be efficient (Alabo, et al., 2022). Akpadumefien, & Tobomini, (2022) as also seen in Bukola, & Maria, (2022) orated that, maintenance is a routine activity of keeping equipment used in an organization or a machine or a facility in its normal working condition so that it can perform its optimal capacity and satisfactorily without causing any loss, idle time with regard to its expected service time on account of its breakdown. Fante, et al., (2022) and also in Hunt, & Batholome, (2022) posited that, maintenance as its used here is any activity designed to keep equipment at its perfect working state or to restore the equipment to its operating status, hence, it is a significant resource used to add value to products. Therefore Lloyd, & Calton, (2021) suggested that, asset should be maintained regularly. Miemeti, (2021) contributed that, if not, there may be too much down time and break in production, if the asset is a part of an assembly line. Prabhuswamy, et al., (2022) alluded that, malfunctioning of equipment may lead to issues related to time wastage and quality. Thus, it would be good, if the equipment or machinery is always maintained in working condition at a minimum possible cost (Rogers, & Hartman, 2022). Therefore, minimization of overall maintenance cost is required for a wholistic approach. Offiong. et al., (2021) and in Muñoz-Porcar, et al., (2020) posited that, oftentimes, the asset may be obsolete over a time horizon. If the organization or company wishes to operate competitively in business, it is vital to look at whether to maintain with the existing (old) machinery or to outrightly replace the asset, considering the cost of operation and maintenance and its original investment (Nwabueze, & Desmond, 2022). Hitney, & Shola, (2022) asserted that, maintenance of equipment used in road construction is indispensable to achieve a specified level of task actualization, quality, reliability and time efficient of the organization. Maintenance activity helps in maintaining and increasing the operational efficiency of equipment or facilities and, thus, contributes immensely to the growing income of the organization by reducing the operating costs and increasing to production (Francisco, et al., 2022; Ekeocha, et al., 2022).

Empirical Review

Ameachi, et al., (2021) carried out a study on predicting repair and maintenance of tractor in Enugu State Agricultural Development Program in Nigeria, the objective were to determine the relationship between the accumulated hours of usage and total accumulated repair and maintenance (ARM) cost, as well as the general fixed and operating cost of the tractors under government owned management system. The study was limited to two tractor models; Massey Fergusson (MF) and Flat tractors. The study adopted both primary and secondary data, and was subjected to statistical analysis using knowledge based software analytical tool, Matlab (2014 version) for generating models that was used to predict repair and maintenance cost of the need tractors in Nigeria.

Theoretical Framework

The study was hinged on the theory of repairs, maintenance and betterments propounded by Earl A. Saliers in 1943 in Ekeocha, et al., (2022) The theory postulate the need of an accounting for depreciation of capital assets as generally recognized for enhancing operational activities inan organization (Anan, & Aham, 2022). Hartforth, & Olagbege, (2021) posited that, the same understanding as regards repair does not exist. It is known, however, that depreciation and repairs are related for, to establish a reasonable depreciation rate, it is necessary to consider the policy pursued. Also, as inadequate depreciation policy is liable to render unsatisfactory any attempt to treat repairs scientifically (Hytone, &

Christopher, 2021).

Methodology

The study adopted a correlation design. This method was considered appropriate because it enabled the researcher to have a direct contact with respondent in cause of data collection with the aid of a structured questionnaire as a source of primary data, while Pearson Product Moment Correlation Coefficient was used as statistical tool for analyzing respondents responses in the returned questionnaires from employees among the 4 construction firms studied. The sample size of 385 respondent was determined using Taro Yemani formula, and proportional sampling technique was used to ascertain the sample size drawn from each firm studied.

Analysis

Table 1 Multivariate Analyses of all Variables

		Original Investment	Replac- ement	Obsole- scence	Production Optimization	Mainte- nance
Original Investment	r - Value	1				
	t - Value					
	N	285				
Repla- cement	r - Value	0.73	1			
	t - Value	0.00				
	N	285	285			
Obsol- escence	r - Value	0.77	0.88	1		
	t - Value	0.00	0.00			
	N	285	285	285		
Production Optimization	r - Value	0.56	0.60	0.63	1	
	t - Value	0.00	0.00	0.00		
	N	285	285	285	285	
Maintenance	r - Value	0.67	0.58	0.635	0.62	1
	t - Value	0.00	0.00	0.00	0.00	
	N	285	285	285	285	

Source: SPSS 22.0 Output, based on Field Survey (2023).

Table 1 showed the Pearson's correlation coefficient (r) on the relationship between variables of the study

Table 2: Aggregate Summary of Bivariate Analysis and Test

		r-Value	r ² -Value	t-Value	P-Value	DECISION
HO ₁	OI / PO	0.56	0.53	0.53	0	Reject
HO ₂	RP / PO	0.60	0.66	0.60	0	Reject
HO ₃	PO / PO	0.63	0.369	0.63	0	Reject
HO ₄	MT/PO	0.62	0.58	0.62	0	Reject

Source: Field Survey Data (2022)

OI (original investment), RP (replacement), PO (prevention of obsolescence), CE (cost efficiency).

Discussion of Findings

With the use of Table 2, the values (r- value, p-value, t-value) presented the direction for which decision was based in the study. It was found that all variables tested in the table were sign at the measure greater than the probability value. Such as: Original Investment on each piece of equipment used for road construction and production optimization stood at r - value 0.56 > 0.00 p-value. This finding collaborates with the work of Kim, & Tekpe, (2021) with asserts that every investment made in the purchase of equipment significantly reduces cost of operation. This assertion closely integrates with that of Timothy, et al., (2021). Replacement of Equipment and production optimization in the studied firms was sign at 0.60 r- value > 0.00 p – value, which suggest that group replacement approach positively impacts of productive activities in the studied firms. This findings is in conformity with the study of Schuman, & Brent, (2021), and the work of Reagler, et al., (2021). Prevention of obsolescence on each piece of equipment used for road construction and production optimization in the studied firms was sign at 0.63 r - value > 0.00 p – value, which revealed that obsolescence equipment maintained either as scrap value reduces cost burden on the firms significantly. This findings is id agreement with the work of Neamite, (2022), Otagrima, & Shiabu, (2021), and Gillis, & Martha, (2021). Finally, maintenance of each piece of equipment used for road construction and production optimization in the studied firms was sign at 0.62 r - value > 0.00 p – value. In the study of Forthel, & Dennis, (2021), and Charity, & Frances, (2021) are in collaboration with the findings. This signified that maintenance is partly tied to utility optimization, as well reduction in the cost components in the operational activities of the studied firms. From the analyses, it is very obvious to ascertain that there exist a positive correlation among both predictor and criteria variables studied.

Recommendations

1. Equipment acquisition should be a model whose spear parts are replaceable in the market to avoid complete abandonment
2. Maintenance of equipment is a function of technological expertise, hence equipment for productive activities should be that whose maintenance would not attract high cost
3. Equipment whose useful life has been out used should be depreciated based on its present value

Contribution to Knowledge

The novelty of this study was in the exposition of how the useful life of equipment used for productive activities can be adequately determined and maintained by holding idol time and capacity utilization constant.

Conclusion

Hence effective maintenance as adopted in the study positively stimulates or influences operational speed and at the same time holds cost components are at stable and manageable rate that spur or enabled optimal productivity and work utility. It is most ideal for the studied firms to consider maintenance option as means for improving and actualizing operational objective, hence optimizing capacity utile of both equipment and operations. Thus, maintenance is a veritable approach that helps in the selection of best-fit option for the organization.

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