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Optimizing Operations as a Competitive Strategy through Asset Replacement of Monier Construction Company in River State, Nigeria.

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Abstract *-This study sought to explore the correlation in sustaining operations flow through asset replacement in the Nigerian road construction industry. The main purpose of the study was to empirically evaluate how asset replacement decision influences performance in Monier Construction Company. The study was necessitated in recourse to interruption of productive processes due to sudden failure and breakdown of equipment used for road construction, thus enhancing inefficiency. The study adopted primary source of data with the aid of structured questionnaire to solicit responses from a sample size of 63 respondents of the studied firm. Pearson Product Moment Correlation Co-efficient and t-test was used to determine the correlation and degree of association between the independent and dependent variables; and a correlation matrix was adopted as a comparative design. Findings from the tested null hypotheses revealed a positive significant relationship between paired variables of the independent and dependent, although their degree differs in accordance to firms compared. The study concludes that, asset replacement model is reliable technique for solving equipment maintenance problem. The study recommends that, facilitated unit with trained staff on quantitative technique be instituted in maintenance department of road construction firms.*

Key Words: *Assets, Replacement, Maintenance, Obsolescence, Original Investment*

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I. Introduction

In our contemporary business world, the pace of standardization of goods and services offered by organization is partly tied to the increasing sophistication of equipment used in the transformation process; resulting to increasing competition, leadership and dominance among firms in the road construction sector, geared towards optimizing their objective function of the firm. Equipment is important asset to organizations, used in the processing stage of productive activity. It forms the bulk of road construction firm's asset, thus, referred to as asset (Loveday, 2020). Hence, deliberate replacement decision is required to sustain and improve organizational efficiency; since, equipment is subject to maintenance, obsolescence, change in the original investment, deterioration, depreciation, and sudden failure (Herald, Verma, Lubert, & Cloutier, 2019).

Replacement of a piece of equipment in the road construction firm is necessitated as a result of increasing repair and increasing maintenance resulting from usage over the passage of time, which is measured with its original investment, maintenance, and obsolescence (Amiens, Oisamoje, & Inegbenebor, 2019). Bukola, & Samuel, (2020) opined that performance is the ability of a firm to implement and actualize its objective function with minimal resources. Madu, (2019) posited that actualizing organization's objective function is partly tied with efficient utilization and performance of equipment deployed for work. Performance of an organization is measured or determined in terms of; task actualization, time required for completion of work, and quality of work (Nwabueze, 2018).

Replacement decisions adopt different methods. Offiong, Akpan & Ufot (2020) asserted that, replacement decision could adopt a mathematical model that captures the relationship between modeled variables. Ekeocha, Odukwe, & Agunwamba, (2019) noted that, the model considered optimum replacement intervals, using the initial cost of the equipment, the annual operating cost, and the annual increase in the maintenance cost. Theusen and Fabrycky in Ananda, & Ahmed, (2019) express the average annual cost for each piece of equipment with increasing maintenance cost as follows, equation (1):

$$\mathrm{C} = \frac{I}{M} + Q + (n-1)\frac{\mathrm{M}}{2} \qquad (1)$$

Where: C = average cost; **I** = initial cost of asset; **Q** = operating cost for the first year, **M** = increase in yearly maintenance cost; **n** = life of equipment in years

The useful life of each piece of equipment is determined by applying the classical optimization procedure using calculus by differentiating with respect to **n**, equating to zero and solving for **n (**Opuwari, 2018). Prabhuswamy, Nagesh, & Ravikumar, (2018) observed that the optimal life is determined, by Equation (2)

$$\frac{dC}{dn} = \frac{P}{n^2} - \frac{m}{2} = 0 \qquad (2)$$

$n = \frac{\sqrt{2I}}{M}$

Thus, (Achumoze, 2019) the useful life of equipment is a function of the square root of original cost (investment) multiplied by two, divided by the rate at which maintenance changes overtime. Equation 2 shows that the duration or useful life of equipment before replacement takes place depends on the original cost (investment) of the equipment and the rate at which maintenance changes over time (Regnier, Sharp, & Tovey, 2018).

II. Statement of Problem

In road construction, completion date is an important part of the project. In fact, Lloyd, (2019) allured that every road construction activity is a project because it must have been in-built in the bidding, planning and execution processes, the beginning and termination periods. Osama, (2018) pointed that availability and readiness of equipment the company has determines the rate or speed of project completion. Oftentimes, as contributed (Godwin, & Martins, 2019), some of these companies fail to meet their project completion date as a result of equipment functioning at sub-optimal rate which are not usually predicted a finite horizon organizational operation. The contributory problem to this are: i. Inability to make budgetary provision to invest on equipment, which contributes to poor task actualization in the studied organization; ii. Lack of maintenance resulting to time (useful life) inefficiency in the studied organization; iii. Inability to discover obsolete equipment, has affected the quality of road in the studied organization.

III. Objectives of the Study

The objectives of the study was to determine whether there is a relationship between asset replacement and performance in the studied organization, with emphasis on:

1. To determine the co-variation between original investment (cost) in each major piece of equipment used for road construction and task actualization in the studied organization.
2. To determine the extent to which maintenance of equipment correlates with useful life (time) required for road construction in the studied organization.
3. To find the extent to which prevention of obsolescence correlates with quality of each piece of equipment used in the studied organization.

IV. Conceptual Review

The replacement problems deal with situation that arise when some components (equipment or machinery) requires replacement because of reduced efficiency, breakdown or complete failure (Fan, Machemehl, & Gemar, 2019). Fan, Machemehl, Gemar, & Brown, (2018) observed that, such decreased efficiency or complete failure may be either gradual or all of a sudden and this situation could be predicted with the use of replacement model. A model is a replica of a real or existing system (Nepal, Madhav, Prasad, Park, & Moonseo, (2019). It demonstrates the interrelationships between various decision variables in the system. Providing a path to analyze the system behavior for improving its performance should be the primary objective of a model. Application of mathematical model uses a set of equations, establishing a relation between the decision variables, to describe the system behavior (Lucey, 2018).

Asset replacement problems deal with maintenance of equipment in a situation where some components (men or machinery) require replacement because of reduction in efficiency, breakdown or complete failure of the equipment. Gits, (2019) assert that, suboptimal efficiency of the equipment often times leads to complete failure of the equipment that could be associated to or categorized as gradual or sudden failure. Shoitti, & Coria, (2019) posited that, the application of replacement is always associated with the use of model, which is a replica of a real or existing system. Akpadumefien & Okente (2018) noted that, it portrays and demonstrates the interrelationships between various decision variables in the system. The application of a model is important because it provide a path to analyze the system behavior that would help in improving the performance of the asset (Bagui, Chakraborti, & Bhadra, 2019).

The use of model in replacement problem provide a systematic and step-by-step procedure thought the use of mathematical algorithm and equation in establishing a relationship between the decision variables, to the extent of describing the system behavior (Alabdulkarim, Ball, & Tiwari, 2020). Replacement decision often times emanate in the use of both human and non-human resources, thus, the adoption of probability theory provides a wing from which (Ameachi, Okorocha, & Jane, 2019) chances of failure and when replacement could be carried out are predicted at various stages of the engaged resource.

V. Empirical Review

The following are some of the related literature reviewed in this study.

Ajibade, Odusina, Rafiu, Ayanrinde, Adeleke, & Babarinde (2019) carried out a study on the use of replacement model to determine the appropriate time to replace deteriorating industrial equipment in Ibadan Polytechnic, Bruwa Campus, Nigeria; the objective of the study was to determine the exact time and year which replacement of the given equipment is most economical. While, Tsado & Theophilus (2019) carried out a study on equipment maintenance: An effective aspect of enhancing construction project profitability in Abuja and Mina. These studies were hinged on equipment maintenance, but the methodology both study adopted defers. Ajibola, et. al adopted a mathematical model of equipment maintenance when cost increases with time, ignoring changes in the value of money over a period of time. Whereas, Tsado & Theophilus (2019) adopted frequency table analyses method in accordance with their respective years of usage. Both results were similar, showing the specific time horizon for equipment maintenance, at an average annual lest cost of the nth year. Though, both finding were in agreement, but Ajibola, et. al findings was expressed in naira terms (N970,221.60) as average minimum cost for replacing the equipment at the fifth year of its usage. Whereas, Tsados & Theophilus findings was represented in simple percentage distribution; it reveals that only 42.5% of construction firm attached high priority on equipment maintenance, while 51.5% construction firms do not attach high priority. Both findings are in agreement with straight line method of asset maintenance (Muñoz-Porcar, Alonso-Nuez, Flores-García, & Duret-Solanas, (2019).

VI. Theoretical Framework

This study was based on Investment Theory propounded by Irving Fisher 1906 in his nature of Capital and Income, and Rate of Interest. Fisher assumes the investment decision of the firm as an intertemporal problem (Jorgenson 1967 in Love, Zitron, & Zhang, 2019). The assumption was that, all capital was circulating capital. Therefore, all capital is used up in the production process, thus a stock of capital **K** does not exist; rather, all capital is, in fact investment. Francisco, Romero, Rajkumar,& Essam, (2019) defined investment as the change in capital stock over a period, and investment is a flow term and not a stock term, but can be measured over a period of time **t**; while capital **K** is a stock term that can only be measured at a point in time. Fan, Machemehl, & Kortum, (2019) noted that, the quantity of a flow always depends on the period in consideration. Thus, Chinedu, & Fidelis, (2020) contributed that investment flow is calculated as the flow in a period as the difference between the capital stock at the end of the period and capital stock at the beginning of the period.

VII. Methodology

The study adopted the survey research design which was anchors on correlational design. Question items from the 63 questionnaire were drawn from the decomposed and operational variables generated in the objective of the study, from which Pearson Product Moment Correlation Co-efficient was used to calculate correlation co-efficient in line with responses derived from seventy eight respondents of the studied organization.

Table 1. Correlation Matrix on all Variables

		Original Investment	Maintenance of Equipment	Prevention of Obsolescence	Task Actualization	Time	Quality
Original Investment	Pearson Correlation						
	Sig. (2-tailed)						
Maintenance of Equipment	Pearson Correlation	.727**					
	Sig. (2-tailed)	0.00					
Prevention of Obsolescence	Pearson Correlation	.802**	.939**				
	Sig. (2-tailed)	0.00	0.00				
Task Actualization	Pearson Correlation	.481**	.745**	.741**			
	Sig. (2-tailed)	0.00	0.00	0.00			
Time	Pearson Correlation	.721**	.780**	.816**	.689**		
	Sig. (2-tailed)	0.00	0.00	0.00	0.00		

Quality	Pearson Correlation	.781**	.789**	.843**	.690**	.982**
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.00

Source: Survey Data (2021), SPSS Output, Ver. 25

VIII. Discussion

Using Table 1 all variables were prevalent (mean scores > 3.0) the result showed that; the Predictor Variable, Asset Replacement which had Original Investment showed that all question items were prevalent at 3.24 – 3.32 > 3.0; Maintenance of Equipment showed that all question items were prevalent at 3.05 – 3.44 > 3.0; and Prevention of Obsolescence showed that all question items were prevalent at 3.21 – 3.59 > 3.0). The Criterion Variable – Performance which has Task Actualization showed that all question items were prevalent at 3.37 > 3.00 for question item 1, while item 2, 3, 4, 5 were are 2.25 – 2.57; Useful Life / Time showed that all question items were prevalent at 3.32 – 3.41 > 3.00; and Quality showed that all question items were prevalent at 3.33 – 3.49 > 3.00 stated in the studied organization

Inter-Relationship between the measures of Asset Replacement on equipment used for road construction and measures of Performance as revealed in Table 1.

Ho_1: Original Investment on each piece of equipment used for road construction does not have any significant relationship with Task Actualization in the studied firm. However, Pearson Correlation (r) Value was at 0.481 and the Probability Value (PV) at 0.000 < 0.005 of the tested hypothesis. Hence the null hypothesis was rejected, while the alternate hypothesis (H_A) which states that, there is a significant relationship between Original Investment on each piece of equipment used for road construction and Task Actualization in the studied firm was accepted.

Original Investment on each piece of equipment used for road construction does not have any significant relationship with Useful Life (Time) in the studied firm. It was found that the r value was sign at 0.721 and the PV was 0.00 < 0.05. Thus, the null hypothesis was rejected, whereas, the alternate hypothesis (H_A) was accepted which states that, Original Investment on each piece of equipment used for road construction have a significant relationship with Useful Life (Time) in the studied firm.

The null hypothesis states that Original Investment on each piece of equipment used for road construction does not have any significant relationship with Quality in the studied firm. Thus, the r value derived from the Correlation Matrix was sign at 0.781, and the PV at 0.00 < 0.05, which implied that the null hypothesis was rejected. Hence, the alternate hypothesis (H_A) which states that Original Investment on each piece of equipment used for road construction have a significant relationship with Quality in the studied firm was accepted. Conversely, it was of interest to note the differences (increase) found in the r values of the criterion (Dependent) variables while holding the predictor (Independent) variables constant.

Ho_2: Maintenance on each piece of equipment used for road construction does not have any significant relationship with Task Actualization in the studied firm. The Pearson Correlation (r) Value at 0.745 and the Probability Value (PV) at 0.000 < 0.005 was instructive. Hence the null hypothesis was rejected, while the alternate (H_A) which states that, there is a significant relationship between Maintenance on each piece of equipment used for road construction and Task Actualization in the studied firm was accepted.

Maintenance of each piece of equipment used for road construction does not have any significant relationship with Useful Life (Time) in the studied firm. It was found that the r value was sign at 0.780 and the PV was 0.00 < 0.05. Thus, the null hypothesis was rejected, whereas, the alternate hypothesis (H_A) was accepted which states that, Maintenance on each piece of equipment used for road construction have a significant relationship with Useful Life (Time) in the studied firm.

The null hypothesis states that Maintenance on each piece of equipment used for road construction does not have any significant relationship with Quality in the studied firm. Thus, the r value derived from the Correlation Matrix was sign at 0.789, and the PV at 0.00 < 0.05, which implied that the null hypothesis was rejected. Hence, the alternate hypothesis (H_A) which states that Maintenance on each piece of equipment used for road construction have a significant relationship with Quality in the studied firm was accepted. Conversely, it was of interest to note the differences (increase) found in the r values of the criterion (Dependent) variables while holding the predictor (Independent) variables constant.

Ho_3: Prevention of Obsolescence on each piece of equipment used for road construction does not have any significant relationship with Task Actualization in the studied firm. Table 4.48 revealed the Pearson Correlation (r) Value at 0.741 and the Probability Value (PV) at 0.000 < 0.005. Hence the null hypothesis was rejected, while the alternate hypothesis (H_A) which states that, there is a significant relationship between Prevention of Obsolescence on each piece of equipment used for road construction and Task Actualization in the studied firm was accepted.

From the same Table, Prevention of Obsolescence on each piece of equipment used for road construction does not have any significant relationship with Useful Life (Time) in the studied firm. It was found that the r value was sign at 0.816 and the PV was 0.00 < 0.05. Thus, the null hypothesis was rejected, whereas, the alternate hypothesis (H_A) was accepted which states that, Prevention of Obsolescence on each piece of equipment used for road construction have a significant relationship with Useful Life (Time) in the studied firm.

The null hypothesis states that Prevention of Obsolescence on each piece of equipment used for road construction does not have any significant relationship with Quality in the studied firm. Thus, the r value derived from the Correlation Matrix was sign at 0.843, and the PV at 0.00 < 0.05, which implied that the null hypothesis was rejected. Hence, the alternate hypothesis (H_A) which states that Original Investment on each piece of equipment used for road construction have a significant relationship with Quality in the studied firm was accepted. Conversely, it was of interest to note the stable increase found in the r values of the criterion (Dependent) variables while holding the predictor (Independent) variables constant.

IX. Findings

The findings revealed that Original Investment (OI) has a significant relationship with Task actualization (TA) of equipment used for road construction. Hence the measure at which Original Investment correlated with Task Actualization was found at 0.564 which signified a strong positive correlation between the independent (OI) and dependent (TA) variables. This simply implied that OI affects or influences TA, though the rate at which the independent (OI) variable correlated with the dependent (TA) differs in magnitude in the studied organization. However, the measure of correlation depicted a positive correlation which collaborated with the work of Abubakar, Zakari, Shittu & Attanda (2018). Atul, Nitin, Bharti, & Anoop, (2019), posited that any money spent for purchasing a work relate equipment is by a guarantee to function at it optimal capacity in line with the value used to acquire it.

Findings showed that Maintenance of Equipment (ME) correlated with Useful Life (UL) Span of a piece of equipment used for road construction. Their correlation value was sign at 0.588 which signified that ME have a strong positive correlation with UL, It is inferable to assert that ME increases the efficiency rate and the UL span of a piece of equipment deployed for road construction. This finding is in accordance with the work of Ernest, Michael & Anthony, (2018) avowed that, productive activity would not be interrupted either will its useful life easily worn with timely and periodic maintenance schedule. Mark, Ogaji, & Probert, (2019) opined that with the regularization of maintenance value, the productive life of the asset is enhance for improved efficiency; and Fallahnezhad, & Niaki, (2019) alluded that, equipment life value can be decapacitated in the absence of planned maintenance routine..

From the result, findings revealed that the extent to which Prevention of Obsolescence (PO) correlated with Quality (Q) of a piece of equipment used for road construction was measured at 0.636, which implied that PO has a strong positive correlation with Q, hence PO influences Q positively. This finding was in harmony with the assertion of Bleazard, & Khu, (2018) which declared that the degree of obsolescence on the piece of equipment certainly diminishes the quality expectation of a product, hence capacity is ensured in construction activity when the equipment is new, with functional features to satisfy desired result. Cohen, (2020) agreed that, the quality of a product is as good as the tools deployed for such productivity engagement to meet contesting desire of our modern society; Radnar, & Jorgenstin (2020) in his studied contributed that, desire of our society today has outlived the used of some equipment and at the same time, it has increased the pressure on manufacturing firm of equipment in catching up with the society by producing equipment that can only replicate it quality and accuracy on products.

X. Conclusion

The analyses and results satisfactorily accomplished the objectives of the study both at the firm and industry levels; hence is was imperative to conclude that application of Asset Replacement Decision is an strategic option for improving Performance in the Road Construction Industry in Nigeria. Thus, proactive strategies were exemplified as against productive interruptions, breakdown and sudden failure of a piece of equipment used for road construction in Nigerian.

XI. Recommendations

It would be of immense advantage to the studied firms, if the recommendations derived from the findings of this study are adopted and implemented. Thus, the followings are recommended.

1. Road construction firms should equip or train their maintenance staff in the use and application of quantitative method of optimizing asset utilization as to minimize operating cost (repair and maintenance of equipment) thereby enhancing organizational performance.
2. Maintenance manager should ensure adherence of asset replacement policy in order to minimize productive interruption as a result of equipment breakdown, hence improving performance in the organization.

3. The classical objective of every firm is geared towards profit maximization, hence productive activity should ensure a flow sustained by use of equipment that meets right capacity.

References

[1]. Abubakar M. S., Zakari M. D., Shittu S. K. and Attanda M. L. (2018). Determination of Repair and Maintenance Cost for MF375, Tractor: A Case Study in Kano Metropolis, Nigeria, Arid Zone Journal of Engineering, Technology and Environment. August, (9); 27-3.

[2]. Achumoze, T. I, (2019). A Strategic Approach to Managing Maintenance Performance, International Journal of Quality in Maintenance Engineering, (2); 3-17.

[3]. Ajibade, A. D., Odusina, M. T., Rafiu, A. A., Ayanrinde,A. W., Adeleke, B. S., and Babarinde S. N. (2019). The use of Replacement Model to Determine the Appropriate Time to Replace a Deteriorating Industrial Equipment in Ibadan Polytechnic, Bruwa Campus, Nigeria, Journal of Mathematics, 10(2); 9-13.

[4]. Akpadumefien U., and Okente, F. (2018). Analysis of a System with Minimal Repair and its Application to Replacement Policy, European Journal of Operational Research, (12), 176–182.

[5]. Alabdulkarim, A., Ball, P. and Tiwari, A. (2020). Assessing asset Monitoring Levels for Maintenance Operations; Journal of Manufacturing Technology Management, 26(5), 632-659.

[6]. Ameachi, U. F., Okorocha, K. A., and Jane, C. A. (2019). Effect of Production Facilities Maintenance on Competitive Advantage of Selected Firms in Nigeria, International Journal of Research in Management Science and Technology, 3(4); 177-190. Available at www.ijrmst.org

[7]. Amiens, E. O., Oisamoje, M. D., and Inegbenebor, A. U. (2019). A Dynamic Programming Approach to Replacement of Transport Vehicles in Benin City, Nigeria, British Journal of Mathematics and Computer Science, 6(5); 204-214.

[8]. Ananda, S. J. and Ahmed, M. S. B. (2019). A Strategic Procurement Concept for Physical Asset Management Framework; A Paper Presented on the Proceeding of the 2014 International Conference on Industrial Engineering and Operations Management Bali; 2587 – 2592.

[9]. Atul, K.S., Nitin, K.S., Bharti, S., and Anoop, K.S, (2019). Replacement of Machines and Equipment before Failure should be Preferable, International Journal of Maintenance and Operations Research, 4(3); 310-312.

[10]. Bagui, S. K., Chakraborti, A. K. and Bhadra, B. M. (2019). Application of Replacement Theory in Determination of PAVEMENT Design Life, Journal of Civil Engineering, 6(1), 147.

[11]. Bleazard, D.G. and Khu, P.T. (2018). Physical Asset Management Philosophies, Engineering and Mining Journal, 202, 36.

[12]. Bukola, O. B. and Samuel, B. A. (2020). Evaluation of Maintenance Culture in Manufacturing Industries, International Journal of Machine, Tools and Manufacture, 44, 759-766.

[13]. Chinedu C. N., and Fidelis, I. E., (2020). Building Construction Project Management Success as a Critical Issue in Real Estate Development and Investment; American Journal of Social and Management Sciences, 2(1); 56-75.

[14]. Cohen, L. (2020). Physical Assets in the M&A Mix: a Strategic Option. Journal of Construction and Engineering Management, 17(11); 132-137.

[15]. Ekeocha, R. J. O, Odukwe, A. O, Agunwamba, J. C. (2019). Machinery Replacement Problems Model, International Journal of Supply and Operations Management 4(3):81-87.

[16]. Ernest, O. A., Michael D. O., and Anthony, U. I., (2018). Dynamic Programming Approaches for Equipment Replacement Problems with Continuous and Discontinuous Technological Change, IMA Journal of Management Mathematics, 17 (2), 143-158.

[17]. Fallahnezhad, M. S., Niaki, S.T.A., (2019). A New Machine Replacement Policy based on Numberof Defective Items and Markov Chains, Iranian Journal Of Operations Research 2(2); 17-28

[18]. Fan, W., Machemehl, R. and Gemar, M. (2019). Equipment Replacement Optimization: Part II. Dynamic Programming-Based Optimization, Journal of Operational Research and Societal Building, Washington: 2 (5), 22-26.

[19]. Fan, W., Machemehl R., Gemar, M. and Brown, L. (2018). A Stochastic Dynamic Programming Approach for the Equipment Replacement Optimization with Probabilistic Vehicle Utilization, International Journal of Operational Research, Washington: 1 (7), 67-84.

[20]. Fore, S. and Zuze, L. (2018). Improvement of Overall Equipment Effectiveness through Total Productive Maintenance, World Academy of Science, Engineering and Technology, 37, 402-410.

[21]. Francisco, J., Romero, R., Rajkumar, R., and Essam, S. (2019). Obsolescence Management for Long-life Contract: State of the Art Future Trends, International Journal of Maintenance Technology, 49(12), 1235-1250.

[22]. Gits, C. W. (2019). Structuring Maintenance Control Systems, International Journal of Operations and Production Management, 14, 5-17.

[23]. Godwin, H. C., and N., Martins, C., (2019). Impact of Maintenance Performance in Cable Manufacturing Industry: Cutix Cable Plc Hub example, International Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS) 4(1); 94-99.

[24]. Herald, T.,Verma, D., Lubert, C., and Cloutier, R., (2019). An Obsolescence Management Framework for System Baseline Evolution-Perspectives through the System Life Cycle. Systems Engineering, 12(1); 1-20.

[25]. Lloyd, C. (2019). Asset management: Whole-life Management of Physical Assets, Journal of Quality in Maintenance Engineering; 16(13); 134-146.

[26]. Loveday, A. N. (2019). Hire Purchase Strategy of Physical Capital Investment and Financial Performance of Construction Companies: Illustrating from the Nigerian Stock exchange, Mediterranean Journal of Social Science, 4(4); 449-460.

[27]. Love, C., Zitron, M. and Zhang, Z. (2019). An SMDP Approach to Optimal Repair/Replacement Decisions for Systems Experiencing Imperfect Repairs. Journal of Quality in Maintenance Engineering, 4(2); 131-149.

[28]. Lucey, T. (2018). Quantitative Techniques in Assuring Utilization of Equipment for Production: An Instructional Manual, International Journal for Building and Production Management 6(4) 36 -44

[29]. Madu, C. (2019). Competing through Maintenance Strategies, International Journal of Quality and Reliability Maintenance, 17(9), 691-698.

[30]. Mark C. E., Ogaji, O. T., and Probert, S. D., (2019). Planning Horizon Procedures for Machine Replacement Models with Several Possible Replacement Alternatives; Naval Research Logistics Quarterly, 29, 483-493.

[31]. Muñoz-Porcar, A., Alonso-Nuez, M., Flores-García, M. and Duret-Solanas, D. (2019). The Renewal of Assets using a Tool to Aid Decision Making. Management Decision, 53(7); 1412-1429.

[32]. Nepal, Madhav Prasad & Park, Moonseo, (2019). Downtime Model Development for Construction Equipment Management. Engineering, Construction and Architectural Management, 11(3); 199-210.

[33]. Nwabueze J., C. (2018). Vehicle Replacement in Government Parastatals: A Comparative Study of Major Government Replacement Policies. Global Journal of Mathematical Science and Operations research 2(1):37-41.
[34]. Offiong A, Akpan WA, Ufot E. **(2020).** Asset Life Cycle Management: towards Improving Physical Asset Performance in the Process Industry. International Journal of Operation & Production Ethics, 3(4); 566-579.
[35]. Opuwari, P. (2018). History of construction equipment; International Journal of Construction Engineering and Operations Management, 137(10); 14-18.
[36]. Osama, T. R. A. (2018). Total Productive Maintenance Review and Overall Equipment Effectiveness Measurement, Jordan Journal of Supply and Operations Management 4(4), 517-522.
[37]. Prabhuswamy, M., Nagesh, P. and Ravikumar, K. (2018). Statistical Analysis and Reliability Estimation of Total Productive Maintenance, Journal of Operations Management 12(1), 7-20.
[38]. Radnar, r. And Jorgenstin, d. R. (2020). Optimal Replacement and Inspection of Stochastically Failing Equipment, International Journal of Plant Maintenance, 5(2), 67 – 75.
[39]. Regnier, E., Sharp, G., Tovey, C. (2018). Replacement under Ongoing Technological Progress, International Journal of Engineering Transactions, 36, 497 – 508.
[40]. Shoitti, H. S. and Coria, R. T. V., (2019). A Multi-Stage Two-Machines Replacement Strategy using Mixture Models, Bayesian Inference and Stochastic Dynamic Programming, Communications in Statistics-Theory and Methods, 40, 702-725.
[41]. Tsado, T.Y. and Theophilus, Y. T., (2019). Equipment Maintenance: An Effect Aspect of Enhancing Construction Project Profitability, International Journal of Engineering Science Invention, 3(4); 34-41.

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