



e-ISSN:2582-7219



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 9, September 2023



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.54



6381 907 438



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Assessment of Equipment Maintenance Culture in Nigeria

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ABSTRACT: This study is centered on the evaluation of the prevailing equipment maintenance culture within Nigeria. The research pursues three specific objectives: identifying the factors contributing to subpar maintenance practices in Nigeria, ascertaining methods for augmenting the condition of public assets through improved maintenance practices, and investigating the repercussions of deficient maintenance culture on Nigeria's economic advancement. Employing a descriptive survey research approach, three engineering firms comprising a total staff population of 1200 were selected within Ogun state, Nigeria, as the focus of the study. The Yamane Taro method was employed to ascertain the study's sample size, resulting in a determined size of 300. Consequently, the simple random sampling technique was utilized to select respondents from the engineering firms. The data collected were subjected to descriptive statistical analysis and presented through frequency and percentage tables. The outcomes of the analysis uncovered that corruption, substandard work attitudes, and dysfunctional education are among the principal contributors to the unsatisfactory state of maintenance culture in Nigeria. A majority of the respondents (over 64%) concurred with this finding. Furthermore, it was established that public assets can be improved by fostering proper maintenance culture, with roughly 68% of respondents acknowledging that the formulation of policies for public infrastructure maintenance management serves as a means to enhance the quality of public assets through refined maintenance practices. Lastly, the study disclosed a noteworthy interconnection between Nigeria's economy and the degree to which infrastructures are upheld, a viewpoint shared by approximately 62% of the respondents. Conclusively, the study opined that Nigeria's inadequate maintenance culture is underpinned by a range of attitudinal challenges within the country. In light of this, it is advised that the Nigerian government formulates a comprehensive national policy focused on promoting maintenance culture that can be effectively implemented across all tiers of governance.

I. INTRODUCTION

Maintenance culture in this study suggests the habit of regularly and consistently keeping a machine, facilities, equipment, infrastructures etc. in good working condition. In support of this assertion, [1] posited that maintenance culture is the values, way of thinking, behaviors, perception and the underlying assumptions of any person or group or society that considers maintenance as a matter that is important and practices it in their life. If a nation must develop, it is imperative that installation as well as maintenance of its existing facilities be given priority.

This is more so for developing nations like Nigeria where there is a huge gap between the supply and demand for such facilities due to high rate of population growth and other factors [2]. Nigerian government, according to [3] took certain economic steps towards being among the best twenty economies in the world by the year 2020. Attaining sustainable infrastructural development by successive governments and cultivation and practicing maintenance culture are essential in achieving this vision.

Infrastructure facilities generally referred to as economic and social overhead capital which includes education, water supply, sewage systems, and energy. Others are postal and telecommunication services, transport system, hospitals and roads [4]; [5]. Governments (Federal, State and Local), private organizations and individuals need to have a strategy on how to maintain their infrastructural facilities to ensure sustainability of same. This can be achieved through



maintenance culture which is said to have a correlation with national development. It is common knowledge that the deplorable state of public facilities in Nigeria poses great concern to stakeholders.

Facilities at Nigeria's airports, hospitals, schools, roads etc. would give indication that the society lacks an agent that would have helped manage, ensure effective and efficient functioning of the facilities as well as fostering national development. Thus, [6], while working on the state of Nigerian Aviation Industry, opined that the flaws in the Nigerian Aviation sector was attributed to lack of maintenance culture and the training of professional engineers. The author further argued that, acquiring aircrafts is not as relevant to the industry as good maintenance of the existing ones, adding that a well-maintained aging aircraft is as good as a poorly maintained new aircraft.

This paper wholly agrees with the author. Existing maintenance records as posited by studies carried out by [7] had suggested the deteriorating nature of public facilities in terms of street lights that were erected some years back by the past and present governments that would have served as means of beautification and illumination in our society, but due to lack of maintenance culture in terms of bulbs replacement or fixing minor faults has turned our roads to death traps and hubs of illicit games, such as arm robbery stations.

Nigeria as a developing country is seriously confronted with insufficient resources for establishment of capital overheads or infrastructure which are essential for harnessing the available raw materials for production. But the desire to reshape, improve and develop the economy has been paramount in the various programmes, strategies and policies of the country. Since after independence, a large chunk of the country's resources have been channeled to transportation infrastructure construction, industries, government administrative buildings for ministries and parastatals, schools, colleges and universities. Besides, assorted types of vehicles, tractors and trucks are acquired for essential services.

All are geared toward repositioning the underdeveloped economy. However, one remarkable action needed to ensure sustainability of these varieties of infrastructure has not been given the right and sufficient attention. Maintenance culture which encompasses provision for adequate care of the hard earned infrastructure have not gained ground in the consciousness of resource managers in the country over the years, and consequently, you see government buildings at the verge of collapsing, abandoned factory plants and machinery, dilapidated school buildings, pot-holes and chasms on the constructed highway roads, deserted vehicles with minor problems, moribund industries and a host of other property belonging to the country which have little or insignificant problem. These actions in myriad ways have resulted to a colossal waste of scarce resources. It is really one of the major problems, hitherto ravaging and undermining the developing countries, especially Nigeria. Given this, [9] posits that maintenance is the art of bringing back the operating condition of an asset into normal functioning at a minimal cost capable of enhancing the life span of the item. In other words, maintenance is the ability and skill of keeping machines, equipment or infrastructures available for normal use and the designed life span of many infrastructures are at present very low in Nigeria.

Life span enhancement necessitates a culture of adequate maintenance. They are various perception of the term culture, but in this work culture is perceived as the key that influences behaviour of getting things done the right way without which there is a hindrance of the attainment of goals. It is shaped by the interaction between individual and groups that share the value, perception and goal they have assimilated from previously generation which is continued in other generations. Really, culture in the context of a work establishment or organisation is put in place when social relationship among members influences their pattern of thinking, behaviour and belief This implies that maintenance culture brings to bare the adoption of the attitude of ensuring regular servicing, repairs and maintenance of working assets or established system to guarantee their continuous usefulness.

II. REVIEW OF RELATED LITERATURE

Chukwuemeka and Nsobundu [10] aimed at integrating the efficiency and effectiveness of the production function into equipment and plant maintenance in Cutix Cable Manufacturing Plc. Nnewi, Nigeria, through the review of their maintenance input for the year 2017. The objectives were: 1. to identify the lapses in their maintenance culture using the maintenance performance productivity model, 2. to identify the effectiveness and efficiency of their production



system using the overall equipment effectiveness/efficiency model (OEE) and 3. to establish the correlation between their performance and the productivity of their system using the statistical analysis technique. Findings revealed 98.8 hours of breakdown resulting to ₦990,000 being cost of breakdown repair. Equipment effectiveness/efficiency varies throughout the year 2017 with values between 81% and 86%.

Prasanth et al. [11] worked on “total productive maintenance and role of interpretive structural modeling and structural equation modelling in analyzing barriers in its implementation –a literature review on total productive maintenance and the barriers in implementation of total productive maintenance (TPM)”. The study began with a brief description of TPM and the barriers in implementation of TPM. Interpretive Structural Modeling (ISM) and its role in analyzing the barriers in TPM implementation was examined and explained in brief. Applications of ISM in analyzing issues in various fields are highlighted with special emphasis on TPM. The studied moved on to introduce the Structural Equation Modelling (SEM) and its role in validating ISM in analyzing barriers in implementation of TPM. The studied concluded with a gap analysis from the current literature, research which can be further carried out and expected its outcomes from the proposed research.

Fredriksson [12], did “an analysis of maintenance strategies and development of a model for strategy formulation in Sweden”. The study found that More frequent and maintenance focused education opportunities for the maintenance craftsmen concerning new technology in assets will contribute to a higher level of efficiency and effectiveness for the maintenance work. The management should encourage the craftsmen’s ideas and utilize the competence they possess. This will also engage and motivate them to improve the organization which will facilitate reaching the desired state –a proactive environment. The authors noted that it is also essential that education concerning the ongoing changes within the organization is provided so that the customers gain knowledge about what is changing, why it is changing and what the objective of the change is. Otherwise, the resistance to change will most certainly be high.

Kariuki [13], studied the maintenance practices and performance of power sector in Kenya. The case study was done with a target population of all the three operational areas with different generation technology of hydro, thermal and geothermal. The study used primary data which was gathered by means of a self-administered questionnaire issued to respondents and secondary data which was extracted from internal operational reports in Eastern hydro power stations. The study established that KenGen has in place good maintenance practices. When they were benchmarked with world best practice, it was apparent that breakdown maintenances works were extremely high but surprisingly the plants availability recording very good results. There was a weak relationship between O&M cost, number of breakdowns and the plant availabilities.

Adedokun [14] analyzed “education for maintenance culture in Nigeria: Implications for community development”. Two null hypotheses were formulated and tested at 0.05 level of significance. The survey design used for the study are sample of 120 men and women at various governmental levels which were randomly selected from Oyo State Ministry of Agriculture, Department of Works and Services Ibadan North Local Government and the Ministry of Commerce and Industry. A 12-item questionnaire called Maintenance Culture for Development scale was constructed on a four-point Likert-type scale and used for data collection. The data was analyzed using chi-square statistical tool. The result indicated that there was a significant relationship between maintenance of facility and development and that education has a significant impact on maintenance culture.

III. METHODOLOGY

Research designs serve as frameworks within research proposals, illustrating how the intended variables of the study will be examined or manipulated to acquire essential data [15]. The adopted research design for this study is the cross-sectional qualitative research design. Employing the survey method, this study aims to uncover the perceptions of the relevant population regarding equipment maintenance culture in the Nigerian setting. This approach facilitates the exploration of existing conditions and the formulation of potential solutions. The selection of this design is grounded in its appropriateness for capturing research subjects’ opinions on pertinent matters, aligning well with the objectives of this study.



3.1 Area of the Study

The research is centered within Ogun state, Nigeria. Ogun state is situated within the South West geopolitical zone of Nigeria and is acknowledged as one of the six states in this region. Notably, Ogun state holds a prominent position as an industrial nucleus within Nigeria, housing numerous engineering firms distributed throughout its expanse. This industrial prominence is often attributed to its geographical proximity to Lagos state, a cosmopolitan metropolis in Nigeria. The strategic location of Ogun state in relation to Lagos contributes significantly to its industrial stature.

3.2 Determination of Sample size

The sample size was determined using the Yamane Taro sampling technique. The techniques essentially consist in using the following formula;

$$n = \frac{N}{1 + N(e)^2} \tag{3.1}$$

Where n = sample size

N = Total population of the study

e = degree of error (0.05 in this study)

Using equation 3.1, 300 was determined as the sample size for the study from a population of 1200 staff of Coloman cables, Lafarge Cement and Nigerian Machine Tools.

The study adopted simple random sampling technique to sample the respondents across the organisations. This method is considered convenience in that there is an equal chance for all the population who are considered knowledgeable enough to be selected. It was also adopted due to its time saving characteristic. The researcher doesn't necessarily have to wait for any specific respondents.

IV. RESULTS AND DISCUSSIONS

Table 4.1 provides an overview of the respondent's viewpoints regarding the role of corruption as a contributing factor to inadequate maintenance culture in Nigeria. Out of the total participants, 100 individuals, making up 33.3 percent, expressed strong agreement that corruption indeed constitutes one of the causes behind the deficient maintenance culture prevalent in Nigeria. Additionally, 93 respondents, equivalent to 31.0 percent, concurred that corruption plays a part in fostering poor maintenance culture within the country. A segment of 48 participants, accounting for 16 percent, remained undecided on this issue. In contrast, 41 respondents, corresponding to 13.7 percent, held a contrary perspective, indicating that corruption does not significantly contribute to poor maintenance culture in Nigeria. Lastly, the remaining 18 respondents, comprising 6 percent, strongly disagreed with the notion that corruption is among the causes of poor maintenance culture in the Nigerian context.

Table 4.1: Corruption is one of the causes of poor maintenance culture in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	100	33.3	33.3	33.3
Agreed	93	31.0	31.0	64.3
Undecided	48	16.0	16.0	80.3
Strongly Disagreed	18	6.0	6.0	100.0
Total	300	100.0	100.0	



With 64.3% of the responses agreeing that corruption is one of the causes of poor maintenance culture in Nigeria, this opinion is accepted as against 22% that disagree.

Table 4.2 presents an overview of the responses obtained from the participants regarding the role of attitudinal problems as a contributing factor to the deficient maintenance culture in Nigeria. From the collected data, 102 respondents, accounting for 34.0 percent of the total, expressed strong agreement that attitudinal problems indeed constitute one of the causes of the inadequate maintenance culture prevalent in Nigeria. Moreover, 135 participants, equivalent to 45.0 percent, concurred that attitudinal problems play a significant role in fostering poor maintenance culture within the country. A portion of 30 respondents, making up 10.0 percent, remained undecided on this matter. On the contrary, 21 respondents, corresponding to 7.0 percent, held a differing perspective, indicating that attitudinal problems do not significantly contribute to poor maintenance culture in Nigeria. Lastly, the remaining 12 respondents, comprising 4.0 percent, strongly disagreed with the assertion that attitudinal problems are among the causes of subpar maintenance culture in Nigeria.

Table 4.2: Attitudinal problem is one of the causes of poor maintenance culture in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	102	34.0	34.0	34.0
Agreed	135	45.0	45.0	79.0
Undecided	30	10.0	10.0	89.0
Disagreed	21	7.0	7.0	96.0
Strongly Disagreed	12	4.0	4.0	100.0
Total	300	100.0	100.0	

From the foregoing, it can be concluded that attitudinal problem is one of the causes of poor maintenance culture in Nigeria. This results from 79% of the responses inclining positively to this as against 11 respondents that disagreed.

Table 4.3 presents an overview of respondents' perspectives concerning the impact of poor educational infrastructure as a contributing factor affecting maintenance culture in Nigeria. Among the participants, 100 respondents, comprising 33.3 percent, expressed strong agreement that poor educational infrastructure indeed constitutes one of the factors influencing maintenance culture in Nigeria. Similarly, 93 participants, corresponding to 31.0 percent, agreed that poor educational infrastructure plays a role in affecting maintenance culture in the country. Conversely, 48 respondents, making up 16 percent, remained undecided on this matter. In contrast, 41 participants, equating to 13.7 percent, held a differing view, indicating that poor educational infrastructure does not significantly impact maintenance culture in Nigeria. Lastly, the remaining 18 respondents, comprising 6 percent, strongly disagreed with the notion that poor educational infrastructure is a contributing factor affecting maintenance culture in Nigeria.

Table 4.3: Poor infrastructure education is one of the factors that cause poor maintenance culture in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	100	33.3	33.3	33.3
Agreed	93	31.0	31.0	64.3
Undecided	48	16.0	16.0	80.3
Disagreed	41	13.7	13.7	94.0



Strongly Disagreed	18	6.0	6.0	100.0
Total	300	100.0	100.0	

64.3% of the responses agreed that poor infrastructure education is one of the factors that cause poor maintenance culture in Nigeria while 19.7 disagreed. Since the percentage of responses that agreed is greater than the percentage that disagreed, the former is accepted

Table 4.4 provides an overview of the responses obtained from participants concerning the influence of a lack of policy as a factor affecting maintenance culture in Nigeria. Among the respondents, 85 individuals, accounting for 28.3 percent, expressed strong agreement that the absence of policy indeed constitutes one of the factors influencing maintenance culture in Nigeria. Similarly, 142 participants, corresponding to 47.3 percent, concurred that the lack of policy contributes to affecting maintenance culture within the country. In contrast, 38 respondents, making up 12.7 percent, remained undecided on this matter. Conversely, 22 participants, equating to 7.3 percent, held a differing view, indicating that the lack of policy does not significantly impact maintenance culture in Nigeria. Lastly, the remaining 13 respondents, comprising 4.3 percent, strongly disagreed with the notion that the absence of policy is a contributing factor affecting maintenance culture in Nigeria.

Table 4.4: Lack of policy is one of the factors affecting maintenance culture in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	85	28.3	28.3	28.3
Agreed	142	47.3	47.4	75.7
Undecided	38	12.7	12.7	88.3
Disagreed	22	7.3	7.3	95.7
Strongly Disagreed	13	4.3	4.3	100.0
Total	300	100.0	100.0	

Since 75.5% of the respondents agree that lack of policy is one of the factors affecting maintenance culture in Nigeria, this opinion is accepted as against 11.6% that disagreed.

Table 4.5 provides an overview of respondents' perspectives concerning the role of formulating public infrastructure maintenance management policies as a means to enhance the quality of public assets through improved maintenance culture. Within this dataset, 116 respondents, accounting for 38.7 percent, strongly expressed agreement that the formulation of such policies indeed constitutes one of the approaches for elevating the quality of public properties via enhanced maintenance culture. Moreover, 85 participants, corresponding to 28.3 percent, indicated agreement with the notion that formulating public infrastructure maintenance management policies contributes to enhancing the quality of public assets through improved maintenance practices. Conversely, 52 respondents, making up 17.3 percent, maintained an undecided standpoint on this matter. On the other hand, 28 participants, equating to 9.3 percent, expressed disagreement regarding the role of policy formulation in enhancing the quality of public assets through improved maintenance culture. Lastly, the remaining 19 respondents, comprising 6.3 percent, strongly disagreed with the assertion that the formulation of public infrastructure maintenance management policies contributes to enhancing the quality of public properties through improved maintenance culture.



Table 4.5: Formulation of public infrastructure maintenance management policy is essential in entrenching improved maintenance culture in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	116	38.7	38.7	38.7
Agreed	85	28.3	28.3	67.0
Undecided	52	17.3	17.3	84.3
Disagreed	28	9.3	9.3	93.7
Strongly Disagreed	19	6.3	6.3	100.0
Total	300	100.0	100.0	

It is accepted that formulation of public infrastructure maintenance management policy is essential in entrenching improved maintenance culture in Nigeria. This results from a 67percent of total responses agreeing to this fact while only 15.6 disagree

Table 4.6 provides an insight into respondents’ viewpoints regarding the role of education and training for maintenance engineering and management personnel as a strategy to enhance the quality of public assets through improved maintenance culture. The dataset reveals that 85 respondents, accounting for 28.3 percent, strongly align with the assertion that education and training in this field indeed constitute a method for elevating the quality of public properties through improved maintenance culture. Additionally, 142 participants, corresponding to 47.3 percent, concur that education and training of maintenance engineering and management personnel contribute to enhancing the quality of public assets through improved maintenance practices. However, a segment of 38 respondents, making up 12.7 percent, remained undecided on this matter. Conversely, 22 participants, equating to 7.3 percent, held a dissenting perspective, indicating that education and training of maintenance engineering and management personnel are not among the approaches for enhancing the quality of public properties through improved maintenance culture. Lastly, the remaining 13 respondents, comprising 4.3 percent, strongly disagreed with the assertion that education and training of maintenance engineering and management personnel play a role in improving the quality of public assets through enhanced maintenance culture.

Table 4.6: Providing education and training of maintenance engineers can improve maintenance culture in Nigeria’s public sector

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	85	28.3	28.3	28.3
Agreed	138	47.3	47.3	75.7
Undecided	42	12.7	12.7	88.3
Disagreed	22	7.3	7.3	95.7
Strongly Disagreed	13	4.3	4.3	100.0
Total	300	100.0	100.0	



Evidently from the foregoing, an overwhelming number totaling to 75.7 percent of the respondents agree with the opinion that providing education and training for maintenance engineers can enhance maintenance culture in Nigeria. Thus, this is accepted as against the 11.6 percent who disagreed.

Table 4.7 outlines the responses collected from participants concerning the existence of a noteworthy correlation between inadequate maintenance culture and the economic conditions of Nigeria. Within this dataset, 98 respondents, comprising 32.7 percent, indicated a strong agreement with the premise that a substantial relationship indeed exists between poor maintenance culture and the economic situation in Nigeria. Similarly, 102 participants, equating to 34.0 percent, concurred that there is a significant connection between the two factors. Conversely, 53 respondents, making up 17.7 percent, held an undecided stance on this matter. In contrast, 33 participants, corresponding to 11.0 percent, expressed disagreement regarding the presence of a significant relationship between poor maintenance culture and Nigeria's economic status. Lastly, the remaining 14 respondents, comprising 4.7 percent, strongly disagreed with the assertion that a significant correlation exists between inadequate maintenance culture and Nigeria's economic conditions.

Table 4.7: Poor maintenance culture slows down the economic viability of infrastructures in Nigeria

Level of Agreement	Frequency	Percent	Valid percent	Cumulative Percent
Strongly Agreed	98	33.3	33.3	33.3
Agreed	102	31.0	31.0	64.3
Undecided	53	16.0	16.0	80.3
Disagreed	33	13.7	13.7	94.0
Strongly Disagreed	14	6.0	6.0	100.0
Total	300	100.0	100.0	

With 64.3% of the responses agreeing that poor maintenance culture slows down the economic viability of infrastructures in Nigeria, this opinion is accepted when compared to 19.7% that disagreed.

The data presented in Table 4.8 illustrates the responses provided by the respondents concerning the noteworthy impact of inadequate maintenance culture on the Nigerian economy. Among the participants, 150 individuals, constituting 50.0 percent, expressed strong agreement with the notion that poor maintenance culture significantly affects the Nigerian economic situation. Additionally, 73 respondents, corresponding to 24.3 percent, concurred that there is a substantial influence of poor maintenance culture on the Nigerian economy. A group of 32 respondents, making up 10.7 percent, remained undecided on the matter. Conversely, 25 respondents, accounting for 8.3 percent, held a dissenting view, indicating that there is no significant effect of poor maintenance culture on the Nigerian economy. Lastly, the remaining 20 participants, comprising 6.7 percent, strongly disagreed with the assertion that poor maintenance culture significantly impacts the Nigerian economy.



Table 4.8: Poor maintenance culture on infrastructure hinders economic growth in Nigeria

Level of Agreement	Frequency	Percent	Valid Percentage	Cumulative Percentage
Strongly Agreed	150	50.0	50.0	50.0
Agreed	73	24.3	24.3	74.3
Undecided	32	10.7	10.7	85.0
Disagreed	25	8.3	8.3	93.3
Strongly Disagreed	20	6.7	6.7	100.0
Total	300	100%	100%	

Evidently from the foregoing, 74.3 percent of the respondents agreed that poor maintenance culture on infrastructure hinders economic growth in Nigeria, while only a mere 15 percent of the respondents disagreed. Given this, the opinion that poor maintenance culture on infrastructure hinders economic growth in Nigeria is deemed to be true.

V. CONCLUSION

This research focused on investigating the consequences of inadequate maintenance culture and administration in Nigeria. The study conducted a comprehensive review of relevant conceptual, theoretical, and empirical literature. The outcomes of the research highlighted a notable and meaningful impact of poor maintenance culture on Nigeria's economic condition. Additionally, the investigation revealed that corruption emerges as one of the fundamental causes contributing to the prevailing poor maintenance culture in Nigeria.

Furthermore, the findings demonstrated a significant association between the deficient maintenance culture and Nigeria's economic landscape. The study also identified attitudinal problems as another pivotal factor driving the inadequate maintenance culture within the Nigerian context. Moreover, the research showcased that education and training for maintenance engineering and management personnel offer a viable avenue for improving the quality of public assets through enhanced maintenance practices.

In conclusion, the study established a substantial linkage between the subpar maintenance culture and its significant effect on Nigeria's economic condition. The collected evidence underscores the pressing need for addressing and rectifying the challenges posed by poor maintenance culture within the country.

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