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Evaluation of Building Maintenance Strategies in Public Buildings: A Case of Onikan Area of Lagos State Nigeria

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A B S T R A C T

Maintenance as a terminology has to do with a facility, people involved, the process, and the strategies employed or to be employed. This has always been a topic of discussion in Nigeria's building industry, thereby causing the professionals to be concerned about the best possible strategies and techniques for a sustainable maintenance culture as a means to the preservation of public facilities. Observations have shown that even after some of these strategies were effected, most of these buildings were still poorly managed. That necessitated the need to further analyse the strategies in use through post-occupancy evaluation. This will help to determine the effectiveness of these measures, and then further research on the probable reasons for their ineffectiveness. This research analysed the extent to which selected public buildings in Lagos state are maintained. Data for the research was collected from a review of literature, and a well-structured questionnaire which was administered to the users and managerial staff of the buildings. The data collected was analysed. The findings revealed that management issues and financial constraints are the major problems associated with maintenance of these buildings, the most frequently carried out strategies are the emergency maintenance strategy and the corrective maintenance strategy; whereas the most effective of the maintenance strategies is, the preventive maintenance strategy.

Keywords:**Building; Evaluation; Maintenance; Management; Public-Facility; & Strategies**

1. Introduction

Building maintenance is the effort made to keep a structure in good repair or to reinstate it to its original condition or to a revised and approved standard so that it can uphold its economic value and longevity (Olanrewaju, S., Anifowose, O.S., 2015). Building maintenance is a recurring topic in Nigeria because of the steady growth of dilapidating facilities in the country. Neglect of maintenance has accumulated consequences aiding the rapid increase in the deterioration of the finishes of a building; accompanied by a harmful effect on the inhabitants. Most buildings in Nigeria, public and private, undergo these challenges of maintenance that lead to multiple deteriorations and ultimate defects to various extents. For capital investments of any nation to uphold sustainability, a major and global concern, especially in developing countries where infrastructural development is still in the infancy, has been raised and the majority of government expenditures and investments in Nigeria, a developing country, focus on infrastructural development even though the developing nation still faces the problems of sustainability. The major focus of the government lies in granting contracts for new infrastructure, giving almost no attention to the maintenance of the already existing facility. A long-known remedy to the longevity of sustainability is the maintenance of the existing availability of infrastructural facilities and services.

Building maintenance problems are usuallyregarded asfaults or defects in the function, performance, laws, or user requirements of the building,which may occur in its structure,service, or other facilities (Dahal, R.C., & Dahal, K.R., 2020). Construction defects mainly occur in the operation phase of construction.Themaintenanceof suchdefectsis not only manifested initself but also manifested before and during the construction phase.Construction

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defects are dividedinto latent defectsand patent defects (Saka, A.B., Olaore, F.O. & Olawumi, T.O, 2019). Patent defects can be identified during inspections during the construction period and the Project DefectLiabilityPeriod (DLP). Latent defects often appear over time the building is occupied. The most detective elements in architectural works are doors and finishes (Kameli, M., Sardroud, J.M., Hosseinalipour, M., Behruyan, M. & Syed, M., 2019) plumbing fixtures, electrical systems, and air conditioning systemsare oftenthe most flawed in mechanical engineering. There iswidespread dissatisfaction with the selection and acquisition of certain materials, equipment, and specifications,whichcreates operational problems when taking over the building.

The mainbuilding maintenance problems are 15% of electrical problems, 28% of plumbingwork,26% of cracks, 10% of painting work, 5% of construction work, floor, and 16% of elevator repairs (Bhargava Reddy, P., Ratnamala R.S., & Asadi, S.S, 2018). In addition, the main maintenance issues are hygieneissues, water leakage, elevator stops, and humidity. The common problems faced by operations and maintenance departments can be divided into three categories: management problems, human resourcesproblems, and technical problems (Alshehri, A., Motawa, I. & Ogunlana, S., 2015). The operation and maintenance industry facesfourteenmajor obstacles. They include;high-levelmanagementissues (improper maintenance team management,procurementmanagement,unskilledmaintenancecontractors,governmentregulations and standards,stakeholdercommunication), human resourcesissues(lack of supervisionby the maintenanceteam,lack of engineers and experts,training and motivation,jobdescription and departmentstructure is not clear,lack of awareness),technicalproblems(lack of maintenancesoftware,shortage of spraygun parts,preventivemaintenance failure). A survey was conducted in JimmaCity,Ethiopia, to find out the causes of defects, factors affecting maintenance management, and maintenance management practices forlow-costbuildings. The research found the following maintenance problems and sortedthem indescending order of weight (Awol, A., Adugna, T. & Alemu, M., 2016)

Maintenance culture is a lifestyle that is lacking and is one of the problems affecting maintenance in the country (Ebekozien, A., 2020). (Chukwudum J.E., Juliet A.O. & Stella. N.Z,, 2018) states that poor maintenance exercises have become a recognizably notable problem in Nigeria, which has affected the state of public properties. As maintenance issues began to receive attention in the country, many strategies and policies were formulated and tested to increase the servicelife of buildings; therefore, architects and designers began to implement these methods. It was observed that even after some of these means effected, buildings were still poorly managed and therefore dilapidating. Further analytic strategies such as post-occupancy evaluation needed to be carried out to determine the effectiveness of these measures and then further research on the probable reasons for their ineffectiveness. Therefore, this study aims to examine the adequacy of building maintenance strategies in entertainment centres in Lagos. The objectives the research seeks to achieve include;

1. To examine the causes of poor building maintenance practices in public buildings in Nigeria,
2. To analyze the strategies that aid building maintenance,
3. To evaluate the extent these strategies are being implemented.

2. Methodology

2.1 Study Area

The study was conducted in Onikan, Lagos State, Nigeria. Onikan is the home of major stadia in the city; the National Theatre, Tafawa Balewa Square, and the Music Society of Nigeria (MUSON) centre. Lagos State is located in the geopolitical area of southwestern Nigeria.Lagos State is the smallest state in Nigeria. It can be said to be the most important state in the country's economyand the largest urban area. It is animportant financial centre and willbecome the fifth-largest economy in Africa if it is a country initself. It also has the highest population density of any state in Nigeria; the actual total population is disputed between the 2006 Nigerian official census and the higher figures claimed by the Lagos state government. Lagos State bordersOgunState in the north and east. In the west, it borders the Republic of Benin. Its southern border is the Atlantic Ocean,and 22% of its 3,577 square kilometres are lagoons and streams.

2.1.1 National Theatre

The building was constructed under the Gowon regime in Nigeria and it is dedicated to promotingNigerian art and culture, as well as theirprotection and display. The World Festival of African and Black Art and Culture will be held thereafter itsconclusion. Since its inception,numerous national and international events have been held there. The theatre has a simple circular design with a central bowl and some concentric circles for restrooms and other convenience facilities, as well as corridors, parking lots, and public facilities, located on the Floor in differentlocations. The house is located in a large

green area, based on the principle of concentricity. The Main Bowl: Itcanhold 5,000 seats and 3,500 seats onthestage. It is a multifunctional space. It has a folding stage, a movie projector, and three rows of curtains,which can be used for variousactivities, such as dramas, concerts, sports events, etc.
Cinemas:Thereisa secondcinema,which can accommodate 700 people,and each cinema is equipped with standard movie projectors and stage installations.
Conference Hall:a room that can accommodate 1,500 people anda stage.
Exhibitionhalls:The second exhibition hall is about 1830 square meters.

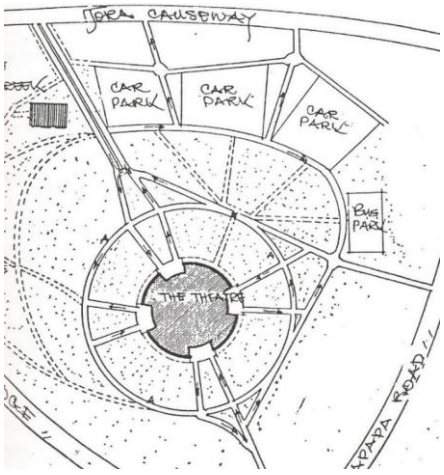

Plate 1: National Theater site plan(Anon., 2021)

The theatre has four (4) large entrances: "A","B","C" and "D", entrance "A"is used as VIP entrance, and entrances"B" and "D"are used as an entrance. Corridors to other spaces, such as lounges, shops, and bars, and the "C" entrance as the main entrance. Showrooms:the second showroom is about 1830 square meters.

Plate 2: National Theatre aerial view (Anon., 2021)

2.1.2 Tafawa Balewa Square (TBS)

Lagos state racecourse now TBS, was a sports field that organized horse races but also included in the field, a ground to play soccer and cricket. Oba Dosunmu provided the land to the Colonial Construction authorities in 1859, who thereafter constructed the surrounding areas. The course was later destroyed by the Government of Yakubu Gowon to give way to Tafawa Balewa Square. On its better days, the course hosted Empire Day parades. The horseracing track was approximately 7 to 8 furlongs or miles. In 1960, the course was re-developed to celebrate the lowering of the Union Jack and Nigeria's independence. TBS was built in 1972 on an abandoned horseracing track. Awolowo Road, Cable Street, Force Road, Catholic Mission Street, and a 26-story independence building along its perimeters bound it. At the entrance of the square, four gigantic white horses are hovering above the gate

and a giant sculpture of seven red eagles, which are the national emblems symbolizing strength and dignity respectively. Other monuments on the square include Remembrance Arcade 1 (the monument to the victims of World War I, World War II, and the Nigerian Civil War) and the 26-story Independence house built in 1963, which has long been the tallest building in Nigeria. The square can accommodate 50,000 people. It also has plaza facilities include shopping centres, airline travel agencies, restaurants and parking lots, and a bus terminal. TBS's main national events include the celebration of Nigerian independence, which took place on October 1, 1960, with a speech by Prime Minister Tafawa Balewa, Democracy Day, as well as other colorful events, such as music festivals and religious gatherings.

Plate 3: Tafawa Balewa Square stage(Author's fieldwork 2021)

2.1.3 Music Society of Nigeria (MUSON) Centre

The Nigerian Music Association (MUSON) was established in 1983 (before the inauguration of the centre's facilities by Prince Charles in 1995) on the site of the former "Garden of Love". The establishment of MUSON stems from the commitment and dedication of some outstanding Nigerians and foreigners to inspire Nigerians, especially due to their love and recognition of the richness of classical music on the lake. The need for music training and teaching prompted the establishment of the MUSON School of Music in 1989. MUSON represents the joint committee of the Royal Academy of Music of Nigeria (ABRSM) and provides ABRSM theoretical and practical exams. MUSON regularly organizes concerts in Nigeria and Western genres. The MUSON Choir began performing in 1995, and the MUSON Symphony Orchestra, Nigeria's only professional symphony orchestra, began performing in 2005. They perform regularly at the annual MUSON musicfestival and the Association's concerts. The MUSON Choir and the MUSON Symphony Orchestra are also invited to perform outside of MUSON. Facilities in the MUSON centre include the Shell Hall Nigeria, AGIP Recital Hall, and MUSON garden, Board Room 1, Board Room 2, and the function room.

Plate 4: AGIP recital hall 3D view (Author's fieldwork 2021)

2.2 Research Design

The research design used in this study is descriptive. Due to the use of frequency and percentagetodescribe the characteristicsof thedata (Khalid, 2019) or variables. Large amounts ofdata, such as published and unpublished materials in books, encyclopaedias, websites, journals, research materials, seminars, conferences, and worksheets (including documents, maps and sketches, and related publications)are used to extract these data.

2.3 Sample size

The size of thesurvey sample refers to the number of participants or respondents included in the study (Sim, J., Saunders, B., Waterfield, J., & Kingstone, T, 2018). To gather information about the maintenance strategies of entertainment halls in Lagos state, questionnaires were administered to both staff and users of the selected entertainment centres for four weeks in April 2021. The sample size is determined by howwell it represents the population.
There are multiple ways to obtain the sample size. Some examples are Cochran'slimited population formulaor the use of research consultants. The Cochran formulaused to determine the finite population sample size is as follows

$$n^1 = \frac{n_0}{\left(1 + \left(\frac{n_0 - 1}{N}\right)\right)}$$

Equation 1: Cochran's formula(statisticshowto.com, 2021)

Where,
n^1 = sample size for finite population
n_0 = Cochran's sample size for infinite population = 384
N = population size
Therefore,

$$n^1 = \frac{384}{\left(1 + \left(\frac{384 - 1}{10131}\right)\right)} = 370$$

Equation 2: Derived population formula (Author's fieldwork 2021)

From the calculation, a sample size of 370 was derived. Therefore, a sample size of 370 was used.

2.4 Data collection instruments

The instrument for collecting data was a self-administered questionnaire. Questionnaires ensure that questions posed to all respondents are phrased consistently and this allows an objective evaluation of results. The questionnaire was made of close-ended questions in combination with Likert Scale questions and had two sections. Section A addressed biodata, personal characteristics, and demographic details of the respondents as well as the purpose of visit to the selected venues. Section B on the other hand, asks questions related to the respondents' perception of the maintenance state of the buildings. The researchers ensured to enforce ethical measures in the administration of questionnaires and handling of data.

2.5 Data Analysis

Statistical tools used for data analysis are a statistical package for the social sciences (SPSS 23) where frequencies and percentage distribution (expressed using tables) mean score rating, factor analysis, and backward stepwise regression.

3. Results and Discussions

3.1 Characteristics of Respondents

This section reviews the results and analysis of the qualitative data used for this research, a compilation of the results derived from the questionnaire responses, and an analysis of the findings. Though, some findings have been discussed to identify similarities between this study and previous studies in

the literature review. The responses to the questionnaire are arranged with tables and inferences are made below.

Table 1: Gender

GENDER	NUMBER OF RESPONSES	PERCENTAGE
FEMALE	231	59.1%
MALE	159	40.9%

Table 1 shows the statistic gender of the total number of people that participated in the study. More females participated in the survey.

Table 2: Age

AGE	NUMBER OF RESPONSES	PERCENTAGE
16-25yrs	110	28.2%
26-35yrs	107	27.4%
36-45yrs	96	24.6%
46- 55yrs	59	15.1%
above 55yrs	18	4.7%

Table 2 shows the age statistics of the respondents with the mode being 16-25 years of age. The result of table 6 shows that 24.5% of the population visit these venues very frequently while 54% visit frequently. This implies that the participants are conversant with the state of the building as frequent visit gives them the awareness needed. This information helps to back up the credibility of the answers. Having frequent visits to a particular place will eventually cause a person to notice the difference in minute details of a place with every return.

Table 3: Level of Education

LEVEL OF EDUCATION	NUMBER OF RESPONSES	PERCENTAGE
O-level	36	9.1%
BSc	177	45.5%
MSc	159	40.9%
PhD	18	4.5%

Table 4: Entertainment Centre

ENTERTAINMENT CENTER	NUMBER OF RESPONSES	PERCENTAGE
Tafawa Balewa Square	160	41%
Music Society of Nigeria (MUSON) Centre	35	9%
National Theatre	195	50%

Table 5: Frequency of Visit

FREQUENCY OF VISIT	NUMBER OF RESPONSES	PERCENTAGE
Very frequently	95	24.5%
Frequently	210	54%
Neutral	50	12.8%
Not frequently	35	8.7%
I do not visit any of the places	0	0%

Table 6: Basis of Visit (Author's fieldwork, 2021)

BASIS OF VISIT	NUMBER OF RESPONSES	PERCENTAGE
As a visitor or guest	297	76.1%
As a member of staff	93	23.9%

The result in **Table 6** reveals the relationship of respondents to the building and 23.9% being staff of these venues helps to ensure further credibility of the answers provided, as the perception of the state of the building will be from the people directly involved in managing the buildings.

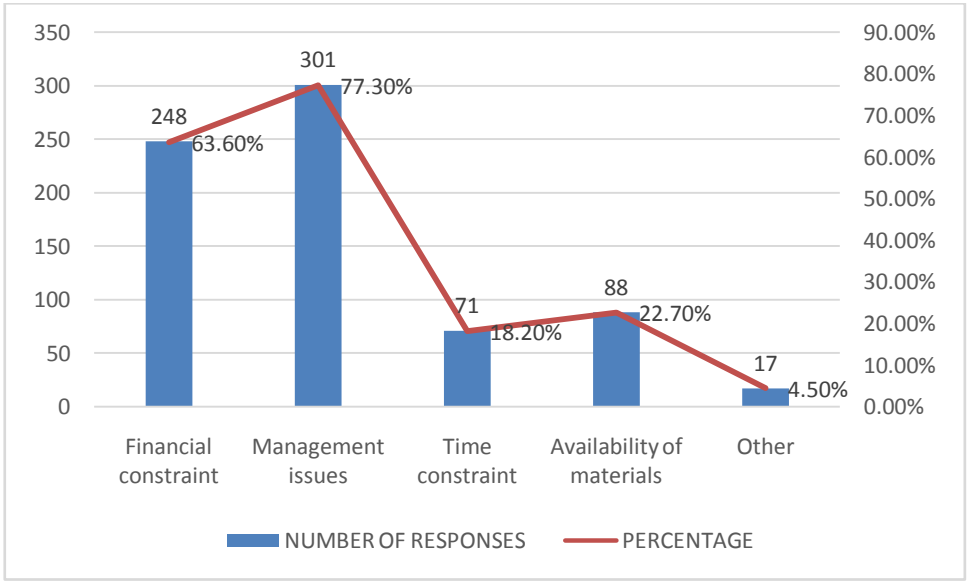

Figure 1: Factors that hinder the maintenance process

In **Figure 1**, it is revealed that the major cause of maintenance problems stems from managerial issues. This could include improper planning, poorly done maintenance schedule from inception, and many more. The second major cause of poorly maintained buildings is the lack of financial power for the upkeep of the buildings. This can also be because of managerial issues where funds needed for the upkeep are not properly handled and therefore limits the budget for the building's touch-up.

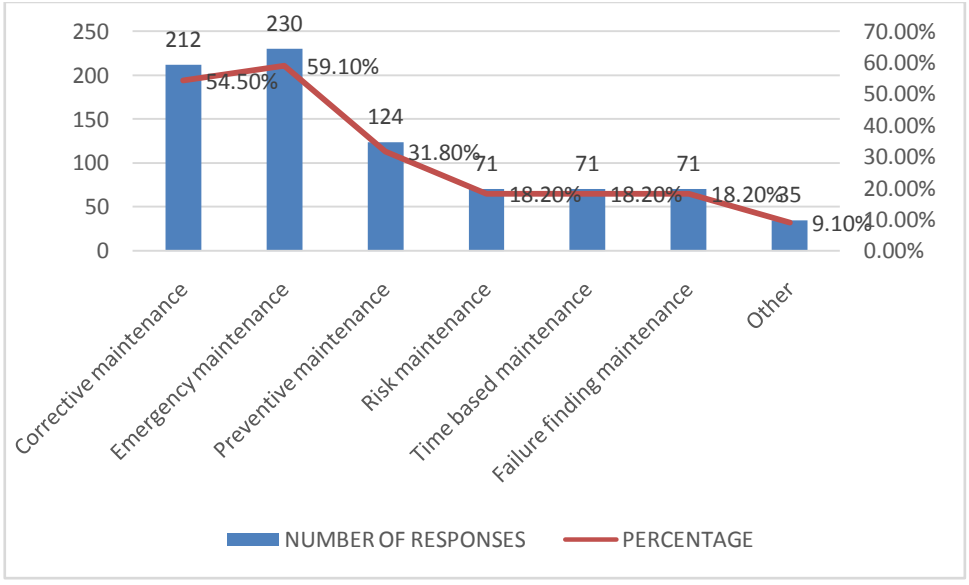

Figure 2: Familiar maintenance types

Figure 2 shows that the most familiar maintenance technique is emergency maintenance, the type done when a part of the building component suddenly breaks down. The other is corrective maintenance, similar to the emergency maintenance that is carried out to repair the damage done to the whole or part of a building.

Table *7*: When is the building maintained?

WHEN IS THE BUILDING MAINTAINED?	NUMBER OF RESPONSES	PERCENTAGE
After damage has occurred	167	42.9%
When the building is under a threat	130	33.3%
Periodically according to a maintenance schedule	167	42.9%
Before damage occurs	112	28.6%
To fix any probable failures or faults in the building	37	9.5%

Table 8: Frequency of building maintenance

HOW FREQUENTLY IS THE BUILDING MAINTAINED	NUMBER OF RESPONSES	PERCENTAGE
Very frequently	18	4.6%
Frequently	55	14.3%
Neutral	169	43%
Not frequently	148	38.1%
Never	0	0%

It is evident in **Table 7** that the buildings are usually mostly maintained after the damage has occurred (emergency/ corrective maintenance) or periodically, according to a maintenance schedule. **Table 8**, on the other hand, indicates that these buildings are maintained neither less frequently nor very frequently but in optimum amounts of time, neutral at intervals.

Table 9 and **Table 10** discuss the appearance of the buildings. It is observed that the general outlook of these buildings has a neutral look, neither making it very good nor very bad; although 22.7% agree that it appears to look good. In general, 66.6% concur that the buildings have been sustained in optimum conditions.

Table 9: General building outlook

GENERAL BUILDING OUTLOOK	NUMBER OF RESPONSES	PERCENTAGE
Very good	53	13.6%
Good	88	22.7%
Neutral	213	54.5%
Bad	26	6.7%
Very bad	10	2.5%

Table 10: Is the building in optimum conditions?

IS THE BUILDING IN OPTIMUM CONDITIONS?	NUMBER OF RESPONSES	PERCENTAGE
Yes	260	66.6%
No	130	33.4%

Table 11: Effective maintenance strategy

WHICH OF THESE STRATEGIES ARE MORE EFFECTIVE TO YOU?	NUMBER OF RESPONSES	PERCENTAGE
Corrective maintenance	71	18.2%
Emergency maintenance	126	13.6%
Preventive maintenance	248	63.6%
Risk maintenance	89	22.7%
Time based maintenance	142	36.4%
Failure finding maintenance	88	22.7%
Other	0	0%

Table 11 shows that the most effective maintenance strategy is the preventive maintenance strategy according to the survey conducted.

4. Findings and Conclusions

The questionnaires were distributed to the visitors/ end users of the building and the managerial staff of the building. **The result** shows the knowledge of maintenance strategies most common to them are emergency maintenance, corrective maintenance, and preventive maintenance. This implies that the maintenance strategies mostly carried out on the buildings is that of repair and sometimes, to prevent damage to specific components of the building frame. Findings show that the most effective maintenance strategy to be carried out on the buildings is preventive maintenance. It makes it more evident that the buildings are maintained mostly after these damages have occurred. Also, periodically, according to a maintenance schedule, maintenance is carried out on these buildings. This helps to keep the building standing longer and elongate its life span and optimum performance. On a general note, the buildings have been said to be in a neutral aesthetic state and a neutral look. The implication of this is that the buildings, although not perfectly maintained to standard measures, have upheld their initial building integrity from after construction and use.

Maintenance has always been a topic for discussion in the built industry of Nigeria thereby causing the professionals to come up with techniques for sustainability. Observation has shown that even after some of these means were effected, buildings were still poorly managed so the need for further analytic strategies such as post-occupancy evaluation needed to be carried out to determine the effectiveness of these measures and then further research on the probable reasons for their ineffectiveness. Also, creating a maintenance schedule to guide the affairs of the building maintenance by the architect from inception and may help managerial staff to plan the funds needed for the maintenance exercise. This research recommends paying attention to one building with expansive analysis that will give a more detailed explanation of the maintenance strategies used in the building and the extent of their effectiveness.

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