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YARDSTICKS FOR EFFECTIVE MAINTENANCE OF PUBLIC BUILDINGS IN NIGERIA: A CASE STUDY OF ONDO STATE

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Abstract:

Building maintenance has until recently been a neglected issue in most of our government policy formulation and execution. The sustainability of such maintenance demands serious attention. However, the study is aimed at developing yardsticks for effective maintenance of public buildings in Nigeria, with due consideration given to identifying noticeable defects and causes associated with public buildings. The study was carried out in selected public buildings of the three Senatorial Areas of Ondo State, wish are Post Offices, Libraries and Schools.In achieving the aim of the study, seventy-eight (78) retrieved questionnaires were analyzed using Relative Significance Index (RSI). The findings showed that users attitude to staining of paintwork at wall surfaces, peeling of plastered/rendered surfaces; leakages of waste/water pipes causing dampness: amongst other were the types of defects in the building facilities, while it was equally revealed that care free attitude of the users/occupants of the buildings, use of inferior materials, lack of regular check-up of the building for early detective for effective maintenance, Poor workmanship due to lack of control and proper monitoring, availability of fund to quickly effect remedy when the need arises were among major causes of the defects in the building facilities. The paper, therefore, recommends that there should be awareness for users/occupants in the usage of the buildings, regular check-up of the building for early detective and prompt response to provision of fund for maintenance work, early engagement of professionals, strict compliance to specifications and good workmanship to enhancing effective maintenance of the buildings.

Keywords: Buildings, Public Buildings, Maintenance, Yardsticks for Maintenance, Ondo State.

Introduction

Building maintenance is an important programme for the sustainability of infrastructural development (Baba &Buba, 2013). While Adenuga (1996) observed maintenance as an issue that is concerned with the planning and control of contribution resource to ensure that necessary repair and renewal are carried out with maximum efficiency and economy, Eti et al. (2006) &Ajibola (2009) submitted that maintenance is the work that is done regularly to keep a building in good conditions, and as near as possible in their original state. According to Igiri (2003), buildings are crucially to man existence and survival. It plays an important role in the actualization of the goals and objectives by satisfying the physical and emotional needs of the occupiers and users (Zulkarnain*et al.,* 2011, Asabiaka, 2008). According to Ogunmakinwa, Akinola&Siyanbola,(2013), maintenance of building received little attention from the users, designers and contractors. The users do not always make use of the property and the services in good condition. Often, users do not obey the information contained in the maintenance manual of the building if at all it exists. Most property owners sometimes

endeavour to keep maintenance expenditure to the least, eliminating the consequences of the long-term effect of such action.

The condition in most of the publicbuildings in Ondo state consequently reveals a pathetic picture of neglect, deterioration, decay, dilapidation and threatening collapse (Ogundipe, 2005). Corroborating this, Adenuga, Odusanmi&Faremi, (2007), opined that, culture generally in public sector in Nigeria suffered from lack of funds for a considerable time. In Adenuga and Iyagba (2003) as mentioned by Adenuga, Odusanmi&Faremi (2007), it is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, requisite building materials and methods. Therefore as the components of a building begins to deteriorate, it becomes necessary to take measures to ensure that the desired characteristics of that facility, which provides safety and convenience are retained. Thus, their production is accorded huge financial budget. All these reveal the need for a critical look at our building maintenance culture in our national life (Akingbohungbe, 2000).

What is Public Building?

Public buildings are any type of building that is accessible to the public and is founded from public sources. All types of governmental offices are considered public buildings. Examples are: post offices, libraries, courthouses and public schools. (VanBaren, 2017, Designing Buildings, 2017). While Designing Buildings (2017) opined that only those public schools that are also used for daily community functions are regarded as public schools. VanBaren, (2017) was of the opinion that any school that is funded through governmentare regarded as public school.

MATERIALS AND METHODOLOGY

Overview of Maintenance Culture in Nigeria

Most public and private buildings in Nigeria are faced with maintenance challenges resulting in deteriorations and ultimate defects of various degrees (**nairaproject.com, Online 2017; Mbamali 2003;**Olanrewaju&Anifowose, 2015). Maintenance according to BS 3811 (1984) is the combination of all technical and associated actions intended to retain an item or restore it to a state in which it can perform its required function.

It is a well-known fact that the primary objective of building maintenance is to preserve buildings in their initial functional, structural and aesthetic states (Adejimi, 2005). This is to ensure that such facility continues to remain in such state and retain their investment value over a long period of existence, and provide safe and conducive environment for the performance of various human activities (Baba &Buba 2014). Yet, Mbamali (2003) opined that poor maintenance culture has become a widely recognized problem in Nigeria which has poorly affected the quality of public properties. Corroborating this, Nairaproject (Online, 2017) said that maintenance culture in Nigeria is one of the lowest around the world, especially, in our principal towns and cities where the majority of public properties are located.

Moreover,Akingbonhungbe (2000) said that maintenance attitude remain low at individual and government level. Maintenance culture in Nigeria is one of the lowest around the world, especially, in our principal towns and cities where the majority of public properties are located. The physical buildings (except new one and a few others) wear blistering and fade look with many door key window screen (glasses) already disused.

What is Maintenance Culture?

The Oxford Advanced Learner's Dictionary (2005) in this context defined maintenance as the act of keeping something in good condition by checking or repairing it regularly. While BS 3811(1984) defined maintenance as the combination of all technical and associated administrative actions intended to retain an item in or restore it to a state in which it can perform its required function, BS 3811 (1974) defined building maintenance as work done to keep a building in, or restore it to its initial state, or to a currently acceptable standard. To retain implies that defects are prevented from developing by carrying out work in anticipation of failure, and to restore means that minor defects had already occurred before they are corrected; in order for an item or facility to continue to perform its required function, some degrees of improvement are needed over the life span of the building as standards of comfort and amenity arise where there are statutory requirements for maintenance (Olanrewaju and Anifowose, 2015). Whereas, Olagunju (2012) opined that maintenance of buildings therefore needs cure so as to enhance durability, improve quality of life, protection of human health and the environment.

Ahmed (2000) and Odediran et al. (2012) were of the opinion that maintenance program in Nigeria has not received much attention in the past as the emphasis is on the development of new properties. This is also in line with the statement of Kunya et al.(2007) who observed that there is an apparent lack of maintenance culture in Nigeria, and that emphasis is placed on the construction of new buildings for public sector and neglecting the aspect of maintenance which commences immediately the builder leaves the site. Zubairu (1998) stated that the country does not have a maintenance policy which resulted in the persistent problems of building maintenance. Execution for maintenance work is mostly left for the maintenance department to handle on direct labour basis or contract. Jobs of higher amounts, according to Kunya et al. (2007), are given out in form of maintenance contracts to mostly unqualified maintenance contractors.

Types of Maintenance in Building

Maintenance, according to BS 3811 (1984), is subdivided into planned and unplanned maintenance. While planned maintenance is subdivided into preventive maintenance, corrective maintenance, predictable maintenance and schedule maintenance. Unplanned maintenance also, is subdivided into unpredictable maintenance, avoidable maintenance and emergency maintenance.

Purpose of Maintenance Culture

Ajibola (2009) was of the opinion that we must imbibe maintenance culture in order to enjoy the best value for our money, for us to enjoy the best of life, for how well we use and enjoy our buildings, household equipment, furniture etc, dependent on how well we have imbibed the culture of maintenance. The purpose of carrying out maintenance work on buildings according to Adejimi (2005), is to preserve the building in its initial state as far as practicable in order to effectively serveits desired purpose.

Al-Zabaidi (1997) identified some of the main purposes of maintaining building as follows:
i. To preserve a building in its initial state as long as practicable so that it serve effectively the purpose for which it is built.
ii. To maintain an acceptable quality standard in term of structural stability to meet the current taste and demand.
iii. To attract higher rental value whenever such buildings are to be placed on commercial use.
iv. To assist in the minimization of production cost
v. To keep down time and maintenance costs themselves to a minimum.
vi. To maintain and retain aesthetic value
vii. To improve the general condition of such buildings.
viii. It must also be stressed that in as much as it is hardly feasible to produce building that are maintenance free, the amount of necessary building maintenance work could still be kept to a minimum through improved method of design, specification and construction as well as feedback of maintenance data to the designer (Akingbohungbe, 2002).

The Need for Maintenance in Building

Previous studies revealed the effects of numerous factors affecting building for necessary maintenance. Assaf (1996) opined that design and construction faults that affect maintenance of buildings are defects in structural design, defects in architectural design, defects due to consultants firm's administration and staff, defects due to construction drawings, defects due to construction inspections, defects due to construction, defects due to contractual administration, defects of construction materials, defects due to construction equipment, defects arising from specifications and design defects in maintenance practicability and adequacy.

Adejimi (2005) asserted that to a large extent, building maintenance problems can be attributed to problems originating from poor design. Adejimi (2005) in his study identified twelve relevant factors affecting the maintenance strength of buildings as design resolution, structural strength, specified material strength, maintenance manual, safety measures, skill maintenance personnel, maintenance plants, environmental factors, usage factors, quality control factors and post construction prevention strength. Kiong and Akasah (2012) analyzed the maintenance factors for IBS precast structural system in Malaysia in order to produce a better quality of the IBS precast building. They identify design aspect as an important factor of the building quality.

Zulkarnain et al.(2011) reviewed the critical success factor in building maintenance management practice for University sector under four perspectives; customer (customer satisfaction, service quality, customer complaint, reaction to customer needs), internal processes (service excellence, technology capability, customer employee, competence, process efficiency, e.t.c.), financial perspective (management expectations, financial growth, cost reduction, productivity improvement, e.t.c.) and learning and growth perspective (technology leadership, continuous service improvement, upgrading staff competence, e.t.c.). They concluded that critical success factors can help in providing a successful competitive performance for the university sector in the area of maintenance management. Olagunju (2012) identified factors that influence the level of maintenance of building standard. In the study, eight factors were identified to be significant to physical condition of building in Niger State, Nigeria. The variables are structural components condition, roof components, toilet facilities, discharge of waste water component, exterior wall condition, condition of walkway within the building premises, electrical wire and switches conditions, interior walls surface condition.

The Study Area

The Study was carried out in three senatorial areas of Ondo State. That is The Southern, The Central and The Northern Senatorial Areas of Ondo State.Ondo State was carved out of the old Western State as one of the seven states created on February 3, 1976 (Ondo State, 2010 and myondostate.com, online, 2015). The State is dominated by Yorubas who speak various dialects in the Yoruba language. Education is accorded higher priority by the state government with the state reputed as the education factory of Nigeria as a result of emphasis in the sector over the years with more than 2,000 Public buildings, ranging from primary, secondary, technical schools and tertiary institutions; some, which are owned by the federal government, some by the state government and the rest by private corporations/individuals. Other public institutions arehospitals, event centers, markets buildings, government offices, post offices, libraries, etc.

Research aim and objectives

The aim of the study is to determineyardsticks for theeffective maintenance of public buildings in Ondo State with a view to proffering solutionsfor effective maintenance of public buildings. The objectives are:

(1) To assess thenoticeable defects associated with public buildings in Ondo State.
(2) To assess major causes of defects associated with public buildings in Ondo State.
(3) To determine yardsticks for the effective maintenance of public buildings in Ondo State

Methodology

In an attempt to achieve these objectives, data were obtained from both primary and secondary sources. Primary data were collected through the administration of a well-structured questionnaires administered to organization heads, technical staff of public buildings,users of the public buildings andpofessionals in the building industry as well as oral interview. Seventy eight (78) questionnaires were returned out of the

one hundred (100) administered. Secondary data comprised information which was derived from textbook, paper presentation, journal and information from the internet which were relevant to the study. The method adopted for this are the major tools used to validate the project research question. The study areas are the three senatorial areas of Ondo State. The research adopted both quantitative and qualitative frame work with a case study design approach adopted to identify the concept yardsticks for effective maintenancewith particular reference to some selected public buildingsin Ondo State. They are: Post Offices; Libraries and Schools.

The Likert scale involving rating on interval scale of 5 and 1 developed for application in social sciences and management researches for quantification of qualitative variables was used. "Extremely Important" (EI) were scored 5, "Very Important" (VI) were scored 4, "Somewhat Important" (SI) were scored 3, "Not very Important" (NVI) were scored 2 and "Not Important" (NI) were scored 1. Bakhary (2005), Olanrewaju and Anifowose (2015) gave an equation that could be useful for determining the:

Relative Significance Index (RSI) in prevalence data as:

$$\mathbf{RSI} = \frac{\sum \mu}{AN}$$

Where μ is the weighting given to each factor by respondents;

A is the highest weight (i.e. 5 in this case);

N is the total number of respondents

But for this type of research work where a 5-point scale was used, the RSI shall be calculated via the equation:

$$\mathbf{RSI} = \frac{5a + 4b + 3c + 2d + 1e}{jN} \qquad (0 < \text{index} < 1)$$

And

$$\mathbf{TWV} = \sum (5a + 4b + 3c + 2d + 1e)$$

Where: a = number of respondents "extremely important and perfectly known",

b = number of respondents "very important and partially known"

c = number of respondents "somewhat important and known"

d = number of respondents "not very important and partially unknown"

e = number of respondents "not important and perfectly unknown"

N = sample size, i.e. total number of respondents = 78

j = number of response categories = 5

2. RESULT AND DISCUSSIOON.

The data were presented using tables for clarification and better interpretation. The analysis tools included both descriptive and inferential statistics.

Table 1: Type of Respondents in order of its frequency

S/N	Respondents	Frequency	%
1	Users of the Public Buildings	30	38.46
2	Professionals in the Building industry	23	29.49
3	Technical Staff of Public Buildings	15	19.23
4	Maintenance organization Head	10	12.82
	Total	**78**	**100.00**

Table 2: Types ofPublic Building Surveyed in the three Senatorial Areas of Ondo State.

S/N	Respondents	Frequency	%
1	Post Offices	19	43.18
2	Libraries	15	34.09
3	Schools (Post Secondary Institutions)	10	22.73
	Total	**44**	**100.00**

Table 3: Number of the type of Public Buildings Surveyed from the three Senatorial Areas of Ondo State. (A= Number of building; B= Percentage; C= Rank).

N		POST OFFICES			LIBRARIES			SCHOOLS		
		A	B	C	A	B	C	A	B	C
1	SOUTHERN SENATORIAL AREA	5	26.32	3rd	4	26.67	3rd	2	20.00	3rd
2	CENTRAL SENATORIAL AREA	7	36.84	1st	6	40.00	1st	4	40.00	1st
3	NORTHERN SENATORIAL AREA	7	36.84	1st	5	33.33	2nd	4	40.00	1st
	Total	**19**	**100.00**		**15**	**100.00**		**10**	**100.00**	

Table 1 shows the type of respondents in the order of its frequency. It shows that the highest number of respondents, 38 (38.46%),are users/occupants of the public buildings. The second with 25 (29.49%) are professionals in the building industry, followed by Technical Staff of Public Buildings with 15 (19.23%), and the last with 10 (10.82) are the maintenance organization heads.

Table 2 shows the types of building surveyed in the three Senatorial Areas of Ondo State. 19 (43.18%) are respondents' on Post Offices, 15 (34.09%) are respondents' on Libraries and the remaining 10 (22.73%) are respondents' on School Buildings.

Table 3 shows the type of public buildings surveyed from the three senatorial areas of Ondo State.From the Southern Senatorial Area, 26.32% are Post Offices; 26.67% are libraries while 20.00% are school buildings. From the Central Senatorial Area, 36.84% are Post Offices; 40.00% are libraries while 40.00% are school buildings. And from the Northern Senatorial Area, 36.84% are Post Offices; 33.33% are libraries while 40.00% are school buildings.

Table 4: Respondents' Ranking of Noticeable Defects Associated with Public Buildings in in the Studied Areasof Ondo State

Noticeable Defects	1	2	3	4	5	Total	TWV	RSI	Rank
Staining/Peeling of paintwork at wall surface	0	0	5	30	43	78	350	0.897	1st
Peeling of plastered/rendered surfaces.	0	2	8	29	39	78	339	0.869	2nd
Leakages of waste/water pipes causing dampness.	2	2	16	26	32	78	318	0.815	3rd
Doors/Window defects – broken blades/glass, damaged/stiff louvre carrier, decay in door/window frames, etc.	4	8	11	25	30	78	292	0.749	4th
Crack in the wall	6	10	34	16	12	78	252	0.646	5th
Leaking Roof	13	14	15	15	21	78	220	0.564	6th
Sagging of carcassing members	18	20	20	10	10	78	208	0.533	7th
Blockages of sanitary/water pipes	22	27	10	9	10	78	192	0.492	8th
Weak foundation/foundation failure	29	28	10	5	6	78	165	0.423	9th

Table 5: Respondents' Ranking of Major Causes of Defects Associated with Public Buildings in the Studied Areasof Ondo State

Identified Major Causes	1	2	3	4	5	Total	TWV	RSI	Rank
Care free attitude of the users/occupants of the buildings.	7	16	12	18	25	78	278	0.713	1st
Use of inferior materials	8	20	10	22	18	78	256	0.656	2nd
Lack of regular check-up of the building for early detective for maintenance	10	22	15	16	15	78	235	0.603	3rd
Poor workmanship due to lack of control and proper monitoring	13	25	20	8	12	78	215	0.551	4th
Insufficient fund to quickly effect remedy when the need arises	15	25	15	12	10	78	208	0.533	5th
Slow responsiveness of the authority to request of remedy of any affected area	22	20	18	10	8	78	196	0.503	6th
Non compliance with specifications as contained in the designed documents and the bill of quantities	22	24	18	8	6	78	186	0.477	7th
Non consultation with/involvement of qualified professionals	23	23	20	6	6	78	183	0.469	8th

Table 6: Respondents' Ranking of Yardsticks for Effective Maintenance of PublicBuildings in Ondo State.

Identified Yardsticks	1	2	3	4	5	Total	TWV	RSI	Rank
Awareness for users/occupants towards strict compliance to enhance effective maintenance culture of the buildings	8	12	19	20	30	78	317	0.813	1st
Periodic/regular check-up of the building for early detective for maintenance work	9	10	16	18	25	78	274	0.703	2nd
Prompt response to provision of fund for maintenance work to effect remedy when the need arises	8	15	15	16	20	78	256	0.656	3rd
Involvement of professionals from inception to completion and at every stage of maintenance for the use of standard materials and for proper management of the building facilities	16	16	16	12	18	78	234	0.600	4th
Strict compliance to specifications as contained in the design documents, Bill of Quantities and construction documentations in the usage of approved materials	20	18	16	10	14	78	210	0.539	5th
Quick response of the department concerns to request of remedy when the need arises	25	24	10	8	10	78	185	0.474	6th
Optimization of design process to enhance good workmanship, labour, equipment and plant to									

Table 4 shows the relative significance index (RSI) of the type of the defects of building facilities in the study areas.The first ranked defect with RSI value of 0.897 is the Staining/Peeling of paintwork at wall surface, as was corroborated by the respondents. Peeling of plastered/rendered surfacesranked second

Table 4 shows the relative significance index (RSI) of the type of the defects of building facilities in the study areas.The first ranked defect with RSI value of 0.897 is the Staining/Peeling of paintwork at wall surface, as was corroborated by the respondents. Peeling of plastered/rendered surfacesranked second with RSI value of 0.869.Leakages of waste/water pipes causing dampness is ranked third with RSI value of 0.815. Doors/Window defects – broken louvre blades/glass, damaged/stiff louvre carrier, decays in door/window frames, etc. ranked forth with RSI value of 0.749. Crack in the wall ranked fifth with RSI value of 0.646. Leaking Roof ranked sixth with RSI value of 0.564. Sagging of carcassing membersranked seventh with RSI value of 0.533. Blockages of sanitary/water pipes ranked eighth with RSI value of 0.492.

While the least defect of weak foundation/foundation failure, ranked ninth with RSI of 0.423, as reflected in table 4.

Table 5 shows the causes of defects in facilities in the study area. Care free attitude of the users/occupants of the buildings is ranked the most major cause of defects with RSI value of 0.713. The second is Use of inferior materials with RSI value of 0.656. The third cause is Lack of regular check-up of the buildings for early detective for maintenancewith RSI value of 0.603 The forth cause is poor workmanship due to lack of control and proper monitoring with RSI value of 0.551. The fifth cause is insufficient fund to quickly effect remedy when the need ariseswith RSI value of 0.533. Thesixth cause is slow responsiveness of the authority to request of remedy of any affected areawith RSI value of 0.503. The seventh cause is non compliance with specifications as contained in the designed documents and the bill of quantitieswith RSI value of 0.477. While the last cause, is non consultation with/involvement of qualified professionals with RSI value of 0.469.

Table 6 shows the yardsticks that are recommended in order to give room for effective maintenance culture in tertiary institutions in Nigeria. The first recommended yardstick with RSI value of 0.813 is that there should be awareness for users/occupants towards strict compliance to enhance effective maintenance culture of the buildings. The second recommendation with RS value of 0.703 is that there should be periodic/regular check-up of the building for early detective for maintenance work. The third with RSI with the value of 0.656 is that there should be prompt response to provision of fund for maintenance work to effect remedy when the need arises. The forth recommended yardstick with RSI value of 0.600 is that there should involvement of professionals from inception to completion and at every stage of maintenance for the use of standard materials and for proper management of the building facilitiesThe fifth recommendation with RS value of 0.539 is that there should be strict compliance to specifications as contained in the design documents, bill of Quantities and construction documentations in the usage of approved materials. The sixthwith RSI with the value of 0.474 is that there should be quick response of the department concerned to requestsfor remedy when the need arises, and the last with RSI value of 0.431 is that there should be optimization of the design process to enhance good workmanship, labour, equipment and plant to reduce maintenance problems

CONCLUSION

Even though this research work may not have thoroughly discussed full causes of the whole scenario of

public buildings in respect of the defects and their major causes in the stated Senatorial Areas, it tries to give an overview on the common problems facing the building facilities. The paper therefore had identified that staining/Peeling of paintwork at wall surface, peeling of plastered/rendered surfaces, leakages of waste/water pipes causing dampness, doors/Window defects – broken louvre blades/glass, damaged/stiff louvre carrier, decays in door/window frames, etc, crack in the wall, leaking Roof, sagging of carcassing members, blockages of sanitary/water pipes and weak foundation/foundation failure were the noticeable defects associated with public buildings in the studied areas. The causes of the defects in facilities in the research are identified as slow responsiveness of the authority to request for remedy of any affected area; lack of regular check-up of the building for early detection for maintenance; improper management of the building facility; insufficient fund to quickly effect remedy when the need arises; use of inferior materials; bad workmanship due to poor control and supervision; non compliance with specifications as contained in the designed documents and the bill of quantities, while the last factor is non consultation with/involvement of qualified professionals in the building industry.

Recommendations

As a result of the issues discussedabove, the followings are, therefore, recommendedas solutions*towards developing a model for the maintenance of public buildings in Nigeria,*:

(i). There should be awareness for users/occupants on strict compliance towards enhancement of effective maintenance culture of public buildings.

(ii). There should be periodic/regular check-up of the building for early detection for maintenance work.

(iii). There should be prompt response to the provision of fund for maintenance work to effect remedy when the need arises.

(iv). There shouldinvolvement of professionals from inception to completion and at every stage of maintenance for the use of standard materials and for proper management of the building facilities.

(v). The strict compliance with specifications as contained in the design documents, bill of Quantities and construction documentations in the usage of approved materials.

(vi). There should be quick response from the department concerns to request of remedy when the need arises.

(vii). There should be optimization of design process to enhance good workmanship, labour, equipment and plant to reduce maintenance problems.

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