

APPRAISAL OF MAINTENANCE MANAGEMENT SYSTEMS FOR RESIDENTIAL QUARTERS IN KADUNA POLYTECHNIC

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Abstract

Maintenance is generally defined by BS4811 "as the combination of all technical and associated administrative actions intended to retain an item in or restores it to a state in which it can continue to perform its functions". The maintenance of a built environment affects everyone for it is the state of our homes, offices and factories that depend not only for our comfort but for economic and structural survival. This study seeks to appraise the maintenance management systems of residential quarters in Kaduna Polytechnic. To guide the study, two objectives and research hypotheses were formulated. A review of the existing practices was carried out and the factors responsible for maintenance management systems in the residential quarters identified. Survey research design was adopted for data collection for the study. The population comprised of all the 385 staff residence in eight locations of Kaduna Polytechnic Quarters. The proportionate stratified random sampling technique was used to constitute 100 respondents out of the population. Data, collected was then analysed using one way Anova and Post Hoc test to establish findings. The findings have shown that Kaduna Polytechnic do not have an organised maintenance management systems and the absence of adequate maintenance for its properties. The study recommends that Kaduna Polytechnic authority should adopt the planned preventive maintenance Management Systems for use in Kaduna Polytechnic.

Keywords: Building maintenance, Maintenance, Maintenance culture and Maintenance management.

Background to the Study

Lately, when the economy suffered a severe setback and new buildings are rare, dilapidated and derelict buildings have become common sight in the country, owners have had to embark on the development of a maintenance culture that will ensure the

preservation of the existing building. This backward integration as it is often referred to, increased public and private sector awareness on the maintenance of the existing building stock as opposed to the erection of new ones. According to Miles and Sugya, (2007), the maintenance of a built environment affects everyone for the state of our homes, offices and factories that depend not only for our comfort but for economic and structural survival. Building maintenance is accorded little or no merit and a neglected field of technology. A casual stroll around a city, town or village in almost any developing country suggest that many important national capital assets such as school buildings, roads, residential houses and apartments, hospitals and civil buildings are run-down beyond the point of economic repair. Why should this be, when the building maintenance is known to be among the labour intensive of construction activities? A complete answer is yet to be found but it seems that their main failure is at the root of most of the problems. Maintenance work is considered waste of money and time by most property owners, funds are usually directed towards new buildings rather than the upkeep of existing ones. Maintenance management is an orderly and systematic approach to planning, Organizing, Monitoring and Evaluating maintenance activities and their costs. A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems, environmental damage, and yield longer asset life with fewer breakdown and result in lower operating costs and a higher quality of life.

Statement of the Problem

Within the 70's during the oil boom era, the construction industry was relatively busy. During this period the economic implication of embarking on most capital projects were given less thought because money was in good supply. Maintenance has therefore until recently been a much neglected sector of the construction Industry and because of its non-glamorous nature, it never get the attention it deserves Maintenance/renovation works according to Oyediran and Odusanmi (2004), account for less than 20% of the total workload of the construction industry in Nigeria. This neglect has manifested in the sorry state of most infrastructure in both public and private sectors. Thus, this study seeks to appraise the Maintenance Management systems for residential quarters in Kaduna Polytechnic.

Main Objective

The main objective of this study is to apprise the maintenance management systems used in residential quarters of Kaduna Polytechnic.

Specific Objectives

1. Examine the present Maintenance Management system used by the authority of Kaduna Polytechnic.
2. Identify factors responsible for maintenance management systems in the residential quarters of Kaduna Polytechnic.

Research Hypotheses

Ho: The present Maintenance Management Systems used by the authority of Kaduna polytechnic does not differ significantly.

Ho: Factors responsible for Maintenance Management Systems in the residential quarters of Kaduna Polytechnic do not differ significantly.

The Importance of Building Maintenance

The condition and quality of buildings is one of the most fundamental components of the quality of life. The vast majority of people spend over 95% of their time in or next to a building of one kind or another, so in this sense, the built environment has become our “natural” environment.

BS3811 defines maintenance as a combination of any action carried out to retain an item in or restore it to, an acceptable condition. The actions referred to are those associated with initiation, organization and implementation. There are two processes envisaged, 'retaining', i.e., work carried out in anticipation of failure, and 'restoring' i.e. work carried out after failure. The former is usually referred to as 'preventive maintenance' and the later as 'corrective maintenance'

Types of maintenance

Planned preventive maintenance

This is maintenance carried out at pre-determined intervals or to other prescribed criteria and intended to reduce the likelihood of an item not meeting an acceptable condition, for example, regular cleaning to drainage systems to prevent blockages.

Planned corrective Maintenance

This is maintenance carried out to restore an existing facility to an acceptable standard. This is executed when failure of a facility has already occurred, for example, replacing failed florescent bulb.

Unplanned Maintenance

This is maintenance carried out without planning. This would generally be corrective in nature, would include emergency work and would be in tandem with planned maintenance.

Primary causes of Deterioration

Faulty design: Good design need to

- a. Take account of its sources of maintenance
- b. Provide suitable protection of prime materials by adequate detailing
- c. Consider location and orientation of the building with regard to area and weather conditions.
- d. Consider standard of workmanship which can be achieved on site
- e. Have adequate knowledge of nature of materials.

Faulty execution: Usually due to

- a. Bad workmanship – quality of work being reduced by use of materials incorrectly.
- b. Inadequate Supervision. Number and /or quality of supervisors inadequate.

Faulty materials: Materials which are unable to fulfill required functions due to

- a. Defects brought about by manufacture, transportation, handling
- b. Incorrect choice of location regarding conditions and usage.
- c. Incompatibility of certain materials in certain situations.

Vandalism: caused by intentional damage and disfigurement resulting in:

- a. Natural life of material or component being reduced
- b. Reduce aesthetics of building.
- c. Increase cleaning requirements.
- d. Increase Maintenance costs.

Research Framework

The primary variable of interest of the study is the dependent variable of Maintenance Management Systems which is measured by the functions and the upkeep of the existing residential buildings in Kaduna Polytechnic. The Independent variables that may influence the dependent variable are Present Maintenance Management Systems and the factors responsible for maintenance management systems of residential quarters of Kaduna Polytechnic. The relationship between the dependent and independent variable are shown in figure 1

Independent Variables

Influence

Dependent Variable

Influence

Figure 1: Conceptual frameworks

Research Method

Descriptive survey design was adopted for this study. This design was chosen due to the fact that the opinion of occupant respondents were sought for and this design has been found to be suitable. The area of study is the residential quarters of Kaduna Polytechnic covering all the locations namely: Panteka, Crescent road, Express bye pass, Ungwan Rimi, Main Campus, Keffi Road, Zamfara estate and Barnawa residential quarters.

The proportionate stratified random sampling technique was adopted to determine the sample of the study. 100 occupants which represented 26% of the total occupants of 385 housing units were used as the accessible population. The research questionnaire was divided into two main sections organized according to the sequence of the research hypothesis that guided this study. The questionnaire was designed mainly based on likert scale of four ordinal measure from 1-4 according to the level of importance. To establish the validity of the instrument, the questionnaire was subjected to both face and content validation by three experts: two professionals in the building industry and one research expert. The corrections made by these experts were used in improving the content of the instrument. The reliability of the instrument was tested with test-retest reliability method. A pilot study was conducted in NNPC residential quarters. After a period of two weeks the same questionnaire was re-administered to the same respondents. Data collected was analysed using spearman Brown formula to establish the coefficient of stability of instruments. The coefficient of 0.90 was obtained which indicates a positive correlation of the instruments. The researchers administered the instrument for data collection personally. The questionnaire was administered to the sampled occupants of residential quarters of Kaduna Polytechnic.

Data Analysis

One way Anova

Ho: Present Maintenance Management System used by the authority of Kaduna Polytechnic does not differ significantly.

Where $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

μ_1 represents planned preventive maintenance.

μ_2 represents planned corrective maintenance

μ_3 represents unplanned maintenance

μ_4 represents direct labour system

μ_5 represents contract system.

= level of significance is 0.05

		Descriptive							
MAINTENANCE MANAGEMENT SYSTEM									
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	
					Lower Bound	Upper Bound			
PLANNED PREVENTIVE MAINTENANCE	4	75.0000	101.55130	50.77565	-86.5908	236.5908	12.00	225.00	
PLANNED CORRECTIVE MAINTENANCE	4	25.0000	17.68238	8.84119	-3.1366	53.1366	12.00	50.00	
UNPLANNED MAINTENANCE	4	25.0000	17.68238	8.84119	-3.1366	53.1366	12.00	50.00	
DIRECT LABOUR SYSTEM	4	25.0000	17.68238	8.84119	-3.1366	53.1366	12.00	50.00	
CONTRACT SYSTEM	4	25.0000	17.68238	8.84119	-3.1366	53.1366	12.00	50.00	
Total	20	35.0000	47.40087	10.59916	12.8157	57.1843	12.00	225.00	

Test of Homogeneity of Variances				
MAINTENANCE MANAGEMENT SYSTEM				
Level	Statistic	df1	df2	Sig.
4	4.837	4	15	.010

ANOVA					
MAINTENANCE MANAGEMENT SYSTEM					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8000.000	4	2000.000	.865	.507
Within Groups	34690.000	15	2312.667		
Total	42690.000	19			

Contrast Coefficients						
Contrast	ITEMS	PLANNED PREVENTIVE MAINTENANCE	PLANNED CORRECTIVE MAINTENANCE	UNPLANNED MAINTENANCE	DIRECT LABOUR SYSTEM	CONTRACT SYSTEM
1		-1	-1	-1	-1	4

Contrast Tests							
		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
MAINTENANCE MANAGEMENT SYSTEM	Assume equal variances	1	-50.0000	107.53294	-0.465	15	.649
	Does not assume equal variances	1	-50.0000	63.74428	-0.784	6.019	.463

POST HOC TEST						
Multiple Comparisons						
Dependent Variable: MAINTENANCE MANAGEMENT SYSTEMS						
Schedule						
(I) ITEMS	(J) ITEMS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
PLANNED PREVENTIVE MAINTENANCE	PLANNED CORRECTIVE MAINTENANCE	50.00000	34.00490	.708	-68.8824	168.8824
	UNPLANNED MAINTENANCE	50.00000	34.00490	.708	-68.8824	168.8824
	DIRECT LABOUR SYSTEM	50.00000	34.00490	.708	-68.8824	168.8824
	CONTRACT SYSTEM	50.00000	34.00490	.708	-68.8824	168.8824
PLANNED CORRECTIVE MAINTENANCE	PLANNED PREVENTIVE MAINTENANCE	-50.00000	34.00490	.708	-168.8824	68.8824
	UNPLANNED MAINTENANCE	.00000	34.00490	1.000	-118.8824	118.8824
	DIRECT LABOUR SYSTEM	.00000	34.00490	1.000	-118.8824	118.8824
	CONTRACT SYSTEM	.00000	34.00490	1.000	-118.8824	118.8824
UNPLANNED MAINTENANCE	PLANNED PREVENTIVE MAINTENANCE	-50.00000	34.00490	.708	-168.8824	68.8824
	PLANNED CORRECTIVE MAINTENANCE	.00000	34.00490	1.000	-118.8824	118.8824
	DIRECT LABOUR SYSTEM	.00000	34.00490	1.000	-118.8824	118.8824
	CONTRACT SYSTEM	.00000	34.00490	1.000	-118.8824	118.8824
DIRECT LABOUR SYSTEM	PLANNED PREVENTIVE MAINTENANCE	-50.00000	34.00490	.708	-168.8824	68.8824
	PLANNED CORRECTIVE MAINTENANCE	.00000	34.00490	1.000	-118.8824	118.8824
	UNPLANNED	.00000	34.00490	1.000	118.8824	118.8824

HOMOGENEOUS SUBSET		
MAINTENANCE MANAGEMENT SYSTEM		
Schedule		
ITEMS	N	Subset for alpha = 0.05
		1
PLANNED CORRECTIVE MAINTENANCE	4	25.0000
UNPLANNED MAINTENANCE	4	25.0000
DIRECT LABOUR SYSTEM	4	25.0000
CONTRACT SYSTEM	4	25.0000
PLANNED PREVENTIVE MAINTENANCE	4	75.0000
Sig.		.708
Means for groups in homogeneous subsets are displayed.		
a. Uses Harmonic Mean Sample Size = 4.000.		

One-way Anova

Ho: Factors responsible for Maintenance Management Systems in the Residential Quarters of Kaduna Polytechnic does not differ significantly

Where $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

μ_1 represents faulty design

μ_2 represents construction method

μ_3 represents occupant's activities

μ_4 represents quality of material used

μ_5 represents inadequate maintenance

= level of significance is 0.05

Descriptive								
REASONS RESPONSIBLE FOR MAINTENANCE MANAGEMENT SYSTEMS								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
FAULTY DESIGN	4	25.0000	12.90994	6.45497	4.4574	45.5426	10.00	40.00
CONSTRUCTION METHOD	4	25.0000	12.90994	6.45497	4.4574	45.5426	10.00	40.00
OCCUPANT ACTIVITIES	4	25.0000	12.90994	6.45497	4.4574	45.5426	10.00	40.00
QUALITY OF MATERIALS USED	4	25.0000	12.90994	6.45497	4.4574	45.5426	10.00	40.00
INADEQUATE MAINTENANCE	4	25.0000	12.90994	6.45497	4.4574	45.5426	10.00	40.00
Total	20	25.0000	11.47079	2.56495	19.6315	30.3685	10.00	40.00

Test of Homogeneity of Variances

REASONS RESPONSIBLE FOR MAINTENANCE MANAGEMENT SYSTEMS

Level Statistic	df1	df2	Sig.
.000	4	15	1.000

ANOVA

REASONS RESPONSIBLE FOR MAINTENANCE MANAGEMENT SYSTEMS

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.000	4	.000	.000	1.000
Within Groups	2500.000	15	166.667		
Total	2500.000	19			

Contrast Coefficients

Contrast	ITEMS				
	FAULTY DESIGN	CONSTRUCTION METHOD	OCCUPANT ACTIVITIES	QUALITY OF MATERIALS USED	INADEQUATE MAINTENANCE
1	-1	-1	-1	-1	4

Contrast Tests							
		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
REASONS RESPONSIBLE FOR MAINTENANCE	Assume equal variances	1	.0000	28.86751	.000	15	1.000
	Does not assume equal variances	1	.0000	28.86751	.000	4.615	1.000

Post Hoc Tests

Multiple Comparisons						
Dependent Variable: REASONS RESPONSIBLE FOR MAINTENANCE MANAGEMENT SYSTEMS Schedule						
(I) ITEMS	(J) ITEMS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
FAULTY DESIGN	CONSTRUCTION METHOD	.00000	9.12871	1.000	-31.9143	31.9143
	OCCUPANT ACTIVITIES	.00000	9.12871	1.000	-31.9143	31.9143
	QUALITY OF MATERIALS USED	.00000	9.12871	1.000	-31.9143	31.9143
	INADEQUATE MAINTENANCE	.00000	9.12871	1.000	-31.9143	31.9143
CONSTRUCTION METHOD	FAULTY DESIGN	.00000	9.12871	1.000	-31.9143	31.9143
	OCCUPANT ACTIVITIES	.00000	9.12871	1.000	-31.9143	31.9143
	QUALITY OF MATERIALS USED	.00000	9.12871	1.000	-31.9143	31.9143
	INADEQUATE MAINTENANCE	.00000	9.12871	1.000	-31.9143	31.9143
OCCUPANT ACTIVITIES	FAULTY DESIGN	.00000	9.12871	1.000	-31.9143	31.9143
	CONSTRUCTION METHOD	.00000	9.12871	1.000	-31.9143	31.9143
	QUALITY OF MATERIALS USED	.00000	9.12871	1.000	-31.9143	31.9143
	INADEQUATE MAINTENANCE	.00000	9.12871	1.000	-31.9143	31.9143

QUALITY OF MATERIALS USED	FAULTY DESIGN	.00000	9.12871	1.000	-31.9143	31.9143
	CONSTRUCTION METHOD	.00000	9.12871	1.000	-31.9143	31.9143
	OCCUPANT ACTIVITIES	.00000	9.12871	1.000	-31.9143	31.9143
	INADEQUATE MAINTENANCE	.00000	9.12871	1.000	-31.9143	31.9143
INADEQUATE MAINTENANCE	FAULTY DESIGN	.00000	9.12871	1.000	-31.9143	31.9143
	CONSTRUCTION METHOD	.00000	9.12871	1.000	-31.9143	31.9143
	OCCUPANT ACTIVITIES	.00000	9.12871	1.000	-31.9143	31.9143
	QUALITY OF MATERIALS USED	.00000	9.12871	1.000	-31.9143	31.9143

Homogeneous Subsets

REASONS RESPONSIBLE FOR MAINTENANCE MANAGEMENT SYSTEMS		
Schedule		
ITEMS	N	Subset for alpha = 0.05
		1
FAULTY DESIGN	4	25.0000
CONSTRUCTION METHOD	4	25.0000
OCCUPANT ACTIVITIES	4	25.0000
QUALITY OF MATERIALS USED	4	25.0000
INADEQUATE MAINTENANCE	4	25.0000
Sig.		1.000
Means for groups in homogeneous subsets are displayed.		
a. Uses Harmonic Mean Sample Size = 4.000.		

Major Findings

1. For research hypothesis 1 $P > 0.05$, value of p is 0.507, therefore H_0 is not rejected this means that all the Maintenance Management Systems are in use by the authority of Kaduna Polytechnic.
2. For research hypothesis 2 $P > 0.05$, value of P is 1.000 therefore H_0 is not rejected. This means that all the factors identified are responsible for Maintenance Management Systems in the residential quarters of Kaduna Polytechnic.

Discussion of findings

The discussion of findings of this study were based on research hypotheses as stated below

Research Hypothesis 1

Ho: Present Maintenance Management systems used by the authority of Kaduna Polytechnic do not differ significantly. Using One-way Anova, the study reveals that all the maintenance Management Systems are presently used by the authority of Kaduna Polytechnic with the planned preventive maintenance been the most frequently used with a mean of 75. This result was further confirmed using the post hoc test that also revealed planned preventive maintenance with a mean of 75 and the P value of 0.708 i.e. $P > 0.05$

Research Hypothesis 2

Ho: Factors responsible for Maintenance Management Systems in the residential quarters of Kaduna Polytechnic do not differ significantly. Using one-way Anova, the study reveals that all the factors responsible contributed equally to the Maintenance Management Systems of the residential quarters of Kaduna Polytechnic. However, faulty design, construction method and quality of materials used are supposed to be taking care of during construction. Therefore, only occupant activities and inadequate maintenance will be of use in this research. This result was further confirmed using the Post Hoc test that also revealed equal contribution of mean 25 and the P-value of 1.000 i.e. $P > 0.05$.

Conclusions

It is desirable to erect buildings to provide shelter and other centres of human activities for the need of the staff of Kaduna Polytechnic so as to ease the accommodation problems encountered. It is also expected that maintenance of these accommodation units be done with vigor used in erecting the buildings. The imperative for Maintenance Management Systems for Kaduna Polytechnic cannot be over-emphasized particularly in the areas of functionality and the upkeep of these buildings become of the inherent benefits economically and socially to the status of the staff of Kaduna Polytechnic among the citizenry of the nation at large.

Recommendations

Based on the findings of this study and subsequent discussions the following recommendations are proffered.

- 1 Kaduna Polytechnic authority should adopt the use of Planned Preventive Maintenance Management Systems so as to always retain the buildings in an acceptable condition.
- 2 There should be adequate awareness from the Management of the Polytechnic to the occupants on how to use and report any damage or repair needed to the appropriate authority.

- 3 The authority should endeavor to carry out adequate Maintenance on all the Polytechnic properties especially the residential quarters.

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