

Critical Factors Influencing Facility Maintenance Management of Tertiary Institutional Buildings in Southwest Nigeria

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Abstract Building maintenance has until recently been a neglected field of technology in most of our governmental policy formulation and execution. This is reflected in the maintenance of housing stocks held in our various institution of Higher learning. Every Tertiary institutional building whether old or new requires being maintained and constitutes parts of our most valuable asset, providing learners with shelter facility for study, work and leisure. This project take as a look at the "Assessment of the Factors Influencing Maintenance Programme of Tertiary Institutional Buildings in Southwest Nigeria" through examination of environmental and climatic conditions, availability of funds, socio-political reasons, mishandling and overpopulation. Two hundred and fifty administered to were returned out of the Three hundred and fifty administered to Hostel occupants, Technical staffs and Maintenance organization heads. The method adopted was simple percentage and inferential statistical tool for the analysis of data. The findings of the study revealed that the claims of the Maintenance department to practicing combined maintenance of planned and unplanned are faulted. Findings revealed that they lacked the wherewithal to make it a success. This paper recommends that budget allocation for maintenance of tertiary institutional buildings be made by the government in view of the inflationary trend in the economy, adequate and skilful staff should be provided for the maintenance department to avoid delay in job execution, while rate of response to maintenance request, repair to damages and faults identified should be made faster.

Keywords: Facility Maintenance Management, Tertiary Institution, Buildings, Facilities.

1. Introduction

Tertiary institution is considered throughout the world to be key to both individual and societal aspirations. For individuals, education beyond the secondary level is assumed to be the way to societal esteem, better paying jobs, expanded life options, intellectual stimulation and frequently a good time in the pursuit of any or all of the above.

For societies, tertiary institution is assumed to be the key to technology, productivity, and the other ingredients of international competitiveness and economic growth. Tertiary institution also shapes and preserves the value that defines culture. And it is believed to be a major engine of social justice, equal opportunity, and democracy. Tertiary institution

faces immediate pressure to preserve existing college of its campuses and enhance the capacity of its higher education system to address growing demands. In order to serve the current population of students, tertiary institution must maintain, renovate, and expand their building where necessary and keep equipment and technology current to meet changing workplace needs. For higher institutions, the money for maintenance comes from the government as part of each school annual budget. This poses some difficulties for such institutions maintenance programme because expenditure from the government budget is not only adequate, and tied to strict financial regulations and payment control system.

The government release of maintenance budget for the year which might run contrary to the institution's maintenance programme. The construction and development of capital projects in institution such as university is each university's administration priority; thus new buildings are designed and constructed as hostels, classrooms or facility buildings every year while little or nothing is allowed for maintenance of such facilities from the planning stage. Many times without numbers, School programme are distorted and becomes irregular, hence making maintenance programme difficult. Academic environment sometimes becomes volatile which makes facilities in the higher institutions a high risk insurance property; incidence of complete destruction and willful damage are common occurrence this differentiate the institutions environment from normal environment. In view of these numerous problems the study undertook the assessment of those factors influencing maintenance programme of tertiary institutional buildings in Southwestern Nigeria with a view to determine the effect of inadequacy of maintenance staff, environment, socio political, management decisions on the maintenance programme of such institutions. The most common problems in the institutions are also investigated while the factors leading to them are examined.

This sudden boom exerted higher pressures on designers. This designers in most instance embraced imported westernized designs meant for temperate climate but unsuitable to Nigerian environment; Mahmoud (1997) said such design cloning not only come with its attendant maintenance problems but when urgency is also attached to their production; draw on system and materials without having enough time to test their relevance and suitability works on construction sites been handicapped by the lack of an experienced workforce; construction methods, harsh climatic conditions, presence of chlorides, and sulphates are some of the factors generating need; a well planned system which reflect adequate keeping the building and its fabric in functional state of performance.

2. Past Works on the Study

The performance of tertiary institution buildings and their components depends to large extent on continuous and planned periodical maintenance, which challenges the management and maintenance managers, to institute precise planning based on a well structure maintenance programme (shohet, 2002). Seeley (1976) stated that it is highly desirable to produce maintenance free building; the task according to the study is hardly feasible. Amusan (2003) opined that all elements of houses deteriorates at a greater or lesser rate dependent on the materials, design adequacy quality of workmanship environmental condition; function and use of the building the economic boom of the seventies and eighties made the country to witness rapid development in all facets of its infrastructural facilities amongst which are educational buildings.

2.1 Climatic Conditions

Southwest Nigeria is located in the rainforest belt of Nigeria with temperature ranging from 22 degree Celsius to 35 degree Celsius. In this region, there are extreme variations in humidity and radiation as the belts transits between rainy season of October to March and dry season of April to September. The university town of Lagos is located in the lowland of ocean belt characterized by usually heavy down pours and flooding; rain water is accompanied with sulphates and chlorides which are agents of corrosion on metal products. The ravaging effects of this is seen on the buildings and properties located along the coastal line of Ahmadu Bello Street, Bishop Oluwole street in Victoria island. University of Lagos has properties like theatre, classrooms, and office accommodations located near the lagoon front, which opened them to avarice of whether directly and indirectly, by the sulphates carrying rainwater from the ocean. In the dry season, the absence of hills and thick forest too dampen the effect of the ravaging wind allows it have a direct impacts on the properties. Such impacts sometimes increases aging process of the building while elements like roofs, window – panes, hand- railing are affected making repairs necessary. Hence, increasing the maintenance need of the buildings. The problems highlighted here as confronting university of Lagos is also applicable to Yaba College of Technology, which is located within 1 kilometer of one another. University of Ibadan and state polytechnic is located in the relief town of Ibadan, which contract to Lagos is located on a high land.

The town enjoys relief rainfall regularly and windstorm associated with Lagos environment is less prevalent. The effect of sulphates and sulphides in rainwater is highly reduced. The clear skyline with varying temperature however encourages radiation of heat from the sun to have a degrading effect on the properties. The presence of iron in the rainwater is noticeable from the corroding zinc roof covering that corrodes shortly after installation and get discolored. Mamoud, (2000) in his study, confirmed that clear skies promote high level of radiation and that climate is an important factor of influence in maintenance needs. Obafemi Awolowo university is however located on a lowland and rainforest belt of old western Nigeria, where regular rainfall [promotes the growth of tree crops like cocoa and kola Nut University enjoys similar climatic conditions with her counterpart in Ibadan.

2.2 Soil and Water

The environment for building in Lagos shoreline and lagoon front or land adjacent to or within proximity is particularly very hostile because of chlorides and sulphates pressure in soil and water. According to Shamsideen (2004), the pressure of chlorides in soil promotes rising water level which results in rising damp. A survey carried out by Iyagba (2005) revealed that most buildings along the coastline experiences rising damp their wall, which encourages algae growth that consequently leads to sick building syndrome. The salinity of the soil and water in the presence of high ground water levels, is noted to affect concrete in foundations and other parts of the building (Mahmoud, 2000).

This claim was however contradicted by Fatokun (2005) whose study revealed that presence of salt in water and soil increases the compressive strength of concrete in foundation. This contribution might be due to short period of the study by Fatokun (2005), which covered only six months.

2.3 Building Materials

Mahmoud (2000) listed factors which influence choice of materials in a locality as availability, climate, economy and building techniques. The growth in population, which resulted in increase of the age brackets that required higher education, had necessitated the needs to build more classroom, theater, office blocks and hostel accommodations. The advancement in management techniques and the discovery of the fact that less duration of contract execution implies less cost have appreciably influenced the choice of building materials and systems. The construction Booms in the oil boom period; and increased construction works led to importation and use of various building materials of which substantial quantities are inferior. Various tests carried out on selected building materials indicate some do not meet the required standards (Mahmoud, 2000 and Windapo, 2004). Steel reinforcement ranked highest in this study.

The other approach is to adopt the use if in houses maintenance crew to oversee the daily maintenance of the facilities. This method also has its own problems which are:

- Inadequate knowledge of specialized maintenance works
- Unmotivated civil servants
- Inadequate numbers of skilled maintenance works to work with.

3. Survey of Tertiary Institutions in Southwest Nigeria

Data for the study were obtained from a structural questionnaires served on a target population. The questionnaires were administered on selected respondents in the tertiary institutions across southwestern Nigeria. The questionnaire was structured to capture information from maintenance heads, technical staffs and office /hostel occupants. 350 questionnaires were distributed and response was from 275 respondents. Mean item score (MIS) were computed from the responses to the factors listed in the scale of likert used for the study. The factors were then ranked in order of importance, effectiveness and agreement respectively. The formulae used was

$$\text{MIS} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{N}$$

Where: n = frequency of occurrence of the options
N = total number of respondents

3.1 Survey Results

Table 1. Maintenance Problems in Tertiary Institution

Maintenance Problem	Respondents	Ranking	MIS
Irregular cleaning	10.0	1.0	6.6
Untimely replacement of bad fitting (plumbing)	8.0	2.0	8.25
Plumbing leakage	8.0	2.0	8.25
Untimely replacement of defective fitting	7.0	3.0	9.43
Untimely disposal of refuse	7.0	3.0	9.43
Algae growths on walls	6.0	4.0	11.0
Irregular dislodgement of septic tanks	6.0	4.0	11.0
Roof leakage	6.0	4.0	11.0
Non –instant connection to generator	4.0	5.0	16.5
Untimely response to repair call	2.0	6.0	33.0
Irregular sweeping of offices, classroom and Hostel	2.0	6.0	33.0
Total	74.0		

The most occurring amongst maintenance problems from the sampled respondent are irregular cleaning, untimely replacement of bad fittings (plumbing), and plumbing leakage. Others followed suit as can be seen in table 1 above.

Table 2. Factors influencing defects occurrence in tertiary institution buildings.

Influencing factors	Respondents	Ranking	MIS
Environmental&climatic conditions	28	1	2.64
Availability of funds	25	2	2.96
Socio-Political reason	12	3	6.16
Lack of appropriate knowledge of maintenance	9	4	8.22
TOTAL	74		

The respondents in all agreed that environmental and climatic conditions, availability of funds, socio – political reason and lack of appropriate knowledge of maintenance influence defects occurrence in a tertiary institution buildings in southwest Nigeria.

Table 3. Factors leading to maintenance problems

Factors	Ranking	MIS	COMMENTS
Lack of foresight for projection	1	4.1	Most leading factor
Inadequate experience of designer	2	1.8	Moderate leading factor
Client insistence constraints	3	1.4	Least leading factor
Non incorporation of user's need into design	3	1.4	least leading factor
Non –introduction of feedback from previous Works into design	3	1.4	
Use of inappropriate materials	1	4.1	Most leading factor
Poor workmanship	2	2.4	Moderate leading factor
Poor control mechanism	2	2.4	Moderate leading factor
Poor funding	1	5.0	Most leading factor
Poor management attitude to maintenance	2	4.5	Most leading factor
Inadequate maintenance tool	3	4.1	Next after most leading
Absence of effective maintenance culture	4	2.3	Moderate leading factor
Ineffective use of maintenance vote	4	2.3	Next after moderate
Absence of maintenance plan	5	1.4	leading factor Least
Non- involvement of user's idea on maintenance	6	0.5	Least leading factor
Absence of effective maintenance staff	6	0.5	Least leading factor

The analysis of table 3.0 highlighted the factors contributing to defects occurrence in building as ranked by the respondents. These problems are classified into three viz factors at design stage which contributes to future development of defect. In this stage, lack of foresight for projection of user's needs is ranked most followed by inadequate experience of designer.

While in construction stage, use of inappropriate materials is chosen ahead of poor workmanship and poor control mechanism. However at user's stage; poor funding is ranked most, followed by poor management attitude and inadequate maintenance tool while non- involvement of user's idea in maintenance is considered as not contributing much to defect developments in building.

Table 4. Common Maintenance Problems in Tertiary Institution Buildings

Hostels blocks			Admin/Class blocks		
Maintenance Problems	Respondents	MIS	Respondents	Ranking	MIS
Blocked drain	3	8.2	3	1	8.33
Warped doors	2	12.3	3	1	8.33
Broken pipes	2	12.3	2	2	12.5
Cracked tiles	2	12.3	2	2	12.5
Loss of water pressure	2	12.3	2	2	12.5
Faulty electric accessories	2	12.3	2	2	12.5
Cracked sanitary fittings	2	12.3	2	2	12.5
Loss of shower head	1	24.6	2	2	12.5
Rusty balustrades	1	24.6	1	3	25
Broken pain /louvers	2	12.3	2	2	12.5
Leaking roof/slab	5.6	4.39	4	1	6.25

There is agreement between the respondents, that is the hostel occupants and the office users that the most occurring defects in both hostels blocks and office apartments surveyed, are blocked drain, loss of water pressure, faulty electric accessories and broken pipers which are ranked highest. Cracked walls, cracked ceiling and filled septic tank are rare occurrence.

Table 5. Factor influencing maintenance programme

Factors	MIS	Ranking	Comment
Wear and tear	4.3	1	Most influencing factors
Fittings and components ageing	3.0	2	Second most influencing factor
Exposure to weather	2.70	3	Third most influencing factor
Inadequate fund	4.70	1	Most influencing factors
Delay in release of funds	2.30	2	Second most influencing factor
Over population	3.0	1	Most influencing factors
Approval protocol	2.70	1	Second most influencing factor
Delay in report	2.0	3	Third most influencing factor
Willful damage	1.5	4	Fourth Most influencing factors
Delay in response to complaint	1.0	5	Least influencing Factor
Delay in response to complaint	4.0	1	Most influencing factors
Mishandling	3.0	2	Second Most influencing Factor
Unavailability of appropriate tools	3.0	2	Second Most influencing Factor

The result of the analysis in table 5.0 indicated that inadequate fund is the most influencing factor of maintenance programme while the least influencing factor is delay in response by the management and maintenance department. This result could be appreciated in that in table 5, willful damage came a distant 4th in ranking. The reason for this might not be

unconnected with the fact that at point of decision certain funds might have been set aside while at programme development, how much available to the institution may play a significant role on the planning process and strategy.

Table 6. Factor Influencing Management to Execute Maintenance Works

Factors	MIS	Ranking	Comments
Building Characteristics	5.0	1	Most influencing factor
Building status	5.0	1	Most influencing factor
Building age	5.0	1	Most influencing factor
Building complexity	4,3	2	Moderately influencing factors
Building size	3.7	3	Next after moderate influencing
Building shape	1.0	4	Least influencing factor
Building location	1.0	4	Least influencing factor
Political factors			
User status	4.7	1	Most influencing factor
Use of buildings	3.7	2	Moderately influencing factors
User's persistent complaint	2.3	3	Next after moderate influencing
Management decision	2.0	4	Least influencing factor
Economic Factors			
Proximity to defect generating factors	5.0	1	Most influencing factor
Age of building	4.7	2	Moderately influencing factors
Availability of funds	4.3	3	Next after moderate influencing
Willingness of users to foot the bill for later refund	2.7	4	Least influencing factor
First come first treated	2.3	5	Next to least influencing factor

Respondents in table 6.0 when asked to ranked what they in their opinion influences management decision to effect repairs, chose under building characteristics, status and age as the most influencing factor while they believed that building location and shape had little to do with decision to maintain it. On socio political factors, users status is best considered by the management as perceived by the respondent to management arbitrary decision and under economic factors, proximity to defect generating factors, age of building, revenue generating status of the building and availability of fund are the most influencing of the factors. In overall, however, it is seen from table 6.0 that economic considerations takes uppermost position in the minds of the management building characteristics and socio political factors in taking decision to effect repair in a building.

4. Discussion of Findings

4.1 Frequently Occurring Maintenance Problems

In the tertiary settings of property maintenance and management the frequently occurring problems as survey revealed are mostly of plumbing and electrical natures the damaged fittings inn both hostels and offices, plumbing defects such as broken pipes and blockades filled up septic tanks and broken panes and louvers were the most frequently occurrence defects in the tertiary institutions surveyed. The occurrence of theses defects in the hostels may not be unconnected with the usual over population of the students' hostels and resultant effects of mishandlings of these facilities.

4.2 Management Decision to Effect Repairs.

In taking decisions to effect, repairs in a building or facility, the management is faced with certain factors to consider before finally giving their consent and approval for the repair works to be carried out. These factors are identified as environmental which includes building location, age, status political factors which are management decisions, users status, fund availability, revenue generating status of building, willingness of users to foot bill for refund, proximity to defect generating factors like lagoon front in university of Lagos were the most influencing while arbitrary management decision, the issue of first come first serve and willingness of users to their bill had least influence. It would have been expected that users who had the fund be accorded priorities to salvage time but such approval; might be construed to be inefficiency and might be used to rate the management performance. This might be the reason why it's not encouraged influencing their decisions.

4.3 Factor Influencing Maintenance Programmes

The findings in table 5.0 and 5.1 revealed that environmental and climate conditions availability of funds and socio – political factors are all influencing the tertiary institutions maintenance programme. This findings corroborated in part similar work of mahmoud (2000) in Riyadh university where listed factors influencing maintenance programme of the university as environmental and climate conditions contract system organizations e.t.c.

However, fund availability, with socio [political reason among others like willful damage, vandalism, indecision of management (table 4. 18) is unique to Nigerian environment.

The problem of fund available for maintenance was treated by (Oladapo, 2004) where he painted the picture of under-funding and went to suggest that 10% of cost of constructions of the building should be set aside for effective maintenance.

The unstable academic session characterized by frequent closure occasioned by students unrest is part of our academic experience, in the course of unrest, student embark sometimes violent demonstrations vandalisms, and willful damage which deplete the stock of available sound structures. Most universities that aware of these problems had instituted their programme to alight with development.

Major facilities in the university are overhauled, repaired and refurbished during closure, which is alien to universities in developed economy. The decision to effect repairs by the management when faults are reported is influenced mostly by economic factors such as fund availability, order of fault report, revenue generating status of the building age of building followed by building characteristic of location, complexity size, status and age; while political factors in the least influencing amongst which are management decisions, user, status users persistent complaints and use of buildings.

5. Summary of Findings

From the analysis of the results certain factors influencing maintenance programme of tertiary institution's buildings become obvious as poor time management, lack of effective maintenance culture, High cost of maintenance works; inadequacy of skilled maintenance workers, in availability of tools and equipment to use, ageing of components and fillings, willful vandalism and exposure to weather. Also included in the list of these factors are those classified as management factors and these are: approval protocol, Delay in reporting defects, delay in release of funds from management/bursary and political factors like user status, user record of persistent complaints and use of building. Whereas those found and classified as economic factors are first come first treated, revenue generating status of building, user's willingness to foot bill for later refund and proximity of building to defect generating factors like lagoon front in University of Lagos.

6. Conclusion and Recommendations

6.1 Conclusion

The following conclusions made from the research in line with the findings that inadequacy of staff and lopsidedness in their distribution across the professional discipline exerts significant influence on prompt and qualitative delivery of service to end users measure of efficiency of maintenance works, users measure of efficiency of maintenance departments is anchored on present state and conditions of facilities in the institution as well as prompt response to complaints by both management and maintenance departments while the common maintenance problems in the tertiary institutions are in the area of services.

This is more in plumbing and electrical works while cleaning is equally a major problem in routine maintenance works.

The factor of environment and climatic conditions were also found to influence to a large extent, the effectiveness of the tertiary institution's maintenance programme while availability of funds is the most critical factors influencing the maintenance programme of tertiary institutional building in Southwest Nigeria. It is also noteworthy that socio-political reason is an influencing factor of maintenance programme and Building Characteristic e.g. Building complexity, building size, building status and building age are also factors that influence management decision to effect repairs on a building maintenance. Epileptic academic calendar characterized by unending students unrest is equally a major factor in effecting a workable maintenance programme in tertiary institutions in Southwest Nigeria while willful damage and vandalism also contributes to defects manifestation and maintenance needs in Nigerian university system.

6.2 Recommendations

The following recommendations are proposed in line with the conclusions on how to improve the maintenance programme of tertiary institutional building:

- The budgetary allocation for maintenance of tertiary institution by the federal Ministry of Education is grossly inadequate. The ministry should allocate a substantial budgetary allocation to the maintenance of the facilities and other infrastructures which should be reviewed from time to time to accommodate inflationary trends.
- Adequate training should be encourage among staff of the works and services department to acquire the necessary skills for continual maintenance of the facilities in their schools.
- Approval protocol should be made flexible in order to allow maintenance needs to be met immediately
- Appropriate tools and equipment should be made available for maintenance to be effective
- The management should endeavors to provide maintenance department with adequate staffs, because most departments are understaffed and this in turn delays job execution.
- The rate of response to maintenance need, damages, and faults reported should be made more faster because minor fault get expanded if immediate action is not taken and this increase the cost of repair.
- Management and senate of each university should evolve a conflict resolution technique that will ensure that steady and stable academic calendar is sustained and consequently eliminates willful damages and vandalism associated with students' unrest.
- An enlightening programme should be undertaken by ways of hand bills and postal educating students on collective responsibility of keeping the hostel unvandalized and properly maintained.

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