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# DEVELOPMENT OF STRATEGIES FOR THE IMPLEMENTATION OF NATIONAL PUBLIC MAINTENANCE FRAMEWORK IN TERTIARY INSTITUTIONAL BUILDING IN DELTA STATE, NIGERIA

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## Abstract

There is awareness that appropriate maintenance strategies can help to improve the present conditions of buildings in tertiary institution in Nigeria. However, there are few studies on the most appropriate maintenance strategies to be engaged by maintenance department to improve the conditions of the existing academic buildings in tertiary institution in Nigeria. Therefore, the aim of this research is to access the conditions of current conditions of the student used building in tertiary institution building in Delta State in a view to develop a guild to minimized building defect in the study area. To achieve this aim, objectives were developed. They include: evaluating the current conditions of tertiary institutional buildings in Delta State and hypothesis was formulated; Being qualitative research, the study adopts questionnaire, interview and review of related literature to source the data needed for the analysis. Structured questionnaire was used to extract primary data from maintenance staff and professional in the build environment of the institutions, while direct observations were employed in deriving data on the state of disrepair of the buildings. The data collected was analysed using standards application software's which include Statistical Package for Social Sciences (SPSS version 20) and Microsoft Word 2020. Relative Important Index (RII) was used for ranking. One hundred and thirty-three (133) copies of the questionnaire were administered, and the results obtained were presented in a frequency table and a chart; From the analysed data, it was concluded that the Maintenance policy and practice adopted by the institution are the very significant factor responsible for the current state of institutional buildings in the study area.

**Keywords:** Building Maintenance, Institutional Buildings, Maintenance Strategies, National Public Maintenance Framework, Tertiary Institution

## Introduction

National Incident Management System (NIMS) define national public maintenance framework as provides a consistent nationwide framework and approach to enable government at all levels (Federal, State, tribal, and local), the private sector, and nongovernmental organizations (NGOs) to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents regardless of the incident's cause, size, location, or complexity Maintenance enhances the quality of a building structure to meet modern requirements in order to prolong the life span of the building. It is required to ensure the safety of building occupants. Shohet, Pulen (2002) made it clear that there are increasing

demands on maintenance programme to provide tools that will support maintenance planning. This is also confirmed by Olagunju (2012) who also notes that the absence of appropriate tools for predictive maintenance of existing buildings can have a detrimental effect on the future of such buildings. It is necessary to carry out maintenance works for the safety of users and properties in the buildings, to also preserve the physical condition of the buildings and keep the buildings in good operational state at all times. Appropriate building maintenance can be achieved by providing maintenance tools for public buildings, especially in public institution. This study is aims to provide a guild for implementation of national public maintenance framework for effective maintenance of tertiary institutional buildings in Delta State.

## Literature Review

School buildings should be one of the most important public buildings in the society. It is amazing that such an important structure has been allowed to fall into disrepair in the society. institution building quality can be measured by the level of resources, infrastructure and facilities available in a school. It is the responsibility of government to play a substantial role in providing good education for their citizens. A variety of reasons usually motivate government and this can be either economy or politics. School quality may be measured by the amount of investment from the government not minding the society. Ekundayo (2010) found that most Nigerian school buildings were of poor quality. However, the poor quality was linked with numerous problems bedevilling the system, such as inadequate funding, inadequate facilities, low morale of staff, poor supervision of schools and frequent changes in policies.

Jegede and Owolabi (2003) observed that in Nigeria, emphasis is increasingly placed on academic qualifications; hence, schooling is beginning to be part of people life style. For people to be encouraged, a befitting academic environment must be established. According to Wong. (2006), in Singapore, schools are handled with care to the extent of having guidelines on standards and criteria for the planning of both primary and secondary school's higher institutions. In South Africa, great attention is also given to schools, as explained and there is increased liability in school buildings, considering the importance of schools. The owners, public or private, need informed decision in setting out the priorities that could drive maintenance of their properties, Silva (2009). Shohet *et al.* (2002) noted that regular inspection is a fundamental part of preventive maintenance. That study suggested a condition survey for effective maintenance work to carry out an assessment of the present condition, identification of the intervention moment and maintenance priority for maintenance planning. The study stated clearly that preventive maintenance must have inspection cycle until when failure becomes impossible to avoid. As a follow up to the study, Iyagba (2005) noted that more emphasis should be on preventive maintenance because it is the most important of all types of maintenance practice. The study recommended that regular inspection should be carried out for good maintenance; this must be done with sound knowledge of causes of decay and understanding of building construction. It was further explained that all building properties should be inspected at stipulated intervals to identify existing deterioration and recommend required maintenance planning work. That study concluded that deterioration should be measured within a stipulated time and that, the state and period of interval between one condition survey and the other should be stated.

In the same manner, Olotuah (2006) carry out an appraisal of the state of repairs of buildings in Akure, Ondo State, Nigeria. The study revealed that most buildings were in

poor state and required major repairs. The variables investigated were floor finish, building age, household size, number of bedrooms, amenities, mode of construction, wall materials and type of tenure. These variables significantly showed the state of disrepair and the need for rehabilitation. The problem of poor maintenance culture has been widely recognized in Nigeria (Mbamali, 2003; Adejimi, 2005; Usman, 2012). The lack of maintenance culture was also attributed to the factors responsible to the present conditions of tertiary institution buildings in Nigeria by Waziri and Vanduhe (2013). The lack of maintenance culture reduces the life of buildings before the obsolescence state. Shohet and Perelstein (2004) remarked that resource scarcity gives limitation to building maintenance because people do not have maintenance budget in their agenda. In many developing countries, maintenance of buildings and infrastructures had not been well planned, as remarked in the studies of Zubairu (2001); Almeida (2011).

The physical and functional state of a building is the major feature by which its condition can be evaluated. Adenuga and Dosumu (2012), in a study of the assessment of procurement methods used for maintenance works of buildings, found that only 27% of surveyed respondents perceived their buildings as being in very good condition. Once they have been completed, buildings are generally expected to perform certain functions for a certain period. However, a building must be maintained to keep it in optimal operation since it is impossible to have maintenance-free buildings (Ajetomobi & Olanrewaju, 2015). In fact, the physical and functional condition of any building is a reflection of the amount of maintenance attention given to it. Lateef, Khamidi, and Idrus (2010) assert that a building is an asset whose value changes in accordance with the quality and quantity of maintenance activities invested in it. The essence of building maintenance is, therefore, to increase the service life of a building by delaying deterioration, decay, and failure.

Building maintenance must, therefore, be considered as a strategic process if the value of a building is to be sustained (Idrus, Khamidi and Lateef, 2009). It has thus been established in the literature that for optimum performance in tertiary institutions, functional assets are required. Waziri and Vanduhe (2013) observe that both public and private buildings in Nigeria are faced with neglect owing to lack of maintenance, which in turn results in a rapid rate of defects, deterioration, and failure in some cases. Adenuga (2012) presents a comprehensive list of various building elements and maintenance services that are required for keeping a building well maintained: building fabrics, services, environment, and aesthetic. This study adopts the list of maintenance services as presented by the authors of reviewed literature to evaluate the operational state of buildings in tertiary institutions in South-West Nigeria.

Building problems can be classified as defects or failure. The term ‘defect’ has been defined differently by researchers. It means the shortcomings in the design and construction practices for some of them, while to others; it implies the inadequacies that arise from normal wear and tear. Some of these definitions are thus; Maisarah and Mastura (2012), opined that; a defect can be defined as a shortcoming in the performance of a building element. A defect will occur after the building has been occupied. Watt (1999) view building defects as “failing or shortcoming in the function, performance, statutory or user requirement of a building, and might manifest itself within structure, fabric, services or other facilities of the affected building”. “A defect is a shortfall in performance occurring at any time in the life of the product, element or building in which it occurs (Building Research Establishment BRE Digest 268). Olanrewaju and Idrus (2010) indicates that design and construction

defects are those that are caused due to wrong methods of construction, poor materials and bad labour practices.

According to the Insurance and Risk Management Institute, a building defect is a deficiency in the design or construction of a building or structure resulting from a failure to design or construct in a reasonably workmanlike manner, and/or in accordance with a buyer's reasonable expectation.

However, Table 1 shows that there has been recent increase in research on defects in the building sector

**Table 1:** Definition of Defects in various context

| Context of definition | Definition | Literature Sources |
|---|---|---|
| Wider Construction environment | Wider construction at any time in the life of the environment | BRE (1990) |
| Wider Construction | Non-fulfillment of intended usage environment requirements | Josephson and Hammarlund (1999) |
| House building Environment | Failing or shortcoming in function, performance, statutory or user requirements of a building that manifests itself within the structure, fabric services and other facilities of the building. | Ilozor, (2004) |
| Wider Construction environment | Part of work which is not in accordance with the work's information | NEC (2005) |
| House building Environment | A final product that does not meet the required quality | Kim,(2007) |
| House building Environment | A component has a shortcoming and no longer fulfils its intended Function. | Georgiou (2010) |
| House building Environment | Breach of any mandatory requirement by builder or anyone employed by or acting for the Builder. | NHBC (2011) |
| House building Environment | Something that is unfinished, or an imperfection that is inadequate or causes failure. | Beattie (2011) |

**Source:** Dahanayake and Ramachandra (2015)

Generally, building defect is defined as a defect or deficiency in the design, the construction, and/or in the materials or systems used on a project that may not be readily observable and results in a building, structure or component that is not suitable for the purpose intended. It includes both design and construction defects that result in financial harm (either property damage or personal injury) to the owner or to a third party (Metropolitan Engineering Consulting and Forensics Services, 2013).

## Common defects in building

In general, there are several building defects which usually occur to building parts such as foundation, roofs, walls, floors, ceiling, painting, plumbing and toilets, doors and windows. (Tan, 2008). Building defects that are commonly found includes; wall crack, peeling paint, dampness, timber decay, fungi and small plant attack, sagging or deformation, erosion of mortar joint, defective plaster rendering, insect or termite attack, roof defect, and also unstable

foundation, and services (Nurul and Azree, 2014).

### (a) Crack on walls

Cracks in a building are of common occurrence. A building component develops cracks whenever stress in the component exceeds its strength. Cracks are classified into structural and non-structural categories. The structural ones are due to faulty design, faulty construction or overloading which may endanger safety of buildings. The non-structural cracks are due to internally induced stresses (Kalyana, Raghava, Sampath and Vickranth, 2009) It is the nature of many construction materials to crack as they age and as they expand and contract, particularly with exposure to moisture as they get wet and dry out alternately. There are cracks in common areas, such as exterior walls, interior walls at corners of doors and windows, and ceilings (usually in the middle) (Nurul and Azree, 2014). Cracks can be classified depending on width of crack and visible damage to walls. See Table 2.

**Table 2:** Classification of cracks

| Category of Damage | Degree of Damage | Description of Typical Damage | Approximate crack width (mm) |
|---|---|---|---|
| **0** | Negligible | Hairline crack of less than about 0.1 mm widths are classed as negligible. No actions required. | Up to 0.1 |
| **1** | Very slightly | Fine cracks which can be easily treated during normal decoration. Damage generally restricted to internal wall finishes, crack rarely visible in external brickwork. | Up to 1 |
| **2** | Slight | Crack easily filled. Recurrent crack can be masked by suitable linings. Cracks on not necessarily visible externally, some external reappointing may be required to ensure weather tightness. Doors and windows may slight and require easing and adjusting. | Up to 5 |
| **3** | Moderate | Crack which required some opening up and can be patched by a mason. Repointing of external brickwork and possibly small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weather tightness often impaired. | 5 to 15 (or several of 3mm) |
| **4** | Severe | Extensive damage which required breaking-out and replacing sections of walls, especially over doors and windows. Windows and doors frame distorted, floor sloping noticeably. Wall leaning or bulging noticeable, some loss of bearing in beams. Service pipes disrupted. | 15 to 25 But also depend on number of crack |
| **5** | Very Severe | Structural damage which requires a major repair job involving partial or complete rebuilding. Beams lose bearing, wall lean badly and require shoring. Windows broken with distortion. Danger of instability. | Usually greater than 25 but depends on the number of crack |

**Source:** Nurul and Azree (2014)

### (b) Peeling of Pain.

Peeling paint significantly lowers the attractiveness of a building. It can turn a beautiful house into a rotting structure, a clean bathroom into an unsanitary mess. And, if the peeling happens on the interior walls or ceiling, it can even cause health issues for the occupants; falling paint chips can be harmful if they land in your eyes, and breathing in paint dust can irritate your lungs (Januaris, 2019). Peeling usually occurs on building facades, mainly on plastered walls, columns and other areas which are exposed to excessive rain and great dampness. Peeling paint is always the result of poor paint quality. The majority of peeling paint problems occur on surfaces exposed to the rain, sun, and the variation degree of temperature. Peeled Walls can be an unsightly in a home or building. If paint peels

from an interior wall, the reason for the peeling paint is mostly often due to an improper preparation of the surface before painting. Apart from that, the moisture surrounding the wall also seeps in through from the wall to the paint surface. It happens when new plastered or skimmed walls or ceiling are not given enough time to completely dry before painting. Generally, the common causes of peeling of paints according to Januaris (2019) are; Water, high humidity and excessive condensation, poor surface preparation, dirty surface, high temperatures and intense sunlight, using a paint incompatible to the surface, many different coats on the same surface, too many layers of paint, low-quality paint brands, using the wrong paint or primer, expired paint, corrosive substances, extreme dryness, poor application methods, and an old coat of paint.

**(c) Rising Dampness Problem**

Dampness is generally defined as unwanted and excessive water or moisture. The existence of dampness in building is one of the most damaging failures that really must be taken care of. It can cause damage in brickwork by saturating them, decaying and breaking up of mortar joints, rotting in the timber structures, defecting by the corrosion of iron and steel materials and also destroying the equipment in the building. Dampness in walls has been taken into consideration in recent years. Dampness can be a serious matter, particularly to the building located near water lodge area. Somehow, the water can enter the building bit by bit through different routes resulting in dampness.

Dampness also occur when water penetrate through capillaries or cracks between mortar joints, and bricks or blocks before building up trap moisture behind hard renders. The other factor such as leaking gutters or down pipes, defective drains, burst plumbing, and condensation due to inadequate ventilation also can be the factors yielding to dampness occurrence. Dampness in building originated from a number of sources such as: Rain, Condensation, Services leaks, use of the building, moisture in the air, Rising damp and flooding.

**(d) Defective Plastering and Rendering**

Plaster is a building material used for the protective or decorative coating of walls and ceilings and for moulding and casting decorative elements. "Plaster" usually means a material used for the interiors of buildings, while "render" commonly refers to external applications.

Plaster or render is like mortar coating over the block work. Plaster and render are different in term of mix and have different function. The render is generally richer and mostly in cement than the plaster this is because it has to function as weather resistant. The plaster insides the walls is to make the walls smooth, easy to clean, prevent from insect, give better appearance and act as a protection against fire. The other functions are breathable for walls, abrasion resistant, and suitable for decorating or covering with coating, wallpaper and tiles.

Defective rendering occurs on the external walls, column and ceiling. Defective rendering is normally caused by biological attacks arising from penetrating rain, evaporation, condensation, air pollution, dehydration and thermal stress (Nurul and Azree, 2014). The mold or harmful growth, insect, animals, and traffic vibration will also cause defective plaster rendering. Prior to being decomposed and broken apart, rendering may crack due to either shrinkage or movement in the substrate. (Ghafar, 2004). Types of defective plaster/render includes; cracking in Plastering, holes in Plaster, plaster falling off from ceiling, Shrinkage Cracking. These defective plaster/render types are cause by the following factors; Loss of bond between coats, surface cracking, water damage, movement of structure,

Chemical attacks, efflorescence, lime Bloom etc.

### (e) Roof Defects

Defects in roofs are often hard to pinpoint. Rainwater entering a flaw in a roof may travel through many different elements of the building before appearing. Water will travel along impervious surfaces such as vapour barriers or structural members, and so defect diagnosis can require more investigative work than for other types of defect (Tan, 2008). Roof is usually exposed, particularly to the extremes of temperature degree and change, solar radiation, and wind action. Roofs have special risk due to the design of the building itself such as services passing through the roof covering, and internal gutters. Roof defect can be structural faults which can be identified from the visual inspection and defect in the waterproofing material. There are so many types of roof defects. Jana (2004) refers to them as roof problems and opined that they include; Roof leaks and moisture, Blow-offs, tenting, reduced wind uplift resistance, and billowing, Poor installation and unsatisfactory workmanship, Lack of maintenance, Ponding water, Punctures and the addition of penetrations post-installation, Improper safety procedure in application, Improper repairs, Shrinkage, and Blistering.

### (f) Unstable Foundation

A foundation is a lower portion of building structure that transfers its gravity loads to the earth. The foundation will be carrying out both the dead and live load and will transfer the load to the soil. The function of the foundation is to avoid building from sinking due to erosion or movement and also to stabilize the building. Foundation is necessary to support a building and all of its loads that are within or on it. The foundation should be made from material that will not fail and loose its stability in the presence of ground or surface water. When the building or property is designed, there should be little or no cracking in the foundation and of course zero water leaks. If there is presence of difficulty in the foundation, it will defect all of the building structure. Some of the effects of foundation problem are building collapsing, crack on the floor and the wall etc. According to Nurul and Azree (2014) the causes of unstable foundation are:

a) Movement of the soil in the presence of water flow
b) Faulty Design
c) Overloaded
d) Faulty Materials
e) Natural Disaster

### (g) Timber Decay

Timber remains one of the most useful materials in a world of diminishing resources and is a major component in most historic buildings. It has many positive structural and aesthetic properties as well as being an energy-efficient and renewable resource. However, timber provides specialised ecological niches and many organisms have evolved to use it as a food. The most common and destructive to timber are dry rot, wet rot, common furniture beetle, and death watch beetle (Jagit, 1996).

Timber defect is classified into two major groups, non-biological and biological deteriorations. Non-biological deterioration consists of physical decay, excessive moisture content, dimensional instability and chemical deterioration. These defects are mainly caused by the timber in service being subjected to environmental exposure. The most common and destructive timber biological deterioration is those due to dry rot, wet rot as well as insect attraction (Nurul and Azree, 2014). Typically, timber decay may occur at roof timber, floor timber and joinery timber such as door frame or window frame. This defect results whether woodworm infestation is active or there is evidence of decay such as wet rot and dry rot. It is essential that the cause and full extent of

the attack is established. Besides that, timber decay in building or home will only occur if the timber becomes sufficiently wet. Timber is durable material and would last indefinitely as it does not deteriorate spontaneously. Magnificently, atmospheric condition such as rain, frost and acids that would normally affect other materials, however only has little effect on timber (Taylor, 2000). The most common causes of timber decay are: wood boring insects, fungi decay, etc.

**(h) Insect (Termite) Attacks**

Termites are an essential member of the soil ecosystem and are found throughout the world. Termites are small, pale to brownish black in colour, insect that capable of feeding on mostly anything including timber. The timber is easily deteriorated if exposed to water penetration, high moisture content and loading beyond its capacity as this greedy and colony-living insect is easily attracted to it. Insect or termite attacks pose a threat to damp and digestible timber found in wall plates, the feet of rafter, bearing ends of beams and trusses. Affected timber can be treated by pressure-spraying with insecticide or fumigant insecticidal process. According to Ghafar, (2004) subterranean termites or underground termites are the most destructive insect pests of wood. Their activity is often not readily noticed because they are hidden behind wallboards, sliding or wood trim. When natural vegetation is cleared and houses are built, termites often switch to feeding on wooden structures. Next, they will continue to enter the building through wood that is direct contact with the soil and by building shelter tubes over or through the cracks found in the foundation. Infestation of termites can do damage to any cellulose-based material in direct contact with the soil. Most of timbers that are commonly affected by termites are plywood, meranti, and selangan batu and also belian (ironwood). Dead wood, tree stumps and nearness to forest areas also increase the likelihood of the attack by termites. To avoid this, the forest must be cleared for building, and the dead wood should be removed and are not left to rot under the residence (Nurul and Azree, 2014). Termites will survive as long as there is moisture, dark and low light Intensity and minimal flow of air. They can spread easily in a blink of an eye into larger area and build their nest there in the building.

**(I) Fungi and Small Plant Attack**

Fungi and Mold are often used interchangeably, but Mold is actually a type of fungi. Fungi (Mold) is found everywhere both indoors and outdoors all the year round. Exposure to Mold can cause a variety of adverse health effects. There are many thousands of species of Mold and most, if not all of the Mold found indoors comes from outdoor sources. It seems likely to grow and become bigger threat only in humid environment. Molds live in the soil, on plants, and on dead or decaying matters. Outdoors, Molds play as a key role in the breakdown of leaves, wood, and other plant debris. Molds belong to the kingdom of Fungi, and unlike plants, they lack chlorophyll and must survive by digesting plant materials, and consequently inverting them and other organic materials as food. Without Molds, our environment would be overwhelmed with large amounts of dead plant matter. Molds produce tiny spores to reproduce, just as same as those plants that produce seeds. These mold spores can be found in both indoor and outdoor air, and settled on both of the surfaces. When Mold spores land on a damp spot, they may begin growing and digesting whatever they are growing on in order to survive. Since Molds gradually destroy the things, they grow on, you can prevent damage to building materials by eliminating their growth. Molds produce and release millions of spores small enough to be in the air, water, or insect borne. They can also produce toxic agents known as mycotoxins. Spores and mycotoxins can have

negative effects on human health. Spores of Mold from trees can be spread to the building by the assistance of air, water and insect borne. Molds can grow on almost any substances when moisture presents. Molds reproduce by spores which can be carried by air current. When these spores settle on a moist surface that is suitable for life, they begin to grow. Common causes of molds include; Water leakage leading to high humidity

The body of knowledge has shown that there is still existing knowledge gap in developing a guild for the implementation of public maintenance framework to minimise defects in the tertiary institutional buildings in Delta State.

## Methodology

Considering the nature of the questionnaire of the study, the set of data needed for this study is qualitative in nature. Two survey techniques were used such as administration of questionnaire and interview. The techniques enable the researcher to collect qualitative data from the tertiary institution maintenance staffs and professionals in the build environment and is a survey design category. The survey design concentrates on the population of the study where data were collected for intensive study and analysis of the maintenance defects in the study area. The survey assists to evaluate the current conditions of tertiary institution student use buildings within the study area the population of this study constitutes maintenance staff and other professionals' in the build environment that comprises the four tertiary institution in Delta state such Petroleum Training Institute (PTI) located at Uwie L.G.A, Federal University of Petroleum Resources (FUPRE), also located at Uvwie L.G.A, Delta State University (DELSU) Abraka, located at Ethiope West L.G.A. and Delta State University of Science and Technology, Ozoro (DSUST) at Isoko north L.G.A. in Delta State. The study covers student used building in the four tertiary institutions such as library, laboratory, workshops, ICT building, lectures buildings and student hostels as contain in the Table 3. Since the population for this study is not that large, effort was made to administer the question to the 144 members on the sampling frame. The data set needed was quantitative data obtained through well-structured questionnaires.

**Table 3:** Questionnaire Responses for institutions

| PROFESSIONALS | PTI | FUPRI | DELSU | DSUST | TOTAL |
|---|---|---|---|---|---|
| Architects | 4 | 3 | 5 | 7 | 19 |
| Builders | 2 | 2 | 2 | 9 | 15 |
| Civil Engineers | 11 | 12 | 10 | 7 | 40 |
| Electrical Enginner | 11 | 10 | 8 | 4 | 33 |
| Mechnical Engineer | 5 | 5 | 3 | 3 | 16 |
| Quantity Surveyors | 2 | 3 | 3 | 2 | 10 |
| Total | 35 | 35 | 31 | 32 | 133 |

**Source:** Field Survey (2023)

## Results

### Current conditions of student used tertiary institutional building in Delta State

**Table 4:** General Current condition of tertiary institution student used buildings in Delta State

| S/N | Current State | Frequency | Percentage (%) |
|---|---|---|---|
| 1 | Some buildings have deformed roof | 7 | 5.3 |
| 2 | There is general deterioration | 15 | 11.3 |
| 3 | Observable Erosion/moisture penetration into building | 9 | 6.8 |
| 4 | There is disjointed doors and fittings | 17 | 12.8 |
| 5 | There are buildings with notable wall cracks | 15 | 11.3 |
| 6 | Most structure carry more users than the capacity of the structure | 21 | 15.8 |
| 7 | Some buildings are Poorly designed and sited | 4 | 3.0 |
| 8 | Some buildings appear to have Poor quality building material | 4 | 3.0 |
| 9 | Some are well structured and still good | 5 | 3.8 |
| 10 | There are obvious Electrical problems | 18 | 13.5 |
| 11 | There are noticeable Plumbing problems | 18 | 13.5 |
| | Total | 133 | 100.0 |

Table 4 shows the current conditions of tertiary institution student used buildings. The results indicate that most of the structure carry more users than the capacity of the structure most especially the laboratory and lecture hull with 15.8%, there is obvious electrical problems and noticeable plumbing problem with 13.5% respectively and it occurred at the hostel building. There is disjointed doors and fitting with 12.8% and notable cracks on most of the accessed student used building and there is a general deterioration in most of the building with 11.3% respectively. Observed Erosion/moisture penetration into building, deformed roof, Poor designed and Poor-quality building material were also notice with lower percentage of 6.8%, 5.3%, and 3.0% respectively. See Figure 1.

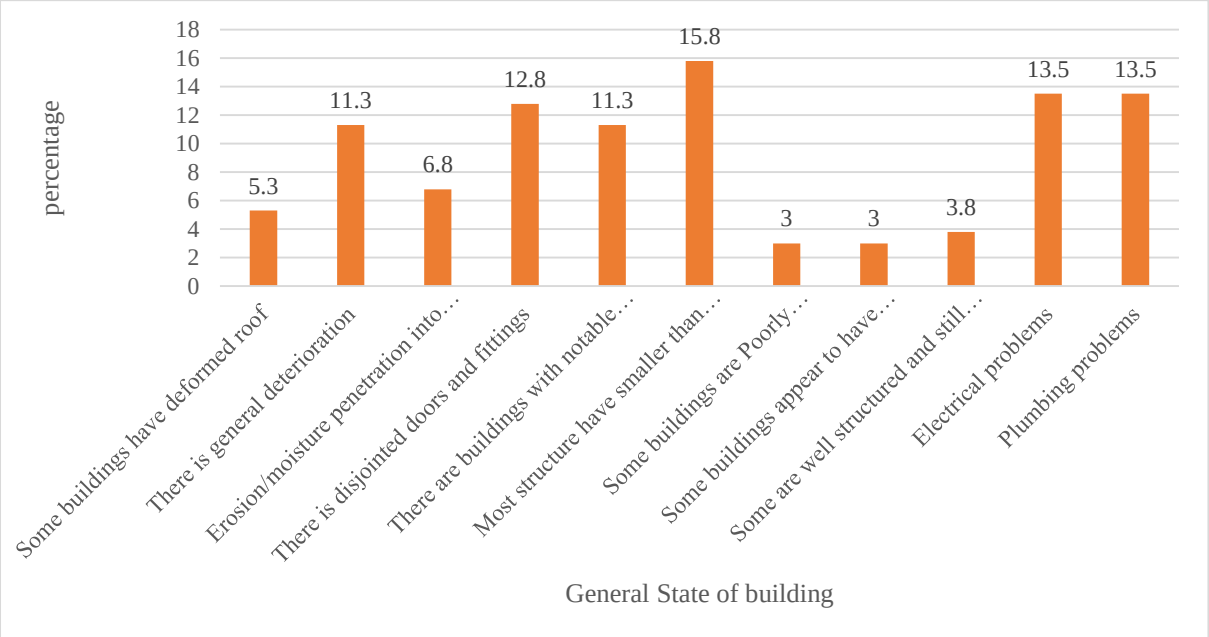



**Figure 1:** General Condition of building.

$H_0$: There is no significant difference in the mean general condition score of tertiary institution buildings in Delta State.

**Table 5:** Result and Interpretation (Hypothesis)

| | School | N | Mean | Std. Dev. | Df | F value | p value |
|---|---|---|---|---|---|---|---|
| **Condition of Library** | PTI | 35 | 3.3536 | 1.18333 | 3 | 0.755 | 0.521 |
| | FUPRE | 35 | 3.5357 | 1.18452 | | | |
| | DELSU | 31 | 3.1169 | 1.23657 | | | |
| | DSUST | 32 | 3.2070 | 1.26108 | | | |
| | **Total** | **133** | **3.3111** | **1.21178** | | | |
| **Condition of Laboratory** | PTI | 35 | 3.3536 | 1.15463 | 3 | 0.243 | 0.866 |
| | FUPRE | 35 | 3.4500 | 1.10613 | | | |
| | DELSU | 31 | 3.2298 | 1.23664 | | | |
| | DSUST | 32 | 3.2500 | 1.27238 | | | |
| | **Total** | **133** | **3.3252** | **1.18075** | | | |
| **Condition of Workshop** | PTI | 35 | 3.1107 | 1.10637 | 3 | 0.548 | 0.650 |
| | FUPRE | 35 | 3.1643 | 1.12695 | | | |
| | DELSU | 31 | 3.1532 | 1.14004 | | | |
| | DSUST | 32 | 2.8516 | 1.16156 | | | |
| | **Total** | **133** | **3.0724** | **1.12723** | | | |
| **Condition of ICT building** | PTI | 35 | 3.8786 | .90621 | 3 | 2.275 | 0.083 |
| | FUPRE | 35 | 3.6429 | 1.05725 | | | |
| | DELSU | 31 | 3.5323 | 1.14199 | | | |
| | DSUST | 32 | 3.2031 | 1.18660 | | | |
| | **Total** | **133** | **3.5733** | **1.08909** | | | |
| **Condition of Lecture hall** | PTI | 35 | 2.6036 | 1.00068 | 3 | 0.596 | 0.619 |
| | FUPRE | 35 | 2.8464 | 1.07019 | | | |
| | DELSU | 31 | 2.8750 | 1.08157 | | | |
| | DSUST | 32 | 2.6094 | 1.23203 | | | |
| | **Total** | **133** | **2.7321** | **1.09159** | | | |
| **Condition of students' hostels** | PTI | 35 | 2.4357 | 1.05474 | 3 | 0.798 | 0.497 |
| | FUPRE | 35 | 2.8036 | 1.19907 | | | |
| | DELSU | 31 | 2.8065 | 1.19541 | | | |
| | DSUST | 32 | 2.6016 | 1.21750 | | | |
| | **Total** | **133** | **2.6588** | **1.16380** | | | |

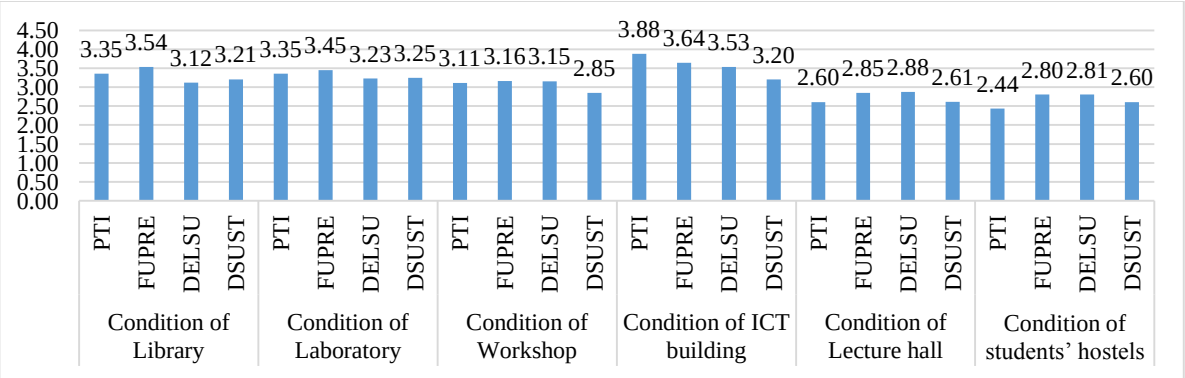



**Figure 2:** Result and Interpretation (Hypothesis)

**Table 6:** General conditions of buildings in public tertiary institution in Delta state

| | School | N | Mean | Std. Dev. | Df | F value | p value |
|---|---|---|---|---|---|---|---|
| **General condition of buildings** | PTI | 35 | 3.1226 | 1.05432 | 3 | 0.359 | 0.783 |
| | FUPRE | 35 | 3.2405 | 1.11356 | | | |
| | DELSU | 31 | 3.1190 | 1.16297 | | | |
| | DSUST | 32 | 2.9538 | 1.21150 | | | |
| | **Total** | **133** | **3.1122** | **1.12618** | | | |

Table 5 shows that the mean conditions of specific student-used buildings in public tertiary institutions in delta state such as library, laboratory, workshop building, ICT building, lecture halls and student hostels show no significant variation from each other. The result shows that there is no significant difference in the mean of each of the condition of tertiary institution buildings in Delta State. In each case, the *p value > 0.05*.

Table 6 affirms that the mean general conditions of student used building in public tertiary institution in delta state show no significant difference. In this case also, the *p value > 0.05*. However, the mean values as presented in Figures 2 and 3 show that the buildings are in fair condition.

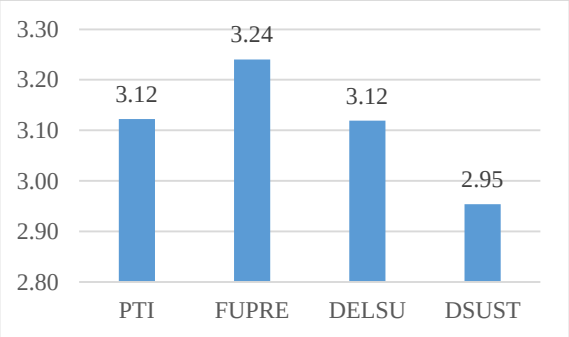



**Figure 3:** General conditions of buildings in public tertiary institution in Delta state

The deduction from Figure 1 and Table 4 is that there are eleven (11) identified current condition in the student used tertiary institution building in the study area. most of the structure must be compel to carry the capacity of the structure designed most especially the laboratory and lecture hull, fixed electrical and plumbing issues that occurred at the hostel building and all other identified defect.

## Discussion

From the result in Table 4, having presented and analysed the data gathered from the questionnaire, personal survey and literature review, a total of eleven (11) general condition of building was identify affecting the value and aesthetic of the institution structure in the study area. The identified problems include; deformed roof, deterioration, Erosion/moisture penetration, disjointed doors and fittings, Cracks on walls, more users than the capacity of the structure, Poor designed and construction, Poor quality building material, well-structured building, Electrical problems and Plumbing problems. The findings further show that out of the building component condition identified and accessed, the top most significant component affected by maintenance are; roof conditions, floor and slab condition, condition of walls, painting condition, window and door condition, electrical and plumbing conditions.

## Conclusion

The findings were done in the selected tertiary institution in Delta state, Nigeria and it clearly showed that maintenance of tertiary institution is very important. Maintaining the buildings of tertiary institution resuscitate the aesthetic of the institution. As academic performance influences the admission of the candidates, so also a well-maintained institution structures entice students. The study has shown that maintenance has direct influence on the buildings of tertiary institutions.

## Recommendations

1. the public institutions to; clearly define, establish and integrate maintenance policy and strategies into business operations and critically analysed and execute maintenance tasks and adoption of corrective and preventive maintenance as the most practicable techniques.

2. Buildings should be well maintained to prevent cracks on the wall and leakage of roofs and Tertiary institution should maintain their buildings regardless the age of existence, to increase the building life expectancy, types of occupancy, quality of repair and maintenance should be put into consideration.

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