IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 2, February 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com

Current Issues Associated With Public Building Maintenance in South-East Nigeria

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Abstract
Focusing on the rate of deterioration and decay, identification of the existing condition of a building must be detail measured to overcome the actual problem and risk associated for the next construction activities. The principal means of obtaining information about the construction and condition of a building comes from undertaking an inspection and survey. The research Primary source of data were questionnaire. The population consists of users of the selected public buildings in south-eastern Nigeria, comprising of Abia, Enugu and Imo state. A sample population of 314 respondents participated in the research. The targeted respondents were drawn from users of the selected public buildings, Estate Management Officers, Estate Assistants and Artisans that are in charge of managing and overseeing government properties of the selected study area as stated in the population of the study. A random sampling technique was used to determine the users of the selected public buildings. Mean, Relative Importance Index (RII) and a T-test was used in the analysis of result. From the result most of the building elements are not in a good position, with exception of Electrical systems which has RII of 0.75. The result with t-statistic value of -0.801 and associated probability value of $0.449 > 0.05$ indicates that there is no substantial development in the conditions of public buildings in the study area. However, the negative coefficient of t-statistic implies that the condition had continued to worsen over period. The research concludes that there is indication of a poor maintenance culture. Improvement of the maintenance of the public buildings and adoption of maintenance plan that are prompt in tackling the maintenance issues of the plumbing system.

Keywords: Building, Maintenance, Survey, Assessment, Public

Introduction

A building is regarded as an enclosure or "envelope" designed and constructed to provide minimum level of comfort, and conveniences for man. Building provides safety, protects human inhabitants, animals and equipment from effects of weather, and gives internal comfort (Ogunoh, 2014). This implies that the primary purpose of buildings is to provide occupants with conducive, safe, comfortable, healthy and secured indoor environment to carry out different kinds of activities ranging from work, study, leisure and family life to social interactions.

In order to achieve this purpose, buildings are designed, planned, constructed and managed based on standards and specifications established by governments, professional bodies and experts who are supposed to have adequate knowledge of users' needs and expectations. Studies such as Kaitilla, (1993); Ukoha and Beamish, 1997; Zeiler and Boxem, 2008; Meir, Garb, Jiao and Cicelsky, 2009; Eziyi, Akunnay, Albert and Dolapo (2013) have however shown that sometimes these standards and specifications do not conform to the changing needs and expectations of users; and thus users are not always satisfied with the performance of their buildings.

The main functional requirement of building is to ensure strength and stability, weather tightness, internal comfort level, optimum use of buildings and a longer serviceable life of buildings. This is only possible through undertaking of periodic and planned maintenance, at regular intervals (Gahlot 2006). Aluga (2001) defines maintenance as work undertaken in order to keep or restore a facility at an acceptable standard. He further recommends that management should view building maintenance as part of its operating strategy for property preservation contributing to the success, well-being and operations of its occupants. He also confirms that proper maintenance contributes in ensuring safety of occupants, users of buildings and the public.

Siyanbola. Ogunmakinde and Akinola (2013) maintained that for proper maintenance of building it is necessary to conduct a condition survey. According to Watt (2009) building condition survey is a survey recording and documenting any damage (by a structural engineer) to the building structure - including superficial damage. It is done to track the occurrence or exacerbation of building damage over time to provide objective proof in the event of any damage claims.

Governments in the developed world have attempted to ensure adequate and quality building for their citizens considering the socio-economic importance of housing. For instance, the United Kingdom (UK) Government undertakes an investigation referred to as the English House Condition Survey every 5 years since 1967 to document the housing stock and monitor its changing condition to provide a basis for Government policies on home improvement and area renewal. The survey entails physical examination of samples of housing stock, determination of history of repair and maintenance and their interests in home improvement as well as ability to finance necessary work, determination of institutional contributions by local authorities in housing renewal and a survey of house values. It assisted in determining stock's need for repair, and what parts need repair, determining work force and resources required and proves whether maintenance policies adopted are adequate.

The levels of defects and deteriorations in a building are the great influence to indicate the building performance instead of the services systems provided. The interaction of both people and surroundings towards the life cycle of a building gives impact on the property values. Dealing with the sub-sale housing properties, calls for Valuers expertise, experience and knowledge in property valuation. It is understood that the scope of inspection is limited for the

purpose of valuation only. Due to integration of skill and knowledge, the condition survey and assessment of building is foreseeable to help the Valuers in preparing an accurate valuation for sub-sale houses (Siyanbola *et al.* 2013).

Despite the significance of buildings to economic development, the housing situation in Africa has greatly been influenced by implementation of structural adjustment programmes which recommended reduction of government expenditures for housing. The change in housing policy had far reaching effects in provision of housing for low income earners in Africa. Subsequently, there has been minimal production of public housing for low income necessitating preservation of already existing housing stock (Ipingbemi, 2010).

Most buildings in Nigeria have suffered lack of maintenance which is manifested in public buildings in all major urban centres in Nigeria, confirming declining investments in the maintenance of housing estates (Ipingbemi, 2010). In recent years, not much has happened to transform this scenario requiring the relevant actors to conserve these assets for purposes of prosperity and posterity. Waziri and Vanduhe (2013) in their study titled "evaluation of factors affecting residential building maintenance in Nigeria" confirm that the country has had challenges of planning, development and management of its residential neighborhoods. This has resulted in deterioration of surrounding buildings and services due to lack of maintenance and unattended wear and tear caused by negligence by local authorities and government agencies responsible for management of the built environment (Cobbinah, 2010).

There are so many problems associated with the maintenance of buildings and infrastructural facilities in the country. One of the serious problems is finance; government financing as regards to maintenance of buildings (both public and private) is minimal. The grant towards maintenance of infrastructural facilities is at its lowest ebb. Most buildings and infrastructures have been neglected by subsequent tenures of government while the private sectors; the individual property owners have little or nothing to contribute towards effective maintenance of their buildings. As long as the buildings afford the owner annual income, he would not care for the maintenance and so long the interior of the building is conducive for the occupants they could not care for outward appearance or other necessary maintenance activity. Another serious impediment to maintenance of building in Nigeria is the state of the economy, according to the United Nation research on profitability index as regards income per capita of nations of the world; Nigeria is rated as fifth poorest country (UN 2010), which implies that the average Nigerian lives below one dollar per day. Because of this economic hardship, residents and citizens have little or nothing to contribute in terms of effective maintenance of their abode thus leading to neglected effects visualized in our cities and metropolis.

In addition, certain buildings in Nigerian cities were constructed during the pre-colonial era. Therefore most of these buildings are aged due to wear and tear, weathering and climatic factors over the years thus resulting in dilapidated nature, which might not respond positively to modern day maintenance techniques. The reason for this assertion being 51% repair replacement strategy, such buildings, the cost of their repairs might equal over 50% cost of new construction.

Buildings and infrastructural decay also stems from poor workmanship and poor supervision (Amobi, 2011). Most of these defects arise from the fact that the skill employed during the production of the buildings are defective, the supervision most times is minimal or left in the hands of unskilled foremen. Thus creating a chance, which were filled by unprofessional ethics thus resulting in failure in the life of the structure and will eventually be translated to the overall life span of the building/structure.

Literature Review

Building Survey

A building is an edifice erected by art, and fixed upon or over the soil, composed of stone, brick, wood, or other proper substance connected together, and designed for use in which it is so fixed (Wikipedia, 2011). The principal means of obtaining information about the construction and condition of a building comes from undertaking an inspection and survey. A Building Condition Survey (BCS) is an essential tool to fully understand the condition of an estate or buildings and to assist with planned maintenance (Watt, 2009).A Building survey is an investigation and assessment of the construction and condition of a building and will not normally include advice on value. A member of any of the contributing organizations who has appropriate experience may carry this out. The survey will generally include the structure, fabric, finishes and grounds; the exposure and testing of services are not usually covered (Che-Ani, 2008). It also means a detail building physical health check from roof to foundation examination of the building, normally conducted by a qualified building surveyor. Referring to the basics inspection skills and medium, the baseline that makes a qualified building surveyor differ from the ordinary people is on how to look and how to see in conducting the inspection (Che-Ani, 2008b).

Kerns (2009) explained that building survey provides an assessment of physical property conditions, whereby the extent of a condition survey can vary depending upon the Client's need for information. Starting with a visual observation of existing condition to periodic monitoring and testing of building and site system, building survey can be summarized in a one page letter or prepared in a bound report complete with test results, calculations, detailed narrative and photographs (Che-Ani, 2008a). This document can prove to be beneficial in the decision making process with respect to purchase, sale, refinancing, and avoiding potential claims, renovation and/or maintenance of a property and building

Mustafa, Roslan, Zakariah, Tawil and Hashim (2010) explained that focusing on the rate of deterioration and decay, identification of the existing condition of a building must be detail measured to overcome the actual problem and risk associated for the next construction activities. As mentioned by Che-Ani (2008), the purpose of having building inspection data are outlined below.

a) To get true picture of building physical condition especially the fabric and the structure
b) To determine how large the damages or defective area and planning preventive maintenance based on priority
c) To predict the strengthens of the old element or structure and provide basic data for repair or extend works in existing building
d) To provide estimate cost for the repair works and giving the value of the building after considered all the defects; and
e) Providing basic and design information for the future

Table 1: Summary of Survey and Assessment Conducted for Building

No	Task	Description
1	Preliminary site visit	Provide information of building occupant, familiarization of building layout, nature and extent of services and ensure availability for safe access of work.
2	Background research	Provide information on the issues concerning location, site, construction, use and occupation of the building. It includes background and historical information of the building,

		documentation oral and anecdotal information
3	Detailed on-site survey	Provide information on which to assess its condition and fitness for the purpose as prescribed by relevant documents or individual need. Identification of all defects and typically include commentary on specific items.
4	Preparation of a written report	Compilation of all relevant information derived from the preliminary site visit, background research, detailed on-site survey and communicate to the client on the implication of the building condition by assessing the defects and their significance from simple palliative measures to complex repair or replacement and cost of remedial work.

Sources: Che-Ani (2008)

According to James (2010),whether you're a developer, property owner, business owner, tenant or landlord, a Condition Survey conducted by a licensed Engineer(s) can prove to be beneficial in your decision making process with respect to purchase, sale, re-financing, avoiding potential claims, renovation and/or maintenance of a property and building(s).

James (2010) ascertained that a building survey provides an assessment of physical property conditions. He noted that survey should identify deficiencies, and maintenance issues including, but not limited to structural, mechanical, electrical, plumbing, fire protection, site layout, site utilities, storm water management, soil erosion and life safety systems. To facilitate an informed decision making process, a Condition Survey should result in a clear understanding of the current condition of operating systems by a Client.

Che-Ani (2008) stated that a preliminary building survey entails the review of existing documentation such as construction drawings, specifications, reports and calculations. He noted that during a preliminary building condition survey, the engineer(s), along with a person such as a building supervisor, visually inspect the site and building system(s). Photographs and video are useful to illustrate deficiencies that may be found during the on-site inspection. After documenting the existing conditions, the engineer(s) analyzes the collected data and summarize the findings and recommendations in a brief report.

After a preliminary building survey is completed, a detailed condition survey maybe requested to gather and document additional detail that were necessary to prepare renovation drawings, upgrade operating systems, and/or negotiate a property purchase or sale. In a detailed building condition survey, on-site interviews, maintenance history review, review of local municipal records, code compliance research, testing of operating systems, design and performance criteria definition, load capacity calculations and preparation of schematic drawings are generally areas addressed in the findings and recommendations report. The report should also address immediate, mid-term and long-term needs.

In addition to the obvious benefit of knowing the current condition and potential renovations and/or upgrade costs for a specific property, there are more benefits. If you are a property owner, with a completed building condition survey, you have a document that clearly defines property conditions at a specific point in time. Should a claim be filed against the property owner as the result of an allegedly defective operating system, the building survey serves as a benchmark to analyze alleged deficiencies. Ambiguity is removed from the investigative process, and that usually results in cost saving for all involved parties.

Maintenance of Public Buildings

Seeley (2002) defines maintenance as the combination of all technical and administrative actions including supervisory actions, intended to retain an item in or restore it to a state, a state where it can perform a required function. Maintenance is also defined as the restoring of an item to its original condition to working order (British Standard Institution, 1984). This can be achieved by repair, replacement of parts or total replacement of the item (Soderholm, 2007). Maintenance is also defined as work undertaken in order to keep or restore every facility i.e. every part of a site, building and contents to an acceptable standard (Wood, 2005).

Wood (2005) in his thesis "Towards innovative building maintenance" defines maintenance in its simplest sense to entail the repair or replacement of worn out or damaged parts in order to keep the building in a standard corresponding to its original characteristics and functions. In this case, maintenance does not include work necessitated by higher demands or for a change in the pattern of use that could not have been foreseen at the time of initial design.

Maintenance works as an important support function in business or organizations with significant investment in physical assets and plays an important role in achieving organizational goals (Lateef, Khamidi & Idrus, 2010). Today maintenance is considered an integral part of business process and it is perceived as creating additional value. Maintenance has also been defined as 'All actions taken to retain material in or to restore it to a specified condition. It includes inspection, testing, servicing, and classification as to serviceability, repair, rebuilding, and reclamation' (Collins, 2003).It includes the routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously utilized, at its original or designed capacity and efficiency, and for its intended purpose.

Obiegbu (1998) defined maintenance as a programmed transformation of a building fabric and services, reflecting changes in pattern of use and technology. Amobi (2006) opined, "Maintenance could be defined in engineering terminology as the continuous upkeep, in good condition of a system(s) to achieve operational reliability with maximum design output result, endurance and stability. This definition has been adapted for building maintenance as work undertaken to keep or restore every facility, that is, every part of a site, building and content to acceptable standard. Thus, maintenance aims at retaining components, equipment as well as the entire structure at specified level of performance. The acceptable standard inferred must be no less than statutory requirement and one, which sustains the facility and the value of the facilities. This may include a degree of improvement over the life of the building as acceptable comfort and amenity standards rise.

Seeley and Winfred (2005) defines building maintenance as actions carried out to restore or improve certain parts of a building to an acceptable standard. The BS 3811 defined acceptable standard as one, which sustain the utility and value of the facility. This definition is found to include some degree of improvement over the life of the building as acceptable comfort and amenity standard rise.

A more functional definition by Lee (2007) is that maintenance is synonymous with controlling the condition of a building so that its pattern lies within specified regions'. The word 'control' suggests a positive activity, which is planned to achieve a defined result, while the term 'specified regions' presumably has a similar meaning to 'acceptable standards'. Lee (2007) definition envisages a range of acceptability with upper and lower limits between which the conditions of the building must be maintained.

Maintenance therefore is all the necessary work done to preserve a building with its furnishes and fittings, so that it continues to provide the same or almost the same facilities, amenities and serves as it did when it was first built. It includes the expenditure necessary to maintain the rental value of the property and involves:

1. Day to day repairs such as leaking taps and electrical effects;
2. Periodic up-keep such as painting; and
3. Major repair requiring heavy expenditure and the services of technical experts.

Chanter and Swallow (2007) in reference to British Institute of Facilities Management define maintenance of buildings as 'the integration of multi-disciplinary activities within the built environment and the maintenance of their impact upon people and the work-place. The institute underscores the importance of facilities management to the success of an organization by contributing to the delivery of its strategic and operational objectives. In another instance, Lee (2007) defines maintenance as 'a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition'. The actions referred to entail initiation, organization, and implementation.

The importance of housing maintenance cannot be ignored. Harrison (2003) states that building maintenance is important in preserving and enhancing standards of appearance and hygiene, preventing deterioration of fabric and ensuring efficient operation of buildings. For efficient repair of existing buildings, on-site visual inspection and close examination of deterioration are essential. This permits understanding the process of deterioration and timely detection of defects and development of effective methods of building maintenance.

According to Syagga (2006), building maintenance aims at ensuring a systematic approach in the overall asset management while serving three major roles which include functional, aesthetic and financial roles. The functional role retains the property within reasonable standards of the user, while the aesthetic is about appearance in relation to surrounding environment. Financial role ensures that value of assets is enhanced.

The process of deterioration of buildings is complex and may set in due to a combination of factors such as human aspects, chemical factors, faulty designs, inappropriate cleaning, and misuse of building and faulty system of maintenance among others, Gahlot (2006). Eilenberge (2010) notes that with increase in size of buildings and need for longer economic life, there's need that buildings be maintained in an optimum condition. This calls for early planning, caution in initial design of the building to permit ease of inspection of structure, selection of most appropriate materials and fabric and a regular maintenance programme to maximize the economic life of buildings. This strategy also makes housing maintenance cost effective.

To avoid substantial building failures, it is important to conduct condition survey to confirm performance of buildings. According to Thomas (2010), a condition survey on the behavior and performance of different types of existing buildings conducted in India revealed that building failure is more often due to negligence in the diagnosis of the defect and faults than the structural failure. He also observed that proper diagnosis and repair of failure and defects can avoid substantial failures.

Housing maintenance is not preserve for governments alone; rather it requires the concerted efforts of all concerned parties. Waithanji (2011) states that the primary initiators of maintenance should be owners and or occupiers or users of the building facility. She however indicates that other parties such as inspectors, insurance companies, employees, or members of the public may influence how maintenance is undertaken. According to Waithanji (2011), maintenance of buildings should be planned for and catered for in any tenancy agreements, while clearly

outlining the party responsible for the maintenance, the areas as well as the scope of maintenance.

Gahlot (2006) outlines the concept of maintenance as:

Prevention: It entails protecting housing by controlling its environment, thus preventing agent of decay and damage from becoming active. It involves clearing schedule, good housekeeping and proper housing management.

Consolidation: Consolidation is the physical addition or application of adhesive or supportive materials unto the actual fabric of housing in order to ensure its continued durability or structural integrity.

Rehabilitation: Rehabilitation involves the modernization of aged building with or without adaptive alteration for use. It means the introduction of modern services into the building without changing its original use.

Repair: Repair is to revive housing to the original state so that it works as it was first put up or built. It involves reactive responses to housing deterioration and it is essentially ad hoc in nature.

Renovation: It consists of work done to restore a structure, services and equipment by a major overhaul to the original design and specification or to improve on the original design. This may include substantial additions and extensions to the original structure and in the extreme re-building. Renovation constitutes the interface with improvement and refurbishment. Renovation to some extent is unavoidable, since in replacing a fitting, such as a bath, the replacement were of a new design.

Refurbishment: Refurbishment means in architectural sense, as involving replacement of missing parts or introduction of new decorative elements into a structure. In addition, it involves working on a housing to make it bright, clean and fresh again.

Extension: With respect to housing, it involves addition of parts to make housing wider or larger in response to what is required of it.

Technology of Maintenance: The technology of maintenance is concerned with all the factors that influence and cause the need for maintenance work. The occurrence of defects in the fabric of a building can result from many unrelated design decisions- unsuitable material, incorrect assessment of loads, inadequate appreciation of conditions of use and inadequate assessment of exposure. Exposure is influenced by rainfall, direction of prevailing winds, microclimate, atmospheric pollution and aspect and height of building. The durability of the building material also influenced by frost action, crystallization of salts, sunlight, biological agents, abrasions and impact, chemical action and corrosion and incompatibility of modern building material.

Cracks in building normally result from failure or defective construction and are invariably unsightful and unacceptable to occupants. If severe, they may result in loss of stability. Furthermore, cracks frequently give rise to air infiltration, heat loss and reduced sound insulation all of which cause reduced efficiency in buildings. Cracking is generally caused by tensile stresses in excess of the tensile strength of the material, produced by externally applied loads or internal movements arising from temperature or moisture changes.

Other important concept of the maintenance can be illustrated by reference to roof construction. A good roof which is well maintained should last the life of a building and it is false economy to save money on roof during construction, because if it ever requires replacement, it will cause serious dislocation of production, occupancy or other activities within the building. A leaking roof apart from causing considerable inconvenience to users can lead to accelerated deterioration of other parts of the building such as ceiling, floors and walls and can cause serious damage to decorations and electrical installation. Traffic over a roof should be kept to a minimum and

where it is essential, appropriate walkways and access ladders must be provided. To ensure that roofs are adequately maintained, they should ideally be inspected every three (3) years or alternatively one-third each year.

Types of Maintenance

British Standard Institution (1984) categorizes building maintenance by means of the following terms and definitions.

i. **Planned maintenance**: 'The maintenance organized and carried out with forethought, control and the use of records to a predetermined plan."
ii. **Unplanned maintenance**: "The plan carried out to no predetermined plan." It refers to work necessitated by unforeseen breakdown or damages. For example, the ripping-off of a building, through the action of a storm, and its remedial action constitute unforeseen damages. It can also be termed unexpected and unavoidable maintenance.
iii. **Preventive maintenance**: "The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item."
iv. **Corrective maintenance**: "The maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function."
v. **Emergency maintenance**: "The maintenance which it is necessary to put in hand immediately to avoid serious consequences." This is referred to as day-to-day maintenance, resulting from such incidents as gas leaks and gale damage.
vi. **Condition-based maintenance**: The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.
vii. **Scheduled maintenance**: The preventive maintenance carried out to a predetermined interval of time, number of operations, mileage, etc.
viii. **Running maintenance**: Maintenance which can be carried out whilst an item is in service.

Research Methodology

The type of research design applied for this study is descriptive survey design. According to Ezejelue, Ogwo, and Nkamele (2008), descriptive survey research design describes a method of gathering data from usually a large number of respondents, who themselves constitute the sample. According to Mugenda and Mugenda (2003), descriptive survey describes the characteristics of existing phenomenon, and provides insights into the research problem by describing the variables of interest. The study used the descriptive survey to define and examine associative differences and relationships. This method provides useful and accurate information that answers questions regarding who, what, when and how (Kombo & Tromp, 2006). For purposes of this study, it was used to describe who undertakes maintenance, how it is conducted and how the maintenance policies influence building maintenance.

Population

A population can be defined as the complete set of subjects that can be studied: people, objects, animals, plants, organizations from which a sample may be obtained (Shao, 1999). Shao, (1999) describe population as the entire group or set of cases that a researcher is interested in generalizing. For the purpose of this research, the population consists of users of the selected

public buildings in Aba in Abia State, Enugu in Enugu and Owerri in Imo state. As of 2006 census, Aba had a population of 534,265, Owerri is 127,213 and Enugu is 722,664.

Also included in the study are one hundred and one (101) respondents from the two study areas who are technical officers from the Government Estate Department (GED) of the Ministry of Housing that is mandated to undertake housing maintenance. This is the department mandated to undertake and oversee management and maintenance of public housing. The technical officers were drawn from three categories of staff namely estate management officers who were in the top management, estate management assistants who were middle level managers and Artisans who were at the operational level. The technical officer's population details are captured in table 2

Table 2 Target Population

Institution	**Strata**	**Population size**		
		Abia	**Enugu**	**Imo**
Government Buildings and Estate Department	Estate management Officers	17	23	22
	Estate Assistants	5	6	5
	Artisans	6	10	7
Total		**28**	**39**	**34**

Source: Ministry of Housing for South East states (2018)

Sampling Size and Techniques

Sampling is defined as the selection of a part of a whole population for a study; unlike a census, which is the study of the whole population (O'Leary 2004). In this particular research, the targeted population that were studied were drawn from users of the selected public buildings, Estate Management Officers, Estate Assistants and Artisans that are in charge of managing and overseeing government properties of the selected study area as stated in the population of the study.

This research employed both random sampling techniques and stratified sampling technique. In the selection of the district for the research, convenience sampling was the main method considering the time and financial implications involved

The random sampling technique was used to determine the users of the selected public buildings to be sampled. The users of the selected public buildings in Aba metropolis and owerri metropolis and Enugu is estimated to be over 100 buildings obtained from South East States Housing Authority (FHA) (2018).

Thus, Cochran's sample size estimation was employed to determine the appropriate sample size in this study. To do this, Cochran's return size formula is first determined using the formula presented in equation 1 (Cochran, 1977)

$$n_o = \frac{(t^2)\,x\,(p)(q)}{(d^2)}$$ ----------Equation 1

Where:

- t = value of selected alpha level usually 0.025 in each tail of a normal distribution obtained as 1.96 (the alpha level of 0.05 indicating that the risk the researcher is willing to take that the true margin of error exceed the acceptable margin of error is 5%).
- (p)(q) = this is the estimate ratio given as (0.5) (0.5) = 0.25

- d= acceptable margin of error for proportion being estimated given as 0.05 (this is the error level the researcher is willing to expect).

Thus, after calculating the Cochran's return sample size no (see Equation 1), we will employ the Cochran's correction formula to obtain the appropriate or final sample size and the formula is given in equation (2) as:

$$N_1 = \frac{N_o}{(1+n_o/\text{Population})}$$ ---------- Equation 2

However, to obtain the sample size using the procedure discussed, equations 1 and 2 would be applied. Applying equation, gave a sample of 384 as presented equation 3 and 4 respectively

$$n_o = \frac{(1.96^2) \times (0.5)(0.5)}{(0.05^2)} = 384$$ ----------equation 3

Thus, the sample size of the respondents for this study is 384. Likewise, using the same formula, the sample size of respondents selected is 390

Questionnaire

Since this research were limited in resources (time), in addition to the need to protect the confidentiality of information sources, it were appropriate to use questionnaires for gathering data. The questionnaires were used to investigate the four key areas which was developed in chapter one to answer the four research questions.

Field Observations:

The researcher to ensure the physical conditions of public buildings carried this out. This should ensure a firsthand assessment of the physical conditions of the buildings at the time of the field study.

Validity of Research Instrument

Validity testing which is accuracy and meaningfulness of data obtained in respect to the variables of the study were measured using content validity test. In this case, construction professional experts did the assessment of content validity from the ministry of housing and the supervisor of the project. The experts evaluated the tool and made recommendations accordingly. They both concurred that the research instruments (Questionnaire) would measure the desired objective and could be used in the industry. They however, suggested changes to be incorporated in the questionnaire, which were effectively done. The questionnaire was reviewed through restructuring and reduction of the questions.

Reliability of Research Instrument

The instrument were subjected to a test of internal consistency to ensure its reliability. In the test of reliability, Cronbach Alpha were used to determine the level of internal consistency of the responses of respondents. This were used to determine the consistency of the respondents for decision-making. Inconsistent responses cannot be used for decision-making as may lead to wrong conclusion. Using Cronbach Alpha at 5% level of significance, Alpha value less than 0.60 is said to be weak and value greater than 0.60 is said to be strong. Hence, Cronbach's alpha of respondents from Abia is 0.827, which indicates a high level of internal consistency for the scale of the questionnaire, while Cronbach's alpha of respondents from Imo is 0.903, which indicates a high level of internal consistency for the scale of the questionnaire.

Method of Data Presentation and Analysis

The data collected for the study was analysed using descriptive statistics such as mean and Relative Importance Index (RII), standard deviation and T-test.

The formula is show below:

$$\text{RII} = \frac{\sum fx}{\sum f} \times \frac{\mathbf{1}}{\boldsymbol{k}}$$

Where,

∑fx = is the total weight given to each attributes by the respondents.

∑f = is the total number or respondents in the sample.

K = is the highest weight on the likert scale.

The rating of all the items for extent of significance was based on the value of their respective relative importance index (RII).

The mean and standard deviation were use to answer the four research questions. Any item with the mean value of 3.0 and above were considered as agree, while any item with the mean value that is less than 3.0 were considered as disagree. The three null hypotheses were tested using T-test at 0.05 level of significance (the computation were done with SPSS package version 25).

Any item where the calculated significance value is greater than 0.05, the hypotheses of no significance different were up-held at probability of 0.05 level of significance, but where the calculated significance value is less or equal to 0.05, the hypotheses of no significance difference were rejected at 0.05 level of significance.

The result were presented is in tables

Data Presentation, Analysis and Discussion

This section encompasses the presentation of the data, analysis of the data and the discussion of the data gotten from the questionnaire and checklist survey

Questionnaire Survey Result and Analysis

Table 3 Questionnaire administered and retrieved

Questionnaires	Frequency	Percentage of (%)
Number returned	314	80.5
Numbers not returned	76	19.5
Total	390	100

Source: Field Survey, (2018)

A total of three hundred and ninety questionnaires were administered to respondents within the areas of study. The percentages of responses are presented in Table 3 below. Form the table it can be gathered that a total of three hundred and fourteen were received adequately filled giving a percentage response of 80.5%.

Respondents Profile

Table 4 Respondents Profile

S/N	Variable	Option		Frequency (No)	Percentage (%)
1	Gender :		a) Male	212	67.7
			b) Female	102	32.3
		Total		**314**	**100**
2	Highest qualification of	a) NCE/ND		42	13.4
		b) HND/BSc		143	45.7
		c) MSc/MEng		109	34.6

	respondent :	d) Phd and above	20	6.3
		Total	**314**	**100**
3	Duration of use of the Public Building	a) 0-5yrs	17	5.5
		b) 6-10yrs	54	17.4
		c) 11- 15yrs	154	48.8
		d) Over 15yrs	89	28.3
		Total	**314**	**100**

Source: Field Survey, (2018)

From the result of the analysis, the profile of the respondents is presented in Table 4. From the table it can be deduced that a greater percentage of the respondents were males (67.7%) while only 32.3% were female. The result also revealed that a greater percentage of the respondents (45.7%) had HND/BSc as their highest qualification. However, 34.6% of the respondents had MSc/MEng; 13.4% had NCE/ND while only 6.3% of the respondents had PhD.

With regard to the duration of stay in the public buildings under study area, a larger percentage of the respondents affirmed to have been using the building for a period of 11-15yrs (48.8%). This is followed closely by those who have spent between over 15years (28.3%) and indication that a larger percentage of the respondent have spent a reasonable number of years in the building to give a reliable information of the maintenance trend of the buildings.

Maintenance Status of the Buildings

Table 5 Maintenance Status of the Building

S/N	Variable	Option	Frequency (No)	Percentage (%)
2	Person responsible for maintenance	a) Occupants	111	35.4
		b) Government	101	32.3
		c) Occupants and house owners	102	32.3
		Total	314	**100**
2	Minimum duration for maintenance of the building :	a) Less than a month	20	6.4
		b) 1-3months	45	14.3
		c) 6- 12months	95	30.3
		d) Above a year	154	49.0
		Total	314	**100**

Source: Field Survey, (2018)

The opinion of the respondents regarding the maintenance status of the buildings were sampled and the results are as presented in Table 4.3 and Table4.4. From the Table 4.3, it can be deduced that the maintenance responsibility is almost evenly distributed; occupants (35.4%), government (32.3%) and House owners (32.3%). similarly, the analysis revealed that most of the respondents attested to the fact that the minimum duration for maintenance of the buildings above a year (49.0%). This was closely followed by 6—12 months (30.3%) while 1-3 months (14.3%). other details are as shown in the Table

Table 6: Respondent's perception on the condition of the Buildings
Source: Field Survey, (2018)

S/N	Building Elements	WEIGHTNG/RESPONSE FREQUENCY									
		1	2	3	4	5	(∑f)	∑fx	MEAN	RII	RANK
1	Plumbing system	43	190	12	59	10	314	745	2.37	0.48	7th
2	Foundation corners	-	124	47	104	39	314	717	2.28	0.46	8th
3	Electrical systems	-	49	74	102	89	314	1173	3.74	0.75	1st
4	Finishes/Appearance	84	07	131	25	67	314	926	2.95	0.59	4th
5	Roof system	32	42	101	126	13	314	988	3.13	0.63	3rd
6	Ceilings	42	99	96	77	-	314	836	2.66	0.53	5th
7	Doors and Windows	-	128	74	44	68	314	994	3.16	0.64	2nd
8	Walls	49	128	71	25	41	314	823	2.62	0.52	6th

Where: 1= Very Poor, 2=Poor, 3=fair, 4=Good, 5=Very Good

The respondents also ranked the state of the observed condition of the building element concerning its present level and the result is as presented in Table 5. From the result of the ranking, it can be established that the plumbing systems of most of the public buildings studies were in a very bad stat as it was one of the lease ranked (RII= 0.48). Similarly, walls (RII=0.52) and the Ceiling (RII=0.53) were also one of the lease ranked. However the highest ranked was the electrical system (RII=0.75) was the highest ranked as the major building component in a good state or condition. Details of the ranking is as presented in the Table

Test of Hypotheses

Ho: There is no substantial development in the conditions of public buildings in the study area.

H1: There is a substantial development in the conditions of public buildings in the study area.

Level of significance (α) = 0.05

Test statistic: t = $\frac{\bar{x} - \mu_o}{\frac{s}{\sqrt{n}}}$

Decision Rule: Reject the null hypothesis for p-value ≤ 0.05, otherwise do not reject.

Result and interpretation

One-Sample Test: Test Value = 3.0

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Mean Responses	-.801	7	.449	-.13625	-.5384	.2659

Diagnostic Tests

Kolmogorov-Smirnov Test stat. = 0.164

Prob.(K-S) = 0.200

Shapiro-Wilk stat. = 0.948

Prob.(S-W) = 0.690

Source: Researcher's SPSS 25.0 output

Interpretation: The result with t-statistic value of −0.801 and associated probability value of 0.449 > 0.05 indicates that there is no substantial development in the conditions of public buildings in the study area. However, the negative coefficient of t-statistic implies that the condition had continued to worsen over period. Therefore, the null hypothesis is upheld.

Conclusion and Recommendations

The responsibility of maintenance of the public buildings studied is even and not peculiar to the occupant, government or house owners and this account for the negligence in the maintenance of such buildings. The minimum maintenance duration/interval is over a year irrespective if there is a demand for maintenance before the intervals. With regards the condition of the buildings studied, the plumbing systems of the buildings were in a terrible state. Similarly, the walls and ceiling finishes of the buildings were in a terrible state. An indication of a poor maintenance culture. Improvement of the plumbing systems of most of the public buildings and adoption of maintenance plan that were prompt in tackling the maintenance issues of the plumbing system. Adequate planning of maintenance work that are proactive nature and not the once that are corrective in nature. Aging building parts should be replaced to avoid it making other parts of the building dilapidating

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