

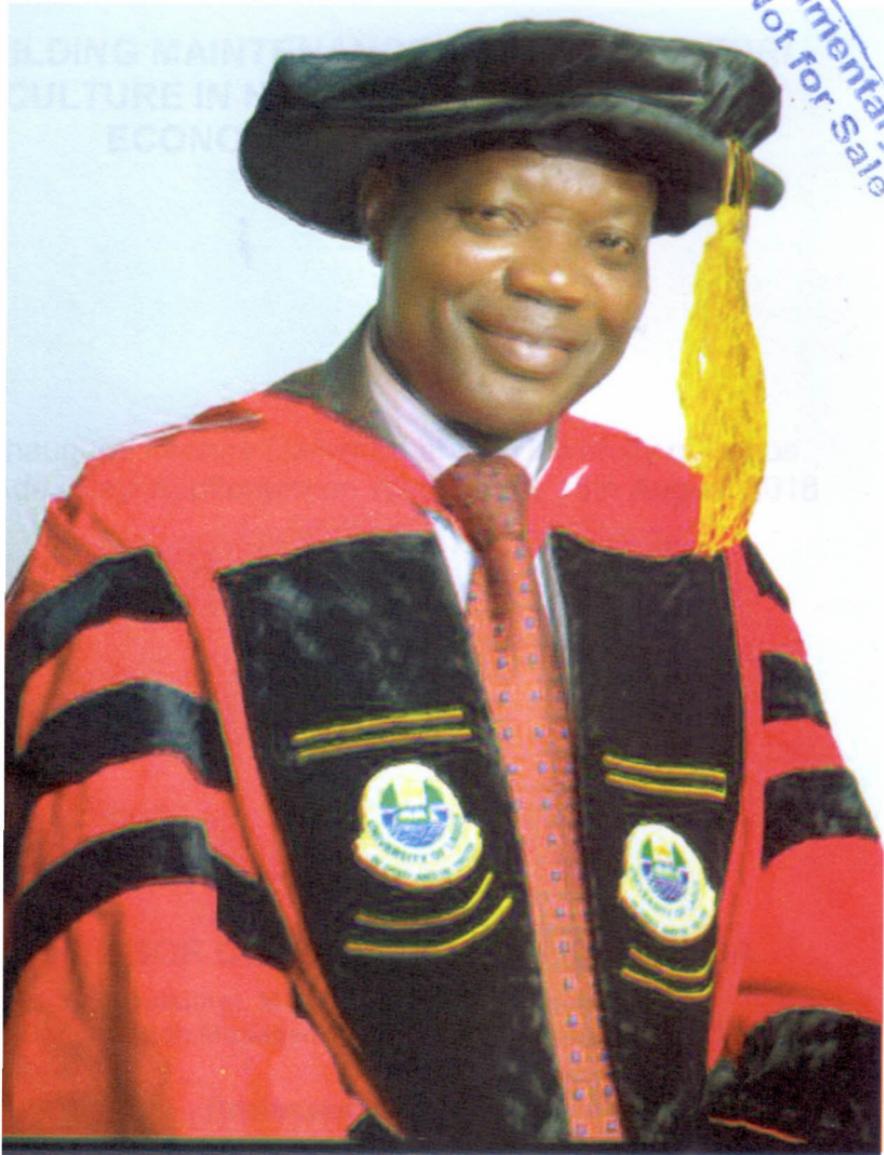
UNIVERSITY OF LAGOS, NIGERIA
Inaugural Lecture Series 2018

TOPIC:

**BUILDING MAINTENANCE:
AN A POSTERIORI CULTURE
IN NIGERIA - THE QUEST FOR
ECONOMIC SUSTAINABILITY**

PROFESSOR OLUMIDE AFOLARIN ADENUGA

Complimentary Copy
Not for Sale



PROFESSOR OLUMIDE AFOLARIN ADENUGA

B.Sc. (Building), M.Sc. (Construction Technology),
M.Sc. (Construction Management), Ph.D (Building), MNIQB, R.Bldr.

Professor of Building

BUILDING MAINTENANCE: AN A POSTERIORI CULTURE IN NIGERIA - THE QUEST FOR ECONOMIC SUSTAINABILITY

An Inaugural Lecture Delivered at the University of Lagos
J.F. Ade. Ajayi Auditorium on Wednesday 15th August 2018

By

PROFESSOR OLUMIDE AFOLARIN ADENUGA

B.Sc. (Building), M.Sc. (Construction Technology),
M.Sc. (Construction Management), Ph.D (Building), MNIOB, R.Bldr.

Professor of Building

Department of Building
Faculty of Environmental Sciences
University of Lagos, Akoka.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means electronic, mechanical, photocopying, recording, or otherwise without the permission of the author.

ISSN: 1119-4456

Published by

University of Lagos Press and Bookshop Ltd
Works and Physical Planning Complex
P.O. Box 132
University of Lagos
Akoka, Yaba
Lagos, Nigeria
E-mail: press@unilag.edu.ng

DEDICATION

This inaugural lecture is dedicated to God Almighty for finding me worthy of this uncommon favour and to humanity.

PREFACE

It is with a deep sense of humility and gratitude to the Almighty that I stand before you today on the 15th of August 2018 to deliver the 12th Inaugural Lecture at the University of Lagos. The Faculty of Environmental Sciences, the University of Lagos, is proud to have me as its 12th Inaugural Lecturer. I am grateful to the Faculty of Environmental Sciences for the opportunity to deliver this lecture. I am also grateful to the University of Lagos for the opportunity to deliver this lecture. I am grateful to the Faculty of Environmental Sciences for the opportunity to deliver this lecture.

PROTOCOL

The Vice-Chancellor,
Deputy Vice-Chancellor (Academic and Research),
Deputy Vice-Chancellor (Management Services),
Deputy Vice-Chancellor (Development Services),
The Registrar,
The Bursar,
The University Librarian,
The Provost, College of Medicine, The Dean, Faculty of
Environmental Sciences and other Deans here present,
Other Principal Officers of the University,
Members of the University Senate,
Heads of Departments,
Distinguished Academic and Administrative Staff, Colleagues,
Your Excellencies,
Your Royal Majesties and Highnesses,
My Lordships (Spiritual and Temporal),
Dear Students,
Gentlemen of the Press,
Distinguished Ladies and Gentlemen.

PREAMBLE

It is with a deep sense of humility and gratitude to the Almighty that I stand before you today, the 15th of August, 2018 to deliver the 12th Inaugural Lecture in the 2017/2018 session of this great institution of learning, the University of Lagos – the University of First Choice and the Nation's Pride. May I point out that this inaugural lecture is only the second in the Department of Building since its establishment in the 1980/1981 session and just the ninth in the entire Faculty of Environmental Sciences.

I make bold to state that the fact that I am only the second Professor to deliver an inaugural lecture in the department after 38 years of its establishment and being the second alumnus of the Department to serve as substantive Head of Department, makes it very significant. Let us make no mistake about it: that I stand here today is neither due to my surpassing brilliance nor to my superior strength and influence.

It is only due to the grace of my Lord Jesus Christ, who makes promises that never fail.

I have come to pay a major debt in scholarship and I am grateful to all who have sacrificed precious time to witness this payment.

I seize this opportunity to pay homage to the first Professor of Building in the University of Lagos and the first Professor of Building Maintenance in Nigeria, who delivered the first inaugural lecture in 2005. He supervised all the lecturers in the Department of Building and made the majority of us PhD holders. Of course, I speak of no other person than Professor Rueben Rimaka Iyagba. I say a big thank you for allowing me take after you as a Building Maintenance Expert.

It may interest us to know that the characteristics of constructed facilities we are examining today were reflected in all the buildings that were prominently mentioned in the Holy Bible: impressive architecture, perfect workmanship, harmonious management of the construction process and enduring maintenance. These are critical issues I hope to address in today's lecture.

Mr. Vice-Chancellor sir, I was trained as a thoroughbred professional in building with specialisation in maintenance. My mandate has therefore been to practise as a Registered Builder in the area of building production and maintenance management.

For me, becoming a Builder had never been on the horizon; it never crossed my mind. Like most other students, I had wanted to become a medical doctor but the pass grade in Biology deprived me of this opportunity. My father was a teacher so I was compelled not to stay at home but to embark on a journey of academics that led me to the Polytechnic. While on the Polytechnic programme, I was inspired in the philosophy of building thus sitting for my Biology never became a reality. After my Youth Service Corps year, my

dream was to practise briefly in a private construction firm and then set up my own private construction practice. However, while practising as Site Engineer I realised the dichotomy between the Higher National Diploma (HND) and the Bachelor of Science (B.Sc.) certificates. This discovery made me to leave the practice and proceed to the University. In any case I had all that was required for University education. Immediately after my B.Sc. Building programme, I enrolled for the M.Sc. Construction Technology programme. After the M.Sc. programme, I went into private practice while also lecturing part-time at the Lagos State Polytechnic, Surulere.

My interest in academics made me to respond to an advertisement by the University of Lagos and one by the Lagos State Polytechnic. The Polytechnic appointment came first hence I took up the offer. However, I was never fulfilled with my career in the Polytechnic, even though I received my promotion as and when due and even became the Head, Department of Building Technology. On August 1, 2002 I finally joined the Department of Building, University of Lagos in pursuit of my PhD, without considering the setback in terms of status and salary since Polytechnic experience is never considered by the University of Lagos. With the encouragement offered by Associate Professor M. B. Olufowobi, I took up the appointment as Lecturer II. Since there was nobody to supervise my PhD in the area of Technology, I registered for the M.Sc. Construction Management programme in 2002 which I completed in the 2003/2004 academic session. I thereafter registered for my PhD in Building in October 2004 which was defended and completed in June 2008. My ability to finish in record time was due to the awesome grace of God and the efforts of my able supervisors, Professor Ruben Rimaka Iyagba and Professor K.T. Odusami. It was also due to the ceaseless support from a brother and mentor, Professor Leke Oduwaye, who egged me on when I was almost frustrated. Mr. Vice Chancellor sir, since 2002, Prof. Leke Oduwaye has remained an inestimable mentor to me.

I am delighted to announce that I have been assigned lecturing maintenance management and construction-based courses from the inception of my career in the University of Lagos. My special interest in maintenance as well as my teaching background influenced my PhD research focus on "Maintenance Management of Public Hospital Buildings in Southwest Nigeria, under the supervision of Professor Ruben Rimaka Iyagba. He taught me all I needed to navigate the turbulence of academics. He taught me perseverance and what it means to have a large heart.

Mr. Vice-Chancellor sir, based on this background, I have done tremendous research and published in various local and international journals, especially in the areas of Building Maintenance Management and Construction Technology. My publications were evaluated in these areas and I was subsequently appointed, in 2016, as a Professor in the Department of Building, University of Lagos.

The title of this lecture is 'Building Maintenance: An *a posteriori* Culture in Nigeria – the Quest for Economic Sustainability'. Maintenance may be framed as a war in which the enemies are the triumvirate of breakdown, deterioration and all types of unplanned events. The soldiers are officers in the maintenance departments of organisations and as many civilians as we can recruit. This lecture therefore aims at creating public awareness on my building maintenance management experience, the Terotechnology practices and contributions to a sustainable economy in Nigeria.

The Concept of Building Maintenance Management

The word 'maintenance' comes from the French verb 'maintenir', which means 'to hold'. In the present context it means to hold, keep, sustain or preserve equipment, building or structure to an acceptable standard of serviceability. Maintenance is as old as creation. God, our Creator, is a Chief Builder who maintains and sustains the Earth. This much is revealed in the Bible, Book of Genesis 2: 7, 8 and 15: "And the LORD God formed man of the dust – of the ground, and

breathed into his nostrils the breath of life, and man became a living soul. And the LORD God planted a garden eastward in Eden; and there He put the man whom He had formed into the Garden of Eden.... to dress it and to keep it".

Mr Vice-Chancellor sir, we are all here to witness this inaugural lecture today not because of what we have been eating or the medical care we receive but by the Grace of God which maintains and sustains us on a daily basis.

Upon the emergence of civilisation, when man decided to settle and abandon a wandering lifestyle, his immediate requirement was a suitable shelter. He used to live in caves and shifted to man-made huts constructed with materials available in nature. Living in the huts, man found that the tasks of repair and maintenance were easy. At the same time the required materials for such purpose were available in abundance in nature. There was no worry about repair and maintenance and both had no relevance in nature at that time. The huts were constructed at locations which were least affected by natural calamities. This very act of construction slowly transformed into a science of construction technology over the centuries. The factors of man, material, machine and money started playing an important role in construction. The skill of man developed further and he could make so many complex, beautiful monuments and intricate structures in addition to magnificent residential accommodations. Among such examples were The Pyramids of Egypt, the Papal States in the old Vatican City, Planetariums, The Golden Temple, and more recent structures like the White House and many others. As time went on available materials in nature were used along with artificial materials for construction of buildings. The use of these materials not only enhanced the aesthetics but also increased the lifespan of the structures. Over a period of time, some of these buildings retained their original glamour and serviceability while others did not. In view of this a few questions arise. Are these structures, monuments, memorials and havelis still in the same serviceable condition as they were at the time of their construction? If yes, then what special

methods and materials were used? If not, then why not? What could have been done to keep them in their original shape and condition? If there were steps that could have been taken to keep these buildings in their original shape and condition, then why have these not been adopted? Are there any constraints and hurdles encountered while to maintain these buildings in their original condition? Such questions make one take repair and maintenance more seriously.

Obviously, certain factors limit efforts to preserve these forts, havelis and monuments in their original shape and condition, and these efforts can be addressed by creating a maintenance system which operates through responses to the following questions:

- Are special materials for repairs and protection available?
- Is the skilled manpower for maintenance available?
- Is the know-how for using such materials available?
- Is the required funding for maintenance available?

The answers to the above questions underpin the planning for repairs and maintenance of buildings. According to Adenuga and Iyagba (2005), it is highly desirable but hardly feasible to produce buildings that are maintenance-free, although much can be done at the design stage to reduce the amount of subsequent maintenance work throughout the life span of a building. All elements of buildings deteriorate at a greater or lesser rate depending on the materials used, methods of construction, environmental conditions and the use of the building. Therefore, repair and maintenance of buildings is important for a long serviceable life and must start at the design stage.

BUILDING MAINTENANCE AND THE NIGERIAN CULTURE

Mr. Vice-Chancellor sir, one of our greatest economic and social problems as a nation is the general absence of a maintenance and thrift culture (Adenuga, 1999). Our buildings, both public and private, lack adequate maintenance and monitoring. It is an unfortunate but glaring fact that our

buildings are in very poor and deplorable conditions of structural and decorative disrepair, being more or less refuse dumps and natural homes for rodents and vermin (Adenuga & Iyagba, 2005). In spite of the billions of Naira being spent to erect and commission imposing and iconic buildings, they are soon abandoned to face premature but rapid deterioration and dilapidation.

There is an unpardonable neglect or laxity in all spheres of our national life. And it is in a bid to address some of these issues that the Federal Government once declared every last Saturday of the month as Environmental Sanitation Day for general clean-up of our buildings and environment. In a related effort, it has also set up the Federal Environmental Protection Agency (FEPA) for the conscious protection of the environment against all forms of human abuse and degradation as well as for the general conservation, preservation of fast-depleting limited natural resources. The various state governments have taken their cue from the Federal Government and promulgated Environmental Sanitation and Protection Edicts.

In spite of the above laudable efforts, however, it is discouraging to observe that more attention is still given to new constructions than the maintenance of existing ones with the unfortunate result that buildings are left to waste, deteriorate and decay at an alarming rate. This unhealthy trend needs to be reversed urgently.

According to Adenuga, Odusami and Faremi (2007), there is the need for an immediate change of attitude in connection with the problems raised above, if national catastrophes and embarrassment are to be averted. Construction of new projects is important but maintaining them thereafter is equally, if not more important, as a country that continues building structures but fails to effectively manage them, burns its wealth and resources in a furnace (Sam Udo-Akagha, 1983).

Proper management and maintenance of our landed property is as important as its actual construction, since it is vital to the economic, historical, social and cultural development of the country. Consequently, it has to be given its due importance; otherwise our nation's history and cultural heritage will be neglected and allowed to decay or even be destroyed (Odudu, 1987).

The built environment expresses in physical form the complex social and economic factors which give structure and life to a community. For example, the condition and quality of buildings indicates the level of prosperity in an area, while these structures also reflect the social values and behaviour as well as all the many past and present influences which combine to give a community its unique character (Adenuga & Faremi 2012). According to Gurjit (1990), a poorly maintained building in a decaying environment depresses the quality of life and contributes in some measure to anti-social behaviour which threatens its sociopolitical environment.

According to Mbamali (2003), the maintenance culture is an attitude that is sadly lacking in Nigeria, whether in homes, offices, schools, hospitals etc. The poor maintenance culture has become a widely recognised problem in Nigeria. Mbamali (2003), concluded that the maintenance culture in Nigeria is the lowest around the world, especially in our principal towns and cities. According to the author, in the rural areas the story is different and more pleasant to hear.

The traditional practice of communal cleaning of community owned places such as markets and playground, continues in almost every village. In their private homes, it is customary to refurbish building interiors with mixtures of cow dung or natural red clay. The end result is attractive and totally indigenous. According to Wahab (1995), the nation accords low priority to property management. Mbamali (2003), asserts that Nigeria has no maintenance policy and therefore no such culture exists.

The lack of maintenance culture in Nigeria can be traced back to the rapid urbanisation of the country since independence in 1960. According to Zubair (1998), in the villages a culture of maintenance still exists, as people take pride in the proper care and maintenance of their houses and surroundings. Mud houses are regularly resurfaced with mud and smoothly polished, while thatched roofs are periodically changed and compounds are daily swept and kept neat and tidy. During the colonial period, traditional towns like Kano and Ibadan were well maintained. The Public Works Department (PWD), which was responsible for maintenance in towns, performed its functions effectively. With the mass rural-urban migration that came in the wake of urbanisation and post-independence, however, this tradition seems to have been eroded (Zubair, 1998; Mbamali, 2003; Iyagba, 2005; Adenuga, 2008). On arrival in the towns, people tend to treat the buildings and surroundings like nobody's property and refuse to take proper care of. According to Zubair (1998), this attitude of indifference derives from the mistaken assumption that the maintenance of buildings, roads and other infrastructure in the urban areas is the sole responsibility of government. According to the author, dropping refuse in the streets, blocking public toilets by misuse and wanton disregard for public property only add to maintenance problems. The Ministry of Works and Housing, which is responsible for the maintenance of public buildings and infrastructure in the urban areas, seems no longer capable of carrying out its functions effectively and its workers seems to lack motivation and direction.

Again, the oil boom of the seventies worsened matters, as it led to a building boom during which very little attention was given to maintenance of the existing stock of public buildings by the government. Iyagba and Zubair (1998) found that there has however been a sharp decline in the Nigerian economy in the past few years. According to the authors, the rates of inflations in 1993, 1994 and 1995 were 57.2%, 57% and 68.5% respectively (Central Bank of Nigeria, 1995 & 1996). To this extent, the Federal Government can no longer afford to

ignore the maintenance work required to preserve buildings and other infrastructure.

Over the years, the Federal Government has made many strong statements on the issue of maintenance (Babangida, 1986; Buhari, 1998). In August 1984, the government appointed a study group on maintenance of public utilities. The group was to examine the causes of ineffective maintenance of public utilities, assess the adequacy of existing resources for effective maintenance and make appropriate recommendations.

The study group submitted its report within three months and the government issued a white paper early in 1985. The first recommendation of the study group was that, there should be sustained effective maintenance of all public buildings in the country (Federal Government, 1985). This recommendation was accepted by the government but, unfortunately, it has not been adequately implemented up till today.

Successive Ministers for Works and Housing in the country have strongly emphasised the importance which the government attaches to the maintenance of public buildings. In 1992, for example, the then Minister of Works and Housing Major General Mamman Kontagora, had announced that the National Council on Works would henceforth ensure that all public buildings would be restricted to four floors to minimise maintenance problems and prevent the hazards associated with high-rise buildings (National Concord, 1992). Numerous conferences and workshops have been held by the NIA, NIOB and NIESV on the theme of maintenance. In spite of all these, private and public buildings continue to deteriorate due to lack of adequate maintenance. On their part, experts have expressed their concern in various research papers delivered at conferences and in the news media (see Zubair & Iyagba, 1998; Adebayo, 1999; Adenuga, 1999; Mbamali, 2003; Adenuga, 2005; Adenuga, 2008; Ajayi, 2015; Faremi, 2017). It is sad to note that most of our national edifices, e.g. the National Stadium at Surulere, the Government Guest House,

the National Theatre, the Independence Building, the NET Building, the Defence House, and the Old Federal Secretariat, which are all in Lagos, are in a state of dilapidation.

The question to ask is: "What is actually responsible for the dilapidation of Nigeria's public edifices?"

This general lack of maintenance culture has persisted in the country's towns and cities mainly due to the fact that Nigeria does not have a statutory maintenance policy.

Nature and Scope of Building Maintenance

All elements of buildings deteriorate at a greater or lesser rate depending on materials, methods of construction, age, environmental conditions, usage of the building, methods of design and maintenance management of the building. Building maintenance is the work that is done to ensure that a building is in a safe, and healthy condition in accordance with specified acceptable standards.

There are many definitions of maintenance, and according to Anderson (1969), the main purposes of maintaining buildings is to retain the value of investment, and to keep buildings in a condition in which it continues to fulfil its function and present a good appearance. The maintenance Practice Committee of the Chartered Institute of Building (1975), confirms that, maintenance is a combination of actions carried out to retain an item or restore it to an acceptable condition. Seeley (1976), discloses that, a prime aim of maintenance is to preserve a building in its initial state, as far as practicable so that it effectively serves its purpose. The British Standard Institution (1975), defines maintenance as "*The combination of all technical and associated administrative actions intended to retain an item in or restore it to, a state in which it can perform its required function*". This is a general definition, which is not restricted to any particular product or industry. Perhaps from this general definition, Crips (1984) developed a more specific definition of building maintenance as "The regular inspection of all parts of a building and the execution of work necessary to

keep the structure, finishes and fittings in a proper and acceptable state of repair, including decoration both internally and externally". In this definition what constitutes a proper and acceptable state of repair is subjective and may differ not only between organisations or individuals but also between building types and usage.

Colen and Brito (2002) on their part see maintenance actions as technical and economic actions that try to raise the quality level of a building's element and/or restores it to the initial performance level in accordance with a certain requirement. This is why property managers should give maintenance a high priority in their day to day activities (Lai et al, 2004). Maintenance, according to Smith (2003) means, to keep in its existing state, preserve, continue in good operating condition and protect.

From the various definitions, the main objectives of building maintenance are as summarised by Alner and Fellows, (1990), Oyefeko (1999), Smith (2003), Iyagba (2005), Adenuga, Odusami and Faremi (2008) to:

- Ensure that the functional requirements of the facility are attained at all times.
- Ensure that buildings and their associated services are in a safe condition.
- Create a conducive and tenable accommodation for owners and occupants (users).
- Ensure that the condition of the building meets all statutory requirements.
- Enhance the quality of building structure to meet the modern-day requirements.
- Prolong the lifespan of the building
- Preserve the physical characteristics of the building and associated services so as to reflect fewer breakdowns and thereby reduce the probability of early failure.
- Maximise the economic and financial returns from the use of the building.
- Ensure the safety of the users/occupants.

As maintenance leaders, we have many strategies and weapons at our disposal, some new, others old, some complex and others simple, some defective as a theatre of operations and some are better than others. Each strategy to consider, works only with the support of the correct weapons and the logistics which are the cardinal point for this study.

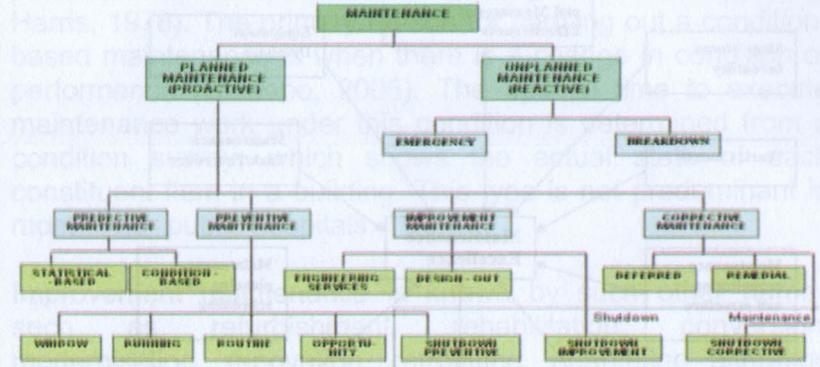


Figure 1: Types of building maintenance

Colen and de Brito (2002), believe that all maintenance actions are performed either in anticipation of an element's failure or to locally correct existing defects. These activities they term proactive and reactive respectively are the two broad classifications of maintenance actions. Smith (2003), believes that a substantial number of people do not know the meaning of maintenance, at least the way they practise it would indicate this. In practice, the prevalent interpretation of maintenance is to "fix it when it breaks down". This is a good definition for repair, but not maintenance. This style of maintenance is reactive. Van Noortwijk (2000), regards these activities as renewal processes where the renewals are the repairs that restore a component to its "as good as new" state. Other authors refer to proactive maintenance and reactive maintenance as planned and unplanned maintenance respectively (Pitt, 1987; Duffuaa et al. 2000; Smith, 2003).

According to Smith (2003), maintenance practices are usually in two separate categories. There are standards, which are the

measurable performance level of maintenance execution, and then the methods and strategies that must be practised in order to meet the standards. The combinations of these are elements of an integrated planned maintenance system classified as Maintenance Excellence (Figure 2).

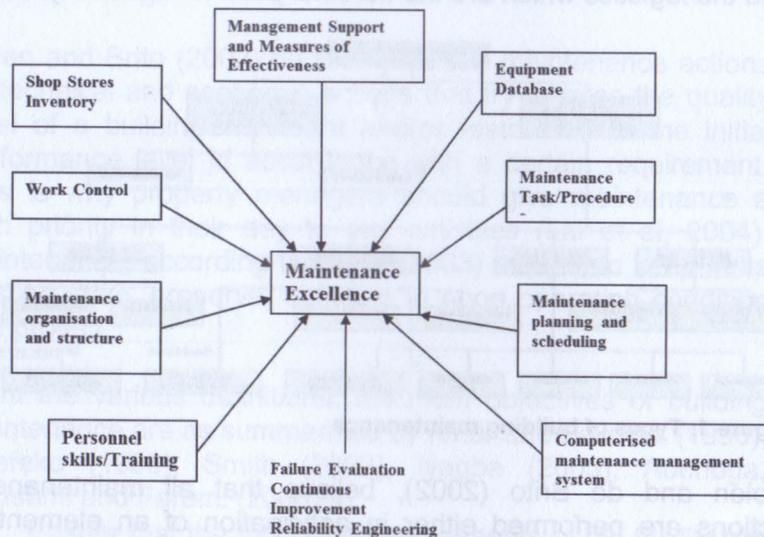


Figure 2: Integrated Planned Maintenance System (2003)

Source: Adenuga (2008)

Planned Maintenance

Planned maintenance, according to Mirghani (2001), is a preventive strategy which involves the repair and replacement of building components/elements and equipment in line with specified periods or schedule, in order to avoid unexpected failure. According to Mann et al. (1995), planned maintenance was introduced to overcome the disadvantages of unplanned maintenance with the primary objective of minimising the total cost of inspection and repair, and equipment down time. Planned maintenance, according to Oladapo (2005) as cited in Duffuaa et al. (1998), is of three types: time-based maintenance, condition-based maintenance and improvement maintenance (Colen & Brito, 2002).

Time-based maintenance tasks are performed on an item in accordance with a predetermined plan at regular fixed intervals regardless of its actual condition (Saranga, 2002; Tsang, 2002). Condition-based maintenance (CBM) is defined as “maintenance carried out in response to a significant deterioration in a unit as indicated by a change in a monitored parameter of the unit’s condition or performance” (Kelly & Harris, 1978). The primary reason for carrying out a condition-based maintenance is when there is a change in condition or performance (Oladapo, 2005). The optimal time to execute maintenance work under this condition is determined from a condition survey, which shows the actual state of each constituent item in a building. This type is not predominant in most of our public hospitals.

Improvement maintenance is known by such other names such as refurbishment, rehabilitation, conversion, modernisation, renovation, retrofitting, adaptation alteration and servicing. Though these terms are used interchangeably and are commonly referred to as refurbishment, a generic term suggested by Quah (1988). Royal Institute of Chartered Surveyors (1998) defines refurbishment as “The extensive repair, renewal and modification of a building to meet the economic and/or functional criteria equivalent to those required of a new building for the same purpose”. This may involve the installation of current standards of building services, access, natural lighting, equipment and finishes.

Adenuga (2005) identified five components of maintenance as:

- **Servicing** – A periodic assignment in the form of cleaning or servicing of essential engineering services in the building either daily, monthly or twice a year. The frequency of cleaning varies. Zubairu (1999) describes servicing as essentially a cleaning operation undertaken at regular intervals and which can be termed “day-to-day maintenance”. However, Williams (1988) is of the opinion that cleaning is not part of maintenance work and therefore their budgets should be made separately.

- **Rectification** – This is maintenance work that results from shortcomings in design, faulty or unsuitable building components, and damage of goods in transit or installation and incorrect assembly. Wahab (1987), describes rectification as work which occurred at a fairly early stage in the life of the building and could have been substantially reduced if the designs were more comprehensive and the building were more effectively supervised during construction.

- **Replacement** – According to Iyagba (2005), it is inevitable because service condition cause materials to decay at different rates and most replacement work stems not from so much physical breakdown of the materials or elements but from deterioration of appearance. Authors like Wahab, (1987), Adebayo, (1991) and Zubairu (1999) see replacement as work involving the removal of a damaged or decayed component and the installation of another in its place.

- **Renovation** – Iyagba (2005) refers to this as work carried out to put back or restore a badly damaged structure or component, services and equipment which are defective to the original design and specification or to improve the original design. Seeley (1976) is of the opinion that renovation is work done to restore a structure, service and equipment to the original design and specification through a major overhaul. Williams (1988), on the other hand, stated that renovation work should be separated from maintenance work because costs for renovation are much higher compare to routine maintenance and therefore their budgets should be separated”.

- **Restoration** – This involves bringing back an affected part of a building into use in another form (Iyagba, 2005). A local Government Operational Research Unit in Britain (H.M.S.O., 1972), also identified three categories of building maintenance work as:

- Fabric maintenance.
- Day-to-day maintenance.
- Improvements and modernisation.

Against the background of this terminological confusion, Colen and Brito's (2002) are of the view that the general focus of all the different terms and perspectives is the replacement of existing elements/components with others which have better characteristics for certain service conditions. Thus the overall purpose of refurbishment is to extend the beneficial use of an existing building by providing a cost – effective alternative to redevelopment. Planned preventive maintenance is based on the assumption that the service life of an element or component can be predicted with some degree of certainty. The reality, however, is that maintenance cannot be totally planned because building components failure prediction is not an exact science. Therefore planned maintenance also involves a certain amount of uncertainty, which is the hallmark of unplanned maintenance.

Another criticism according to Oladapo (2005), is that planned maintenance could be wasteful as items are sometimes replaced well before the end of their useful life spans. Besides, maintenance cannot be totally planned as unforeseen breakdowns even in a so-called planned maintenance system. The views of various authors are interrelated and the present study cannot rule out the importance of this factor as maintenance cost in public hospitals can only be reduced by eliminating or mitigating the effects and not by ignoring them.

Unplanned Maintenance

Zubairu, (1998) defines unplanned maintenance as work comprising of only corrective maintenance, which consists of restoration and replacement. Authors like Adebayo (1991), Zubairu (1999), Vizverberg (2002), El-Harram and Horner (2002), and Iyagba, (2005), see unplanned maintenance as a combination of, day-to-day maintenance strategy, unlike corrective maintenance or breakdown maintenance strategies, where a component/element in a building is used until it completely fails. This strategy simply responds to the complaints of the users after failure has occurred David and Arthur (1989), El-Haram and Horner, (2002), Oladapo (2005).

Planned maintenance is a balanced, comprehensive and orderly process while unplanned maintenance is a reactive and ad hoc process, which is not efficient.

- **Reactive Maintenance:** Is basically the “run it till it breaks”.



Figure 3: Reactive Maintenance Impact

Source:

- **Preventive Maintenance:** It's goal is to reduce the incidence of breakdowns or failures in the plant or equipment to avoid the associated costs.
- Preventive maintenance is periodic
 - Result of planned inspections.
 - According to calendar.
 - After predetermined number of hours.
- The benefits of planned preventive maintenance systems are:
 - known task scheduling
 - known cost and cost measurement; and
 - known labour resource needs.
- **Predictive maintenance:** An attempt to determine when best to perform preventive maintenance activities.
- **Total productive maintenance**
 - JIT approach occurs where workers perform preventive maintenance on the machines they operate.

Decision for Maintenance Strategy Adoption

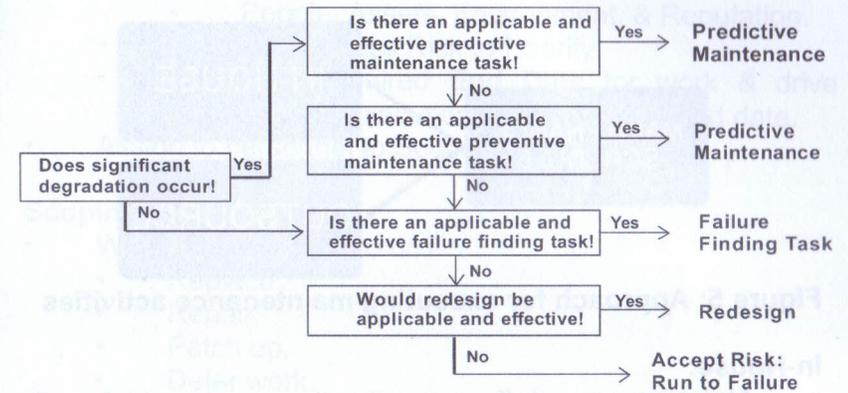


Figure 4: Decision for Maintenance Strategy Adoption

Terotechnological Practice of Building Maintenance

The terotechnological practice of building maintenance refers to the practice associated with the installation, operation and maintenance of the systems, components and elements of a building facility. The phases that constitute the terotechnological practice of building maintenance are discussed as follows:

Maintenance Execution

- The Integrated process covers:
- Job Screening (including Risk & Priority)
- Scoping (**what** to do)
- Planning (**how** to do it)
- Scheduling (**when** to do it)
- Execution (doing it)
- Close-out

Approaches for Executing Maintenance Activities

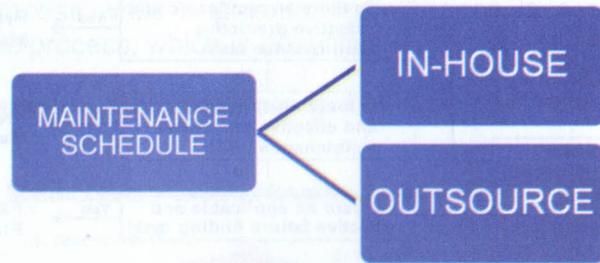


Figure 5: Approach for executing maintenance activities

In-House:

- Maintenance staff are directly employed by the organisation to execute maintenance work directly.
- Category of employee ranges from general, multi-skilled, or unskilled, handyman or repair person to a team of operatives with a range of skills.
- Provides a round the clock service, or may work from Monday to Friday.

Outsource:

- Usually engaged and employed when the maintenance work requires a particular skill, experience, or qualification. Provides a round the clock service, or may work from Monday to Friday.
- Maintenance of lifts, swimming pools, fire extinguisher and other sophisticated plant mostly required special outsourced or contract labour to execute the maintenance work.

Job Screening:

- Identify the work required -
 - CMMS system (SAP Notifications).
 - Can be raised by “anybody”.
- Review the Notifications-
 - Done by somebody who understands business “risk”.
 - Determine the business risk.

- Consequence & Probability.
- People, Assets, Environment, & Reputation.
- Convert Business Risk to Priority.
- Determine required **End Date** for work & drive Maintenance Execution to achieve this end date.
- Assign to personnel to Scope & Plan work.

Scoping:

- What are you going to do?
 - Replace.
 - Repair.
 - Patch up.
 - Defer work.
 - Do nothing.
- Identify duplicate jobs (or similar work).
- Developed by **Subject Matter Experts**.
- Cost considerations must be accounted for.
- Operational Constraints (production requirements, statutory requirements, resource availability, etc.).

Planning:

- How are you going to do the work?
- Basic requirements:
 - Job Tasks, Steps, Duration, & Sequence.
 - Resources;
 - People.
 - Materials.
 - Tools.
 - Equipment.
 - Cost Estimate.
 - Risk Assessment (PPA).
 - Safety Requirements (JSA/JHA).

Scheduling:

- When you are going to do the work?
- Scheduling involves several key plant stakeholders;
 - Supervisors (own the labour & equipment resources).
 - Operations (own the plant).

- Scheduler (**builds** the schedule).
- Warehouse (owns the materials).
- Someone must “own” the Schedule (senior role).
- Cyclic process (usually weekly).
- Separate roles for Planning & Scheduling.

Execution:

- Do the work;
 - Do the work you say you are going to do.
 - Do it when you say you are going to do it.
 - Like taking your car in for a service.
- Measure performance by KPIs;
 - Schedule Attainment.
 - PM Compliance.
 - Orders completed by required end date.
- Ownership of KPIs is at the appropriate stakeholder;
 - **NOT** the Planner (or Scheduler).
 - Schedule Attainment → Supervisor.
 - PM Compliance → Maintenance Engineer.
 - Orders by End Date → Maintenance Engineer.

Closeout:

- Often forgotten part of the process.
- Record completion of each step.
- Collect hours worked.
- Collect history (damage, cause, activities).
- Determine costs.
- Communication and feedback.
- Continuous learning.

The Maintenance Plan

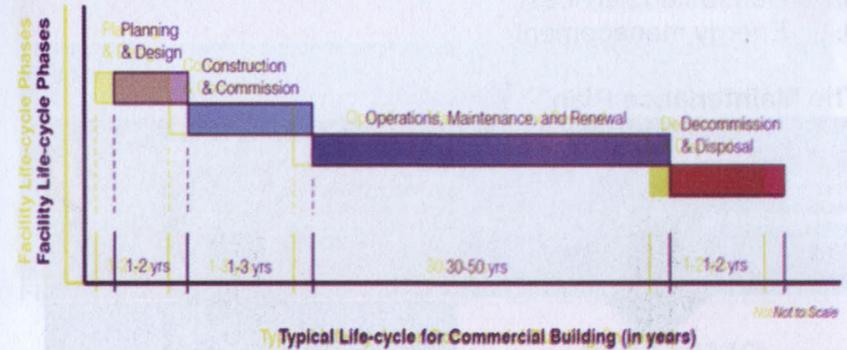


Figure 6: Typical Life Cycle of a Commercial Building

The Importance of a Maintenance Plan



Figure 7: Typical life expectancy of building systems and elements

Typical Content of a Maintenance Plan

1. Mission
2. Health & safety plan and policies
3. Facility inventory
4. Maintenance staffing/organisational structure
5. Systems & services
 - a. custodial service
 - b. grounds maintenance
 - c. integrated pest management
6. Preventive maintenance

7. Work order system
8. Contracted services
9. Energy management

The Maintenance Plan

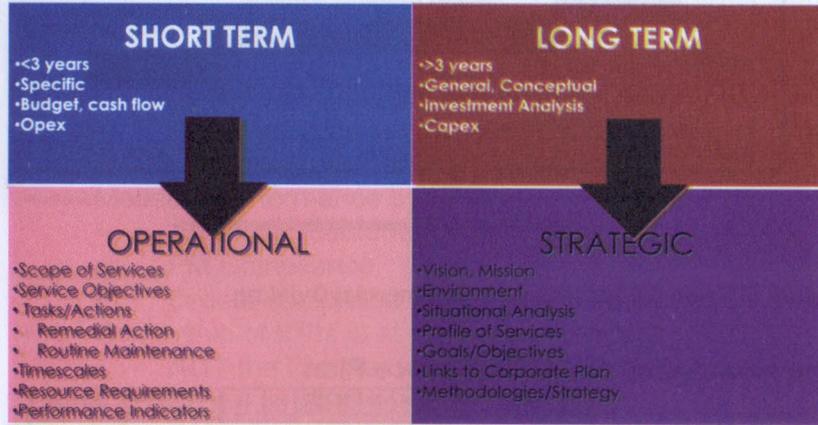


Figure 8: Types of maintenance plan

The Maintenance Programme for Short Term Maintenance Plan

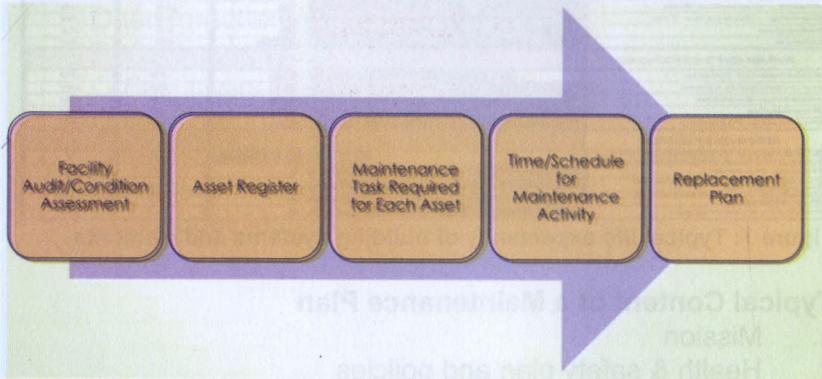


Figure 9: Typical phases of a maintenance plan

Priority Levels for Operational Maintenance Plan

- Priority Levels & Response Time

Critical /Life Critical	5 minutes	Investigate, Fix, Communicate
Important or Business Critical	30 minutes	Investigate, make Safe, Restore or provide temporary alternative within 1 day
Non Critical	2 days	Make safe, Restore within specified SLA

Figure 10: Typical priority levels for operation and maintenance activities

Prioritisation

- 1st priority - work needed immediately or in near future to:
 - meet legal cum contractual requirements;
 - ensure health and safety; and
 - prevent imminent closure or disruption of activities.
- 2nd Priority - work necessary within a year to prevent serious deterioration of building fabric or services or which may lead to higher cost of repair.
- 3rd Priority - work as above which may be deferred beyond one year and work needed to maintain environmental quality of buildings or grounds.

Maintenance Scheduling

Developing Maintenance Schedule

- Collection and analysis of systems and components information.
- Anticipating uncertainty and introducing flexibility and review options within the plan.
- Matching available resources with the workload.

Classification of Maintenance Work According to Scheduling Purposes

- Routine maintenance: are maintenance operations of a periodic nature. They are planned and scheduled and in advance. They are covered by blanket orders.

- Emergency or breakdown maintenance: interrupt maintenance schedules in order to be performed. They are planned and scheduled as they happened.
- Design modifications: are planned and scheduled and they depend on eliminating the cause of repeated breakdowns.
- Scheduled overhaul and shutdowns of the plant: planned and scheduled in advanced.
- Overhaul, general repairs, and replacement: planned and scheduled in advanced.
- Preventive maintenance: planned and scheduled in advanced.
- The maintenance management system should aim to have over 90% of the maintenance work planned and scheduled.

Schedule Levels

1. Long-range (master) schedule.
2. Weekly schedule.
3. Daily schedule.

Long-Range (Master) Schedule

- Covering a period of 3 months to 1 year.
- Based on existing maintenance work orders (blanket work order, backlog, PM, anticipated EM).
- Balancing long-term demand for maintenance work with available resources.
- Spare parts and material could be identified and ordered in advance.
- Subject to revision and updating to reflect changes in the plans and maintenance work.

Weekly Schedule

- Covering 1 week.
- Generated from the master schedule.
- Takes into account current operations schedules and economic considerations.
- Allow 10% to 15% of the workforce to be available for emergency work.

- The schedule prepared for the current week and the following one in order to consider the available backlog.
- The work orders scheduled in this week are sequenced based in priority CPM and integer programming techniques can be used to generate a schedule.

Daily Schedule

- Covering 1 day.
- Generated from weekly schedule.
- Prepared the day before.
- Interrupted to perform EM.
- Priorities are used to schedule the jobs.

Elements of Appropriate Scheduling

- Written work orders that are derived from a well-conceived planning process (Work to be done, methods to be followed, crafts needed, spare parts needed, and priority).
- Time standards.
- Information about craft availability for each shift.
- Stocks of spare parts and information on restocking.
- Information on the availability of special equipment and tools necessary for maintenance work.
- Access to the plant production schedule and knowledge about when the facilities will be available for service without interrupting production schedule.
- Well-defined priorities for maintenance work.
- Information about jobs already scheduled that are behind the schedule (backlog).

Scheduling Procedures (Steps)

- Sort backlog work orders by crafts.
- Arrange orders by priority.
- Compile a list of completed and carry over jobs.
- Consider job duration, location, travel distance, and the possibility of combining jobs in the same area.
- Schedule multi-craft jobs to start at the beginning of every shift.
- Issue a daily schedule (not for shutdown maintenance).

Typical Maintenance WorkFlow

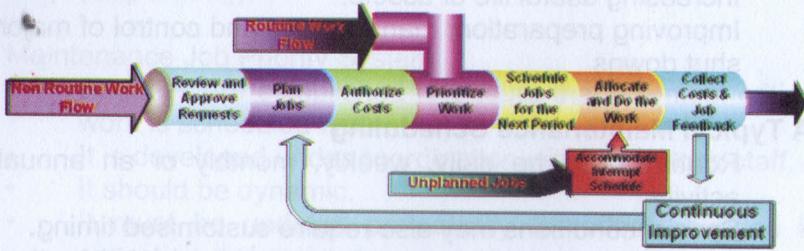


Figure 12: Typical Maintenance Work flow

Maintenance Work flow

- Types of Work
- PMs (Preventive Maintenance).
- Corrective Work.
- Breakdowns.
- Refurbishment.
- Each will have a work flow process.

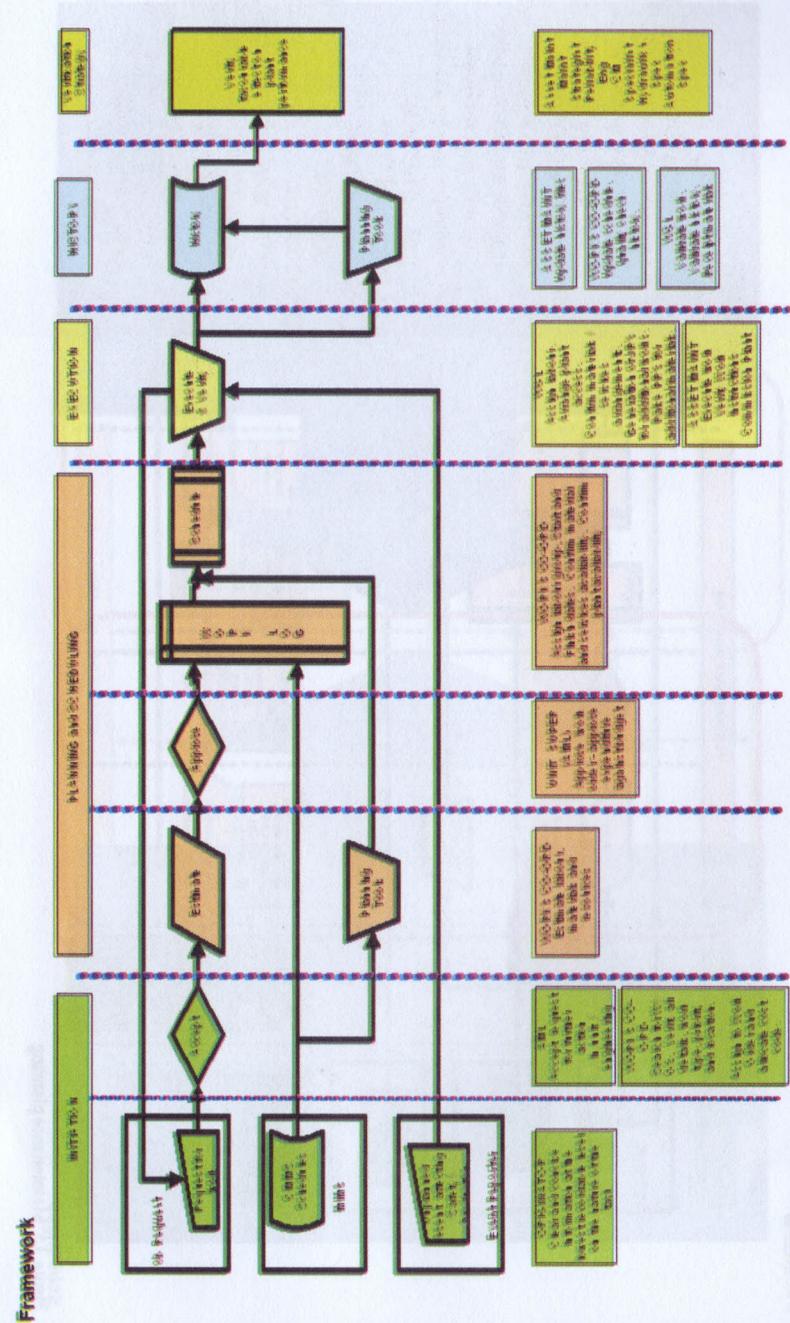


Figure 13: Maintenance framework

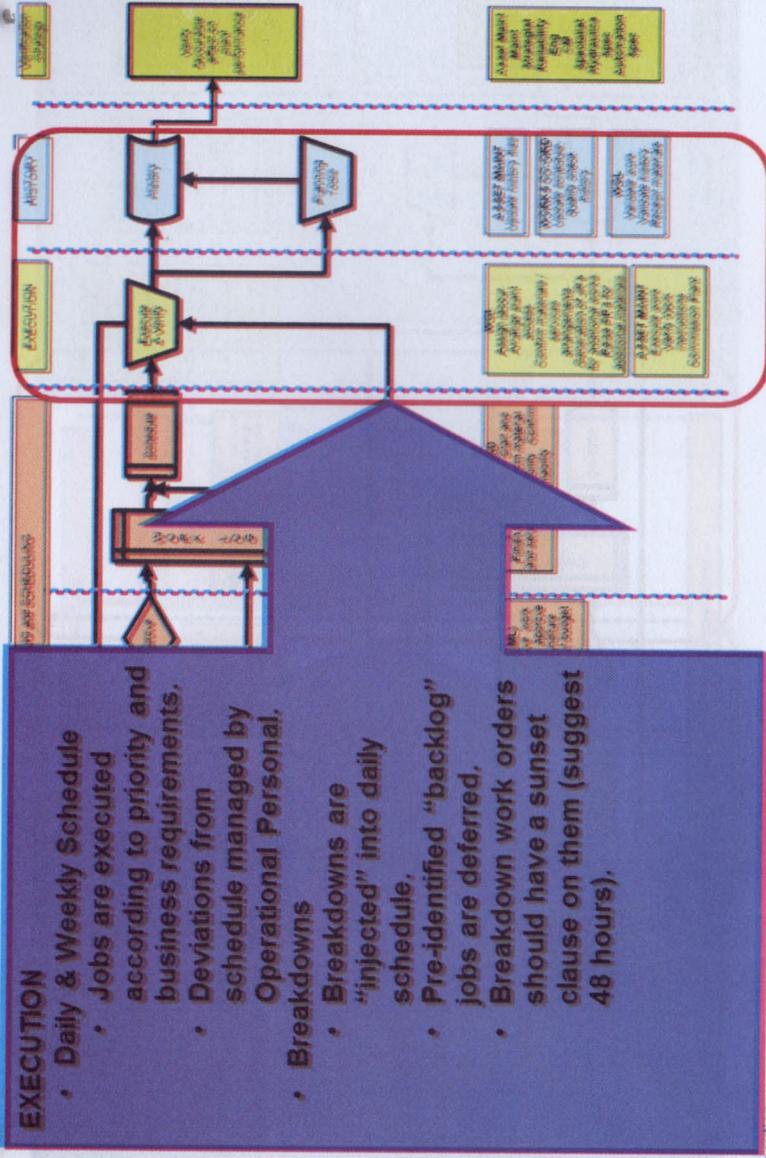


Figure 17: Execution

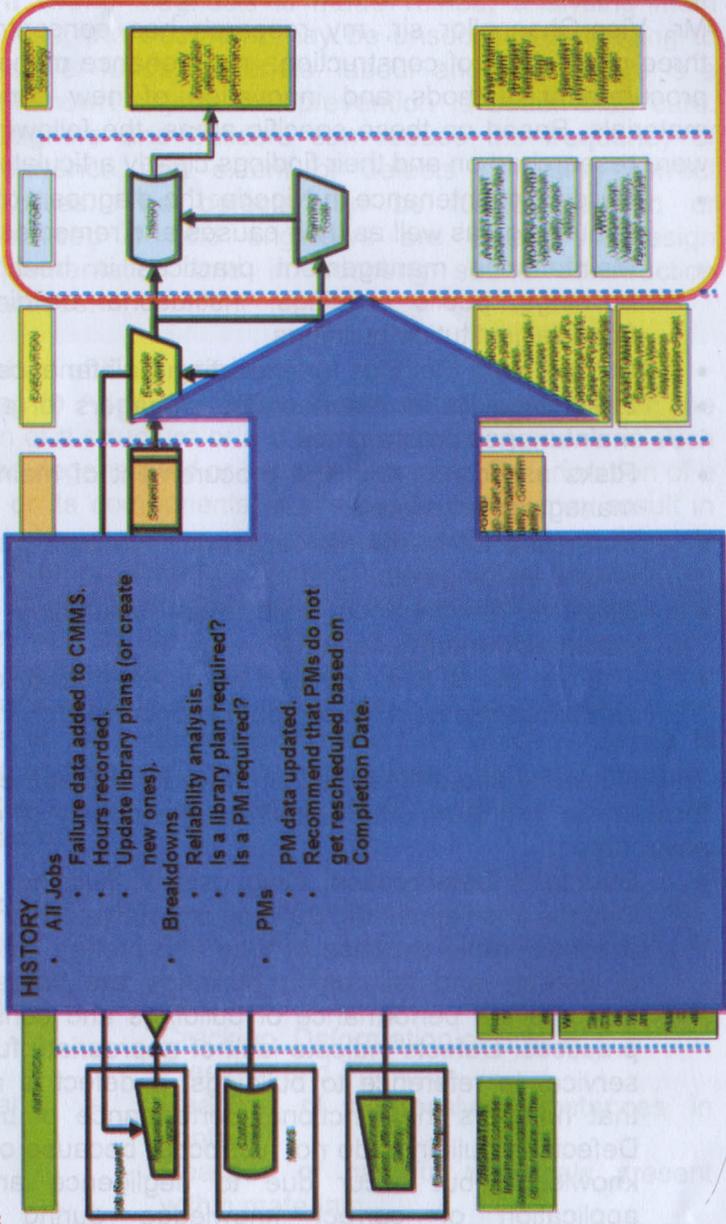


Figure 18: Completion

MY RESEARCH WORKS AND FINDINGS

Mr. Vice-Chancellor sir, my research has concentrated on three pivot areas of construction: maintenance management, procurement methods and innovation of new construction materials. Based on these specific areas, the following areas were researched on and their findings clearly articulated:

- Building maintenance in Nigeria: the diagnosis of defects in buildings as well as their causes and remedies.
- Maintenance management practices in health-related buildings, public buildings, institutional buildings and financial institution buildings.
- Procurement Methods for executing maintenance works.
- Essential skills for maintenance managers for executing maintenance programmes.
- Risks associated with the procurement of maintenance management services.
- Budgeting for maintenance activities in both public and private buildings etc.
- Effective maintenance policies for sustaining housing stock in downturn economy.
- The use of rice husk ash and wood ash from bakeries as partial replacement for cement in concrete etc.

The peculiarity about these research works is that they are all focused on improving and sustaining the quality of our built environment.

- **Structural Deterioration, Diagnosis of Building Defects, Causes and Remedies:** Building structures are created at a considerable expense of time and money. The extent of defects and failures in buildings are yardsticks to evaluate the performance of buildings and construction practices. Defects indicate lack of appropriate functional service. In reference to buildings, a defect is anything that hampers the functional performance of buildings. Defects in buildings do not just occur because of lack of knowledge but occur due to negligence and non-application of correct knowledge during design, construction and maintenance (Adenuga, 1999). Building defects are also the result of poor construction practices.

If a wrong diagnosis is made without analysing main causes, the treatment may be unsuccessful, leading to waste of funds, materials, labour and time. There is a well-known saying that prevention is better than cure. Designers and builders can reduce the frequency of occurrence and extent of defects by using correct practices. The defects can be further avoided or minimised if field engineers are careful in design implementation and in adopting sound construction practices.

Mechanism of Deterioration

According to Adenuga (2008), deterioration occurs when the condition of a structure or a building or its components is such that it has degenerated or become unusable. Deterioration of a building or its components, if allowed to occur, may result in complete decomposition where replacement becomes the only solution. Deterioration is nothing but gradual disintegration on account of any destructive action from aggressive waters and soils, as well as from exposure to weathering agents and relative movements of components (Adenuga, 2005). There are several ways in which the process of deterioration is set off. One is the external environment to which structure is exposed and second is internal causes within the material. Thus, there can be external and/or internal causes of deterioration.

The process of deterioration can also be classified as follows:

- | | | |
|------------|---|---|
| Mechanical | - | Wear and Tear, Fatigue, Impact or Overloading |
| Physical | - | Thermal Change, Volume Change, Cracking, Deformation of Shape, Freezing and Thawing |
| Chemical | - | Reaction of aggressive substances in contact, Reaction of harmful chemicals present within materials, Electro-chemical processes like corrosion |
| Biological | - | Bacteriological growth |

Factors Responsible for Initiation of the Process of Deterioration:

1. **Human Aspects:** Maintenance Staff Lacks Maintenance Culture – The effect of deterioration can be minimised or slowed down by taking corrective actions at the appropriate time and by the persons responsible for the maintenance of structures. Deterioration occurs due to lack of an appropriate maintenance culture on the part of the maintenance staff. However, knowing what, where and how to carry out corrective measures does not ensure that they are, in fact, undertaken. This requires fixing of the responsibilities for executing the repairs and ensuring maintenance.

Deterioration may also be enhanced through the following human factors:

- Failure to carry out routine maintenance well in time
- Lack of knowledge about factors causing deterioration
- Poor planning, budgeting and allocation of inadequate monetary resources to enable maintenance activities to be undertaken
- Lack of sharing of responsibilities and accountability, towards maintenance
- Poor security leading to misuse
- Lack of awareness of maintenance needs among the users
- Adopting a casual approach to repairs
- Failure to establish acceptable standards of maintenance
- Showing a negative attitude of waiting until emergency measures become necessary.

2. **Occupants' Misuse of Buildings:** Blatant abuse of building, its fittings, furnishing and finishes lead to deterioration. Poor cleaning leads to formation of injurious materials which attack the building components when they come in contact.

3. **Chemical Factors:** Interaction of certain materials with the surrounding environment is one of the main factors of

deterioration. The critical chemical factor in the context of deterioration is that of corrosion.

4. **Environmental Aspects:** Environmental factors refer to exposure of building components to atmospheric agents such as, air, rain, moisture, gases, radiation and surrounding soil. The environment generally results in weathering, which is the action of the atmospheric climate on the exposed materials and components. Biological agencies, ground water and salts also affect the durability of materials, components and parts of the building. The various environmental factors causing deterioration are solar radiation, moisture, temperature effects, ground salts and water, as well as gaseous constituents and pollutants of air etc.

5. **Faulty Design:** Faulty design leads to faster deterioration of structures. Unsuitable materials, used owing to lack of knowledge of their characteristics, as well as use of inadequate size of structural members, often results in failure of structures. Lack of adequate attention to the maintenance needs of the future at the time of design will result in faster deterioration of structures.

6. **Faulty Construction:** The factors which contribute to deterioration due to faulty constructions are:

- Lack of supervision during construction.
- Failure to understand and follow exactly the specifications/drawings.
- Failure to replace the defective work.
- Lack of skilled labour.
- Overemphasis on need for quantity rather than quality output.

7. **Faulty Materials:**

- Wrong selection of materials and specifications.
- Use of substandard materials.
- Inadequate inspection of materials.
- Use of inappropriate materials in relation to use.
- Use of stale/expired materials.

8. **Faulty System** – Inadequate knowledge on the part of the designer, unsatisfactory design details, inability of the builder to follow specifications, failure to follow maintenance instructions and inability of the owner to operate the system as instructed.

Steps involved in the investigation of causes of deterioration before undertaking repair work:

- Preliminary investigations.
- Physical inspections.
- Materials testing.
- Non-destructive tests.
- Detailed diagnoses of defects.
- Study of available documents.
- Estimation of actual loads and environmental effects.
- Checking errors in design.
- Retrospective analysis.
- Relevant approach to repair.

In my work I have identified various defects encountered in buildings identified along with their probable causes and remedies. These defects are relevant and common for identification in almost all types of buildings. The table below details various building deterioration features and defects as well as the causes and remedies.

Table 1: Building deterioration/defects: causes and remedies

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
(A) FOUNDATION:	Foundation Failures:	The causes include the following:	
	Indications of these are usually found in the structure above ground level, when movement cracks may indicate movement at foundation level.	<ul style="list-style-type: none"> (a) Unstable conditions – due to inadequate foundations, foundations constructed on loose rubble, and overloading. (b) Changes in ground conditions – due to changes in water content penetration. (c) Ground movements – due to geological faults, mining subsidence vibrations and unequal settlements (d) Chemical reactions – e.g. sulphate attacks upon the concrete. 	<ul style="list-style-type: none"> (a) Provide a new concrete base mass concrete laid in short-working lengths (b) Foundations could be taken to a greater depth of the soil, in order to reach ground of better capacity by <ul style="list-style-type: none"> (i) Underpinning to a greater depth (ii) Piles driven to greater depth to support existing foundations
Materials:	Rot.	Inadequate treatment.	Underpinning/replacement of defective timbers. Underpinning/replacement with longer piles.
(a) Timber (Pillars)			
(b) Concrete/Re-inforced concrete	Spalling/Corrosion/Cracking/reinforcement settlement or V-shaped cracks on walls.	See the above four.	Longer piles, underpinning/replacement underpinning/patching
(c) Steel	Settlement Corrosion due to chemical reaction	Poor foundation (see the above causes) Coating (chemical reaction – see the above causes)	Provide adequate support to main structure Expand recoating.
(B) WALLS:	Walls Failures:	The causes include the following:	
(a) Bricks	a. Settlement cracks.	<ul style="list-style-type: none"> • Uneven settlement of foundations. • Initial settlement of new construction. • Lack of support in the structure. • Failure of ground support. 	Correction of foundation defects. Rebuilding of the wall structure either totally or partially.
	b. Bulging and buckling (Ext. Walls only)	Low tenderness ratio (i.e. insufficient thickness in relation to the weight).	(i) In the short term, provide temporary supports by either shoring the outer walls or propping between the floors in order to give continuous support from the ground.
	c. Spreading.	Occurring at roof level when the roof sags. The sagging action produces a horizontal thrust on the external supporting walls which may cause them to fracture.	A permanent solution is to rebuild the walls.

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
	d. Thermal movement of brickwork.	Variations of temperature Expansion forces brickwork outwards, but when it contracts on cooling it does not return to its original length but causes tension to appear.	Rebuilding and repairing of damaged brickwork. Expansion joints are positions to forestall future occurrences.
	e. Dampness of walls.	Caused by rising moisture movements due to capillary action.	Provision of adequate damp proof barriers.
	f. Shrinkage cracks.	Excessive expansion and contraction. Also, general moisture penetration due to climatic conditions (e.g. during heavy rainfall etc.) Brickwork saturation and penetration due to leakages from roof gutters, rainwater pipes, service water pipes etc.	Correct the design/construction defects. Also the mortar joint of the walls are repointed and thereafter coats of silicone water-repellent solution are applied.
	g. General weathering of brick work (or general erosion of the surface).	During wet periods, moisture is continually absorbed and in the event of limited drying by evaporation can cause bricks to deteriorate. Also through efflorescence.	Check source of moisture and provide suitable damp proof course – Brush away surface efflorescent deposits from the brick face and wash down with proprietary solution. Cut out and replace any deteriorated bricks with new ones. Rake out eroded joints and repoints as necessary.
	h. Atmospheric impurities.	Dust particles, dirt.	Removal by washing with proprietary solution or pressure-clean with suitable equipment.
(b) Timbers:	Rotten Stud/Cladding	Wood rots (and other destructive and wood-attacking insects).	Replacement with well-treated hardwood. Fixing of galvanised insect protective wires. Projection of eaves to provide adequate cover.
(c) Reinforced concrete/Sandcrete blocks	(a) Cracks	i. Structural movement or foundation's support being at fault. ii. Expansion, loading (hair cracks). iii. Spalling (with reinforcement exposed).	As for foundations (and bricks) above. Rebuilding of walls either totally or partially. Seal with 1:3 (cement and mortar) by guniting (under pressure).
	(b) Scarred surfaces	Rusting reinforcing bars in area where the cover concrete has spalled or cracked or has been forced away by expanding iron oxides.	The surfaces are repaired. The loose concrete and loose concrete around reinforcing bars are removed

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
		Loose areas where the concrete has lost its bond with the main core concrete.	and cleaned. Deteriorated bars are cut off and additional reinforcing bars can be fitted.
	(c) Thermal Expansion	Differential temperature changes.	Provide expansion joints in order to allow controlled and even movement.
	(d) Surface deterioration such as: etching of surface (or roughening of surface).	Atmospheric and industrial conditions (e.g. around gas works, chemical plants, railways etc.).	The structure could be rebuilt. Alternatively, the concrete is allowed to dry thoroughly and then coated with bitumen and thereafter the surface is coated with an application of gunite and reinforcement. If the chemical action is severe the walls are demolished and rebuilt with less absorbent concrete.
	(e) Abrasion	Rubbing together of materials and concrete.	Treat as for scarred surfaces above.
	(f) Fire damage.	Fire incidents resulting in excessive stress which causes bars to buckle and the cover concrete to spall.	Depending on the extent of damage, the walls are either partially repaired or totally rebuilt.
(C) FLOORS/FINISHES	Floors/finishes Failures:	The causes include the following:	
(a) Concrete	(a) Spalling (with reinforcement exposed) movement cracks.	Inadequate strength due to inadequate compaction and levelling as well as poor trowelling and finish.	Seal with 1:3 cement sand and mortar by hand or by guniting. If extensive, completely remove and recast (i.e. rebuild). Inclusion of fabric mesh reinforcement will considerably improve the tensile strength of the base.
	(b) Worn Screed/finish.	Due to heavy traffic.	Hack to key and lay 25mm.
	(c) Dirty Terrazzo/Granolithic	Dirt from various sources (e.g. atmospheric, users etc.).	Clean (as appropriate).
	(d) Worn Tile finishes: i. Ceramic. j. PVC. k. Thermoplastic. l. Linoleum/rubber. m. Clay quarry tiles. n. Marble. o. Wood block.	Worn due to abrasion Loose due to dampness or poor adhesive dirt.	Replacement - do - wash/clean.
(b) Timber	Rotten timber.	Attack by wet or dry rot or cellular fungus.	Remove completely for full decays and in parts for partial and replace with well-treated timbers. Also treat all timbers on

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
			the existing floor with preservatives.
	Loose timber skirting.	Due to improper fixing.	Re-fixing.
(D) ROOFS:	Roofs Failure:	The causes include the following:	
(a) Timber or wooden members	(i) Poor strength and stability of the timber framing resulting in sagging and spreading of roof.	Undersized wooden members (e.g. purlins and rafters etc.) Overloading of the roof.	Replacements if deteriorated, misshapen and undersized, wooden roofed members. Also provide additional support to the purlins and additional purlins to support the rafters. Re-design and re-build in case of overloading.
	(ii) Decay (particularly of trusses, shingles, fascia etc.)	Due to fungal attack, dry and wet rots Due to moisture penetration	Treat as for rotten timbers under four above. As for walls, provide three layer of bituminous felt.
(b) Concrete	Cracks	Due to radiation/temperature changes	Treat as for floors above: Lay three layers of hot bituminous felt or any other adequate roof felting.
(c) Asbestos Sheets	Broken roofing sheets	Due to bad handling during construction, vandalism or act of God; falling debris; faulty overlapping of sheets.	Replacement by skilled and experienced hands. The slope and overlapping must be corrected; otherwise a repeat of the problem will continue.
(d) Corrugated zinc or Aluminium or iron Sheets	Corroded or worn out (and possibly leaking) due to age	(i) Oxidation (ii) Age (due to gradual weathering or the deteriorating caused by atmospheric/climatic conditions)	Cleaning. Replacement with new and more durable ones.
	Roof leakage	(i) Poor workmanship (ii) Improper fixing (iii) Incorrect selection of materials (iv) Water seeping through cracks in concrete	Closer supervision of workmen during construction, use of correct roofing materials and correct overlapping of roofing sheets.
	Leaking rainwater gutter	Poor workmanship – Joint work and fixing such as brackets inferior, thus giving way after a short time	Close supervision and review of design details with a view to re-building in parts or totally as the case might be.
	Faulty rood drainage	Poor design Poor construction Poor supervision	Close supervision and review of design details with a view to re-building in parts or totally as the case might be.
	Blocked rain water, gutter, drainage, etc.	Lack of regular maintenance	Clean/maintain them regularly

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
(E) WINDOWS/DOORS JOINERY:	Windows/Doors Joinery Failure:	The causes include the following:	
	1. Decayed frames and doors/windows	(i) Susceptibility of timber (for timber frames) to decay	Replace with treated and seasoned timber frames
	2. Opening of joints	(ii) Poor or infrequent maintenance	Maintenance work to be more regular
	3. Sticking of door and window frames		
	4. Rotten weather boards	(iii) Inadequate seasoning and preservation (iv) Bad design	Replace with seasoned timber Re-design and replace
		(v) Inadequate protection by roof overhang	Project outwards the roof overhang or install a window/door hood or prevent water penetration
		(vi) Water from defective rain water gutters and blocked down pipes	Replace rain water gutter or clear blocked pipes
		(vii) Contract between frame and wet or moist block work.	Rectify family block work
	5. Broken glazed doors	Broken glass panes due to accidents, vandalism or poor fixing or during cleaning or redecorations.	Replacement, re-fixing and throating to sill.
	6. Screeching noise in door handles	(i) Poor maintenance attention	Maintain more regularly
	7. Loose hinges	(ii) Negligence by occupants (iii) Weight of door too much for hinges (e.g. garage doors) (iv) Loose hinge screws in decayed frame	Fix door handle properly Replace hinges with adequate ones Re-screw to stronger wood
	8. Loose louvre blades	(i) Oversight during installation to clip the ends of the louvre carriers (ii) Negligence of occupants	Clip the ends of the louvre carriers properly Replace louvre blades and educate occupants
(F) PAINTS:	Paints Failure:	The causes include the following:	
	1. Peeling of paint	Moisture getting behind paint film through cracks on wall.	Rectify fault and then repaint.
	2. Chipping or flaking, crazing, crocodiling due to atmospheric agencies and poor workmanship (gloss paints)	(a) Poor preparation of wall surface (b) Different rates of expansion of shrinkage of bases surface and paints film. Sudden change in temperature may cause it.	Burning and repainting

ELEMENT/MATERIAL	DETERIORATION/DEFECT	CAUSE	REMEDIAL ACTION
(G) SANITARY FITTING AND APPLIANCES/PLUMBING:	3. Chalking	(a) Applying paint over badly weathered and porous wall surface which absorbs the oil of the paint. (b) Climate (c) Age	Prepare surface to take suitable paint and then repaint.
	4. Checking	(a) Uneven coating (b) Poor building qualities between finish coating and primer	Burning and repainting
	Sanitary fitting and appliances/plumbing:	The causes include the following:	
	1. Septic tank full	Lack of efficient sewage disposal programme	Discharge by suction pump sanitary disposal vehicle.
	2. Soak away pits - perforated concrete lining	Blocked or broken due to defective construction	Rectify concrete lining or construct soakaway.
	3. Inefficient flushing of W.C.	Inefficient flushing of W.C. caused by badly designed system or bad ball valve	Replacement of ball valve or system
	4. Block trap of sanitary appliance	Lack of sieving mechanism at base of appliance	Replace sieving mechanism
	5. Leaking pipes (Main)	Poor connection at joints	Re-connect pipes properly
	6. Faulty water tap	Worn-out washers	Replace washers or tap
	7. Worn out draining board in kitchen	Wear and tear through constant use	Replace with new one
	8. Loose brackets holding pipe to wall	Brackets poorly embedded in walls. Brackets removed accidentally.	Replace and properly fix the brackets
(H) ELECTRICAL:	9. Steel Pipes, plastic pipes	Blocked discharge pipes	Use plunger to clear
	10. Steel valves	Malfunctioning valves	Check water pressure and replace valves. Replace same
	11. Bronze or Copper Taps	Worn-out washer	
	Electrical Failure:	The causes include the following:	
	1. Electrical insulated copper wires	Absence of current	Current fuses
	2. Switches/Socket	Absence of current	Check electrical appliances to ensure no short-circuiting.
	3. Wall brackets	Broken	Replace

• State of Maintenance of Public Hospital Buildings in Southwest Nigeria

Government-owned and government-operated public hospitals are to provide accessible, cost-effective specialist services that are safe and respond to individual needs, with efficient healthcare delivery regardless of geographical location. Public hospitals are usually large buildings that have a significant impact on the environment and the economy of the surrounding community. The physical surroundings in hospitals constitute health problems in public health delivery (Dilani, 1999). Patients in a healthcare facility are often fearful and uncertain about their health, safety and their isolation from normal social relationships. While it is true that good patient care comes from dedicated individuals, it is equally true that the physical structures and hospital environment must be such that they ensure the safety and well-being of patients. The performance of hospital buildings and their components depends largely on continuous and planned periodical maintenance (Shohet, 2003).

Maintenance is the art of controlling the rate at which structures deteriorate towards a state of un-serviceability and collapse (Adenuga, 2008). Government-owned hospitals are confronted with unique challenges that threaten their existence, and hospitals are the most complex of building types (Kliment, 2000; Iyagba, 2005; Adenuga, 2008). According to Nours Hospital Consultants (2002), a hospital is not a mere building but a complex social institution that handles the dynamics of life and death. Nigeria's installed health facilities are as old as the hospitals themselves. The colonial architecture in some of the older hospitals, which were hitherto famous for their sturdiness and functionality, has now lost its attractiveness because of the general neglect of building maintenance. Overcrowding has also led to deterioration of these facilities. Patients in a healthcare facility are often fearful, being uncertain about their health and safety. In my work over the years, it was observed that the staff strength of the maintenance department in public hospitals in southwest Nigeria is inadequate. They do not have much

experience in hospital maintenance management and there is no existing maintenance policy guiding the maintenance work execution. The study also revealed that maintenance operatives are not well motivated and this was attributed to lack of tools/equipment/materials in executing the desired maintenance programme in hospitals. The organisational structure being practised by most maintenance departments in public hospitals in southwest Nigeria involves a wide managerial span of control instead of a narrow managerial span of control that gives better advantage in savings of overheads, better control over resource allocation and coordination of day-to-day activities. It also gives better labour productivity and non-delay of dissemination of information. The study also revealed that there is inadequacy of fund for maintenance management programmes in public hospitals in southwest Nigeria.

Table 2: Operational state of building elements and services in public hospital buildings in southwest Nigeria

BUILDING ELEMENTS/ SERVICES	Lagos ranking	Ogun ranking	Oyo ranking	Osun ranking	Ekiti ranking	Ondo Ranking						
Level of cleanliness	3.89	1	3.65	5	4.08	4	3.52	8	3.65	7	3.69	14
Floorslabs	3.82	2	3.80	1	3.96	6	3.74	3	4.14	1	3.93	5
Sanitation of the environment	3.78	3	3.41	11	4.19	3	3.57	7	3.27	20	4.13	1
Roof slab	3.68	4	3.67	4	3.65	21	3.80	2	3.73	4	3.96	3
Internal painting	3.66	5	3.55	6	3.78	14	3.43	12	3.61	8	3.94	4
Clean water supply	3.66	5	3.19	17	3.75	15	3.46	11	3.54	10	3.47	22
Block walls/internal partitions	3.65	7	3.80	1	3.92	7	3.81	1	3.57	9	3.75	10
Air circulation	3.63	8	2.93	24	4.60	1	3.67	5	3.78	1	3.89	6
Water supply	3.62	9	3.26	14	3.63	22	3.04	20	2.86	27	2.62	28
External painting	3.60	10	3.55	6	3.77	17	3.31	13	3.46	14	3.71	13
Nettings	3.57	11	3.01	23	3.37	26	3.52	8	3.39	15	3.78	9
Doors	3.56	12	3.35	13	3.72	16	3.28	14	3.74	3	3.73	11
Windows	3.56	12	3.52	8	3.69	19	3.61	6	3.69	6	3.89	6
Columns and beams	3.53	14	3.48	10	3.79	13	3.52	8	3.31	18	3.79	8
Security	3.53	14	3.23	15	3.88	9	3.17	17	3.28	19	3.51	21
Sanitary appliances	3.52	16	3.41	11	3.53	23	2.96	23	3.36	17	3.53	19
Floor/wall tiles	3.52	16	3.50	9	3.51	24	3.06	19	3.51	11	3.16	27
Electricity supply (lighting)	3.51	18	3.17	18	3.83	11	2.81	25	2.92	25	3.65	16
Garbage disposal	3.50	19	3.12	20	3.30	27	3.02	21	2.88	26	3.59	18
Ceiling	3.45	20	3.77	3	3.67	20	3.72	4	3.72	5	4.09	2

Water waste disposal	3.39	21	3.15	19	3.50	25	3.19	16	3.11	24	3.30	25
Drains	3.33	22	3.23	15	3.70	18	3.20	15	3.14	23	3.36	24
Fire protection	3.28	23	2.58	26	3.84	10	2.59	26	3.39	15	3.72	12
Human traffic control	3.25	24	2.68	25	3.89	8	2.87	24	3.15	22	3.63	17
Humidity control	3.15	25	3.05	22	4.20	2	3.00	22	3.18	21	3.46	23
Telecommunication systems	3.15	26	2.30	27	3.80	15	2.46	27	3.49	12	3.66	13
Noise protection	3.14	27	3.08	21	4.02	5	3.07	18	3.49	12	3.53	19
Vertical transportation	1.50	28	1.44	28	2.78	28	1.30	28	2.59	28	3.25	26
Valid N (listwise)												

Physical conditions of public hospital buildings and services in Southwest Nigeria

Southwest Nigeria consists of six states: Lagos, Ogun, Oyo, Osun, Ekiti, and Ondo. The state of buildings is examined in terms of building structures and fabrics (floor slab, roof, block walls, columns and beams), services (water supply, electricity supply, telecommunication systems, sanitary appliances, humidity control, and lifts) and the operational environment. The physical condition of the building elements and the services in each state are as discussed below:

Lagos State

Table 2 shows that the building structure and fabrics are rated as above-average in performance. They are ranked better on their state of maintenance than the building services, which are ranked very low in performance. The use of lifts for vertical transportation was rated to be very bad while noise control, telecommunication systems, humidity control, fire protection, the drains and waste disposal were rated average in performance. The level of cleanliness of the surroundings ranked first among others. It is rated good considering the physical condition. This is an indication that more resources are needed from the government for the supply of necessary service to public hospitals in Lagos State, if greater efficiency are to be achieved without compromising the core business of the hospital, which is the cure of patients.



Figure 19: Lagos General Hospital, Lagos as at July 2007

Figure 19 reveals the environment of the Lagos General Hospital, Lagos. The environment is found to be very tidy. Generally, the level of cleanliness is good and the physical conditions of the buildings are good, although some of the buildings have fading paintwork and flaking of walls in a few places.



Figure 20: Ikeja General Hospital, Lagos as at July 2007

Figure 20 indicates the physical condition of Ikeja General Hospital, Lagos. The major problems being faced here are the blockages and flooding due to the poor drainage system.



Figure 21: Ikeja General Hospital, Lagos as at July 2007

Figure 21 shows the physical condition of Ikeja General Hospital, Lagos. The major problems being faced are the blockages and flooding due to the poor drainage system.



Figure 22: Federal Neuro-Psychiatric Hospital Yaba, Lagos as at July 2007

Figure 22 describes the physical condition of Federal Neuropsychiatric Hospital, Yaba, Lagos. The glass panes need to be cleaned more frequently. External walls are dirty especially the walls directly underneath the unit air-

conditioners, which are damp and mouldy due to the water dripping on them. Generally the buildings need a new coat of paint.



Figure 23: General Hospital Beach Road, Ikorodu, Lagos as at July 2007

Figure 23 reflects the physical condition of General Hospital, Beach Road, Ikorodu, Lagos. The environment is untidy. The landscaping needs considerable attention. The lawns are overgrown with weeds. The surroundings are therefore unhealthy for hospital services.



Figure 24: Lagos General Hospital, Lagos as at July 2007

Figure 24 shows the environment of the Lagos General Hospital, Lagos. The environment is very tidy. Generally, the level of cleanliness is good and the physical conditions of the buildings are also good, although some of the buildings have fading paintwork and flaking of walls in a few places.



Figure 25: Lagos University Teaching Hospital, Idi-Araba, Lagos as at July 2007

Figure 25 shows the physical condition of Lagos University Teaching Hospital, Idi-Araba, Lagos. The major problems being faced are the blockages and flooding due to the poor drainage system. The environment is very tidy. The physical structure is good but there is poor illumination in some rooms.



Figure 26: General Hospital, Badagry as at July 2007

Figure 26 shows the physical condition of General Hospital, Badagry. The landscaping needs considerable attention. The lawns are overgrown with weeds. The surroundings are unhealthy for hospital services. Blockages and flooding are observed due to a poor drainage system.



Figure 27: Lagos University Teaching Hospital, Idi-Araba, Lagos as at July 2007

Figure 27 indicates the physical condition of Lagos University Teaching Hospital, Idi-Araba, Lagos. Problems being faced

are the blockages and flooding due to a poor drainage system. The environment is very tidy. The physical structure is good but needs a new coat of paint

Ogun State

Building structure fabrics are rated above average in their state of maintenance. They are also rated better than the building services. The lifts were rated very poor in performance while the telecommunications systems, fire safety devices and human traffic control are rated below average in performance. There is insufficient air circulation for efficient performance due to the arrangement of buildings within the hospital environment. It is rated below humidity control, fire protection and garbage disposal. Electricity supply and clean water supply were rated average in performance. This suggests that public hospitals in Ogun State need immediate attention if they are to provide cost-effective and specialist services that are safe and of high quality. Ventilation plays a key role in infectious disease management, as clusters of infection have been reported in facilities due to imbalance of ventilation systems from lack of mechanical control. Necessary services should be provided to reduce mortality rate.



Figure 28: State Hospital, Ijebu Ode, Ogun State as at July 2007

Figure 28 reveals the physical condition of the State Hospital, Ijebu-Ode, Ogun State. The environment is very tidy. The physical structure is good but there is poor illumination in some rooms.



Figure 29: Federal Medical Centre Idi-Aba, Abeokuta Ogun State as at July 2007

Figure 29 also reveals the physical condition of the Federal Medical Centre, Idi-Aba, Abeokuta, Ogun State. The landscaping needs considerable attention, as the lawns are overgrown with weeds. The surroundings are unhealthy for hospital services.



Figure 30: General Hospital, Ogbere Ogun State as at July 2007

Figure 30 reveals the physical condition of General Hospital, Ogbere, Ogun State. The lawns are overgrown with weeds and the surroundings unhealthy for hospital services. Blockages and flooding are observed due to a poor drainage system.



Figure 31: General Hospital, Ijebu-Ife, Ogun State as at July 2007

Figure 31 reveals the physical condition of General Hospital, Ijebu-Ife, Ogun State. The environment is very tidy. The physical structure is good but there is poor illumination in some rooms.



Figure 32: General Hospital, Ifo, Ogun State as at July 2007

Figure 32 describes the physical condition of General Hospital, Ifo, Ogun State. The external walls are dirty especially the walls directly underneath the unit air-conditioners, which are damp and mouldy due to the water dripping on them. Blockages and flooding are observed due to a poor drainage system. Generally the buildings need a new coat of paint.



Figure 33: Olabisi Onabanjo University Teaching Hospital, Ogun State as at July 2007

Figure 33 reveals the physical condition of Olabisi Onabanjo University Teaching Hospital, Sagamu, Ogun State. The landscaping needs significant attention. Fading paintwork is observed on the walls as well as poor illumination in rooms.



Figure 34: Federal Medical Centre, Idi-Aba, Abeokuta, Ogun State as at July 2007

Figure 34 reveals the physical condition of the Federal Medical Centre, Idi-Aba, Abeokuta, Ogun State. The physical structure is good but there is poor illumination in some rooms.

Oyo State

The arrangement of buildings in public hospitals in the state allows for proper air circulation for efficient performance of the buildings and the services being rendered. Humidity control and sanitation of the environment, based on the level of cleanliness and noise protection are all rated good in their performance. They are ranked best among other factors considered. Services such as security, fire protection, electricity supply and telecommunications systems are rated relatively above average in their performance. The building structures and fabrics are all ranked very low in their state of maintenance; however, they are above average in performance while the garbage/waste disposal is rated average in performance. This is also an indication that considerable resources are still needed from government to improve their standard, especially in the area of building structures and fabric for effective healthcare delivery.



Figure 35: State Hospital, Saki, Oyo State as at July 2007

Figure 35 shows the physical condition of the State Hospital, Saki, Oyo State. The external walls are dirty especially the walls directly underneath the unit air -conditioners, which are damp and mouldy due to water dripping on them. Blockages and flooding are observed due to a poor drainage system.



Figure 36: General Hospital, Iseyin, Oyo State as at July 2007

Figure 36 shows the physical condition of General Hospital, Iseyin, Oyo State. The lawns are overgrown with weeds. The walls are damp and mouldy due to water dripping on them. The surroundings are unhealthy for hospital services.



Figure 37: State Hospital, Saki Oyo State as at July 2007

Figure 37 shows the physical condition of the State Hospital, Saki, Oyo State. The landscaping needs considerable attention. Blockages and flooding are observed due to a poor drainage system.



Figure 38: University College Hospital, Ibadan, Oyo State as at July 2007

Figure 38 reveals the physical condition of the University College Hospital, Ibadan, Oyo State. The physical structure is good but there is poor illumination in some rooms, as well as fading paintwork on the walls. There are numerous potholes on the roads within the complex. The tarred road surface is completely worn off.

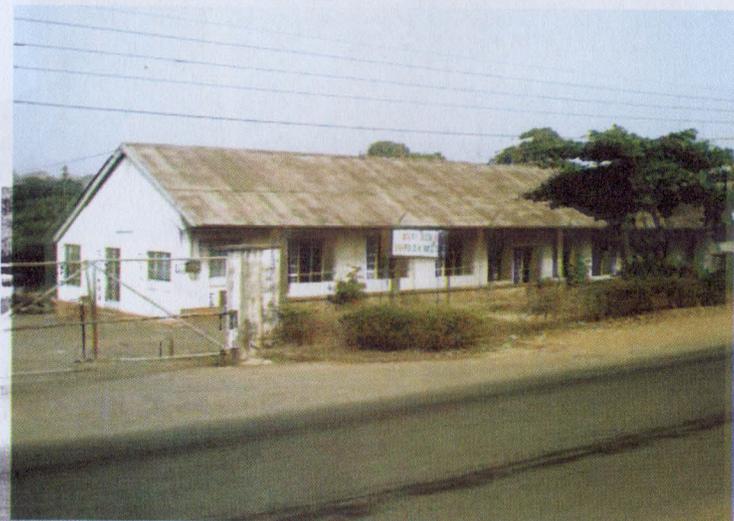


Figure 39: University College Hospital, Ibadan, Oyo State as at July 2007

Figure 39 shows the physical condition of the University College Hospital, Ibadan, Oyo State. The physical structure is old due to the age of the building. There is fading paintwork on the walls and the landscaping needs significant attention.

Osun State

The building structure and fabrics are found to be above average in performance and they are also rated best relative to other attributes considered. There is adequate provision for air circulation for effective performance. The sanitation of the environment, based on the level of cleanliness, is found to be above average in its state of maintenance. The entire building services, i.e. water supply, waste disposal, security, the drains, noise protection, garbage disposal and humidity control, are

rated average in performance. The control of human traffic, electricity supply, fire protection and telecommunication systems are all rated below average. The use of lifts is rated very bad in its state of maintenance. It is ranked lowest among others. This is evidence that government needs urgent attention to avert the collapse of the facilities meant for effective healthcare delivery. It is true that good patient care comes from dedicated individuals, but it is also true that the physical structures and hospital environment must be such that they guarantee the safety and well-being of patients.



Figure 40: Obafemi Awolowo Teaching Hospital, Ile-Ife, Osun State as at July 2007

Figure 40 shows the physical condition of Obafemi Awolowo Teaching Hospital, Ile-Ife, Osun State. The external walls are dirty especially the walls directly underneath the unit air-conditioners, which are damp and mouldy due to the water dripping on them. The landscaping needs more attention and fading paintwork is observed on the wall.



Figure 41: Ladoke Akintola University of Technology Teaching Hospital Osogbo, Osun State as at July 2007

Figure 41 shows the physical condition of Ladoke Akintola University of Technology Teaching Hospital, Osogbo, Osun State. The landscaping needs significant attention. Fading paintwork and cracked floors are also observed. Also observed are blockages and flooding due to the poor drainage system.

Ekiti State

The arrangement of the hospitals' built environment within the state allows for adequate air circulation for effective performance, hence the above-average rating in performance. The surroundings are also rated above average considering the level of cleanliness, just as the building structure and fabrics are above average in their state of maintenance. Services such as telecommunication systems, noise protection, fire protection, humidity and human traffic control as well as drains and waste disposal are average in performance. Electricity and water supply, garbage disposal and vertical transportation are below average in performance; thus, they are ranked lowest among other elements. This is also an indication that more resources are needed for effective health care delivery in the State, as the quality of the physical

environment in which patients receive care tends to affect the patient recovery rate, staff satisfaction and organisational productivity.



Figure 42: General Hospital, Ido-Ekiti, Ekiti State as at July 2007

Figure 42 shows the physical condition of General Hospital, Ido-Ekiti, Ekiti State. The surroundings are overgrown with weeds and the environment unhealthy for hospital services. Blockages and flooding are observed due to a poor drainage system.



Figure 43: State Specialist Hospital, Ikere-Ekiti, Ekiti State as at July 2007

Figure 43 shows the physical condition of the State Specialist Hospital, Ikere-Ekiti, Ekiti State. Fading paintwork and cracked floors are observed, as well as blockages and flooding due to a poor drainage system. Many of the buildings also have rotten wooden panels. In addition, the sewage system is poor.



FIGURE 44: General Hospital, Oye-Ekiti, Ekiti State as at July 2007

Figure 44 shows the physical condition of General Hospital, Oye-Ekiti, Ekiti State. The lawns are overgrown with weeds and the surroundings are unhealthy for hospital services. Blockages and flooding due to a poor drainage system are equally observed, together with fading paintwork and cracked floors.



FIGURE 45: State Specialist Hospital, Ado-Ekiti, Ekiti State as at July 2007

Figure 45 shows the physical condition of General Hospital, Ado-Ekiti, Ekiti State. The lawns are overgrown with weeds and the surroundings are unhealthy for hospital services. There are blockages and flooding due to a poor drainage system, as well as fading paintwork and cracked floors.



Figure 46: State Specialist Hospital, Ikole-Ekiti, Ekiti State as at July 2007

Figure 46 highlights the physical condition of the State Specialist Hospital, Ikole-Ekiti, Ekiti State. Observed here are fading paintwork, cracked floors and blockages as well as flooding due to a poor drainage system. Also observed within the buildings are rotten wooden panels. Furthermore, the sewage system is poor, the landscaping needs more attention and the environment is very untidy.

Ondo State

The building structure and fabrics are rated good in performance and they are rated best among others in their state of maintenance. Services such as fire protection, telecommunication systems, electricity supply, human traffic control, noise protection and sanitary appliances are all rated above average in performance. The security of the surroundings, water supply, humidity control, the drains, waste disposal and the use of lifts are rated average in performance. This is an indication that more resources are needed from the government for an effective healthcare delivery.



Figure 47: Federal Medical Centre, Owo, Ondo State as at July 2007

Figure 47 shows the physical condition of the Federal Medical Centre, Owo, Ondo State. The physical structure is good but there is poor illumination in some rooms and fading paintwork on the walls. There are numerous potholes on the roads within

the complex. The tarred road surface is completely worn off and flaking is observed on the wall plaster.

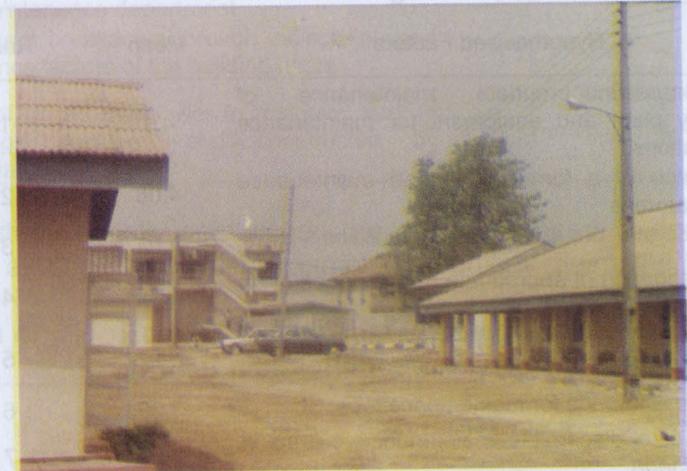


Figure 48: State Specialist Hospital, Akure, Ondo State as at July 2007

Figure 48 reflects the physical condition of the State Specialist Hospital, Akure, Ondo State. The physical structure is good, but there is fading paintwork on the walls. There are potholes on the roads and the environment has a poor drainage system. Some of the rooms have poor illumination, while the tarred road surface is completely worn off. Generally, the landscaping needs serious attention. The study also ranked the factors affecting maintenance management practices in public hospital buildings in southwest Nigeria (see Table 3).

Table 3: Factors affecting maintenance management practices in public hospital buildings in southwest Nigeria

Hypothesised Factors	Mean	Rank
Inadequate/inappropriate maintenance of facility plant and equipment for maintenance operations	4.1	1
Absence of a form of planned maintenance programmes	4.08	2
Attitude of users and misuse of facilities	4.04	3
Non adoption of appropriate maintenance cycle for building maintenance	4.02	4
Lack of long-term arrangements for the supply of essential parts for replacement	4	5
Insufficient funds for maintenance jobs	3.99	6
Lack of a discernible maintenance culture in the Nigeria	3.98	7
Inadequate training and development of personnel	3.95	8
Dependence of the scale of efforts, extent of facilities and resources for maintenance operations on quality of management organization	3.95	8
Ineffective maintenance due to neglect of training, retraining and continuing education	3.94	10
Use of poor quality components and materials	3.94	10
Inflation of the cost of maintenance by the operatives	3.92	12
Lack of skilled personnel in maintenance department	3.92	12
Reluctance of some establishments to adopt innovations and support	3.92	12
Complexity of design and non-involvement of maintenance experts during the design stage	3.89	15
Lack of consideration of our level of technology, cultural background and environment is not during the design stage	3.88	16
Frequent shortage of materials and spare parts due to absence of an efficient inventory system	3.87	17
Natural deterioration due to age and environment	3.86	18

Hypothesised Factors	Mean	Rank
Lack of successful maintenance programme by the maintenance department	3.82	19
Persistent breakdown through indiscipline and ignorance factors of the building users	3.76	21
Lack of skilled manpower to maintain work in buildings designed and constructed by expatriates	3.71	22

The study equally established the economic benefits derived when a hospital's built environment is regularly maintained.

Table 4: Economic Benefits derived from hospital's regular maintenance

S/No	Economic Benefits	Response from maintenance staff		Response from users	
		Mean score	Ranking	Mean score	Ranking
1.	Providing a conducive working environment	4.27	1	4.39	1
2.	Safety in the usage of building and its environment	4.27	1	4.35	3
3.	Promoting local contracting skill	4.27	1	3.89	15
4.	Protection and enhancement of built environment	4.24	4	4.37	2
5.	Preventing the waste of financial resources	4.23	5	4.23	10
6.	Prolonging the economic life span of building	4.22	6	4.35	3
7.	Conducive and healthy environment	4.17	7	4.32	6
8.	Fasten rate of recovery of patient improving the quality of built environment	4.13	8	4.27	9
9.	Protecting infrastructure	4.11	9	4.34	5
10.	Maximising and sustaining the building's economic value	4.09	10	4.27	7

S/No	Economic Benefits	Response from maintenance staff		Response from users	
		Mean score	Ranking	Mean score	Ranking
11.	Ensuring that building and facility operate optimally	4.08	11	4.28	8
12.	Preventing unnecessary investment in new facilities	4.02	12	4.12	11
13.	Preventing increased future cost	3.96	13	4.08	12
14.	Reduces morality rate	3.91	14	3.99	14
15.	Attracting foreign investors	3.88	15	3.87	17
16.	Prolongs life of patient	3.74	16	4.02	13
17.	Reduces healthcare expenses	3.64	17	3.88	16
18.	Cost of healthcare becomes minimal	3.60	18	3.72	18

- Procurement methods for executing maintenance works in the built environment of public hospitals in Southwest Nigeria**

The execution of maintenance works is the practical realisation of all the management decisions, designs and dreams for maximising the results of maintenance efforts. According to Adebayo (1991), Adenuga (2000) and Iyagba (2005), maintenance works are complex in nature and are undertaken by direct labour while some are executed by contractors. The mode of execution of maintenance works is a matter of policy. It is the maintenance policy of the establishment that dictates whether directly employed labour or contractors or both will be most advantageous. Lee (1987) states that "the major problem confronting the maintenance manager is deciding what method of maintenance execution to adopt". The study examined the labour composition and identified if there are any significant differences in the execution of maintenance works using outsourcing and in-house labour.

Seeley (1976) observed that in reaching a decision, the maintenance manager should compare the cost and services

provided by the contractors with the cost of his own directly employed labour force, taking into account the availability of labour and the type as well as location of the building to be maintained. Iyagba and Adenuga (2005) noted that the sizes, types and number of buildings to be maintained will invariably determine the source of manpower either in service or outsourcing. Adenuga (2008) re-affirms that successful execution of maintenance work, be it by direct labour or by contract, depends on detailed specifications, good planning and supervision. Arditi (1997) states that using in-house staff will allow for better control of the services while reducing cost and providing a higher quality of work, thus ensuring more flexibility in staffing. Iyagba (2005) argues that outsourcing holds the promise of flexibility and profitability and that it allows the organisation to focus on its core business and competencies, leaving peripheral and support functions to be serviced by outside experts. Adenuga ((2008) concluded that outsourcing will allow for adoption of the latest technologies with better access to special skills, while in-sourcing will produce higher quality and better quality control of services.

- Essential skills for maintenance managers in the built environment of public hospitals**

As technology changes so do maintenance requirements. No doubt, technology is time-dependent; therefore as time progresses, so does technology changes. Like any other human endeavour, maintenance activities require someone to manage them. According to Adenuga (1999), management is the philosophy or practice of organised human activity and managers are the people responsible for the conduct and control of such an undertaking. The manager is therefore concerned with the ways and means of getting a job done.

According to Geneen (1997), cited in Krass (2000), management is not a collection of boxes with names and titles on the organisational chart. Management is a living force. To the author, it is the force that gets things done to acceptable standards. Ubeku (1975) describes a manager as a person who guides other people to obtain desired results.

Geneen (1997), as reported by Krass (2000), describes a great manager as someone who has the courage to gamble, to delegate and to be tough. To the author, management must have a purpose, a dedication, and that dedication must be an emotional commitment. It must be built in as a vital part of the personality of anyone who truly is a manager. He or she is the one who understands that management must manage.

Adenuga (2008) describes a good manager as somebody with the ability to think creatively, constructively and clearly. To the author, a good manager must be curious, keeping an open mind to the other person's ideas. He must have the ability to judge justly or wisely, especially in matters affecting action. To him, men who are destined for leadership must be men who can make sound and wise decisions. A good manager is not someone who sees nothing but the reasons to kill every new idea at its birth. He further describes the good executive as somebody with administrative skills as well as the ability to foresee the needs of his operation and to forecast its requirements in men, materials, money and time. He must have the talent to resolve these needs into a practical and understandable programme.

Adenuga (2008) further describes a good manager as someone who is inspiring and optimistic while radiating confidence and enthusiasm. According to Adenuga, a discouraged and despondent executive can send a hundred or more employees' morale into the gutter. To him, a worried-looking boss can touch off a wave of fear rolling throughout an organisation. For these reasons, as a good manager, he must be a man of faith, faith in the people to whom he has assigned an important job, faith in himself and in God.

According to Fox (1956) a good manager must be man of high integrity. Indeed, integrity, sincerity and moral posture of a top executive must be unquestionable. A good manager should not complain when assigned responsibilities. He should also be able to use his initiative when immediate action is called for. He must have the confidence of his superiors that his

actions will be the same whether his deeds are subject to observation or not. This is integrity. Finally, according to Fox (1956), a good manager must not be arrogant, as arrogant leaders usually do not last on the job. They may survive because they own their businesses or have their boards of directors buffaloes. However, their companies never attain full potential because most people cannot show loyalty to arrogance. Blissett (2004) describes a good manager as somebody who can carry others along. According to Blissett, "if the people involved don't understand the initiative or if their attitude is such that they don't support it, or don't collaborate effectively in their support of it, then the initiative is unlikely to be successful".

On his part, Eade (1996) states that whether you work in a hospital, private hospital, health maintenance organisation or government facility, your behaviour as a manager has a direct impact on staff performance, productivity, satisfaction and turnover. To the author, good management, like good health, is the result of daily conditioning. A good maintenance manager must be able to plan, teach and delegate, not dump; encourage independent thinking; build a team; listen; set an example and accept responsibility. Eade suggests the following as being necessary to be a successful maintenance manager, i.e. developing leadership skills:

- Assume responsibility for your own actions. If you are not successful, don't blame anyone else. Take it on the chin and learn from it.
- Assume responsibility for your emotional reactions. It's not what happens to you that matters; it's what it means to you that determines how you react. Stand back and get perspective. Ask yourself, "what can we learn from this?" and it's easier to control yourself.
- Identify the potential in each of your subordinates. Remember that people tend to live up to our expectations of them. Let your people know how terrific you think they are.
- Make an inventory of the resources at your disposal and use those resources to help your staff perform better.

- Be optimistic. Optimism is contagious, so is pessimism. If your team is going to develop a positive, can-do attitude, you will need to set the tone.
- Develop a team vision for your department. Define what the team will become – make it inspiring.
- Set specific and measurable goals to make that vision come true. Include time frames and resource requirements.
- Treat others with empathy and respect – no matter what. Gain the independence, power, and self-respect that come from doing the right thing, without regard to what others do.
- Think less about your own needs and more about the needs of your team.
- Set an example – be a high performer; work hard and smart. People will follow your example. Be honest with yourself and your team. Be open to their criticism and learn from it.
- Set a schedule for your own training and development – stick to it. This will keep you growing and motivated.
- Model your management style after someone who inspires you.
- Good input = good output. Find and consistently use good sources of management guidance for reading, viewing and listening.

Iyagba and Adenuga (2005) identify the traits of a good manager as courage, decisiveness, dependability, judgement, sensibility, loyalty, enthusiasm, endurance and initiative.

Katz and Thamhain (1983), cited in Odusami (2001), listed ten specific essential skills for programme managers, which are: team-building skill, leadership skill, conflict resolution skill, technical skill, planning skill, organisational skill, entrepreneurial skill, administrative skill, managerial support building skill and allocation.

- Team building skill: This is the ability to integrate people from many disciplines into an effective team.

- Leadership skill: This is the programme manager's ability to lead the team within a relatively unstructured environment. The ability to integrate individual demands, requirements and limitations into decisions that will affect overall project performance.
- Conflict resolution skill: This is the programme manager's ability to understand the determinants of conflicts and to deal with it effectively.
- Technical skill: This is the capacity to manage the technological innovation and integration of solution for the success of a project.
- Planning skill: This involves the preparation of a project summary plan before the project starts; it requires communication and information passing skills.
- Organisational skill: The programme manager must understand how the organisation works and how to work with the organisation. It requires defining and reporting relationships, responsibilities as well as lines of control and information needs.
- Entrepreneurial skill: This is the programme manager's ability to identify and pursue some important goals that are critical to the success of the programme. Some of these goals are customer satisfaction, future growth and cultivation of related market activities.
- Administrative skill: This involves planning, staffing, budgeting, scheduling and other control techniques.
- Management support building skill: This is the programme manager's ability to build favourable relationships with senior management.
- Resource Allocation skill: The programme manager needs to work out specific agreements with all key contributors and their superiors on the tasks to be performed and the associated budgets and schedules.

Although the programme manager is mentioned in relation to the skills highlighted above, they are all applicable to maintenance managers especially in the maintenance management of buildings, since their roles are similar.

- **Effective maintenance policy for sustaining housing stock in a slumping economy**

Improved housing policies and programmes are a major component of achieving the goal of adequate shelter for all. It is clear that the total supply of buildings is inelastic in the long run and the only way to sustain the stock of housing at a particular period is through repairs and maintenance. Historically, in both the public and private sectors, maintenance was seen by many as an avoidable task, which was perceived as adding little to the quality of the working environment while consuming scarce resources that could be directed to more profitable sectors (*Higher Education Backlog Maintenance Review*, 1998). Fifty years ago, the challenge was to get people to identify and care about historic buildings; twenty-five years ago, the challenge was to avert redevelopment. Today, the challenge is to stop the unnecessary loss of historic buildings through neglect (Adenuga 2008).

Buildings are human-made assets which require regular maintenance if they must contribute to economic development. A good maintenance manager must be willing to admit to a maintenance problem and actively pursue a solution. How can a good maintenance manager actively pursue a solution? It's by being proactive, disciplined and accountable. He must maximise available resources while managing based on information. He should be able to give reports on production/operations and feedback from work reports (Adenuga, 1999).

The study identified a number of reasons in contemporary maintenance practices which cause neglect of maintenance responsibilities. It also suggested a proactive approach to maintenance by providing guidelines for maintenance checklist operations on key building elements. The study equally provided frequencies for maintenance operations, the type of staff and the number of operatives required for effective implementation. As a matter of policy every individual, especially those in the building industry, should preserve the

quality of existing dwellings and neighbourhoods so that people will find their community a healthy, safe and attractive place to call home today and in future.

Budgeting for Maintenance Works

To provide estimation for maintenance work is to ensure all the elements are duly observed, that is, establishing their physical condition, as well as defects, causes and how the deterioration could be minimised or eliminated. According to Adenuga (2012) elements that determine the estimate of the maintenance budget are:

1. Size of the asset
2. Type of the asset
3. Type of construction, materials and workmanship
4. Quality of design
5. Age of building and equipment
6. History of that particular structure
7. How asset is used
8. The location
9. Knowledge and dedication of staff
10. Availability of spare parts and quality contractors
11. Type, knowledge and expectation of users
12. Amount of change in your organisation or user's organisation
13. Competition
14. Amount of deferred maintenance
15. Hours of use
16. Production level or speed of operation

The formula for estimating maintenance budgets is:

$$(RCB \times MR) + (RCSE \times EMR) \times CR = MB$$

RCB = Replacement Cost of Building or Facility

This number can be determined from the RS, which means costing information or experience. The basics include all standard HVAC, plumbing and electrical equipment. Replacement cost can be obtained from square footage estimate.

MR = Maintenance Ratio

This number is the percentage of the asset value which may be reinvested to work off deterioration. The range for standard type buildings is 0.75% to 2% per year. The exact amount depends on the use of the building, part of the country in which the building is located and the type of construction. It should be recognised that a 2% MR would mean that the entire building would be replaced in 50-year.

RCSE = Replacement Cost of Special Equipment

This would include production equipment

EMR = Equipment Maintenance Factor

CR = Construction Ratio

Construction ratio is the ratio of time and materials spent during renovations and new construction to the total time spent on all maintenance activities.

MB = Maintenance Budget

The maintenance budget includes labour, materials, fringe benefits and overheads but not the janitorial cost.

MB/Rev = Maintenance Budget per naira Revenue

MB/sq. Meter = Maintenance Costs per square metre of building or facility

MB/output = Maintenance Costs per unit of output.

• **Professionals of the built environment and the incidence of building collapse in Nigeria**

The study identified the causes of building failure and the effects of such failures on construction professionals, clients and the nation as a whole.

An impressive edifice will surely attract attention and prompt inquiries about the architect who designed it. However, when there is a failure which results in a collapse, people are more likely to inquire about who built the structure? Building failures

have resulted in waste of materials as well as of financial resources; they also lead to loss of lives. Such losses affect the economy (Adenuga, 2000). Building failure affects the confidence of prospective and present clients in the building industry as well as the integrity of professionals in the industry. Building failure is deemed to have occurred when a building or building components can no longer be relied upon to fulfill its principal functions. This tends to occur during and after construction. According to Iyagba and Odulami (1989), failures in buildings are of two categories: cosmetic and structural.

It is cosmetic when something has been added or subtracted from the building, thus affecting the structure's outlook. It is structural when both the structural stability and the outlook of the building are affected.

In Nigeria, building failures have been attributed to causes such as design faults (50%), faults on construction sites (40%), product failure (10%) Oyewande, (1992); Adenuga (2012); Ayinoluwa, 2004. Faulty design, faulty execution of works and the use of faulty materials are the major causes of structural failures (Iyagba & Adenuga, 2005). Adenuga (2000) identified environmental changes, natural and human-made hazards as well as improper presentation and interpretation as major causes of structural failures. Other reasons include lack of supervision, non-conformity with building regulations, poor construction techniques and bad usage, among others.

According to Adenuga (2000), incompetent doctors kill in units while incompetent builders kill in tens. Buildings fail not only because of how they are designed but also because of how they were built. Besides, the management of a building will also affect its life expectancy. All buildings are prone to deterioration (i.e. wear and tear) and no structure can reasonably be expected to last forever. During construction works, effective quality control checks at periodic intervals with constant and adequate maintenance care will prolong building longevity. This proneness of buildings to depreciation (and degradation) is traceable to the materials, elements and

composites used in constructing them. They exhibit different reactions when exposed to the environment, human-made conditions and the types of use they are subjected to. The geographical location and environmental conditions of the immediate environs of the building also have significant effects on materials specifications.

To cite Akeju (1984), Oloyede (1991), Adenuga (1999), Adenuga (2000), as well as Iyagba and Adenuga (2005), other causes of structural defects are as follows:

- (a) Social-Economic Habits of Nigerians – Non-professionals design buildings and after the design by these quacks, for fear of paying appropriate fees to qualified people, the local planning authorities approve them.
- (b) Owner-Contractor Syndrome – In a bid to save cost, the owner usually wants to build by himself using the so-called direct labour. The owner of the property buys the materials himself, buying cheap and inferior building materials without any idea of what type of materials should be bought for a particular job.
- (c) Improper Supervision of Project during Construction – The project competently created on paper must be faithfully and accurately reproduced on the site. A structure is said to be as good as its construction and not its design. An appropriate qualified professional must supervise every stage of the work.
- (d) Constructional Problems – Some developers wrongly believe that by compromising slightly on materials quality, the overall effect on the structure will be little and the monetary gain will be large. This is wrong, the gain, moneywise, will be small and the danger to the structure will be enormous and destructive. Having good materials in the hands of experienced artisans is the best way of saving cost (Adenuga, 2000; Warnang, 1989).
- (e) Failures caused by Foundational Problems – Foundational failures are never due to a single cause, but there will always be one major cause. Akeju (1984), Warnang (1989), Olateju (1991), Adenuga (2000), as well as Iyagba and Adenuga (2005) established that

foundational failure may be due to any or a combination of the following:

- Lack of a proper investigation of the site or wrong interpretation of the result of such investigation
 - Faulty design of the foundation
 - Bad workmanship in the construction of the foundation
 - Use of poor materials during construction
 - Insufficient provision in the design construction for exceptional natural phenomena such as thermal and biological conditions, rainfall and floods which are greater than those hitherto recorded at the site.
- (f) Site Development Error – This is often the case when construction is carried out with insufficient or nonexistent geotechnical studies.
 - (g) Design Error – These include errors in concept, assessment of loading, calculation errors, improper elemental assemblage, interrelationship errors, connection details errors, maintainability etc.
 - (h) Inadequate Maintenance – Maintenance is a stitch in time that saves nine. Generally, not enough attention is paid to maintenance, something for which the government is the most guilty, as observed by Adenuga (1999).

Reasons for the Present Trend

The reasons advanced for the present situation, according to Adenuga (1999, 2000) as well as Iyagba and Adenuga (2005) may be summarised thus:

- Decline in site skills
- Lack of on-site trade training
- Wide communication gap between designers and site operatives
- Building regulations not being applicable to certain buildings
- Difficulty in understanding bye-laws and codes of practice
- Absence of maintenance manual or lack of understanding of maintenance

- Graft and corruption by some unscrupulous elements who have given the construction industry an unenviable reputation
- Non-recognition of CORBON-certified builders in the construction industry

ECONOMIC IMPLICATIONS OF BUILDING MAINTENANCE NEGLECT

Buildings, be they residential, commercial or institutional, are powerful economic engines with benefits that often last over their lifetime. This explains why huge investment goes into the development of buildings globally. It is however important to stress that the maintenance of the existing building stock of any nation is as important to the economy as the construction of new buildings. Peck (2010) reported that the commercial real estate industry in the US generated \$40 billion in annual expenditure in 2009 alone. The reported expenditure supported local employment and business activities directly associated with the operation and maintenance of some commercial buildings in the US. It was also reported that the \$40 billion was spent on consumer goods and services which ultimately contributed \$118.4 billion to the US economy in 2009. Simply put, for each \$1 of operating and maintenance spending, an average of \$2.90 was put back into the US economy.

The operation and maintenance of buildings comprise activities that could stimulate capital and operating expenditures, which could in turn funnel down into a nation's economy. It can be seen that the return on investment on operation and maintenance of buildings is about 300% as jobs are created and new personal earnings are generated to be spent on consumer goods, while buildings and associated facilities are enhanced for optimum productivity.

The economic potential of the real estate market in Nigeria is huge, with continuous massive developments across major cities of the federation. For example, by the end of the development circle of 2016, completed real estate

development in Lagos State comprised 232,000 sq.m of retail space, 360,000 sq.m of gross lettable office space and 12,294 hotel rooms spread across 74 hotels within the state. It is however unfortunate that most of the buildings and facilities (public and private) in Nigeria suffer maintenance neglect which results in huge economic loss for the nation. These facilities, especially those belonging to the Federal Government of Nigeria, continue to lie waste at various locations across the country even when they could be converted to profitable economic assets that could generate incomes for the nation. Citing Lagos State as a case study, it is disturbing that since the relocation of the Federal Government from Lagos State to the Federal Capital Territory (FCT) Abuja in the year 1991, over 20 of the buildings which used to be the centre of economic activities of the Federal Government and its agencies have been abandoned. Operations and maintenance activities have been completely withdrawn from these buildings and the buildings have been subjected to accelerated deterioration through misuse and vandalism by miscreants.

Some of the Federal Government monuments that have been neglected over the last three decades include:

- The National Stadium, Surulere, Lagos
- The Federal Secretariat Complex, Ikoyi, Lagos
- The NET Building, Marina, Lagos
- The Defence House, Lagos
- Former Navy Headquarters Building, Marina, Lagos
- Former National Assembly Complex, Tafawa Balewa Square, Lagos
- Former Supreme Court Building

The National Stadium, Surulere, Lagos

This multipurpose stadium was built in 1972 to host the 1973 All African Games and remains one of the biggest stadiums in the country with an initial spectator capacity of 55,000. The stadium comprises an Olympic-size swimming arena and arenas for basketball, volleyball, table tennis, wrestling and boxing matches. Constructed to provide expression for the

abundant energy of the nation's youth to excel in most fields of sports, the facility's main bowl fulfilled that purpose for about three decades, hosting several national and international sports competitions and also serving as a training ground for sportsmen and women. Unfortunately, things began to fall apart in 2004 when the stadium started to suffer neglect, perhaps due to the construction of a new national stadium in Abuja, the Federal Capital Territory at that time.

The facilities of the once-magnificent stadium are now thoroughly dilapidated following the stadium's abandonment since the year 2004. The main bowl turf has lost its green (see plate 1), the seats and roof members have deteriorated (see plate 2 and plate 3) and the entire facility is in a state of disrepair. The edifice that was once a national monument has deteriorated into an eyesore, to the embarrassment of a nation that is increasingly incapable of maintaining its national assets. In the past one decade, the facilities have degenerated from providing skeletal sports functions to a religious events centre and now a den of social misfits called area boys, who use it as a hideout for attacking innocent citizens living in the vicinity.



Figure 49: Present condition of the track of the National Stadium, Surulere, Lagos

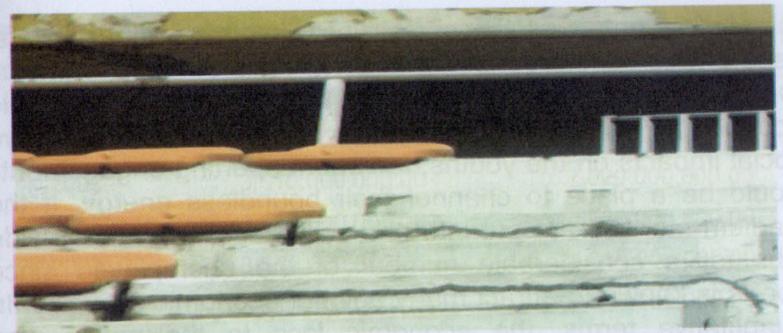


Figure 50: Present condition of seats at the main bowl of the National Stadium, Surulere, Lagos



Figure 51: Present condition of the main bowl roof of the National Stadium, Surulere, Lagos

Sadly, the same fate has befallen all the other national stadia, especially those in Ibadan, Enugu, Bauchi, Kaduna, and Abuja. All of them have become a huge economic waste as a result of operation and maintenance neglect. The state of the Abuja Stadium is worse. Built in 2003 at the cost of \$360million (more than N100 billion at today's exchange rate), the 60,491-capacity edifice is one of the most expensive of such projects in the world. The stadium has been renovated several times at the cost of billions of naira between 2009, when it hosted the Junior World Cup, and 2012, when it went into disuse. In fact, the stadium is now an unofficial grazing reserve for cattle.

It is unfortunate that these facilities, like many other federal assets which could generate incomes for the nation, continue to lie waste even when they could be converted to profitable economic assets. This is not to talk of their potential positive social impacts on the youths, for whom sporting engagements would be a place to channel their boundless energy. If the stadium facilities are put into productive use, it would provide jobs for a considerable number of the unemployed since sports is known to attract many adjunct economic activities. In quantitative terms, the economic loss to the nation was calculated based on the present 45,000-seat capacity of the national stadium, with the assumption that the facility is used for major sport activities three times a week at 50% capacity and at an average gate fee =N=1,000. , the cumulative potential economic loss to the nation from the neglect and lack of maintenance of this facility was estimated over the years at =N=52.6BN, as shown in Figure 1.



Figure 52: Estimated revenue loss accruing from abandonment of the National Stadium, Surulere, Lagos over the period 2004-2018

Detailed breakdown of the computations shown in Figure 1 is presented in table 1.

Table 5: Breakdown of potential economic loss accruing to the abandoned National Stadium

Year	Estimated Annual Revenue	Cumulative Revenue Loss
2004	3,510,000,000.00	3,510,000,000.00
2005	3,510,000,000.00	7,020,000,000.00
2006	3,510,000,000.00	10,530,000,000.00
2007	3,510,000,000.00	14,040,000,000.00
2008	3,510,000,000.00	17,550,000,000.00
2009	3,510,000,000.00	21,060,000,000.00
2010	3,510,000,000.00	24,570,000,000.00
2011	3,510,000,000.00	28,080,000,000.00
2012	3,510,000,000.00	31,590,000,000.00
2013	3,510,000,000.00	35,100,000,000.00
2014	3,510,000,000.00	38,610,000,000.00
2015	3,510,000,000.00	42,120,000,000.00
2016	3,510,000,000.00	45,630,000,000.00
2017	3,510,000,000.00	49,140,000,000.00
2018	3,510,000,000.00	52,650,000,000.00
TOTAL	52,650,000,000.00	

Federal Secretariat Complex, Ikoyi

Before its abandonment the Federal Secretariat complex, Ikoyi was a powerhouse for deliberations and implementation of issues that concerned the development of the country. It was an administrative complex built by the Yakubu Gowon-led administration to serve as office accommodation for the country's administrators. However, since the seat of government moved from Lagos to Abuja on the 12th of December 1991, the building has been neglected. The Federal Secretariat now houses rodents, reptiles and hoodlums who take advantage of its derelict state to perpetuate illegal activities. Plate 4 shows the present state of dilapidation of the Old Federal Secretariat Complex.



Figure 53: Abandoned Federal Secretariat Building Complex, Ikoyi, Lagos

In the course of my research work on abandoned assets of the Federal Government of Nigeria, the economic loss owing to the neglect of operation and maintenance of the Federal Secretariat Complex was evaluated. The evaluation was premised on the conversion of the complex to luxury residential apartments as proposed by Resort International Limited (RIL). This proposal was to convert the complex to 480 units of luxury residential apartments following the concession of the complex to the firm in 2006. Sadly, the proposed conversion suffered a setback when the concession award was challenged in court by the Lagos State Government. Assuming the building had been converted to the proposed number of luxury apartments prior to its abandonment and assuming the year 1995 as a base year, the estimated revenue that could have been generated till date is =N=72BN. Figure 2 shows the cumulative estimated revenue that could have been generated from the building.

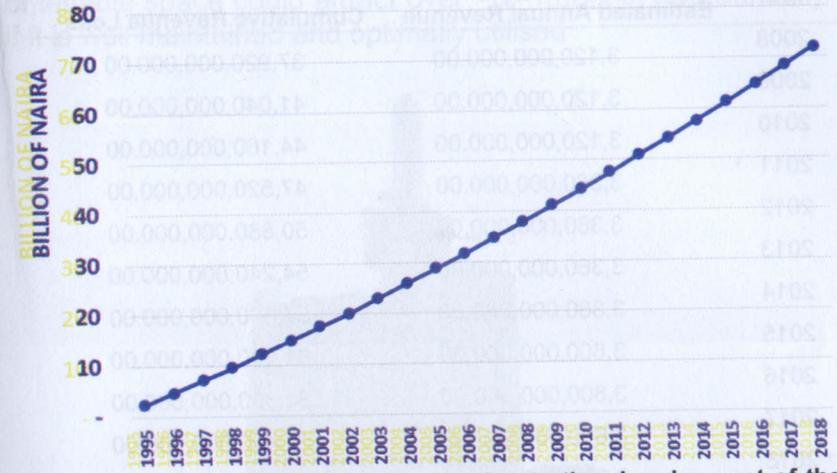


Figure 54: Estimated revenue loss owing to the abandonment of the Federal Secretariat, Ikoyi, Lagos over the period 1995-2018

Detailed breakdown of the computation of the sums shown in Figure 54 is presented in Table 6.

Table 6: Breakdown of potential economic loss owing to abandonment of the Federal Secretariat

Year	Estimated Annual Revenue	Cumulative Revenue Loss
1995	2,400,000,000.00	2,400,000,000.00
1996	2,400,000,000.00	4,800,000,000.00
1997	2,400,000,000.00	7,200,000,000.00
1998	2,400,000,000.00	9,600,000,000.00
1999	2,640,000,000.00	12,240,000,000.00
2000	2,640,000,000.00	14,880,000,000.00
2001	2,640,000,000.00	17,520,000,000.00
2002	2,640,000,000.00	20,160,000,000.00
2003	2,880,000,000.00	23,040,000,000.00
2004	2,880,000,000.00	25,920,000,000.00
2005	2,880,000,000.00	28,800,000,000.00
2006	2,880,000,000.00	31,680,000,000.00
2007	3,120,000,000.00	34,800,000,000.00

Year	Estimated Annual Revenue	Cumulative Revenue Loss
2008	3,120,000,000.00	37,920,000,000.00
2009	3,120,000,000.00	41,040,000,000.00
2010	3,120,000,000.00	44,160,000,000.00
2011	3,360,000,000.00	47,520,000,000.00
2012	3,360,000,000.00	50,880,000,000.00
2013	3,360,000,000.00	54,240,000,000.00
2014	3,360,000,000.00	57,600,000,000.00
2015	3,600,000,000.00	61,200,000,000.00
2016	3,600,000,000.00	64,800,000,000.00
2017	3,600,000,000.00	68,400,000,000.00
2018	3,600,000,000.00	72,000,000,000.00
TOTAL	72,000,000,000.00	

The estimated revenue loss shown in Figure 2 and Table 2 respectively were computed based on the assumption of the year 1995 base rent of =N=5 million per annum and 10% rent increment every 4 years. Apart from the estimated =N=72 billion naira that could have been generated from the operation and maintenance of the Federal Secretariat, the utilisation of such building would have contributed to reducing the shortfall in the nation's housing stock.

The NET Building: The Nigerian External Telecommunications (NET) building is known under different names. NITEL and NECOM are two other names that are associated with the building. The tallest building in West Africa and once a national heritage representing engineering strength and innovation, the building and its focus have gone down the drain. NITEL has become a thing of the past and this Federal Government skyscraper is now an eyesore. The building is situated at number 15 Marina, Lagos Island. The building is presently underutilised and has suffered a significant level of deterioration due to poor maintenance. The 32-storey building of over 160m in height and about 720 Sq.m

of lettable space could attract over =N=1.6BN in rent annually if it is well maintained and optimally utilised



Figure 55: The under-utilised NET building – rapidly depreciating due to maintenance neglect

Defence House: Defence House is a 25-storey building. Originally called independence building to commemorate the country's independence, the high-rise building was taken over by the military and renamed Defence House. Since then, the story of the structure has been a disturbing one. The heritage of the house and what it signifies is lost to the eyesore that now stands in its place. The building is plagued with numerous building defects due to total operation and maintenance neglect.



Figure 56: Defence House – dilapidated due to maintenance neglect

The present dilapidated state of these buildings does not only constitute a nuisance to the city of Lagos and its residents but is also a source of economic loss deriving from abandonment and underutilisation of these buildings. I therefore appeal to the Federal Government to take quick steps at reactivating these buildings as well as other buildings that have been abandoned at different locations across the country.

CONTRIBUTIONS TO THE UNIVERSITY AND BUILDING EDUCATION

Mr Vice Chancellor sir, I wish to highlight some of my contributions to the university system and to building education/professional practice.

At the departmental level, I am the second alumnus to be appointed as Substantive Head of Department of Building (2016 – 2017) and also the first alumnus to serve as full Head of Department in Professorial capacity (2017 till date) for a tenure of three (3) years. For the first year in office, the department experienced a new phase of development through consultations with past students of the department. Bringing my maintenance expertise to bear, various dilapidated components in the department were changed and the entire

environment was renewed for academic excellence. Within the first one and half years in the office, the department graduated six (6) PhDs including all our academic staff that had been on the programme for not less than five (5) years.

Mr. Vice Chancellor sir, I am very proud to say that only one of our academic staff is yet to complete his PhD programme, apart from the newly recruited staff members who has just started their programme. Also, the department has the highest number of PhD staff in the faculty. It is the mercy of God that has been our strength.

It is worthy of note that under my current leadership, the old students have agreed to form an alumnus in order to contribute to the development of the Department and the University as a whole. Presently, many of our old students have initiated prize awards for various courses in the department in order to promote academic excellence. My target is that before leaving the office all of our final-year courses will have attracted a prize award. I am indeed very grateful to all the donors, some of whom have pledged to transform the department in due course.

Mr. Vice Chancellor sir, the department is interacting with some foreign Universities for exchange programmes and collaboration in research as part of the vision and mission of the present administration. All our Graduate Assistants have completed their M.Sc. and are already upgraded to Assistant Lecturers. All of this is to the Glory of the Almighty God. The department has been able to produce an edition of our construction journal and preparations are in top gear to publish another one soon.

At the Faculty level, I have been a member of various Statutory Committees, such as Accreditation Committee, Strategic Planning Committee, Research Committee etc.). I am happy to announce that the first Construction Summit initiated by the faculty was successfully delivered under my leadership as Chairman, Local Organising Committee.

At the university level, I have served as a member of the Safety Committee (2013 – 2017) under the leadership of Professor Kehinde of Chemical Engineering. This committee audited our buildings both at Idi-Araba and here in Akoka. The recommendations of the report are clearly being implemented, as there are now fewer fire outbreaks on our campuses. I have supervised some of the staff in the works department of the University. They were specifically guided on the maintenance management of the existing buildings within the campus (Engr. Abioye and Bldr. Ganiyu). The objective was to enhance the performance of the buildings including the services involved. I have been a member of Senate (2012 – 2014) and presently a member (2017 till date) in capacity as a full professor.

Mr Vice Chancellor sir, while giving the account of my stewardship within the confines of University of Lagos, kindly permit me to say a bit about my stewardship in other universities.

CONTRIBUTIONS IN OTHER UNIVERSITIES

In 2012, I was at Bells University of Technology for my sabbatical leave. While in the institution, I was made the Head of Department of Building Technology and Quantity Surveying. I would like to put it on record that the first NUC and CORBON-accredited programme for the Department of Building Technology was obtained under my leadership as the Head of Department. While in the institution, I equally contributed to the entire infrastructural development as a member of the Development Committee, especially on their proposed permanent site at Badagry. I was also nominated as Member of the Research Committee at Bells University of Technology. I have also served as visiting Professor at Caleb University, Imota, Lagos. I am currently involved as an External Examiner on the Building undergraduate and postgraduate programmes at Covenant University, Ota, Ogun State; Obafemi Awolowo University, Ife; University of Uyo, Uyo; and Federal University of Technology, Minna. I have also served as an External Examiner to Federal Polytechnic, Ilaro; Federal Polytechnic, Offa; Yaba College of Technology; Lagos State Polytechnic.

Academic Mentorship

Mr Vice Chancellor sir, the greatest exercise for the heart is for a person to bend down and lift someone else up. In the course of my academic sojourn, I have been privileged to contribute to mentoring the next generation of Building professionals and academics. I have contributed to the training of well over 1000 Building graduates in the University and in the Polytechnic. It is a great joy to me that many of them are key stakeholders in the construction industry. Some of them owned their companies and are currently contributing to the development of the department. I have also supervised over 200 students at undergraduate and postgraduate levels (M.Sc., MPM, MFM). I have supervised four (4) PhD candidates; two (2) of them were directly supervised by me, i.e. Dr. Faremi and Dr. (Mrs.) Ajayi, the Maintenance experts in the Faculty of Environmental Sciences. The other two were co-supervised.

Mr Vice Chancellor sir, I have also been privileged to be invited to present papers by my professional body, the Nigerian Institute of Building. I have also served as a member of the publications and examination committees.

CONCLUSION AND RECOMMENDATIONS

Our buildings are in deplorable states of structural and decorative repairs. We do not have any maintenance culture, a fact which manifests in the general apathy for maintenance of buildings. There is also unexplained ignorance on the part of the public and occupants about the benefits of planned preventive maintenance and care of buildings. There is poor funding of maintenance work on the part of both public authorities and private property owners.

According to Seeley (1987), no building can exist throughout its span without needing one form of maintenance or another; this implies that much can be done at the design stage in order to reduce the amount of subsequent maintenance work.

Adenuga (2008) established that it is highly desirable but hardly feasible to produce maintenance-free buildings.

However, he admits that much can be done at the design stage to reduce the volume of maintenance work. All elements of buildings deteriorate at a greater or lesser rate depending on the design, materials, methods of construction, age and environmental conditions, usage of the building, and maintenance management of the building.

Dekker (2002), Kachashkin (2002), Mbamali (2003) and Adenuga (2008) found that "thinking on the maintenance should start in the design phase". It is at the design stage that the maintenance burden can be positively influenced for better or for worse. Where the designer fails to make adequate consideration for minimising maintenance problems, it always turns out to be a big problem when the building is eventually occupied for usage. According to Arayela and Adams (2001), Iyagba and Adenuga (2008), Ajayi (2015) and Faremi (2017), it is often said that building defects start on the drawing board. Bad briefs may lay down totally unrealistic cost limits or fail to give vital information on the building. Design deficiencies could result in a building disaster if adequate attention is not given to the bearing support, calculation errors, deformation errors in assumed loading (especially wind) and changes in alteration of existing structure, all of which could contribute substantially to building failures and disasters. Adenuga (2008) also observed that a skillful design can reduce the amount of maintenance work and also make it easier to perform, since good maintenance begins on the drawing board. Overtime, all buildings, as well as the materials and components therein, deteriorate or suffer loss in aesthetics, strength and or functional value, with constant exposure to weather elements. The inability of the building team to come together and contribute towards the building's maintainability at the project inception sometimes causes frustration and annoyance to maintenance personnel when they take over new buildings and finding themselves faced with bad details, poor choice of finishes, materials and components as well as lack of basic information about the building and its services.

According to Zubairu (2001), the extent to which the various factors contribute to maintenance problems, especially in public buildings in Nigeria, is as follows:

• Inadequate architectural design	6%
• Inadequate structural design	7%
• Inadequate electrical design	9%
• Inadequate mechanical design	11%
• Poor construction	12%
• Use of poor quality components and materials	14%
• Natural deterioration due to age and environment	18%
• Misuse by occupants	18%
• Others (i.e. political influence)	5%

In order to reverse the above trend with a view to ensuring better or more effective maintenance, use and care of our buildings, the following recommendations are made:

- 1) The adoption of preventive maintenance system by maintenance managers (or the appropriate authorities) of both public and private buildings. This system would include:
 - a. The formulation and formalisation of repair programmes to include an estimation of minimum repair times based on experience and/or further observation as well as repair testing programme to establish same.
 - b. Regular and effective inspections of all the fabrics of buildings including their surroundings as well as comfort of the occupants to detect signs of current disrepair and potential ones. These would be recorded and diagnosed to establish or ascertain their causes. This would be followed by remedial solutions that would cure such faults and prevent future occurrences.
 - c. Inspection reports are to be attended to promptly. Necessary actions to prevent further deterioration and/or eliminate the spread of the defect (or decay) taken.

- d. Balanced strategies for keeping the buildings in acceptable standards but not overlooking cost implications should be devised.
- 2) To facilitate the implementation of planned preventive maintenance, reasonable care should be taken at the design and construction stages of building development in the selection of materials and the construction method. The principle of cost-in-use should be borne in mind while making these selections with a view to ensuring adequate future maintenance of the building.
 - 3) Prompt corrective maintenance or repairs should be undertaken where faults are detected in buildings to avoid further deterioration or spread of the defects or faults.
 - 4) Occupiers of buildings should be adequately educated to report, as soon as noticed, defects to the maintenance manager (or maintaining authorities) of the property to enable quick inspection and allow for early remedial action to be taken.
 - 5) Governments should make positive efforts in encouraging individual home ownership. Studies have shown that owner-occupiers maintain their properties better than the best of tenants.
 - 6) All tenants/occupants of public properties must endeavour to use the property in such a manner as to keep them in good tenable conditions (fair wear and tear exempted). No part of the premises should be assigned nor any part thereof altered or improved in any way without the express permission of the designated authority in writing.
 - 7) Occupiers of public properties should be responsible for the repairs and maintenance of these properties, in liaison with and under the supervision of designated maintaining authorities. It is generally known that if they are left all on their own (unsupervised) to do this, they would not do it, even if the buildings are in danger of collapse. Therefore, it is necessary that the designated authorities should regularly inspect such properties and defects detected during these inspections, with

- 8) Both the public and private owners of buildings should avoid alterations which may lead to immediate or eventual decline in the status, character and aesthetic value of the property. However, alterations that will enhance the value of and prolong the life of the property should be encouraged.
- 9) Adoption, at design stage, of standardisation of components and fittings, forms of construction, type of dwellings and adequate dimensional coordination would help greatly in the reduction of future maintenance costs. In the eventual maintenance period, careful programming of repairs, renewals, improvements and redecorations can ensure a steady and easy flow of maintenance work.
- 10) The training of the Maintenance/Property Managers and their fellow professionals in the area of building maintenance should be encouraged in institutions of higher learning.
- 11) Property owners (both public and private) should make conscious efforts to prevent the over-use of facilities in buildings resulting from overcrowding, which very often results in undue pressure on sanitary facilities.
- 12) Government should be disposed to releasing buildings that are not utilised to private investors through concession or outright sale. This will forestall the incidents of abandonment and contribute to the economic growth of the nation through maintenance activities.

ACKNOWLEDGEMENTS

Mr. Vice Chancellor sir, first, I would like to express my appreciation to God Almighty for keeping me alive and taking me this far. Not only am I a recipient of God's mercy, but also a product of His mercy. I am what I am today by His Grace. Now unto Him who alone dwells in light so dazzling that no mortal can approach, to the immortal, invisible God, the only wise God, our Saviour; be Glory and Majesty, Dominion and Power, now and forever (Amen). I say thank you for guiding my steps in all my endeavours. To God be the glory.

Second, I wish to express my gratitude to the many hands that have lifted me up and contributed to my success at different stages of my life and the University Management under the able leadership of the Vice Chancellor, Professor Oluwatoyin Ogundipe, for the opportunity given me to present this inaugural lecture today. I am very grateful, sir, and wish you further uncommon success.

Iya ni wura; baba ni jigi being interpreted in English as mother is gold, father is the mirror. I remember my departed father, Chief Macaulay Olukoya Adenuga, a wonderful teacher who taught me how to be obedient and diligent in doing every task assigned to me. And, of course, my dearest mother, who is also now on the other side of Time, Mrs Agbeke Odeyemi; the conduit pipe through which I came into this world. Mom, I will always treasure your memory. They both worked and prayed hard, and by God's guidance helped me to navigate life in the midst of storms, shaping my career path by giving me a good head start in life. I thank the Almighty God for their lives.

Special thanks to my aunty, Mrs. Olufunke Osunsanya (Mama Seyi), who nurtured me at a critical period. You are not just an aunty but also a mother for taking care of me when I was less than a year, and brought me up until I grew to know my biological mother. Sweet Aunty, I can never forget your labour of love towards me. The Almighty God will continue to guide you and your children.

To all my siblings, who have contributed immensely to my academic advancement, I owe an unpayable debt of gratitude – Pastor Olukayode Adenuga, Chief Olufemi Adenuga, Mrs. Toyin Ogunsanwo, Mrs. Ronke Olawunmi Ebenezer Okumadewa, Seyi Adenuga, Mrs. Oluwakemi Ogunsanwo, and Mr. Damilola Odubela.

Mr. Vice Chancellor, I wish to quickly move to another phase and space in this journey by recognising and appreciating men and women of God, friends and brethren within the corridor of transcendental discourse space.

I acknowledge the prayers, love and support of my spiritual family; the Redeemed Christian Church Of God and Gospel Faith Mission. I benefited immensely from the training, mentoring and teaching programmes which redefined my journey in life. Beginning with our Father in the Lord, the General Overseer, Redeemed Christian Church Of God, Pastor Enoch Adejare Adeboye. The General Overseer, Gospel Faith Mission, Pastor Elijah Abina and Prophet Sunday Dare Iyunade; President, Pentecostal Sanctuary Bible Ministry, Pastor Bayo Olatunji; The General Overseer, Sunrise Evangelical Commission, Pastor Ephraim Osunde; The Provincial Pastor, Lagos Province 60, Pastor Olumide Ogunro, the Pastor-in-Charge, Family Church, Ifako,Ogba; under whom I receive my spiritual food on a daily basis. Others that I cannot but mention are: Pastor Sesan Akanbi Bello, Pastor Anayo Okpara, Apostle Ademola Oladejo, Pastor Kolawole Emmanuel, Deacon Suyi Ajayi and the host of Army Generals in the Lord. I thank you all.

I am especially grateful to my brother, pastor, and spiritual father, Pastor-in-charge of Gospel Now Ministry, the Sanctuary of Mercy, whom God revealed what I am presenting today. He had woken up one beautiful Sunday, then at Gospel Faith Mission, Kekere-owo, Ilasamaja, as a Resident Pastor and he said, "Bro Olumide, you are a Professor". Today, the dream has come to pass in my life after 30 years of God's revelation. Every moment I realise my position in academics, my heart

rejoices and pray for you and your children. I am so delighted to have come your way in the Christian journey. My father in the Lord, Pastor Emmanuel Oluwayemi, Otunba & Pst. (Mrs.) Otayemi Olusegun, Deacon & Pst. (Mrs.) Adedamola Odubanjo and others too numerous to mention. I am very grateful for all your spiritual supports.

There are a couple of very special individuals and families that have touched my life in one way or another in the course of this journey. Our mummy, a cheerful giver, Mummy Aderinola Aboyade Cole, as you have decided to will your property to God, the Almighty God will reward you accordingly. The staff of the West African Theological Seminary, Ipaja, Lagos, where my beloved wife works as a Registrar of the institution. Beginning with the founder of WATS, Rev. Dr. Gary S. Maxey and the wife, your mission in Africa has greatly affected many families through sound biblical principles. You left your position in the United State of America for a pilgrimage to Africa. The Almighty God will reward you accordingly. Members of the governing council, Rev. Dr. Wilson Badejo (chairman) and Dr. Fred Odutola, Professor(Emeritus) and Mrs. Emele Uka, Engineer Isaiah Ajayi, I thank you all.

The Provost, West African Theological Seminary, Professor John Brown Okwii, a visionary leader, Dr. Ugo Ikechukwu (Deputy Provost Academics), Mrs. Charity Ajayi (Deputy Provost Administration), Pastor and Mrs. Olayinka Morebise, Pastor and Mrs. Tunji Atilola, Pastor Olufemi Martins, the Deans, Faculty members and all the students of WATS; you have all remained our loving and ever supporting brethren. You are all well appreciated.

My wife's former boss, Dr. Williams Udotong, Pastor and Mrs. Olayinka Morebise, Mrs. Jacinta Olusoga, Pastor Oljide Aderimboye, Rev. Ajayi Joshua and Pastor Japhet Otunjirin, you are all appreciated.

There are a couple of very special individuals and families that have also touched my life in one way or the other in this

journey. Our mummy, a cheerful giver, Mummy Aderinola Aboyade Cole, as you have decided to will your property to God, the Almighty God will reward you accordingly. The staff of the West African Theological Seminary, Ipaja, Lagos, where my beloved wife work as a Registrar of the institution. Beginning with the founder of WATS, Rev. Dr. Gary S. Maxey and the wife, your mission in Africa has greatly affected many families through sound biblical principles. You left The United State of America for a pilgrimage to Africa. The Almighty God will reward you accordingly. Members of the governing council, Rev. Dr. Wilson Badejo (chairman) and Dr. Fred Odutola, Professor(Emeritus) and Mrs Emele Uka, Engineer Isaiah Ajayi, I thank you all.

The Provost, West African Theological Seminary, Professor John Brown Okwii, a visionary leader, Dr. Ugo Ikechukwu (Deputy Provost Academics), Mrs. Charity Ajayi (Deputy Provost Administration), Pastor and Mrs. Olayinka Morebise, Pastor and Mrs. Tunji Atilola, Pastor Olufemi Martins, the Deans, Faculty members, and all the students of WATS; you have all remained our loving and ever supporting brethren. You are all well appreciated.

My wife's former boss, Dr. Williams Udotong, Pastor and Mrs Olayinka Morebise, Mrs Jacinta Olusoga, Pastor Oljide Aderimboye, Rev. Ajayi Joshua and Pastor Japhet Otunjirin, you are all appreciated.

I cannot forget a group of very special friends, supporters and ministers of God who have in the last couple of years contributed immensely to my career's progress. They are: Engr. Abiodun Awe, Bldr. Tayo Awobusuyi, Bldr. Arinola S.A, Bldr. Akinpelu Jelili, Waheed Olajire, Pastor Kolawole Emmanuel, Pastor Andrew Asogbon, David Adelani, Joseph Ibidapo, Ayodele Ilesanmi, Reuben Soneye, Gbenga Osunuga, Bro and sis Tope Akintomide, Bro and Sis Ediare Cliffson, Bro and Sis Olumide Balogun, Bro and Sis Tunde Iwamofe, Bro and Sis Koleowo S., Bro and Sis Rotimi Awopetu and other brethren in the household of faith. I appreciate you all.

I wish to specially acknowledge my wonderful in-laws for the excellent relationship we enjoy. Many of them are present here: Sola Olukotun, Sunkanmi Olukotun, Raphael Ogunyando, and Segun Olukotun. My caring mother-in-law, Mrs. Comfort Arinke Olukotun. She is a great mother indeed, always very generous and accommodating. She always assured me that 'Tomorrow will be well.' My father-in-law, Chief Abraham Olukotun, was a rare man indeed. Despite pressures mounted on him to give his daughter's hand in marriage to their Kabiyesi's son, he wholeheartedly gave her to me. *Ah, ile n je'niyan!* Even in the grave your nobility of spirit looms large.

I must also express my profound appreciation to those whom the Almighty God have used in moving me forward in life. One of them is Associate Professor Mabayoje Olufowobi, my father and mentor; a beacon of hope for humanity. My journey to study Building was by God's grace and the guidance of Associate Professor Olufowobi. He was my Head of Department at the Federal Polytechnic, Ilaro, and until he finally retired in the Department of Building, University of Lagos, he was one of those who nurtured me till I got my PhD. By the mercies of the Lord and with Professor Olufowobi's words of encouragement, I became what I am today. Mr. Vice chancellor, sir, I am indeed eternally grateful to Professor Olufowobi, who is here to witness this great occasion.

Professor Rimaka Iyagba, the father of all in the Faculty of Environmental Sciences, I say a big thank you for all that you did to make all of us what we are today in our careers. Other wonderful influences have been Professor K.T. Odusami, Professor G.I. Idoro, Professor Kayode Oyediran, Professor Martins Dada, Professor Olumide Olusanya, Professor Olaniyi Okedele, Professor Joseph Igwe, Professor Leke Oduwaye, Professor Aluko, Professor (Mrs.) I.C. Nwokoro, Professor (Mrs.) Ngozi Osarenren, Professor T.G. Nubi, Professor Mike Adebamowo (my wonderful Dean), Dr. E.O. Ogunsanmi, Professor L.A. Salawu, Professor G.I. Oyekan, Professor

David A. Adesanya, Professor Areola. I thank God for the positive influence they have had in my life.

To my colleagues in the Faculty of Environmental Sciences and across all departments; words are not enough to express how you have all enriched my life. I wish to mention some of my colleagues: Dr. O.J. Ameh, Dr. O.J. Oladiran, Dr. A. Soyngbe, Dr. Henry Onukwube, Bldr. O.A. Akinkunmi, Mr. F. Achi, Dr. O.M. Ajayi, Dr. H.A. Koleosho, Dr. C.O. Ilechukwu, Dr. A.S. Afolayan, and Dr. M.I. Ayankora.

In the course of my administrative work as the Head of Department, I have been privileged to work with wonderful administrative staff such as: Mrs. A. Akinsola, Mr. C. Egbe, Mrs. V.O. Aderibigbe, Mrs. M.D. Adekoye, Mr. O.O. Ojenike, Mrs. O.L. Aina, Mr. G. Kadir, Mr. Alli, and Miss A.I. Onyekwere.

My friends and associates from other universities are well appreciated, especially Professor Taiwo Edun, Professor Fagbenle, Professor Daramola, Professor K. Raheem, Professor A. Aina, Professor K. Olusola, and Professor K. Durodola, among others.

I am particularly grateful to members of the Nigerian Institute of Building, especially those that have also helped to shapen my professional life. Worthy of mention are: Prof. Akin Akindoyeni, Prof. Kunle Wahab, Bldr. Olatunde Jaiyesimi, Bldr. (Mrs.) Iyabo Bolarinwa, Bldr. Siraj Borokini, Bldr. (Mrs.) Bolanle Araba. I am grateful to the current chairman, Bldr. Adekanmbi Adelaja and the past chairmen, Bldr. Kunle Awobodu, Bldr. Dola Arilesere, Bldr. Omoife Chuks, Bldr. Jellili Akinpelu, Bldr. Elegbede Fadil, Bldr. Aladeloba shina, Bldr. Olumide Odunuga, Bldr. Femi Akinsola and other members, who in, one way or the other have contributed to my success. I thank you all.

I will like to express my profound gratitude to IPYA members: Engineer Oluleye Odufuwa, Toyin Odufuwa, Chief Adekunle

Adeniyi Kunle Osunsanya, Sunday Osilagun Dr.Kunle Osilagun Yemi Odufuwa, Rev (Mrs) Adesanya, Rt. Bishop Odufuwa, Hon. (Mrs.) Solagbade Onas Abisola, to mention but a few. I am very grateful to you all.

My appreciation will not be complete if I fail to express my gratitude to my friends, particularly my secondary school friends at Abusi Odumare Academy, Ijebu-Igbo; many of whom are here today. They include: Barrister Samson Bamgbose, Dr. Thomas Osinowo, Engineer Abel Makinde, Deacon Enitan Ajibike, Alhaji Sina Dairo, Chief Oludemi, Niyi Adebajo, Builder Dapo Onafuye, Mrs. Abiola Adekoya, as well as Taiwo and Kehinde Kukoyi, among others.

I am particularly grateful to my neighbours in Harmony Estate, Ifako, Ogba where we enjoy a serene and secure environment. Among them are: Barrister Shina Agbesusi, Elder Odunuga Adeleke, Rotimi Idowu, Mr. and Mrs. Oni, Mrs. Babalola, Alhaji Animashaun, and Alhaji Oreagba, Mr. Yinka Aderibigbe, to mention a few.

I am also grateful to the students of the Faculty of Environmental Sciences in general and the Department of Building in particular. Thank you all.

To the maintenance experts in the Department of Building, my beloved brother and sister, Dr. Olajide Julius Faremi and Dr. (Mrs.) Oluranti Olupolola Ajayi respectively, you are so precious to God and to me. I enjoyed your companionship and good understanding even when you were with me as your PhD supervisor. I am very proud of you and I pray the Lord will perfect all that concerns you both. Thank you. I also appreciate other members of my inaugural planning committee, namely Dr. (Mrs.) Zakariyah Ibilola K., Mr. Sotubo Adegboyega, Mr. Tunde Aregbesola, Dr. John Iniobong you are fantastic and I really appreciate you all

Hmmm... What would we do without family?

Mr. Vice Chancellor, I wish to quickly turn to my family members that are here today and those not able to attend from the two families that brought me forth: The Adenugas, the Odeyemis, the Adebajos and the Bamiros. My wonderful daddy, Elder Abel Adebajo (Baba Lekan), my brother of blessed memory, Mr. Bosun Bamiro, you are one of those that instilled in me the value of hard work, discipline, and integrity. I thank you all.

And finally, Mr. Vice Chancellor, I now come to the love of my life, my dependable partner, a selfless spouse, my adorable, a great prayer warrior. In my case, I have been blessed with an incredibly awesome wife, Mrs. Modupe Elizabeth Adenuga, an alumnus of University of Ibadan and a diligent administrator. She is the Registrar, West African Theological Seminary, Ipaja, Lagos. I am standing here today to give this lecture to the Glory of God, because God used her quiet, easy-going character to complement my character. God has made her the pillar on which I remain standing. I will forever remain grateful to God for this great gift. Through my amiable wife I have received three other invaluable gifts from God: my son, Olamide Emmanuel Adenuga, a Civil Engineering graduate of the University of Lagos, the University of First Choice and the Nation's Pride; and my beautiful and wonderful daughters, Eniola Mercy Adenuga and Oluwateniola Blessing Adenuga. I treasure you all.

My beloved, May the good Lord continue to preserve our lives so that we will all fulfill our divinely assigned destinies and enjoy the fruits of our labour together.

I am eternally grateful to the Almighty God and my Loving Saviour Jesus Christ, and The Holy Spirit. The God who gave me the power and the essence to travel this far.

And here I rest my argument; this is my story! This is my song! Praising my Saviour all the day long!

Mr. Vice Chancellor, sir, distinguished ladies and gentlemen, I thank you all for your kind attention. God bless you.

REFERENCE

- Adebayo, S. O. (1991). *A Study of the Maintenance Management of Public Buildings in Nigeria*. Unpublished Ph.D. thesis, University of Lagos, Dept. of Building, Lagos, Nigeria.
- Adenuga, O. A. (1996). *Significance of Maintenance as a Determinant of Economics Value of Buildings*. Unpublished M.Sc. Thesis, University of Lagos, Department of Building, Lagos, Nigeria.
- Adenuga, O. A. (1999). Building maintenance in Nigeria; Structural Deterioration, Recognition and Diagnosis of Causes and Remedies. *Shelter watch Lagos*, 1(01), 10-25.
- Adenuga, O. A. (2000). Building Collapse: Causes Preventions and Remedies. *Shelter Watch, Habitat Communications, Lagos*, 1(4), 6-15.
- Adenuga, O. A. (2003). Management of Labour Only Contracts in the Nigeria Construction Industry : Basis of Award and Execution. *Proceedings of the 1st International Conference on Challenges of Globalization and Capacity Building in the Construction Industry of Developing Economies. Global Construction 2003. Department of Building, University of Lagos, 1st - 4th December, 2003*, (pp. 18-38).
- Adenuga, O. A. (2008). *Evaluation of Maintenance Management Practice in Public Hospital Buildings in South West Nigeria*. Unpublished Ph.D. thesis, University of Lagos, Department of Building, Lagos, Nigeria.
- Adenuga, O. A. (2010). Labour Composition for Maintenance Works in Public Hospital Built Enironment in South-West Nigeria. *Journal of Building Performance, Department of Architecture, Faculty of Engineering and Built Environment, Universiti Kebangsaan, Malaysia*, 1(1), 83-92.
- Adenuga, O. A. (2011). Assessment of Factors Affecting Maintenance Management of Public Hospital Buildings in Lagos State, Nigeria. *Journal of Contemporary*

- Issues in Real Estate, Department of Estate Management, University of Lagos, Akoka, Yaba, Lagos*, 1(1), 153-15.
- Adenuga, O. A. (2012). Compliance to Quality Standards in the Construction of Infrastructural Services in Lagos State, Nigeria. *Journal of Contemporary Issues in Real Estate, Department of Estate Management, University of Lagos, Akoka, Yaba, Lagos*, 2(1), 214-230.
- Adenuga, O. A. (2012). Maintenance Management Practices in Public Hospital Built Environment: Nigeria Case Study. *Journal of Sustainable Development in Africa, Clarion University of Pennsylvania, Clarion, Pennsylvania*, 14(1), 185-201.
- Adenuga, O. A. (2012). Professional in the Built Environment and the incidence of Building Collapse in Nigeria. *Organisation, Technology & Management in Construction: An International Journal, University of Zagreb, Faculty of Civil Engineering, Department of Construction Management, Croatia, Zagreb*, 4(2), 461-473.
- Adenuga, O. A. (2013). Comparison of the Performance of Traditional and Direct Labour Methods of Project Procurement: A Case Study of some selected projects of the Nigeria Army. *Ethiopian Journal of Environmental Studies and Management, Bahir Dar University, Bahir Dar, Ethiopia*, 6(1), 21-30.
- Adenuga, O. A. (2013). Factors Affecting Quality in the Delivery of Public Housing Projects in Lagos State, Nigeria. *International Journal of Engineering and Technology IJET Publications, UK*, 3(3), 323-344.
- Adenuga, O. A. (2014). Maintenance Management Financing in Public Hospital Buildings: A Case of South Western Nigeria. *Construction Research Journal, Department of Building, University of Lagos, Akoka, Yaba, Lagos*, 3(1), 129-149.
- Adenuga, O. A., & Dosunmu, O. S. (2012). Assessment of Procurement Methods used for executing maintenance works in Lagos State. *Ethiopian Journal of*

Environmental Studies and Management, Bahir Dar University, Bahir, Dar, Ethiopia, 5(4), 475-481.

Adenuga, O. A., & Faremi, O. J. (2012). Evaluation of Maintenance Management Practice in Banking Industry in Lagos State, Nigeria. *International Journal of Sustainable Construction Engineering and Technology, 3(1), 45-53.*

Adenuga, O. A. (2012). Maintenance Management Practices in Public Hospital Built Environment: Nigeria Case Study. *Journal of Sustainable Development in Africa, Clarion University of Pennsylvania, Clarion, Pennsylvania, 14(1), 185-201.*

Adenuga, O. A. (2012). Professional in the Built Environment and the incidence of Building Collapse in Nigeria. *Organisation, Technology & Management in Construction: An International Journal, University of Zagreb, Faculty of Civil Engineering, Department of Construction Management, Croatia, Zagreb, 4(2), 461-473.*

Adenuga, O. A. (2013). Comparison of the Performance of Traditional and Direct Labour Methods of Project Procurement: A Case Study of some selected projects of the Nigeria Army. *Ethiopian Journal of Environmental Studies and Management, Bahir Dar University, Bahir Dar, Ethiopia, 6(1), 21-30.*

Adenuga, O. A. (2013). Factors Affecting Quality in the Delivery of Public Housing Projects in Lagos State, Nigeria. *International Journal of Engineering and Technology IJET Publications, UK, 3(3), 323-344.*

Adenuga, O. A. (2014). Maintenance Management Financing in Public Hospital Buildings: A Case of South Western Nigeria. *Construction Research Journal, Department of Building, University of Lagos, Akoka, Yaba, Lagos, 3(1), 129-149.*

Adenuga, O. A., & Dosunmu, O. S. (2012). Assessment of Procurement Methods used for executing maintenance works in Lagos State. *Ethiopian Journal of Environmental Studies and Management, Bahir Dar University, Bahir, Dar, Ethiopia, 5(4), 475-481.*

Adenuga, O. A., & Faremi, O. J. (2012). Evaluation of Maintenance Management Practice in Banking Industry in Lagos State, Nigeria. *International Journal of Sustainable Construction Engineering and Technology, 3(1), 45-53.*

Adenuga, O. A., & Ibiyemi, A. (2009). An Assessment of the State of Maintenance of Public Hospital Buildings in South-West, Nigeria. *The Australasian Journal of Construction Economics and Building, Faculty of Business, Technology & Sustainable Development, Bond University, Gold Coast, Queensland 4229, Australia, 9(2), 51-60.*

Adenuga, O. A., & Iyagba, R. O. (2005). Strategic Approach to Maintenance Practices for Public Buildings in Lagos State. *The Lagos Journal of Environmental Studies, 5(1), 20-28.*

Adenuga, O. A., & Sotunbo, G. (2014). An Assessment of Time Variation in Solid and Hollow Floor Construction in Lagos State. *Organisation, Technology & Management in Construction: An International Journal, University of Zagreb, Faculty of Civil Engineering, Department of Construction Management, Croatia, Zagreb, 6(1), 984-993.*

Adenuga, O. A., Akinsola, E. O., & Soyngbe, A. A. (2006). Quality, Time and Cost Performance of Labour only Contract in some selected cities in Nigeria. *Urban and Regional Planning Review, Department of Urban and Regional Planning, University of Lagos, 1(1), 13-26.*

Adenuga, O. A., Dosunmu, O. S., & Oshodi, O. (2013). Delay on Building Projects in Lagos State: Causes, Effects and Remedies. *Urban and Regional Planning Review, Department of Urban and Regional Planning, University of Lagos, 4(1&2), 132-147.*

Adenuga, O. A., Iyagba, R. O., Odusami, K. T., & Ogunsanmi, O. E. (2007). Appraisal of Maintenance Strategies used in Public Hospital Buildings in Lagos State, Nigeria. *Construction Research Journal, Department of Building, University of Lagos, Akoka, Yaba, Lagos, 1(1), 65-85.*

- Adenuga, O. A., Odusami, K. T., & Faremi, J. O. (2007). Assessment of Factors Affecting Maintenance Management of Public Hospital Buildings in Lagos State Nigeria. *In the Construction and Building Research Conference of the Royal Institute of Chartered Surveyors*, (pp. 6-7). Georgia, Atlanta, USA.
- Adenuga, O. A., Odusami, K. T., Farinloye, R., & Oladiran, O. J. (2008). Essential Skills for Maintenance Managers in a Hospital Built Environment in South-West, Nigeria. *Proceedings of the Construction and Building Research Conference (COBRA) of the Royal Institution of Chartered Surveyors held at Dublin Institute of Technology, London, UK, 4-5 September 2008*, (pp. 3-18). London.
- Adenuga, O. A., Olufowobi, M. B., & Raheem, A. A. (2010). Effective Maintenance Policy as a Tool for Sustaining Housing Stock in Downturn Economy. *Journal of Building Performance, Department of Architecture, Faculty of Engineering and Built Environment, Universiti Kebangsaan, Malaysia*, 1(1), 93-109.
- Adenuga, O. A., Soyngbe, A. A., & Ajayi, O. M. (2007). A Study of Selected Safety Measures on Construction Companies in Lagos, Nigeria. *Proceedings of the Construction and Building Research Conference (COBRA) of the Royal Institution of Chartered Surveyors, held at Georgia Institute of Technology, Atlanta, USA, 6-7 September 2007*, (pp. 16-25). USA.
- Adenuga, O. A., Soyngbe, A. A., & Ogunsanmi, O. E. (2010). The Use of Rice Husk Ash as Partial Replacement for Cement in Concrete. *The Lagos Journal of Environmental Studies, Faculty of Environmental Sciences, University of Lagos, Akoka, Yaba, Lagos*, 7(2), 47-50.
- Adesanya, A. A., Dekolo, S., & Adenuga, O. A. (2010). Assessment of Factors Generating Sick Building Syndrome in Ikorodu, Lagos State. *Urban and Regional Planning Review, Department of Urban and Regional Planning, University of Lagos*, 2(1&2), 118-124.
- Ajayi, O. O. (2016). *Maintenance Management of Prison Facilities in South-West, Nigeria*. Unpublished Ph.D. thesis, University of Lagos, Department of Building, Akoka, Lagos.
- Ajayi, O. O., & Adenuga, O. A. (2010). Poor Maintenance Culture of Hospital Buildings in Lagos State, Nigeria. *The Lagos Journal of Environmental Studies, Faculty of Environmental Sciences, University of Lagos, Akoka, Yaba, Lagos*, 7(2), 9-15.
- Akeju, T. A. (1984). Lessons from recent structural failures. *The Nigeria Engineer*, 19(2).
- Akinpelu, J. A. (2002). The need for code of conduct, building regulations and by-laws for the building industry in Nigeria. *The Professional Builder, Nigeria Institute of Building*, (pp. 11-14).
- Akinsola, O. E., Adenuga, O. A., & Iyagba, R. O. (2007). Appraisal of the Factors affecting effective implementation of the National Housing Policy. *Urban and Regional Planning Review, Department of Urban and Regional Planning, University of Lagos*, 1(2), 108-115.
- Alner, G. R., & Fellows, R. F. (1990). Maintenance of local authority school buildings in U.K: a case study. *In Quah, L.K.(ed.): Building Maintenance and Modernisation Worldwide, Singapore*, 1, 90-99.
- Arayela, O., & Adams, J. J. (2001). Building Disasters and Failure in Nigeria: Causes and Remedies. *Association of Architectural Educators (AARCHES) Journal*, 2(6).
- Arditi, D. (1997). Issues in building maintenance: property managers' perspective. *Journal of Architectural Engineering*, 5(4), 117-127.
- Ayininuola, G. M., & Olalusi, O. O. (2004). Assessment of building failures in Nigeria: Lagos and Ibadan case study. *African Journal of Science and Technology*, 5(1), 73-78.
- Blissett, R. (2004). Effective leadership in managing proactive maintenance and reliability programs. *The Maintenance Journal*. Retrieved from www.maintenancejournal.com

- Colen, I. F., & de Brito, J. (2002). Building facade maintenance support system. In Ural, O., Abrantes, V. & Tadeu, A. (Eds): *ibid*, 3, 1899-1907.
- Crips, D. J. (1984). Building maintenance- A Client's viewpoint in Harlow, P. A (ed.). *Managing Building Maintenance* (pp. 23-35). London: CIOB.
- David, W. M., & Arthur, B. (1989). Management to maintain quality in buildings. *Proceedings of implementation of Quality in Construction*, (pp. 212-218). Copenhagen.
- De Blasi, P. J. (2000). *Leadership skills - dealing with difficult members*. Retrieved April 7th , 2006, from <http://www.acm.org/chapter/leader-skills.html>
- Dekker, R. (2001). Application of maintenance optimization models: a review and analysis. *Reliability engineering and systems*, 51, 229-240.
- Dilani, A. (1999). *Design and care in hospital planning*. Ph.D. thesis, Department of psychosocial factors and health, public health and treatment research, Karolinska Institute. Sweden: ISBN 91- 7170 - 371-3.
- Dosunmu, O. S., & Adenuga, O. A. (2013). Assessment of Cost Variation in Solid and Hollow Floor Construction in Lagos State. *Journal of Design and Built Environment, Universiti Malaya, Malaysia*, 13(1), 2-11.
- Dosunmu, O. S., & Adenuga, O. A. (2013). Causes, Effects and Remedies of Errors in Nigeria Construction Documents. *Causes, Effects and Remedies of Errors in Nigeria Construction Documents Organisation, Technology & Management in Construction: An International Organisation, Technology & Management in Cnstruction: An International Journal, University of Zargeb*, 5(1), 676-686.
- Duffuaa, S., Ben-Daya, M., Al-Sultan, K., & Andijani, A. (2000). *A simulation model for maintenance systems in Saudi Arabia*. Final report, KACST Project, No. AR- 16-85.
- Duffuaa, S., Raouf, A., & Campbell, J. D. (1998). *Maintenance planning and control : Modelling and Analysis*. New York: John Wiley and Sons.
- Eade, D. M. (1996). Motivational management: developing leadership skill. *Informative Article*. Retrieved April 7,

- 2006, from <http://www.ledership-grp.com/articles/motivate.htm>
- Ekpo, I. E., Adenuga, O. A., & Umoh, A. A. (2013). Strength Characteristics of Granite-Pachymelania aurita Shell Concrete. *Nigeria Journal of Agriculture, Food and Environment, University of Uyo, Uyo, Akwa Ibom State, Nigeria*, 9(2), 9-14.
- El-Haram, M. A., & Horner, M. W. (2002). Factors affecting housing maintenance cost. *Journal of Quality in Maintenance Engineering*, 8(2), 115-123.
- Faremi, J. O., & Adenuga, O. A. (2012). Evaluation of Maintenance Management Practice in Banking Industry in Lagos State, Nigeria. *International Journal of Sustainable Construction Engineering & Technology, Universiti Tun Hussein Onn, Malaysia (UTHM)*, 3(1), 45-53.
- Faremi, J. O., Adenuga, O. A., & John, I. B. (2013). Assessment of Factors Influencing Facility Management Procurement Route in Lagos State, Nigeria. *Journal of Surveying, Construction and Property, Faculty of Built Environment, University of Malaya, Malaysia*, 4(1), 2-13.
- Faremi, J. O., Adenuga, O. A., Dada, M. O., & John, I. B. (2014). Factors Affecting Maintenance Cost of Institution Buildings. *Proceedings of 9th Annual Research Conference and Fair, University of Lagos, Akoka, Yaba, Lagos*.
- Faremi, J. O., John, I. B., Adenuga, O. A., & Akinbode, T. (2014). Assessment of Risk Associated with the Procurement of Facilities Management Services in Nigeria. *Proceedings of CIB Conference 2014*.
- Farinloye, O. O., Ogunsanmi, O. E., & Adenuga, O. A. (2011). Assessment of Maintenance Practices on Public Buildings: A case-study of Correlational Institutions . *Proceedings of the 6th Built Environment Conference of the Association of Schools of Construction of Southern Africa held at Johannesburg, South Africa, 31st July- 2nd August, 2011*, (pp. 333-345).

- Farinloye, O., Adenuga, O. A., & Iyagba, R. O. (2010). Assessment of Maintenance Management Practices in Lagos and Ogun Prison. *Urban and Regional Planning Review, Department of Urban and Regional Planning, University of Lagos*, 2(1&2), 82-90.
- Fox, J. M. (1956). *What it takes to be a manager. The book of Management wisdom*. Retrieved April 4, 2006, from www.LeadershipNow.com
- Geneen, H. (1984). *Essential Qualities of Great managers. The Book of Management Wisdom*. Retrieved April 4, 2006, from www.leadshipNow.com
- Gurjit, J. (1990). The Surveyor (ISM) establishing a maintenance management system for cinema building maintenance. *American Business Journal*, 3, 255-90.
- H.M.S.O. (1972). *Hospital Building Maintenance: Can Decision-making be improved?* Local Government Operational Research Unit REPORT c 144, Britain.
- Ibiyemi, A. O., & Adenuga, O. A. (2013). An Evaluation of Housing Conditions and Livability in Lagos, Nigeria: A study of Festac Town Housing Estate (Phase 1). *Built Environment Journal, Faculty of Architecture, Planning and Surveying, University of Technology, MARA, Malaysi*, 10(1), 2-14.
- Ibiyemi, A. O., Adenuga, O. A., & Odusami, K. T. (2009). Comparative Analysis of Design and Build and the Traditional Procurement Methods in Lagos, Nigeria. *Journal of Construction, University of Pretoria, South Africa*, 2(2), 2-7.
- Iyagba, R. O. (2005). *The menace of sick buildings- a challenge to all for its prevention and treatment*. An Inaugural lecture delivered at University of Lagos, Lagos.
- Iyagba, R. O., & Odunlami, A. (1989). *Lesson for the Construction Industry from Building Disaster and failures*.
- Kelly, A., & J, H. M. (1978). *Management of Industrial maintenance*. London: Butterworths.
- Kliment, S. (2000). *Building type, basics for healthcare facilities*. John Wiley and Sons.

- Krass, P. (2000). *The book of Management Wisdom: Classic writings by Legendary Managers*. Retrieved from <http://www.leadership.com>
- Lai, J. H., Yik, F. W., & Jones, P. (2004). Disputes arising from vaguely defined contractual responsibilities in building services maintenance contracts. *Facilities*, 22(1/2), 44-52.
- Lee, R. (1987). *Building maintenance management*. Blackwell Science Ltd.
- Mbamali, I. (2003). The impact of accumulation deferred maintenance on selected buildings of two federal universities in the North West zone of Nigeria. *Journal of Environmental Science*, 5(1), 77-83.
- Mirghani, M. A. (2001). A framework for costing planned maintenance. *Journal of Quality in Maintenance Engineering*, 7(3), 170-182.
- Nous Hospital Consultants. (2002). *Generating the master plan for hospitals*. Leading Hospital and Health Care Management Consultants of India pp 1-3.
- Odudu, W. O. (1987). Problems of Property Management & Maintenance. *The Nigeria Institution of Estate Surveyors and Valuers 17th Annual Conference Paper*. Enugu.
- Odusami, K. T. (2001). *Project team leadership and construction project performance in some selected states of Nigeria*. An Unpublished Ph.D. research work, University of Lagos, Department of Building, Lagos.
- Oladapo, Y. (2005). *Evaluation of the maintenance management of the staff housing estates of selected first generation Universities in South-West, Nigeria*. Unpublished Ph.D. thesis, Obafemi Awolowo University, Department of Building, Osun, Nigeria.
- Oladiran, O. J., & Adenuga, O. A. (2007). Exploring Application of Programme Budgeting Management Technique in Construction Companies. *Construction Focus, Department of Building, Ahmadu Bello University, Zaria*, 1(2), 20-28.
- Olateju, B. O. (1991). *Effective Contract Management in the Construction Industry*. Lagos.

- Oloyede, G. (1991). "Structural Failures - Causes, lessons and responsibilities of the Structural Engineers".
- Olufowobi, M. B., & Adenuga, O. A. (2012). Towards the Specification of Windows Sizes for Natural Ventilation in classrooms in a warm climate, Nigeria. *Journal of Building Performance, Department of Architecture, Faculty of Engineering and Built Environment, University Kebangsaan, Malaysia*, 3(1), 10-27.
- Olufowobi, M. B., Adenuga, O. A., & Olanipekun, E. A. (2010). Demand Indicator for Estimating and Predicting Electricity Consumption in Residential Buildings: A Case Study of Obafemi Awolowo University, Ile-Ife, Nigeria. *The Lagos Journal of Environmental Studies, Faculty of Environmental Sciences, University of Lagos, Akoka, Yaba, Lagos*, 7(1), 163-169.
- Onukwube, H. N., Adenuga, O. A., & Enang, I. J. (2009). The Impact of Risk on Contractors Pricing: A Study of Building Projects in Lagos State, Nigeria. *Proceedings of the Construction and Building Research Conference (COBRA) of the Royal Institution of Chartered Surveyors, held at University of Cape Town, South Africa, 10-11 September 2009*, (pp. 114-127). Cape Town.
- Oyefeko, S. (1999). *Strategic approach to maintenance management practice*. Paper presented at Nigeria Institute of Building.
- Oyewande, B. (1992). *A Research for Quality in the Construction Industry*. Builder's Magazine, Lagos.
- Pitt, T. J. (1987). Using models to evaluate property maintenance strategy. In Bradon, P. S.(ed.) : *Building Cost Modelling and Computers E & FN Spon, London*, 534-544.
- Quah, L. K. (1988). *An evaluation of the risks in estimating and tendering for refurbishment work*. An unpublished Ph.D. thesis, Heriot-Watt University, Department of Building, Edinburgh, Scotland.
- Raheem, A. A., & Adenuga, O. A. (2013). Wood Ash from Bread Bakery as Partial Replacement for Cement in Concrete. *International Journal of Sustainable Construction Engineering & Technology, Universiti Tun Hussein Onn, Malaysia (UTHM)*, 4(1), 75-81.
- RICS. (1998). *Building Conservation practice panel: "the Principles of building conservation"*. Appendix B, RICS, London.
- Saranga, H. (2002). Relevant condition- parameter strategy for an effective condition-based maintenance. *Journal of Quality in Maintenance Engineering*, 8(1), 92-105.
- Seeley, I. H. (1976). *Building maintenance*. London: Macmillan Press Ltd.
- Shohet, I. M. (2003). Building evaluation methodology for setting maintenance priorities in hospital buildings. *Construction management and economics*, 21, 681-692. Retrieved December 10th, 2005, from <http://www.fmlink.com/prpfresources/magazines/article.cgi>
- Smith, R. (2003). Best maintenance practices. *Journal of Maintenance and Maintenance Management*, 16(1), 10-15.
- Soyingbe, A., Ogundairo, A. M., & Adenuga, O. A. (2007). A Study of Facilities for Physically Disabled People in Buildings in Nigeria. *Proceedings of the 4th International Research Symposium (SCRI) in conjunction with the International Built and Human Environment Research, University of Salford, 26-27 March, 2007*, (pp. 251-264).
- Tsang, A. H. (2002). Strategic dimensions of maintenance management. *Journal of Quality in Maintenance Engineering*, 8(1), 7-39.
- Udo-Akagba, S. (1985). *Forward to Guidance Note on Property Valuation Nigeria Institution of Estate Surveyor & Valuers* (1st ed.).
- Van Noortwijk, J. M. (2000). Optimal maintenance decisions on the basis of uncertain failure probabilities. *Journal of Quality in Maintenance Engineering*, 6(2), 113-122.
- Wahab, J. A. (1995). Adequate and Affordable Housing for Nigeria in the 21st Century Housing today. *Journal of the Association of Housing Science and its application*, 2(3).

- Wahab, K. B. (1987). An approach to building maintenance management. *Journal of Estate Surveyor and Valuer*, 28(1), 9-15.
- Williams Bernard. (1988). *Premises Audits*. London: Balstrode Press.
- Zubair, S. N. (2001). The most frequency recurring maintenance problems in Government office buildings. *NIAJ*, 11, 8-12.
- Zubairu, S. N. (1999). *Maintenance of government office buildings in Nigeria - a post occupancy evaluation approach*. Unpublished Ph.D. thesis, University of Lagos, Department of Building, Lagos, Nigeria