UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

AN EMPIRICAL EXAMINATION OF MAINTENANCE PRACTICES OF

PUBLIC TERTIARY INSTITUTIONS: A STUDY OF SELECTED

INSTITUTIONS IN GHANA

DAVID CECIL NTOW (JNR.)

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(Construction Technology) degree.

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DECLARATION

STUDENT'S DECLARATION

I, DAVID CECIL NTOW, declare that this Dissertation with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ……………………………………

DATE: ……………………………………………

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidance for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: **NONGIBA ALKANAM KHENI (PhD)**

SIGNATURE: …………………………………

DATE: …..

ACKNOWLEDGEMENTS

DEDICATION

I dedicate this dissertation to the Almighty God and my family especially to my wife

Olivia Gyamfi for her support and encouragement.

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ABSTRACT

Many Ghanaian public tertiary institutional structures are often inadequately maintained and windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair. Some lecture halls and office buildings of public tertiary institutions have not seen any significant maintenance or show little signs of maintenance since they were constructed, some dating back to the colonial era. Based on this, the study aimed at examining the maintenance practices of public tertiary institutions. The specific objectives of the study are to: determine maintenance policies and practices put in place as far as public tertiary institutions in Ghana are concerned, identify drivers to maintenance of building in public tertiary institution, and identify constraints to maintenance of building in public tertiary institutions. The study adopted descriptive survey. Purposive sampling was utilized in selecting 91 staff of the estate department of the selected public tertiary institutions in Greater Accra. The study achieved 95.6% response rate. Questionnaire was used as a data collection instrument. The study found that maintenance department organised maintenance programme, inspect physical condition of the building and its elements, plan head maintenance task and perform when convenient, and do maintenance work on buildings regularly. The study further indicated that building condition, age of the buildings, funding for maintenance activities of public institutions, management decision, and user"s persistent complaint are the major drivers to maintenance of building in public tertiary institutions. Based on this, a conclusions was reached and it was recommended the maintenance department of the various public tertiary institutions should ensure proper planning and executing maintenance programmes, as well as overcome the prevailing maintenance problems.

CHAPTER ONE

INTRODUCTION

1.1   Background to the Study

Maintenance programme is about the technical, administrative and managerial actions during the life-cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function (Parida & Kumar, 2006). The main purpose of maintenance is to provide production capacity to operations. It is therefore of primary importance that public buildings are maintained in order that they can serve both the architectural and aesthetical functions for which they are built. The physical appearance of tertiary institutions constitutes the basis upon which the society makes their initial judgment of the quality of services to be offered. Tertiary institution is considered throughout the world to be key to both individual and societal aspirations. For individuals, education beyond the secondary level is assumed to be the way to societal esteem, better paying jobs, expanded life options, intellectual stimulation and frequently a good time in the pursuit of any (Melvin, 1992).

Tertiary institution faces immediate pressure to preserve existing college of its campuses and enhance the capacity of its higher education system to address growing demands. In order to serve the current population of students, tertiary institution must maintain, renovate, and expand their building where necessary ad keep equipment and technology current to meet changing workplace needs (Oladapo, 2004). For higher institutions, the money for maintenance comes from the government as part of each school annual budget. This poses some difficulties for such institutions maintenance programme because expenditure from the government budget is not only adequate, and tied to strict financial regulations and payment control system. It is programme based which might run contrary to the institution‟s maintenance programme. The

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construction and development of capital projects in institution such as university is each university's administration priority; thus new buildings are designed and constructed as hostels, classrooms or facility buildings every year while little or nothing is allowed for maintenance of such facilities from the planning stage (Mahmoud, 1997). Many times without numbers, School programme are distorted and becomes irregular, hence making maintenance programme difficult. Academic environment sometimes becomes volatile which makes facilities in the higher institutions a high risk insurance property; incidence of complete destruction and willful damage are common occurrence this differentiate the institutions environment from normal environment (Amusan, 2003).

According to Fatokun (2005), the physical appearance of public tertiary institutional buildings gives an impression of the quality of service they offer. Maintenance of public tertiary institutions is imperative. The rationale behind the maintenance of such buildings is to serve both designed and aesthetic functions. Elements of buildings deteriorate at a greater or lesser rate dependent on materials and methods of construction, environmental conditions and the use of the buildings. Dann et al. (1999) and Wordsworth (2001) emphasized that neglect of maintenance has a cumulative result which rapidly increases deterioration of the building fabrics and finishes accompanied by harmful effects on the occupants. However, an effective maintenance management practices might be characterized as the product of prudence, of the sentiment that "a stitch in time saves nine" (Olajide, & Adenuga, 2012).

Good maintenance management systems are essential for economically viable and operationally safe buildings (Rapp & George, 1998). Historically, maintenance is seen as an avoidable task which is perceived as adding little to the quality of the

working environment, and expending scarce resources which would be better utilized. The financial consequences of neglecting maintenance is often not only seen in terms of reduced asset life and premature replacement but also in increased operating cost and waste of related and natural and financial resources (Banful, 2004). This is why property managers should give maintenance a high priority in their day to day activities (Lai *et al.,* 2009).

In a study conducted by Afranie and Osei Tutu, (2009), the role of Public Institutions in National development cannot be over-emphasized. However, in spite of the heavy investment in public buildings, Public institutions allow their structures to care for themselves without any sustainable maintenance plan to preserve the quality of the buildings. The continued efficient and effective performance of public institutions depends on the nature of their buildings in addition to other factors such as enhanced conditions of service, provision of the requisite tools etc. Public Institution buildings consist of both dwelling (residential accommodation) and non-dwelling (office accommodation). Both residential buildings as well as office buildings are prone to defects due to their permanent and lengthy usage. All elements of buildings deteriorate at a greater or lesser rate dependent on materials and methods of construction, environmental conditions and the use of the buildings (HMSO 2002).

According to Bennel- Yintiman, (2008), maintenance brings about improved utilization of buildings ensuring the highest safety standards. It must be emphasized that more rather than less maintenance work is necessary if the value and amenity of the nation‟s building stock was to be maintained. A good maintenance system is also a good disaster mitigation system. Poor maintenance has resulted in damage and deterioration to some public buildings in Ghana. Neglect of maintenance especially in relation to replacing electricity cables after thirty years of use can also give rise to fire

and safety hazards, which could result in the Institution owning the buildings being found liable for any injuries and damages. One of the major problems hindering the building in Ghana is the poor maintenance practices and rehabilitation ideas (Afranie & Osei Tutu, 1999).

1.2 Statement of the Problem

Poor building maintenance is widely regarded as the result of people's apathetic attitude which may be referred to as a poor maintenance culture. Many Ghanaian public tertiary institutional structures are often inadequately maintained and windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair. Some lecture halls and office buildings of public tertiary institutions in Accra have not seen any significant maintenance or show little signs of maintenance since they were constructed, some dating back to the colonial era. This has resulted in such buildings being in a dilapidated state with some being abandoned. This lack of maintenance by the authorities often leads to reduced lifespan of these buildings which invariably defeat the purpose for which they are put up.

Most offices in the public tertiary institutions in Accra are dilapidated and lacked the basic necessities and facilities such as toilet due to its state of deterioration of a functioning office. However new buildings are being put up every now and then without giving a thought to the maintenance of the old structures which have been neglected. Frequent visits to public tertiary institutions in Accra by the researcher depicts the abhorring situations in some public tertiary institutions with the buildings showing cracks on the walls, rotten wooden members, leaking roofs and missing louver blades, faded and discoloured surface coating (painting).

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However, despite the various policies and practices been adopted by the government for maintenance of public tertiary institutions, effect of prolong neglect and poor maintenance culture is manifesting in various degrees in the public tertiary institutions buildings in Accra. In order to evolve an effective good maintenance practice regime for public tertiary institutions in general, knowledge of effectiveness of the strategies adopted in the past is very pertinent, hence, this study examine the maintenance practices of public tertiary institutions in Accra .

1.3 Aims and Objectives of the Study

The aim of the study was to examine the maintenance practices of public tertiary institutions. The specific objectives of the study are:

- determine maintenance policies and practices put in place as far as public tertiary institutions in Accra are concerned.

- identify drivers to maintenance of building in public tertiary institution in Accra

- identify constraints to maintenance of building in public tertiary institutions in Accra.

1.4 Research Questions

In order to achieve the aim of the study, the following research questions were used to guide the study:

- What maintenance policies and practices are in place as far as public tertiary institutions in Ghana are concerned?

- What are the drivers to maintenance of building in public tertiary institution in Ghana?

- What are the constraints to maintenance of building in public tertiary institutions in Ghana?

1.5 Significance of Study

This study is important because not only would it be contributing to the body of knowledge and theory, but will also contribute to good maintenance management practice in the public tertiary institutions in Ghana. In addition, the study will assist the management of the public tertiary institutions in Ghana to become aware of the current state of their building.

From the study, the other stakeholders may use the findings in strengthening policies related to the maintenance of tertiary institutional buildings. To the academia and students, this study will help build the knowledge base in the discipline by adding on the existing literature on the maintenance programme. The study will be used as a source of reference material besides suggesting areas where future research may be conducted.

1.6 Scope of the Study

The study was geographically limited to selected tertiary institution buildings in Greater Accra region. The study was conceptually, theoretically and empirically limited to the research objectives.

1.7 Organization of the Study

The study was organized into five chapters. The first chapter, which is the general introduction, covers the background to the study, problem statement, objectives of the study, research questions, significance of the study, scope of the

study and organization of the study. This was followed by chapter two which reviewed extensive related empirical literature on the subject matter.

Chapter three covered the methodology for the study. It comprises the research population, sample and sampling technique, research design, sources of data and data collection instruments, method of data analysis, questionnaire design, and measures of variables. The data presentation and analysis are contained in chapter four. The last chapter which is chapter five contains the summary of major findings, conclusion, recommendations and recommendation for further research, the references and appendices follow this.

CHAPTER TWO

LITERATURE REVIEW

2.1   Introduction

This chapter reviews in-depth, literature on issues relating to the concept of building and the significance that is attached to the maintenance of buildings. It covers division of building maintenance, components of maintenance, maintenance policy and standards, maintenance management of building, drivers to maintenance of building in public tertiary institution and constraints to maintenance of building in public tertiary institutions

2.2   Concept of Building Maintenance

Building maintenance has for many years been regarded as the "Cinderella" of the building industry, with little attention paid to innovation and "free thinking" in the delivery of its service (RICS, 2009). However, it should be pointed out that building maintenance is not only key to sustaining the built environment, but its value in terms of employment and expenditure in the economy is also significant. Maintenance, according to the British Standard (BS 3811) is defined as "a 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 functions".

Building maintenance is one of the important topical, which has attracted much research attention, in building construction (Christian & Pandeya 1997; Fu, Kaya & Aouad 2007; Olanrewaju, Khamidi & Idrus 2011), and the state of art in maintaining the building facilities sustainably is another hot topic which have been studied in many countries (Fu, Kaya & Aouad 2007; Kishk et al. 2003; Matthews

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2007; Narayan 2012; Róka-Madarász 2011; Yiu 2007) but seldom researched in Ghana. In fact, the rapid economic growth during the past decades has resulted in significant increases in the value and number of commercial buildings in Ghana (McLean, 2012). However, limited attempt has been made to study the sustainable maintenance of this type of development (Kofoworola & Gheewala 2008).

The entire life cycle of the building include manufacturing of building materials, construction, operation, maintenance, demolition and removal, and the normal expected life span of a commercial building is 30 years, 50 years to 100 years" time frame upon the completion and occupation (Ding &Itoh 2002; Rojahn et al. 2011). In order to maintain the usability and efficiency of the building premises, there is a need to be regularly maintained and refurbished.

Effective building maintenance can contribute immensely to reducing the lifecycle cost (LCC) of a building through optimal maintenance execution at the operation and maintenance phase of a building"s lifecycle. Moreover, the reduction of building maintenance cost can be achieved through deep understanding of building maintenance cost concepts. Al-arjani (2002) asserts that governments of developing countries all over the world commit considerable expenditure to maintenance and operations of buildings but according to chanter and swallows (2007), the backlog of repair and maintenance work are depriving these country"s building stock from attaining minimum acceptable maintenance level consequently, the deterioration of these building stock are growing at an unacceptable rate.

Francis, Yik and Lee (2002) posited that building maintenance management is an operation that involves interaction or combination of technical, social, legal and fiscal determinants that govern and manage the use of buildings. For instant, the state of facilities in an academic institution may impact the quality of academic service

delivery. In other words, the assets of tertiary institutions must be in optimum operable performing state at all times in order to deliver quality education. Institutions asset comprises funds, technology, human capital, equipment, plants and buildings. Although, human capital is institution"s most significant resource, because tertiary educations are labour intensive, building is the most valuable asset of the institutions. Specifically, institutional buildings are procured to create a suitable, conducive, and adequate environment to support, stimulate and encourage learning, teaching, innovations and researches (Olanrewaju, Khamidi & Idrus, 2010). The cost of maintaining buildings consumes a great portion of the limited resources available for running organisations and institutions.

2.2.1   The Significance of Maintenance in the Building

Buildings are important assets of any nation. The elements and components that make up the building have a finite lifespan and therefore tend to develop defects over time (Al-Hammad & Assaf, 1996). These defects may be described as failings or shortcomings in the function, performance, statutory or user requirement of a building. In order for buildings to continue to fulfil their functional requirements, they must be regularly maintained. Maintenance is required to ensure the optimum performance of building as specified by the users. The building"s elements and components should not fail at any inconvenient instant as required by the users (Al-Hammad & Assaf, 1996).

In Ghana, the neglect of housing stock and institutional buildings has resulted in grave concerns about the low priority accorded to maintenance. Lack of maintenance is blamed on little concern shown by clients particularly government departments and in some cases lack of consideration of maintenance at the design

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phase by consultants (Quayson & Akomah, 2016). However, a few old church buildings are exemption of this apparent neglect of buildings. The triple standard is that a building should be well designed, soundly built and conscientiously maintained in order to prolong its lifespan. Whilst a lifespan of 100 years is expected, buildings in existence for centuries are common in developed nations. For instance, the British House of Parliament is over 700 years old. The following key points underscore the need to carry out maintenance works:

- Defects are critical to safety, security and comfort of users. One key function of buildings is to provide shelter and security. Defects in buildings lead to a compromise of these basic functions.

- Good or excellent buildings enhance the productivity of users, particularly students in educational institutions. The efficient functioning of buildings will therefore be necessary to enable users to derive maximum benefits of enhanced productivity.

- The option of replacing all buildings at a time is not viable or feasible because of the huge expenditure involved. Additionally, there are social and environmental implications of replacing buildings some of which are not quantifiable in monetary terms.

- Building materials and components have a finite lifespan and cannot remain new throughout the life of a building. Building materials and components undergo deterioration under the vagaries of weather. For instance, metals corrode, termites attack wood and crystallization occur with time leading to decay and deterioration of building materials and components used to construct buildings.

- Weather and user activities and behavior cause buildings to deteriorate over time. Defacing walls, vandalism are only but a few of the activities of users that negatively affect buildings.

- Economic reasons may justify the need for maintenance to be carried out. Obviously a well maintained house will have a higher rental or market value.

- Public image can justify the need for maintenance.

2.2.2 Sustainable Building Maintenance and Stakeholders

According to BS 3811, building maintenances can be; (1) planned: maintenance organized and carried out with forethought to a predetermined plan; (2) unplanned: ad-hoc maintenance carried out to no predetermined plan. These maintenances are mainly corrective or preventive maintenance (Chanter & Swallow, 2008). The former means "fix it when it breaks", i.e. maintenance is carried out after a breakdown or when an obvious fault has occurred, whilst the latter is performed before facilities failure at a fixed schedule (Tran, Yang, Oh, & Tan, 2008; Wang, Chu, & Wu, 2007).

Even though preventive maintenance can retain facilities in good condition and extend their life, the buildings" usability may not be efficient or any value-added if sustainable components have not been considered. In fact, both traditional maintenance strategies may not suffice to fulfil the client and user"s needs. The traditional approaches are simply for routine or remedial, or planned and unplanned categories but are clearly of limited value. No matter traditional maintenance actions perform passively after a breakdown or to actively prevent a breakdown, they do not materially enhance the building value. Therefore, strategic sustainable maintenance and refurbishment are required (Mobley, 2008).

In fact, the dimensions of building maintenance include raising the standards, providing sustainable and energy-efficient buildings, providing innovative design solutions, increasing community use of facilities, maximizing value for money, and ensuring efficient and effective management of existing capital assets (Chanter & Swallow, 2008).

Contemporary building maintenance approach must be proactive. Sustainable building refurbishment is driven by the market and legislation (Gopalakrishnan & Banerji, 2004). With a focus on energy security, costs and climatic change, the impacts of energy have partly been internalized within the cost of both these drivers, enabling a differentiation to be seen in the market. Whether or not the other environmental practices become internalized will have a bearing on driving these areas forward. How these drivers are packaged together to develop the most appropriate strategy to meet a client‟s objectives with their buildings, and how they are deployed, are critical to the success of the refurbishment (Shah, 2012). Therefore, sustainable building maintenance is the right direction to go.

Although the demand for sustainable buildings has become a trend (Horman *et al.,* 2006), the focus has predominantly been placed on new buildings. According to Chow (2003), it is always important to upgrade the old buildings to satisfy the new "green or sustainable" initiatives, such as refurbishing existing buildings to reduce greenhouse gas emissions is important in meeting Ghanaian government aspirational targets (Hertzsch *et al.,* 2011). Mickaitytė *et al.,* (2008) add that sustainable development principles have reached many spheres of human activities, buildings refurbishment cannot be an exemption. Sustainable upgrading the building facilities supports excellent opportunities to reduce energy consumption in buildings as well as encourages other sustainability principles implementation, such as occupants'

wellbeing, environment protection, rational resources use and stakeholders groups' awareness.

Regarding evaluation, Sijtsma *et al.,* (2011) state that the four key elements in the sustainability evaluation is to adopt a long-term view, concern the global perspective, include at least three crucial components: economic, social and environmental and take the stakeholders" understanding and accountability. Therefore, there is a need to involve stakeholders in sustainable refurbishment. As stated by Wilkinson et al. (2009), the stakeholders involved in a sustainable refurbishment to existing commercial building could include developers, investors, producers, marketers, regulators/policy makers and occupants. These key stakeholders must involve in the decision-making for sustainable refurbishment of building facilities, and this research study will deliberatively collect the views from these stakeholders.

2.3   Types of Building Maintenance

Various authors have classified maintenance into divisions. In BS 3811 cited in Seeley (1987) maintenance has been subdivided into; "planned" and "unplanned" maintenance; the former being further divided into "preventive" and "corrective" maintenance. Zulkarnain *et al.,* (2011) also established that maintenance has been categorized as "predictable" and "avoidable". Predictable maintenance is regularly periodic work that may be necessary to retain the performance characteristic of a product, as well as that required replacing or repair the product after it has achieved a useful life span. Avoidable maintenance is the work required to rectify failures caused by poor design, incorrect installation or the use of faulty materials. The categorization of maintenance according to BS 3811 cited in Seeley (1987) is as follows;

- *Unplanned Maintenance:* Maintenance carried out to no predetermined plan. It refers to works necessitated by unforeseen breakdowns or damages, for example repairing of a ripped off roof after a torrent rainfall.

- *Preventive Maintenance:* Maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intends to reduce the probability of failure in a building.

- *Corrective Maintenance:* Maintenance carried out after a failure has occurred and is intended to restore the facility to a state in which it can best perform its required functions.

- *Emergency Maintenance:* This is maintenance which is necessary to be affected immediately to avoid serious consequences.

- *Conditioned-Base Maintenance:* The preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.

- *Scheduled Maintenance:* The preventive maintenance carried out to a predetermined interval of time, number of operations, seasons, etc.

Queensland Gov. (2012) developed the illustrated table on the classification and sub-categories of maintenance. This table illustrates the elements that should be incorporated in a balanced maintenance works program.

Table 2.1: Balanced Maintenance Works Program

Category	Sub – category	Definition
Planned maintenance	Preventative Service Maintenance	Prevents asset failure by systematic inspection and monitoring to detect and avoid deterioration or failure. It also entails testing to confirm correct operation.
	Condition-Based Maintenance	Programmed maintenance work, based on condition assessment or other priorities, that returns an asset to an acceptable standard.
	Statutory Maintenance	Compulsory maintenance to meet requirements mandated in Acts, Regulations and other statutory instruments. This includes standards and codes referred to in an Act, Regulation or statutory instrument.
Unplanned Maintenance	Corrective and Breakdown Maintenance	Restores an asset to operational condition following an unforeseen failure.
	Incident Maintenance	Brings an asset back to an operational or safe condition following damage caused by Natural disasters, storms, fire, forced entry or vandals.

Source: Queensland Gov. (2012)

Another approach to maintenance classification has been adopted by Speight (1982). It divides maintenance into three broad categories:

- *Routine or day-to-day maintenance*: This is largely of the preventive type, such as daily sweeping, scrubbing, etc.

- *Periodic maintenance* carried out at specific times such as painting every Christmas or fumigating a school every academic year.

- *Major repair or Restoration*: such as re-roofing or rebuilding defective walls and often incorporating an element of improvement.

2.3.1   Planned Maintenance

Maintenance organized and carried out with fore thought, control and the use of records to a predetermined plan. The plan should be comprehensive and systematic encompassing both short and medium term considerations. The program should be based on sound knowledge of the building with particular regards to: The life of the building, the standard to be achieved, the financial implications and the responsibility for maintenance (Horner, El-Haram, & Munns, 1997). Furtherance to this, Zulkarnain *et al.* (2011) also identified planned maintenance as a maintenance that is organized and carried out with forethought, control and the use of records to a predetermined plan. Queensland Gov. (2012) similarly in defining planned maintenance referred to it as planned work executed at predetermined intervals to meet statutory, health and safety, technical or operational reliability considerations, and to preserve the asset and prolong its economic life. Planned maintenance consists of preventative, statutory, and condition-based maintenance.

University of Calgary (2013) explained further that to prevent emergencies and equipment breakdown, Facilities Management conducts ongoing maintenance on building systems and components. Preventive measures include inspections, testing, lubrications, and cleaning, filter and belt changes. Work is performed according to the manufacturer's recommended maintenance procedures and typically does not require a customer request. If a customer wants to have Operations and Maintenance on any special equipment outside the scope of the department's basic responsibilities, such services are chargeable. Planned Maintenance responsibilities include those mandated by government regulations, insurance requirements and building codes. Many of these, such as fire alarm testing, are designed to ensure the safety of building occupants. RICS, (2009) in other words explained planned maintenance as the process

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of periodically undertaking routine tasks necessary to maintain plant (lifts, boilers, etc.) in a safe and efficient operating condition.

2.3.2   Preventive/Predictive

Queensland Gov. (2012) stated that preventative maintenance may be applied to building structures, building fabric, services and site improvements but is predominantly used for maintenance of building services. When preparing their maintenance strategy, departments should be aware of the benefits of preventative maintenance practices which minimize the likelihood of building asset failures, health and safety issues and disruptions to service delivery.

Preventive maintenance by RICS (2009) is generally identified by a condition assessment and is planned to take place to suit the pattern of deterioration of a building and the availability of funds for the purpose. University of Calgary (2013) similarly revealed that a planned and controlled program of periodic inspection, adjustment, lubrication and replacement of components as well as performance testing and analysis, sometimes referred to as a preventive maintenance program.

2.4   Components of Maintenance

Maintenance involves a considerable amount of work which Harper (1969) as cited in (Afranie & Osei-Tutu, 1999) has been categorized into three components namely; Servicing, Rectification and Replacement.

2.4.1 Servicing

Servicing is essentially a clearing operation undertaken at regular intervals of varying frequency and is sometimes termed day-to-day maintenance. Daily sweeping of floors, monthly washing and cleaning of windows and regular painting for decoration and protection every four years are some examples of servicing. However, as more equipment that is sophisticated are introduced so more complicated service schedules become necessary. Servicing becomes necessary because of constant use of facilities, the effect of the weather and atmospheric conditions on the components of the building.

2.4.2 Rectification

Rectification work usually occurs fairly early in the life of a building; but it can also occur sometime within the life span of the building .it arises from shortcoming in design, inherent fault in or unsuitability of component, damage of goods in transit or installation and incorrect assembly. Rectification represents a fruitful point at which to reduce the costs of maintenance, because it is available. All that is necessary at any rate in theory is to ensure that components and materials are suitable for their purpose and are correctly installed. Rectification work could be reduced by the development and use of performance specifications and codes of installation (Lee, 1987). Rectification is the response to inherent defects in design, construction or installation stages of the building process. This provides an opportunity to "trade off" current capital expenditure against future maintenance costs.

2.4.3 Replacement

Replacements occur at all costs in buildings. It is inevitable because service conditions cause materials to decay at different rates. Much replacement work stems not so much from physical breakdown of the materials or element as from deterioration of the appearance (Seeley, 1987). This is because the extent of exposure of materials to the vagaries of the weather varies, and the weather in specific locations also vary whilst the capacity of elements of buildings in withstanding changes and different intensities of the weather vary. This therefore becomes necessary as a result of material decay due to these differential rates of weather conditions. Physical breakdown of materials or elements as well as deterioration appearance may necessitate replacements. However, this brings the problem of distinguishing between maintenance and improvement, which has not been resolved satisfactorily by many definitions. It is however, generally conceded that maintenance should include reasonable elements of improvement, for example, the replacement of worn out component with up-to-date version. Where the intention of work done is to increase efficiency in the use of the building by adding facilities, which were not previous present, the work should be classify as improvement. However, it is logical therefore to extend the meaning of maintenance to cover some localized improvement (Lee, 1987).

Maintenance can also embrace renovations, which consist of work done to restore a structure, service and equipment by a major overhaul to the original design and specification, or to improve on the original design. This may include limited additions and extensions to the original building (Kwong, 2005).

2.5   Maintenance Policy and Standards

BS 3811(1993), defines maintenance policies as a strategy within which decisions on maintenance are taken. Alternatively, it is the ground rule for the allocation of resources between the alternate types of maintenance actions available to management. Closer examination further revealed that maintenance policy is influenced by some criteria which occasionally could be conflicting. These are social – providing a quick service to high standards of quality; financial – investing funds in activities in the most efficient manner with due regard to the effects on debt charges, subsidies and rent. Technical criteria deal with the maintenance of a property at a level deemed necessary after thorough and regular technical survey; to provide continuous employment for certain operatives within a fixed budget. British Standard (BS 3811:1993), as cited in (Afranie & Osei-Tutu, 1999) defines maintenance as "a combination of any actions carried out to retain an item in or to restore it to an acceptable standard".

The concept of „acceptable standard" may be construed as acceptability to the person paying for the work, to the person receiving the benefit or to some outside body with the responsibility of enforcing minimum standards. Additionally, it can also be construed more widely as acceptability to the public at large or to specific sections of the public. Clearly, there are no absolute standards which would be equally acceptable to everybody and remain acceptable to the same group of people over period of time. The standards acceptable at the time of undertaking the work may be higher or lower than the initial design standards. In many cases, the standards deemed acceptable would be higher than the originally provided and the work includes an element of improvement. Buildings, however, with the passage of time are modified to accommodate new uses and it becomes increasingly unrealistic to

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think in terms of keeping or restoring the initial standards. Clearly, standard is related to safety and efficiency determined by the amount of money allocated rather than the results of assessing the benefits obtained from maintaining the building to a particular state. Seeley (1993) stated that maintenance is 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 functions to an acceptable standard.

A more functional definition proposed by Lee and Yuen (1993) is that, "maintenance is synonymous with controlling the condition of a building so that its pattern lies within specified regions". The word "control" suggests a positive activity which is planned so as to achieve a defined end result while the term "specified regions" presumably has a similar meaning to "acceptable standards". The definition envisages a range of acceptability with upper and lower limits between which the conditions of the building should be maintained. Maintenance, therefore, is all the necessary work done to preserve a building so that it can continue to provide the same or almost the same facilities and amenities, and serve its purpose as it was first built. This includes the expenditure necessary to maintain the rental value of the property and involves day-to-day repairs such as leaking taps, electrical effects, periodic up-keep and major repairs requiring heavy expenditure and services of technical experts.

2.6   Maintenance Management of Building

Maintenance management can be defined in as a medium provider and operator that oversee the components related to building condition and services installation so as to ensure it can perform at the optimum level (Musa, 2002). It encompasses many operations and functions and can be described as "the effective and efficient utilization of resources to ensure that the process and its facilities are kept operable to a standard required by the users". In the words of Seeley (1987),

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building maintenance has until recently been a neglected field of technology, being regarded as a "Cinderella" activity. It possesses little glamour and is unlikely to attract very much attention and is frequently regarded as unproductive, although many of the managerial and technical problems are more demanding of ingenuity and skill than those of new works. Miles and Syagga, (1987) mentioned that a casual stroll around a city, town or village in almost any developing country today suggests that many important national assets, such as school buildings, roads, residential houses and apartments, hospitals and civic buildings are run-down beyond the point of economic repairs. The function in this area is mainly of a technical nature and concerned with the planning and control of construction resources to ensure that necessary repairs and renewals are carried out with maximum efficiency and economy. The major decision relate to the following as spelt out in BS 3811 cited in Seeley (1985);

- Determining Standard

- Planning Inspections

- Identifying and Specifying the work necessary

- Estimating the cost of the work

- Planning the work

- Organizing the executive of the work

2.6.1   Determining Standards

For this, it is necessary to have information on the overall objectives of the organization and of statutory and other external requirement so that compatible standards can be fixed (Miles & Syagga, 1987). The expression of these standards in qualitative and quantitative terms demands knowledge of the effects of varying degree of disrepair on user activities and levels of visual acceptance.

2.6.2   Planning Inspections

Fixing the periodicity of inspections requires knowledge of the rates of deterioration of the building elements so that defects are revealed before they reach critical stage. The minimum period will be determined by the inspection cost which should clearly not exceed the cost consequence of failure (Musa, 2002; Seeley, 1987).

2.6.3   Identifying and Specifying the Work Necessary

This is achieved by compiling the information received on the condition of the building from inspectors and other sources with the standards laid down. It demands knowledge of the causes of defects and of the remedial measures which would be appropriate for the circumstance.

2.6.4   Estimating the Cost of the Work

As far as possible the estimates should be based on historic cost data obtained from within the organization for previous similar jobs, but in the absence of such data, cost from external sources and experienced budget have to be used.

2.6.5   Planning the Work

This is mainly in respect of fixing appropriate start and finish times for the individual jobs. It also requires information on the effect of the timing of the work on user activities, its agency, the availability of resources and the labour time required for each operation.

2.6.6   Organizing the Executive of Work

The major decision here is whether to employ labour directly for the purpose or to engage an outside contractor; for this, information will be required on the relative merits of these alternatives from the point of view of both cost and convenience.

2.7   Drivers to Maintenance of Building in Public Tertiary Institution

Researchers (Ramly, 2002; Pitt, 1997; Lee & Scott, 2009; Lateef, 2008; Yiu, 2008; Ali, 2008) identified drivers to maintenance of building. These include:

2.7.1   Complaint Received Regarding Building Performance

According to Lateef (2008), inefficient maintenance works could invite complaints by the building users. Users are normally looking for a comfortable space in a building. This includes well functions of building equipments, clean environment, and safe. If buildings do not fulfil the user's needs, complaints with regards to maintenance performance would be made by the users. Therefore, in formulating decision with regards to maintenance cost, element of user's satisfaction is vital and need to take into consideration (Lateef, 2008). This data are considered important in which the building manager would investigate and try to figure out the reason for the complaints. If the complaint due to non-performance of building equipments or other services, more attention is required to maintain those problem. To do that, more allocation is needed to perfectly maintain the system. Hence, this factor is considered in the decision making of maintenance (Azlan, 2009).

2.7.2   Existing Building Condition

The existing conditions of buildings were assessed through several ways. One of the easiest methods is by using visual survey. The exterior of each building structure was viewed from the ground level and all important information would be documented and some areas of deterioration are noted through annotated sketches and plans. However, with recent new technology, detecting building defects would be more effective by implementing non-destructive test (Pitt, 1997; Lee & Scott, 2009).

For instance, detecting a rusty steel bar is by using scanning instrument. By implementing visual inspection only, not many things about the condition of building can be discovered (Yiu, 2008). Ali (2008) argues that any allocation of maintenance cost must consider existing conditions of a building. This is because decision maintenance is complex and the best solution is by referring to the existing conditions of the building. Hence, factor of existing building condition need to be considered during the decision-making process of maintenance.
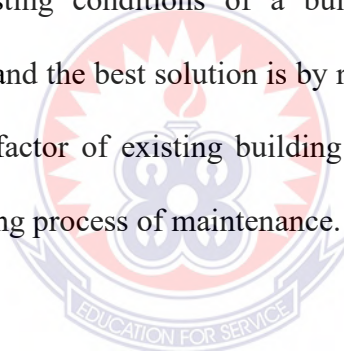
2.7.3   Building's Age

Age of building provides important indication on level of maintenance service required. Lateef (2008) argues that one of the important elements that need to be considered in allocation of maintenance resources is the building"s age. In order to know the future image of building, building manager needs to offer right service so that the building has competitive advantage. Services given must meet expectation in response to time, delivery schedules and within the agreed performance indicator. In general, the older is the building, the more attention and focus to special maintenance works need to be carried out.

Based on the consideration of life cycle management and facility management which are connected to each other, maintenance works such as a major refurbishment and retrofitting of building equipment need to take place when a building has reach its economic life span. To implement this, large allocation of money is required from the building owner. Therefore, the building stakeholders need to consider this factor during their decision-making process of maintaining building (Lee & Scott, 2009).

2.7.4 Client's Request

Client refers to the owner of a building. The client is the one who provides maintenance finance and a project brief in the early stage of maintenance works. Quality of client's brief would influence the building performance. Boyle (2003) notes that the key successful of design is rests much with the clients besides others such as a good budget. Poor briefing and breakdown communication always happened when the client is no committed in the maintenance works. Some of the clients, they have set organization strategies, corporate image and identity. To achieve that, a part of maintenance allocation has been put aside to fulfil those requirements (Ali, 2008). This becomes dilemma to a building manager to make decision when the budget allocation for maintenance work is limited.

2.7.5 Availability of Maintenance Funding

A most trying constraint from the design point of view is the budget allocation. Boyle (2003) noted that most important factor contributing to successful maintenance work was a sufficient budget allocated for a project. The project fund must be sufficient to ensure the maintenance works could run smoothly. One of the reasons clients initiated changes in maintenance planning was due to limited allocation of budget.

Moreover, Tilley and McFallen (2000) claimed that insufficiency in a maintenance fund could affect the maintenance performance. The maintenance brief prepared by the clients should reflect the amount of funds allocated for buildings. A limited project fund could result in low-quality parts being used for buildings, which was incompatible with existing equipment parts. Hence, the clients must be committed in providing resources such as financial and management supports. A committed client would ensure project resources such as financial are sufficient for a project. This is important towards the successful of maintenance works. The clients should be certain on their financing cash flow requirement when the maintenance works started. The lack of ability of the clients to provide faster decision often creates problem to the maintenance works (Azlan, 2009).

2.7.6   Safety and Health Requirements

Safety and health are command factors influenced in the decision making of maintenance works (Lee & Scott, 2009). This is because building maintenance works can lead a risk to maintenance personnel and building users. It is the responsibility of building stakeholders particularly the manager to ensure that health and safety assessments and safety work procedure are documented. This as a guideline to the maintenance personnel who perform maintenance works in buildings.

In addition, control measures need to be available and implement when undertaking the maintenance activities (Ali, 2008; Hashim, 2004). However, to implement and control safety and health in maintenance works demand monetary support. Safety equipment such as harness, glove, shoes, etc. needs to be available when they are required. This is to prevent accidents and work-related health and safety. Hence, some portion of maintenance budget need to be put aside in order to cater safety and health needs.

2.8　Constraints to Maintenance of Buildings in Public Tertiary Institutions

The main considerations for developing maintenance policy are building maintenance objectives, benefits and policies (Armstrong, 1987). The main purpose is to obtain benefits with integration of adequate maintenance policies. It concerns with proper procedures for planning building maintenance activities. Alner and Fellows (1990) summarise that safety is the primary concern for the planning of maintenance strategy to ensure building and associated services are in safe condition, fit for use and comply with the law and all statutory requirements. Maintenance work is carried out to maintain the value of the physical assets of the building stocks and quality. Thus, these factors are considered important for development of maintenance policy. However, apart from the value consideration, Burns (1997) argues that there should be ground rules for the allocation of maintenance resources available to management. Maintenance policies are beneficial to the organization as a whole, it must relate to the cost involved for getting maintenance funding.

Maintenance strategy is adopted in order to extend the life cycle of buildings and its fittings services. Maintenance personnel choose different maintenance strategies depending on allocation maintenance resources. The maintenance policy is the integration of different strategic approaches, which include corrective, preventive and condition-based maintenance (Horner et al, 1997). Ollila and Malmipuro (1999) identify that the main types of categories of maintenance consisted of reactive, preventive, predictive and proactive maintenance. However, Coetzee (1999) argues that the maintenance strategies should be based on the detailed design of the maintenance cycle for different types of organisations. Chan *et al.* (2001) split this into five types of maintenance strategy, including time-based, performance-based, breakdown-based, renovation-based and integration-based. Furthermore, Tse (2002) is

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of the opinion that most of the maintenance practices are failure-driven, time-based, condition-based, reliability-centered and predictive. The basic maintenance strategies include preventive, corrective and condition-based maintenance. According to Chan *et al.* (2001), the time based, performance-based, breakdown-based, renovation-based and integration-based are also developed from the three basic maintenance strategies.

In maintenance works, any decisions made have implications on cost, quality, duration, and resource allocation of the buildings (Ali et al., 2008). To produce good decisions, the quality and the amount of information available are critical. Since the decisions made during this process commit a large percentage of project funds, adequate and accurate information are needed in a timely manner. The quality of decision making depends on the accuracy and completeness of information.

According to Al-Majed (1998), poor communication affects maintenance decision of managements. Workers and even engineers are not informed about the department''s goals, objectives and plans. A number of the interviewees indicated that one of the reasons for not keeping the contractor''s engineers informed about the company is that the relationship between them is temporary.

Maintenance budget is frequently based on the previous year''s allocation plus a percentage. And there are often technical difficulties in assessing the quantity, as well as problems in execution of accurate cost of maintenance works, which results in overruns and underestimates. It is also noted that many facility client consider the maintenance cost a minor portion of the total cost, which they will not allocate enough money for (Mahmoud, 1994). Thus, budgeting for maintaining a facility is considered a secondary obligation and not enough allocation is considered. As affirmed by Al-Hammadand Assaf (1996), financial issues affect management in undertaking maintenance decision. It is most important that government budgets

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include enough financial allocation for maintenance works as it is a critical and needed function.

According to Best, Langston and de Valence (2003), the role of supervision is the most critical of all roles in maintenance of facilities. Most supervisors are appointed one day and are expected to perform all the complex tasks of management the next day without any form of training or preparation. This is not fair to the individual nor is it an effective strategy for management (Best, et al., 2003). Maintenance team in the public sector are working as supervisors only and do not know anything technical and they just receive the maintenance report from the contractor for signature only. The government sector does not have efficient maintenance staff (Alshehri, et al., 2015).

Maintenance work requirement for manpower is different when compared with construction, due to the type of work and services to an existing facility which need special and keen skilled engineers. Availability of maintenance work force is important factor in the process of maintenance work. In the case that little or no manpower is available locally, the need for manpower is dependent on other countries because it is boring environment and the range of resignation is high (Alshehri, et al., 2015). Lack of engineers and specialist are common human problem that affects decision making on maintenance. It is of extreme important to establish a work that will always be around when needed. There is expansion in buildings construction and there is no expansion in the number of man power (Best et al., 2003).

The absence of suitable spare parts in the local market will complicate the process of maintenance works (Brian, 2005). Recommended a spare part are costly solution to the facility or client, as the client is required to spend a large amount of money to procure the recommended spare parts? The problem would be minimized if

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required spare parts were available in the local market, thus it would be cheaper and easier to perform the maintenance works if spare parts were available in local market. Unavailability of spare parts in the local market causes serious problems to the function of maintenance as it will delay repair works, increase the cost of parts which need to be ordered by air from outside market. Unavailability of spear parts in the local market could stop the whole process of maintenance and operation of a facility (Alshehri, et al., 2015).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1   Introduction

In order to help in achieving the research aims and objectives, this chapter examines research methods with the outlook of finding the best methodology to answer the research questions raised. The drive of any research methodology and research design as recognized globally is to provide direction in the planning and implementation of the study in a manner most likely to attain the intended goal. This chapter deliberates the research strategy, and research design and the consequent choice of a quantitative approach. The chapter then provides an overview of the research population, sampling technique and sampling size. The next section discusses the data collection instruction, data collection procedure and then the data analysis.
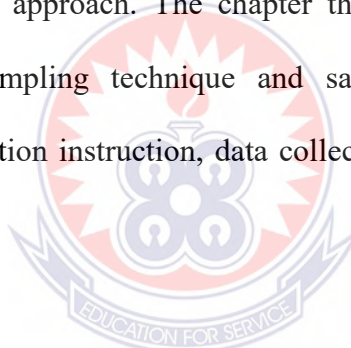
3.2   Research Strategy

This section explains the direction the researcher takes conducting the research. Naoum (1998) defines research strategy as the enquiry of research objectives. Accordingly, Baiden (2006) asserted that, the three main types of research strategies are quantitative, qualitative, and triangulation. However, the choice to adapt any particular strategy depends on the purpose of the study, the type, as well as availability of information for the research (Naoum, 1998; Baiden, 2006). Hence, this research adapts a quantitative strategy, as the main data collection techniques used in this research was questionnaires.

This method allowed the researcher to ask all respondent the same question with predetermined responses, which allowed objective data to be collected throughout the study therefore being in cycle with the positivist tradition with survey as the main data collection approach.

3.3   Research Design

A research design is a collection of guides or rules or data collection (Adams & Schvaneveldt, 1985; Ogoe, 1993). This pacts with the structure for data collection and analysis; the structure that influences the technique for collection and analysis of data and provides the connection between empirical data as well as its conclusions in a logical sequence to the initial research question of the study (Yin, 2003; Bryman, 2004; Baiden 2006).

The study adopted descriptive survey in the quest to examine management practices of maintenance management in public tertiary institution in Ghana. Burns et al. (2001) in explaining descriptive survey intimated that it is a study that observes and describes the presence, frequency or absence of characteristics of a phenomenon as it naturally occurs, in order to gain additional information. The primary purpose of a descriptive survey research is to describe the situation, preferences, practices, opinions, concerns or interests of the phenomenon of interests of the phenomenon of interests (Polit et al., 2006). Naoum (2007) added that the descriptive survey aims to answer such questions as: How many? Who? What is happening? Where? and When? It deals with counting the number of respondents with certain opinions/attitudes towards a specific object. The counting can be later analysed to compare or illustrate reality and trends. Descriptive studies provide valuable base line information. The method is also flexible and can be used to collect information from a large group of respondents (Mouton, 2001).

The descriptive survey was selected because it provides an accurate portrayal or account of the characteristics, for example behaviour, opinions, abilities, and knowledge of a particular individual, situation, or group. This design was chosen to meet the objectives of the study, namely to determine maintenance policies and practices of public tertiary institutions, identify drivers to maintenance of building in public tertiary institution in Ghana and identify constraints to maintenance of building in public tertiary institutions in Ghana

3.4   Population

A research population can be defined as the totality of a well-defined collection of individuals or objects that have a common, binding characteristics or traits (Polit & Hungler, 1993). Burns *et al*. (1993) added that a population is defined as all elements (individuals, objects and events) that meet the sample criteria for inclusion in a study.

The research covers a population of estate department staff responsible for maintenance at public tertiary institutions in Greater Accra, Ghana. The main reason for using this category of people is that their activities directly or indirectly have a bearing on maintenance management practices of public tertiary institutions in Greater Accra.

3.5   Sampling Technique and Sample size

The term "sample" means a part of a whole (population) drawn to reflect the remaining (Naoum, 1998). Thus, sampling refers to the process of selecting a quota of the population to characterise the entire population. A sample, then, consists of a subject of the units that constitute the population (Polit & Hungler, 1999). However,

research studies use simply a small fraction of the population, referred to as a sample. This is because using a sample is more practical and less costly than collecting data from the entire population. Polit and Hungler (1999) asserted that, the major risk of using a selected sample is that it might not adequately reflect the behaviours, traits, or beliefs of the population.

The sampling technique for this study is based on its purpose, design, and practical implication of the research topic is purposive sampling. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard, 2002; Lewis & Sheppard, 2006; Tongco, 2007).

In the context of this research, the targeted groups were the staff of the estate department of the selected public tertiary institutions in Greater Accra, Ghana. More so, purposive sampling was utilized in attaining the sample size because of the difficulties encountered in assessing the population size of the class. Purposive sampling refers to strategies in which the researcher exercises his or her judgment about who will provide the best perspective on the phenomenon of interest, and then intentionally invites those specific perspectives into the study. Table 3.1 gives details of the sample size determination.

Table 3.1: Sample Size Determination

S/N	Public Tertiary Schools in Accra	Sample size
1	Accra College of Education	5
2	Ghana Institute of Journalism	5
3	Ghana Institute of Languages (GIL)	4
4	Ghana technology university college	3
5	Ghana Christian university college	5
6	Ghana Institute of Management and Public Administration (GIMPA)	6
7	University Of Professional Studies - Accra (UPS-A)	6
8	National Film and Television Institute	5
9	University of Ghana	6
10	University of Ghana Business School (UGBS)	6
11	University of Ghana Medical School	6
12	37 Military Hospital Nurses Training College	5
13	Kole – Bu Teaching Hospital Nurses Training College	5
14	Pantang Hospital Nurses Training College	4
15	Pneuma Exousia College	6
16	ST. Karol School of Nursing	5
17	Western hills School of Nursing	5
18	Accra Technical University	4
	Total	**91**

Source: Researcher Field Data, 2018

3.6   Data Collection Instrument

Questionnaire was used as a data collection instrument. It was essential to establish the information to gather for relevant questions to be solicited (Oppenheim, 1996). Contemplations of appeal to respondents ease of reading and supplying the required data guided the format of the questionnaires. This enhanced proper usage of time during the data collection.

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The questionnaire was divided into four sections, i.e. A, B, C and D. The section A consisted of bio data of respondents. Section B reflected the maintenance policies and practices of tertiary institutions. Section C constituted drivers to maintenance of building in public tertiary institution, whiles Section D reflected constraints to maintenance of building in public tertiary institutions of the likert scale of which estate department staff were expected to respond to statements raised. Respondents were expected to tick ($\sqrt{}$) the created boxes of columns where they strongly agree; agree; disagree and strongly disagree to the given statements. In this study, the likert scale which had five (5) columns from number five (5) to one (1) in a requisite order attached to various columns. On the scale the rating was arranged in five (5) columns. The likert scale provides the basis for neutral response, as well as ranking highest and lowest responses of respondents in the study. Here, the weight attached ranges from five (5) to one (1) with responses coded 1-5. Responses were ticked ($\sqrt{}$) in the available boxes with correspondents boxes attached. The likert scale indicated the following: Strongly Agree (SA) - (5); Agree (A)-(4); Uncertain (U)-(3), Disagree (D) – (2); and Strongly Disagree (SD) - (1).The strongly agree (SA) exhibits the most powerful weight of five (5) to the issue of discussion.

3.7   Data Collection Procedure

The format of the questionnaires aligned to meet the objectives of this research has two main parts. Part one emphasis on the background of the respondents whiles part two focused on the maintenance policies and practices put in place, drivers to maintenance of building in public tertiary institution and constraints to maintenance of building in public tertiary institutions.

. The questionnaires were distributed and retrieved in person. This ensured that the intended recipients, in order to help improve the response rate, completed the questionnaires. Some of the advantages of the self-administered questionnaires used include, it been an efficient way to collect statistically quantifiable information and an efficient method as many respondents can be reached within a short space of time (Twumasi, 1993).

3.8   Data Analysis

Creswell (2005) expressed that, data analysis consist of "taking the data apart"" to determine individuals response and "putting them together" and to summarize it (p.231-237). Creswell stated that, analyzing and investigating data refers to taking up the response from respondents and drawing final conclusions about it, where conclusions could be clearly seen and explained to any reader, how the conclusions were arrived in words, to provide answers that benefit each research questions raised. Furthermore, Awanta and Asiedu-Addo, (2008) stated that, data analysis is a systematic approach of finding evidence to support an idea raised in the study with relationship between two or more variables.

In the study, statistical software for quantitative statistical analysis (Statistical Package for the Social Sciences–SPSS 20.0) was used. The data was summarised using frequencies, percentages and mean score and presented in tabular form. Awanta and Asiedu-Addo (2008:158) refer to mean as "average""; the overall responses or views of different respondents based on the information gathered.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1   Introduction

This chapter presents the analysis of the data collected. Analysis of responses was done according to the research objectives. It determined the maintenance policies and practices put in place as far as public tertiary institutions, drivers to maintenance of building in public tertiary institution in Ghana, and the constraints to maintenance of building in public tertiary institutions in Ghana.

4.2   Response Rate

A total of 91 questionnaires were administered to the targeted respondents, of the 91 administered questionnaires a total of 87 questionnaires were retrieved and duly completed representing 95.6% response rate. Bowing (2004) indicated that a response rate of 75% is good in social science research, though he admits that the higher the response rate, the better the analysis. The returned questionnaires were scrutinized for errors, omissions, completeness and inconsistencies and were found to be adequately completed and therefore suitable for analysis.

4.3   Background Information of Respondents

This section of the study discusses the background information of the respondents. It specifically includes the age, gender, educational level, and the number of years the respondents has worked in the institution. Table 4.1 shows the demographic details of the respondents.

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Table 4 1: Respondents

Category	Responses	Frequency (N)	Percentage (%)
Age	18-25 years	3	3.4
	26-35 years	32	36.8
	36-45 years	41	47.1
	46 years and above	11	12.6
	Total	**87**	**100.0**
Gender	Male	61	70.1
	Female	26	29.9
	Total	**87**	**100.0**
Educational level	Diploma	31	35.6
	First degree	45	51.7
	Masters	11	12.6
	Total	**87**	**100.0**
Number of years worked	1-5years	19	21.8
	6-10years	42	48.3
	11-15years	18	20.7
	15years and above	8	9.2
	Total	**87**	**100.0**

Source: Field Survey, 2018

With regards to age of the respondents, Table 4.1 clearly shows that the respondents were fairly distributed among the age brackets set out on the questionnaire. Three (3) respondents representing 3.4% were between 18-25years; 32 respondents representing 36.8% were between the age category of 26-35years; 41 respondents representing 41.7% were between the age category of 36-45years. The remaining 11 respondents constituting 12.6% were 46years and above. From the statistics, it could be inferred that the majority (41.7%) of the workforce at the maintenance department as respondents in the study were aged between 36-45years. Concerning the gender of respondents, more of the respondents were male with a

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percentage of 70.1% while the female respondents amount to 29.9%. This implies that greater number of the workforce of the maintenance department of the various institutions were men.

The study revealed that among the respondents who answered the questionnaires, 35.6% holds diploma, 51.7% holds first degree and 12.6% hold Master's Degree (Table 4.1). This implies that majority of the respondents" are learned hence their ability to comprehend the questions articulated in the questionnaire and to respond accordingly. Table 4.1 further shows the years respondents have worked in the institution. Majority (48.3%) of the respondents have worked for 6-10years. However, 21.8% of the respondents have worked in the institution 1-5years, whiles 20.7% of the respondents have worked in the institutions for 11-15years. The remaining 9.2% of the respondents have worked for 15years and above. This indicates that respondents are in good position to comment on the maintenance practices at the various institutions.
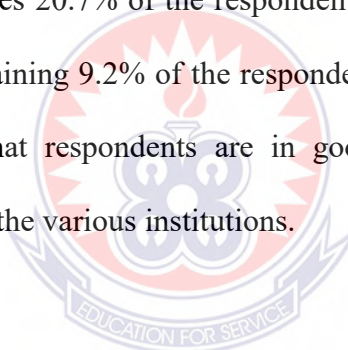
4.4   Maintenance Policies and Practices Undertaken by Tertiary Institutions

The first research question identifies the maintenance policies and practices place as far as public tertiary institutions in Ghana are concerned. The survey concluded and come-up with the analysis of 9 policies and practices undertaken by public tertiary institutions in Accra Metropolis. These policies and practices have been identified and ranked according to their descriptive analysis. The result is presented in Table 4.2.

Table 4. 2: Responses on maintenance policies and practices

Policies and practices	N	Mean	Std. Dev.	Rank	Remarks
Maintenance programme are organized by the maintenance department	87	3.41	1.308	1	Agree
The physical condition of the building and its elements are inspected.	87	3.37	1.322	2	Agree
Maintenance tasks are planned ahead and performed when convenient	87	3.18	1.451	3	Agree
Maintenance/estate department do maintenance work on buildings regularly	87	3.17	1.374	4	Agree
Training and developing personnel to undertaken maintenance work	87	2.95	1.343	5	Disagree
Long term arrangement for the supply of essential parts for replacement	87	2.84	1.397	6	Disagree
Involvement of maintenance experts at the design stage	87	2.71	1.372	7	Disagree
Adequate/appropriate maintenance of facility plant and equipment for maintenance operations	87	2.60	1.426	8	Disagree
Innovate supports services	87	2.33	1.245	9	Disagree

Source: Field Survey, 2018

From Table 4.2 , it became obvious that maintenance programme is organized by the maintenance department at the various public tertiary institutions in Accra Metropolis. This statement was rated 1st with a mean score of 3.41 and a standard deviation (SD) of 1.308. According to Parida and Kumar (2006), maintenance programme is about the technical, administrative and managerial actions to retain or restore the building to a state in which it can perform the required function. It is therefore of primary importance that public buildings are maintained in order that they can serve both the architectural and aesthetical functions for which they are built. The finding contradicts with the study by Amusan (2003) who in his study found many times without numbers, School programme are distorted and becomes irregular, hence making maintenance programme difficult be organized by the maintenance

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department. For higher institutions, the money for maintenance comes from the government as part of each school annual budget. This poses some difficulties for such institutions to organize maintenance programme because expenditure from the government budget is not only adequate, and tied to strict financial regulations and payment control system (Mahmoud, 1997).

With a mean score of 3.37 and a standard deviation (SD) of 1.322, inspection of the physical condition of the building and its elements was rated 2nd. According to Musa (2002), periodicity of inspections of physical condition of building and its elements is important. It helps in acquiring knowledge on the rates of deterioration of the building elements so that defects are revealed before they reach critical stage. The minimum period will be determined by the inspection cost which should clearly not exceed the cost consequence of failure. The study concurs with the study by Olanrewaju, Khamidi and Idrus (2010) who indicated that estate department at the various tertiary institutions in Nigeria at a level inspects physical condition of the building and regular technical survey; to provide continuous employment for certain operatives within a fixed budget. The finding contradicts with the study by Cobbinah (2010) who indicated Estate and Maintenance Managers of public institutions in Ghana do not undertake regular inspection of the building to ascertain its condition neither do they undertake routine and periodic maintenance on the buildings. Cobbinah indicated that the GHS and UEW-K though pay rent as a company policy for the building they occupy, external maintenance work which are to be carried out by the institution is either not done or takes a long time for reported complains to be attended to thus creating a lot of inconvenience and safety problems for occupants.

The statement that maintenance tasks are planned ahead and performed when convenient was rated 3rd with a mean score of 3.18 and a standard deviation (SD) of 1.451. According to the rational decision theory, institution with propensity to plan and innovate can more readily respond to changes, and can take better advantages of new products and market opportunities than those that do not plan (Brown & Eisenhard, 2005). In Quayson and Akomah (2016), management of public institutions scores poorly against the standard measures of planning and innovation; and do not show much readiness towards their maintenance. According to the study, the root cause of maintenance problems were that Estate/Maintenance Managers do not plan maintenance head and perform when convenient, neither do they undertake routine and periodic maintenance on the buildings. The study by Gopalakrishnan and Banerji (2004) hold the assertion that planned maintenance approach improves on the routine maintenance system and requires the maintenance work to be planned in advance. The study by Akeju (2007) on the other hand accepted planning maintenance ahead as the best practices to maintenance decisions. According to Akeju, planned maintenance is used to overcome the disadvantages of corrective maintenance, by reducing the probability of and likelihood of failure of an element.

Table 4.2 further revealed that maintenance/estate department does maintenance work on buildings regularly. This statement was rated 4th with a mean score of 3.17 and a standard deviation (SD) of 1.374. The finding concurs with the study by Akinsola (2012) who indicated that maintenance works are regularly conducted on Tertiary Institutional buildings in Southwest Nigeria. In order to maintain the usability and efficiency of the building premises, tertiary institution buildings are regularly maintained and refurbished. Afranie and Osei-Tutu (1999) on the other hand posited that one of the critical problems confronting the housing

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industry in Ghana is poor maintenance practice. Irregular maintenance practices had resulted in damages and deterioration to most public residential buildings in Ghana. Many of these buildings have not seen any significant maintenance after their construction. Evidence of lack of maintenance and repair are frequently demonstrated on roof, windows, doors, and other building elements and facilities. Dann et al. (1999) and Wordsworth (2001) emphasized that neglect of maintenance has a cumulative result which rapidly increases deterioration of the building fabrics and finishes accompanied by harmful effects on the occupants. This has resulted in damages and deterioration to some public residential buildings in the country. Melvin (1992) argued that lack of maintenance can result in reduction of the lifespan of a building which invariably defeats the purpose for which they were built.

On the contrary the workforce of the maintenance department of the various institutions disagreed that training and developing personnel to undertaken maintenance work (x=2.95, SD=1.343), long term arrangement for the supply of essential parts for replacement (x=2.84, SD=1.397), involvement of maintenance experts at the design stage (x=2.71, SD=1.372), adequate/appropriate maintenance of facility plant and equipment for maintenance operations (x=2.60, SD=1.426), and innovate supports services (x=2.33, SD=1.245) are maintenance policies and practices put in place by public tertiary institutions in Accra Metropolis. These statements were rated 5[th,] 6th, 7th, 8th, and 9th in the ranking order respectively.

The findings revealed that maintenance department organised maintenance programme, inspect physical condition of the building and its elements, plan head maintenance task and perform when convenient, and do maintenance work on buildings regularly.

4.5   Drivers to maintenance of building in public tertiary institution in Ghana

The survey concluded and come-up with the analysis of the 11 drivers to maintenance of building which is the second research question to be dealt with. These drivers have been identified and ranked according to their descriptive analysis. The result is presented in Table 4.3.

Table 4. 3: Responses on drivers to maintenance

Drivers	N	Mean	Std. Dev.	Rank	Remarks
Building condition	87	3.71	1.200	1	Agree
Age of the buildings	87	3.67	1.226	2	Agree
Funding for maintenance activities of public institutions	87	3.53	1.293	3	Agree
Management decision	87	3.51	1.209	4	Agree
User's persistent complaint	87	3.40	1.426	5	Agree
Capacity of the maintenance unit	87	2.75	1.399	6	Disagree
Proximity to defect generating factors	87	2.72	1.227	7	Disagree
User status	87	2.53	1.302	8	Disagree
Apathy and ignorance of maintenance responsibility	87	2.48	1.238	9	Disagree
Building size	87	2.34	1.265	10	Disagree
Building complexity	87	2.21	1.192	11	Disagree

From the analysis, building condition was ranked highest as drivers to maintenance of building with a mean score of 3.71 and a standard deviation (SD) of 1.200. Ali (2008) argued that any allocation of maintenance cost must consider existing conditions of a building. This is because decision maintenance is complex and the best solution is by referring to the existing conditions of the building. Hence, factor of existing building condition need to be considered during the decision-making process of maintenance cost.

In addition, building age was ranked 2nd drivers to maintenance of building in public tertiary institution with a mean of 3.67 and a standard deviation (SD) of 1.226.

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This is considered an important factor affecting building maintenance by the life of existing buildings are difficult to assess as all properties from the date of their erection, have been the subject of varying amounts and standards of maintenance, besides being constructed with the intention that they should last at least sixty (60) years and many number of building also exceeded this period (Seeley, 1987). This justifies the position of Lateef (2008) that one of the essential factors that need to be measured in the allocation of maintenance budgets is the building age. This is probably due to the need of additional maintenance works to be carried out in older buildings. For example, major refurbishment and retrofitting of building equipment or elements need to be implemented when a building has reached its economic life span (Ali, 2009).

Following the building age as the second ranked driver is the funding for maintenance activities of public institutions. This statement was rated 3rd with a mean score of 3.53 and a standard deviation of 1.293. Most constraint for maintenance is budget allocation. Boyle (2003) noted that most important factor contributing to successful maintenance work was a sufficient budget allocated for a project. The project fund must be sufficient to ensure the maintenance works could run smoothly. One of the reasons clients initiated changes in maintenance planning was due to limited allocation of budget. Tilley and McFallen (2000) claimed that insufficiency in a maintenance fund could affect the maintenance performance. The maintenance brief prepared by the clients should reflect the amount of funds allocated for buildings. A limited project fund could result in low-quality parts being used for buildings, which was incompatible with existing equipment parts. Hence, the clients must be committed in providing resources such as financial and management supports (Azlan, 2009).

Also, management decision was ranked 4th drivers to maintenance of building in public tertiary institutions. This statement had a mean of 3.51 and a standard deviation of 1.209. Management supports and provides maintenance finance and a project brief of maintenance works. The management brief would influence the building performance. This result concurs with the position of Boyle (2003) who noted that the key successful of design is rests much with the management besides others such as a good budget. Poor briefing and breakdown communication always happened when the managements is no committed in the maintenance works. Some of the management, they have set organization strategies, corporate image and identity. To achieve that, a part of maintenance allocation has been put aside to fulfill those requirements (Ali, 2008). This becomes dilemma to a building manager to make decision when the budget allocation for maintenance work is limited.

Furthermore, this study reveals that user's persistent complaints influence maintenance of building in public tertiary institution. This statement was rated 5th with a mean score of 3.40 and a standard deviation of 1.426. According to Lateef (2008), inefficient maintenance works could invite complaints by the building users. Users are normally looking for a comfortable space in a building. This includes well functions of building equipment, clean environment, and safe. If buildings do not fulfill the user's needs, complaints with regards to maintenance performance would be made by the users. Therefore, in formulating decision with regards to maintenance cost, element of user's satisfaction is vital and need to take into consideration (Lateef, 2008). This data are considered important in which the building manager would investigate and try to figure out the reason for the complaints. If the complaint due to non-performance of building equipment or other services, more attention is required to maintain those problem (Azlan, 2009).

Conversely, the respondents disagreed to the statement that capacity of the maintenance unit (x=2.75, SD=1.399), Proximity to defect generating factors (x=2.72, SD=1.227), user status (x=2.53, SD=1.302), apathy and ignorance of maintenance responsibility (x=2.48, SD=1.238), building size, (x=2.34, SD=1.265), and building complexity (x=2.21, SD=1.192) are drivers to maintenance of building in public tertiary institutions. The statements were ranked 6th, 7th, 8th, 9th, 10th and 11th respectively.

The decision to effect maintenance of building in public tertiary institutions include: building condition, age of the buildings, funding for maintenance activities of public institutions, management decision, and user's persistent complaint. Afranie and Osei-Tutu (1999) summarizes the principal criteria which could influence the decision to carry out maintenance briefly as, cost, age and condition of property, availability of adequate resources, urgency, future use and sociological considerations.
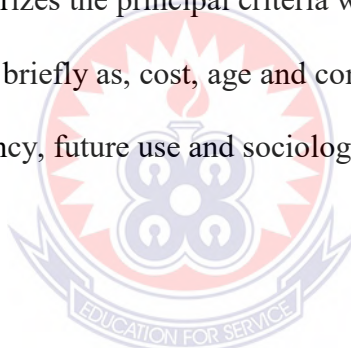
4.6   Constraints to maintenance of building in public tertiary institutions

The study presents the analysis of the 10 factors constraints to maintenance of building in public tertiary institutions in Ghana. These constraints have been identified and ranked according to their descriptive analyse. The result is presented in Table 4.4.

Table 4.4: Responses on constraints to maintenance of building

Constraints	N	Mean	Std. Dev.	Rank	Remarks
Poor management attitude to maintenance	87	3.85	1.334	1	Agree
Poor funding	87	3.83	1.296	2	Agree
Delay in release of funds	87	3.64	1.267	3	Agree
Absence of effective maintenance staff	87	3.53	1.256	4	Agree
Inadequate maintenance tool	87	3.39	1.512	5	Agree
Absence of maintenance plan	87	3.22	1.434	6	Agree
Absence of effective maintenance culture	87	2.74	1.410	7	Disagree
Lack of maintenance standard procedures	87	2.63	1.373	8	Disagree
Ineffective use of maintenance vote	87	2.55	1.237	9	Disagree
Non- involvement of user"s idea on maintenance	87	2.23	1.344	10	Disagree

Source: Field Work, 2018

The first constraint is poor management attitude to maintenance with a mean score of 3.85 and a standard deviation (SD) of 1.334. This affirmed that poor attitude for maintenance responsibility on the part of management play a major role in the current maintenance problems of public tertiary buildings in Ghana. Managements refuse to undertake maintenance works of the various institutions. Afranie and Osei-Tutu (1999) posited that poor attitude towards maintenance is a critical problems confronting the institutions in Ghana. Elements of buildings deteriorate at a greater or lesser rate dependent on materials and methods of construction, environmental conditions and the use of the buildings. Wordsworth (2001) revealed that poor attitude towards maintenance of building has a cumulative result which rapidly increases deterioration of the building fabrics and finishes accompanied by harmful effects on the occupants.

Poor funding was ranked second with a mean score of 3.83 and SD of 1.296, while delay in release of funds is a major constraint to maintenance of building in public tertiary institutions. This is supported by Mahmoud (1994) who indicated that budgeting for maintaining a facility is considered as a constraint. As affirmed by Al-Hammad and Assaf (1996), financial issues affect management in undertaking maintenance decision. It is most important that government budgets include enough financial allocation for maintenance works as it is a critical and needed function. According to Adejimi (1998), inadequate finance is generally acknowledged as a major constraint on effective property management, partly because maintenance budgets are the easiest to cut when money is scarce. According to him, maintenance expenditure can be absorbed more easily in commercial and industrial organizations where it may account for as little as 0.5% of turnover, but even in these cases maintenance is taken for granted except when it threatens production or profitability. Adejimi confirmed that, the situation is more serious in the public sector where damaging effects of poor maintenance are less immediately obvious. Jiboye (2010) further indicated that in the case of housing estates, it is common for organizations to emphasize the provision of new houses, with little funding provided for maintaining existing stock. Not are day-to-day repairs neglected, but efforts at improvements and rehabilitation are considered lower priority than new construction. This problem of inadequate finance indeed result in rapid deterioration of existing stock resulting in increases in the demand for new buildings because poorly maintained building are not only unpopular; but they soon reach the stage where the structure itself deteriorates and rebuilding has to be considered.

From the study delay in release of funds was ranked third with a mean score of 3.64 and a SD of 1.267. Maintenance of buildings requires huge capital expenditure. Public institutions rely on central government funds to cover maintenance incidentals. This was captured in the annual budget of the institution‟s general maintenance and repair funds submitted to the government. Government funding of activities of public institutions have been dwindling and even delay over the years, thereby making it difficult for the maintenance department of public institutions to set aside adequate funds for maintenance work. Delay in release of funds for maintenance was cited by Quayson and Akomah (2016) as the main reasons for building deterioration in the public institutions in Ghana. Maintenance problems become more expensive when not attended to on time. Quayson and Akomah further emphasized that therefore, institutions should be proactive in raising funds for maintenance of their buildings.

Absence of effective maintenance staff was ranked fourth with a mean score of 3.53 and a standard deviation (SD) of 1.256. This is considered an important constraint to maintenance of building in public tertiary institutions. Maintenance work requirement for manpower is different when compared with construction, due to the type of work and services to an existing facility a special and keen skilled engineer is required. Availability of maintenance work force is important factor in the process of maintenance work. Lack of engineers and specialist are common human problem that affects decision making on maintenance. It is of extreme important to establish a work that will always be around when needed (Alshehri, et al., 2015).

In addition, inadequate maintenance tool had a mean of 3.39 and a standard deviation of 1.512. This statement was rated 5th in the ranking order. The absence of suitable maintenance in the local market complicates the process of maintenance works (Brian, 2005). Unavailability of spare parts in the local market causes serious

problems to the function of maintenance as it will delay repair works, increase the cost of parts which need to be ordered by air from outside market. Unavailability of spear parts in the local market could stopped the whole process of maintenance and operation of a facility (Alshehri, et al., 2015).

The last major constraint to maintenance of building in public tertiary institutions is absence of maintenance plan. This statement was ranked six with a mean score of 3.22 and a SD of 1.434. Maintenance plan is an effective tool for achieving a high standard of maintenance work. In the absence of such management plan, it will lead to time consuming and most likely failed maintenance works. The respondents disagreed that absence of effective maintenance culture (x=2.74, SD=1.410), lack of maintenance standard procedures (x=2.63, SD=1.373), ineffective use of maintenance vote (x=2.55, SD=1.237), and non- involvement of user"s idea on maintenance (x=2.23, SD=1.344) are the major constraints to maintenance of building in public tertiary institutions in Ghana. These statements were ranked 7th, 8th, 9th and 10th respectively.

It appeared from the study that poor management attitude to maintenance poor funding, delay in release of funds, absence of effective maintenance staff, inadequate maintenance tool, and absence of maintenance plan are the major constraints to maintenance of building in public tertiary institutions in Ghana.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1   Introduction

This chapter sums up the findings from the study, draws conclusions arising from the study and makes relevant recommendations based on the findings and conclusions.

5.2   Summary of Key Findings

A number of findings were made after a discussion of the responses. They are summarized as below;

5.2.1   Maintenance Policies and Practices put in Place by Public Tertiary Institutions

The study revealed that maintenance department organised maintenance programme, inspect physical condition of the building and its elements, plan head maintenance task and perform when convenient, and do maintenance work on buildings regularly.

5.2.2   Drivers to Maintenance of Building in Public Tertiary Institution in Ghana

The study found that building condition, age of the buildings, funding for maintenance activities of public institutions, management decision, and user"s persistent complaint are the major drivers to maintenance of building in public tertiary institutions.

5.2.3 Constraints to Maintenance of Building in Public Tertiary Institutions

It appeared from the study that poor management attitude to maintenance poor funding, delay in release of funds, absence of effective maintenance staff, inadequate maintenance tool, and absence of maintenance plan are the major constraints to maintenance of building in public tertiary institutions in Ghana.

5.3 Conclusions

Maintenance contains decisions about all the technical, administrative and managerial actions during the life-cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function. Tertiary institution faces immediate pressure to preserve existing college of its campuses and enhance the capacity of its higher education system to address growing demands. Poor building maintenance is widely regarded as the result of people"s apathetic attitude which may be referred to as a poor "maintenance culture" (Ghana News Agency, 2001). Many Ghanaian public tertiary institutional structures are often inadequately maintained and windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair. The aim of the study was to examine the maintenance practices of public tertiary institutions. Public tertiary institutions in Ghana organised maintenance programme, inspect physical condition of the building and its elements, plan head maintenance task and perform when convenient, and do maintenance work on buildings regularly.

The study found that building condition, age of the buildings, funding for maintenance activities of public institutions, management decision, and user"s persistent complaint are the major drivers to maintenance of building in public tertiary institutions. The study concluded that poor management attitude to maintenance poor

funding, delay in release of funds, absence of effective maintenance staff, inadequate maintenance tool, and absence of maintenance plan are constraints to maintenance of building in public tertiary institutions in Ghana.

5.4   Recommendations

The following recommendations are proposed in line with the conclusions on how to improve the maintenance of public tertiary buildings.

- There is the need for public tertiary institutions to embrace preventive maintenance practice as a high priority rather than adhoc maintenance. To gain optimum benefits from preventive maintenance, maintenance department should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. The department should evaluate the preventive maintenance program to improve it over time

- The government should allocate a substantial budgetary allocation to the maintenance of the facilities and other infrastructures which should be reviewed from time to time.

- The management should endeavor to provide maintenance department with adequate staffs and provision of appropriate tools and equipment for maintenance to be effective.

- Maintenance department of the various public tertiary institutions should ensure proper planning and executing maintenance programmes, as well as overcome the prevailing maintenance problems.

5.5   Suggestion for Further Studies

In a study such as this, recommendations for future research would address the issues generated from this study. Based on these findings, future research may start from a relatively higher level of knowledge.

- A replication of this study would be helpful in reexamining the validity of its findings for which the researcher was not able to investigate. Further empirical studies using larger sample sizes from different and greater geographical diversity would be helpful in examining the maintenance practices by public tertiary institutions in Ghana.

- The influence of depleted buildings on the performance of students in public tertiary institutions and why maintenance is important.

- The role the government plays to ensure maintenance of public properties.
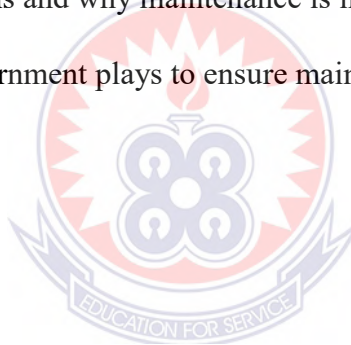
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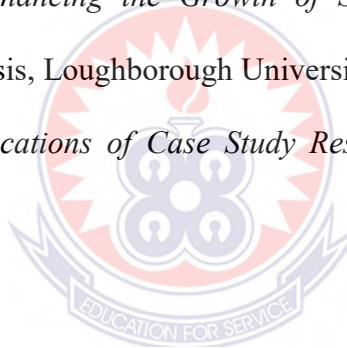
APPENDIX

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

TOPIC: AN EMPIRICAL EXAMINATION OF MAINTENANCE PRACTICES OF PUBLIC TERTIARY INSTITUTIONS. A STUDY OF SELECTED INSTITUTIONS IN GHANA

PREAMBLE: The researcher, a student of the University of Education, Winneba - Kumasi Campus is seeking information relating to the above mentioned topic. The information that you are to provide is purely for an academic exercise and would be treated with necessary confidentiality. You may tick (√) where applicable or give a brief explanation where necessary.

Section A: Background Information

1.   What is the age category you belong? *Please tick [√] the appropriate option.*

18-25 [ ]   26-35 [ ]   36-45 [ ]   46 and above [ ]

2.   What is the gender you belong? *Please tick [√] the appropriate option.*

Male [ ]   Female [ ]

3.   What is your Educational Level? *Please tick [√] the appropriate option.*

Diploma ( )   First Degree ( )   Masters ( )   PhD ( )

Others (specify): ....

4.   How long have you worked in this institution? *Please tick [√] the appropriate option.*

1-5years (   ) 6-10years (   )   11-15years (   )   15years and above (   )

Section B: Maintenance Policies and Practices

5. In your opinion to what extent do you agree that the following maintenance policies and practices are put in place as far as your institution is concerned? Please rate using a scale of 1-5 where 1 represents strongly disagree, 2 represents disagree, 3 represents uncertain, 4 represents agree and 5 represents strongly agree. *Please tick [√] the appropriate box.*

Statement	SD	D	U	A	SA
Maintenance tasks are planned ahead and performed when convenient	[1]	[2]	[3]	[4]	[5]
The physical condition of the building and its elements are inspected.	[1]	[2]	[3]	[4]	[5]
Involvement of maintenance experts at the design stage	[1]	[2]	[3]	[4]	[5]
Training and developing personnel to undertaken maintenance work	[1]	[2]	[3]	[4]	[5]
Adequate/appropriate maintenance of facility plant and equipment for maintenance operations	[1]	[2]	[3]	[4]	[5]
Innovate supports services	[1]	[2]	[3]	[4]	[5]
Maintenance programme by the maintenance department	[1]	[2]	[3]	[4]	[5]
Long term arrangement for the supply of essential parts for replacement	[1]	[2]	[3]	[4]	[5]
Maintenance/estate department do maintenance work on buildings regularly	[1]	[2]	[3]	[4]	[5]

Section C: Drivers to maintenance of building in public tertiary institution

6.   In your opinion to what extent do you agree that the following are drivers to maintenance of building in your institution? Please rate using a scale of 1-5 where 1 represents strongly disagree, 2 represents disagree, 3 represents uncertain, 4 represents agree and 5 represents strongly agree. *Please tick [√] the appropriate box.*

Statement	SD	D	U	A	SA
Building status	[1]	[2]	[3]	[4]	[5]
Age of the buildings	[1]	[2]	[3]	[4]	[5]
User status	[1]	[2]	[3]	[4]	[5]
Building size	[1]	[2]	[3]	[4]	[5]
Funding for maintenance activities of public institutions	[1]	[2]	[3]	[4]	[5]
Apathy and ignorance of maintenance responsibility	[1]	[2]	[3]	[4]	[5]
Proximity to defect generating factors	[1]	[2]	[3]	[4]	[5]
Capacity of the maintenance unit	[1]	[2]	[3]	[4]	[5]
User's persistent complaint	[1]	[2]	[3]	[4]	[5]
Management decision	[1]	[2]	[3]	[4]	[5]
Building complexity	[1]	[2]	[3]	[4]	[5]

Section D: Constraints to maintenance of building in public tertiary institutions

7. In your opinion to what extent do you agree on the following constraints to maintenance of building in your institution? Please rate using a scale of 1-5 where 1 represents strongly disagree, 2 represents disagree, 3 represents uncertain, 4 represents agree and 5 represents strongly agree. *Please tick [√] the appropriate box.*

Statement	SD	D	U	A	SA
Poor funding	[1]	[2]	[3]	[4]	[5]
Poor management attitude to maintenance	[1]	[2]	[3]	[4]	[5]
Inadequate maintenance tool	[1]	[2]	[3]	[4]	[5]
Absence of effective maintenance culture	[1]	[2]	[3]	[4]	[5]
Ineffective use of maintenance vote	[1]	[2]	[3]	[4]	[5]
Absence of maintenance plan	[1]	[2]	[3]	[4]	[5]
Non- involvement of user's idea on maintenance	[1]	[2]	[3]	[4]	[5]
Absence of effective maintenance staff	[1]	[2]	[3]	[4]	[5]
Lack of maintenance standard procedures	[1]	[2]	[3]	[4]	[5]
Delay in release of funds	[1]	[2]	[3]	[4]	[5]

Section E: Strategies for improving building maintenance in public tertiary

      institutions in Ghana

8. Please suggest ways of improving building maintenance in your institution or