UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY (CASE STUDY OF BAGABAGA DEMONSTRATION SCHOOL IN SAGNARIGU DISTRICT)

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A Dissertation in the Department of CONSTRUCTION AND WOOD TECHNOLOGY EDUCATION, Faculty of, TECHNICAL EDUCATION, submitted to the school of graduate studies, University of education, Winneba in partial fulfillment of the requirement for the award of Master of Technology (Construction) degree.

DECEMBER, 2015

DECLARATION

STUDENT'S DECLARATION

I Yaw Felix Dorgbadzie, 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 guidelines for supervision of Dissertation as laid down by the University of Education, Winneba.

MR. MICHAEL K. TSORGALI

SIGNATURE…….…….

DATE……..

DEDICATION

I dedicate this thesis to my dear Mother, Mrs. Joyce Dorgbadzi who nurtured in me the unwavering interest in the value of education. Also to my Father Mr. Felix Dorgbadzi (Snr) who provided the support and encouragement that enabled me to complete my M Tech. Programme.

Thank you all form the bottom of my heart.

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ABSTRACT

A building fabric is referred to as an "environmental envelop" because it is the means by which the natural or the external environment may be modified to produce a satisfactory internal environment for man to live in, buildings do not provide guarantee for their appearance and working conditions and is always subjected to wearing, decay and filth. This research is conducted in Tamale metropolitan area specifically Sagnarigu District to assess maintenance of public buildings in Ghana. The objective of the research was to assess the current conditions and state of public buildings, identify the principal causes of non- maintenance of public buildings, analyze the maintenance policies and practices, make suggestions and recommendations toward the adoption of effective policies. Data collection techniques such as observation, interview, questionnaire and rating scales were employed by the researcher. The outcome of the study depicted that; housing maintenance is a real problem among public institutions in Ghana, with 85 percent of all residential buildings of public institutions surveyed were having maintenance problems, maintenance problems are more prominent in Bagabaga Demonstration School with 45.3 percent of their buildings in a bad condition. To accomplish this aim, extensive study of the practical implications of the research, such as; embracing preventive maintenance practices as a high priority rather than an adhoc maintenance, gain optimum benefit from maintenance, ensure that maintenance department are adequately staffed with requisite manpower etc. Managers should oversee periodic inspection of buildings, there should be effective national maintenance policy, law and regulation to compare managers and occupancies to undertake maintenance.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

It is surprising to note that the occupants of buildings in Ghana do not know the importance of maintenance as to derive the full benefit of the building they occupy. Lee Dowson (1993) states that, over the years many buildings have collapsed which are due largely to the absence of maintenance in the building industry. From the statement, it is clear that many building owners do not know building maintenance is the only means to keep buildings strong and it's largely depend on them.

Poor maintenance habit turned many expensive and attractive buildings to be very watched and unpleasant thereby depriving it occupants of serene environments that enhance good livelihood. Field etal (2nd Ed.) (1997), states that, players in the building industry disregard the rules and regulations governing maintenance and fail to investigate the buildings they work on.

The ignorance and negligence as a result exposed such buildings to hash unpleasant and cruel environmental conditions, the researcher was able to visit some buildings in the country and interviewed the occupants, the buildings visited include both private and public own buildings.

Furthermore, the researcher observed critically the condition of the buildings, almost all the occupants interviewed agreed to the bad nature and deplorable state of the buildings. Most of the buildings inspected were built between 1957 and 1990 and there has not been any major maintenance work on these buildings.

The defect includes large cracks on floors and walls exposing the iron rods in within them, negligence on the part of the building owners and stakeholders has caused a total deterioration on the buildings and it will further worsen if the owners are not ready to conduct investigation before commencing work on the building. (Jacob Field, 2nd Ed, 1997).

According to Dowson etal (1993), Maintenance of buildings has been much neglected sector for the building industry universally. In view of that, maintenance should be part of the Ghanaian culture and its benefits should be in the good books of stakeholders. One of the critical problems confronting the housing industry in Ghana is the poor maintenance practice. According to Afranie and Osei, (1999) the role of the 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 to preserve the quality of the buildings. The continued and efficient effective performance of public institutions depend 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 residential accommodation and non-residential 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, 1972).

According to Seeley (1987), neglect of maintenance has accumulative results with rapidly increasing deterioration of the fabric and finishes of a building accompanied by harmful effect on the contents and occupants. Therefore, buildings are too valuable assets to be neglected in this way, in his hierarchy of needs theory, Maslow (1954), identifies five basic needs which are organized into successive level of importance in an ascending order, he identified physiological needs as the most basic needs of human beings which include air, food, water, shelter (housing), sex, and sleep.

B.S. 3811(1984), define 'maintenance' as the 'combination of all technical associated administrative actions intended to retain an item in or, restore it to, a state in which it can perform its required function'. 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.

Moreover, a well operated system of maintenance for buildings and equipments has the effect of being a very effective disaster mitigation measure in terms of cost and facility usage. It ensures the most economic way to keep the building and equipments in the best of form for normal use, give the original design and materials (http//www.oas.org/en/cdmp).

When buildings are neglected, defect can occur which may result in extensive and avoidable damage to the building fabric or equipment. Poor maintenance has resulted in damage and deterioration to some public buildings in Ghana. Neglect of maintenance especially in relation to replacing electricity cable after thirty years of use can also give rise to fire and safety hazards, which could result in the institution owning the building

being found liable for any injuries and damages. Another case in point is the job 600 built by Ghana's first President Dr. Kwame Nkrumah to host the organization of African unity meeting in 1965 has its main building quite rundown has been under renovation for many years now, the present state of this public building could be attributed to lack of maintenance and neglect after being put into used.

1.2 Problem Statement.

Many Ghanaian public structures are often inadequately maintained, windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair.

Moreover, buildings of Bagabaga Demonstration Junior High School in the Northern Region have not experience maintenance for decades; this has resulted in the deterioration of the structures used as classrooms, and teacher's office.

This deterioration includes;

- Large cracks of floors between 4mm to 25mm with some over grown trees roots.
- Perforated roofing sheets leading to rotten of timber and ceiling members.
- Wall that has been attacked by fungi.
- Hanging doors and lower frames without louver blades.

The above mentioned defects on the whole buildings at Bagabaga Demonstration School have caused a major reduction in the number of students to be admitted each year.

Furthermore, school lessons ran dual during raining seasons therefore, affecting academic performance of the students, parents are also withdrawing their wards; also schools close down during raining season therefore affecting academic performance of the students. Above all, teachers apply for transfer after a year or two of teaching in the school because of the state of the school buildings and teachers office.

Some residential and buildings of public institutions 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 dilapidated state with some being abandoned this lack of maintenance by the authorities and occupants of these facilities often lead to reduced lifespan of these buildings Melvin (1992), which in variably defeat the purpose for which they are put up i.e. to ensure that the nation's stock of buildings, both as a factor of production and accommodation, was used effectively as possible.

1.3 Purpose of the Study

The purpose of this research is to:

- Evaluate the importance of building maintenance practices adopted in public institutions.

1. 4 Objectives of the study

The objectives of the study are to:

- Assess the current condition of buildings of public institutions.
- Identify the causes of non-maintenance of public buildings.
- Analyze the importance of maintenance policy and practice of public institutions.
- Make recommendations to enhance maintenance practices.

1.5 Research Questions.

In embarking upon such study, certain questions should be answered before any credible conclusions can be drawn. The following questions were posed;

1. What are the current state of non- maintenance of public buildings in Ghana?

2. What are the reasons that have accounted for non-maintenance of public buildings?
3. What maintenance policies and practices are in place as far as public institutions are concerned?
4. How will you recommend to enhancing maintenance practices to retain current buildings?

1.6 Significance of the study

The significance of maintaining a building is to ensure that the building continue to serve the purpose for which it was put up. The significance of maintenance includes;

- To maintain the value of the building; - a better maintain building normally has greater value.
- To ensure optimum use of the buildings; - good maintenance should allow buildings to be used to their full potential.
- To create or maintain suitable appearance; - can make a positive contribution to external environment and social conditions. Dilapidated buildings can contribute to social deprivation and badly maintained services and facilities, waste energy and resources and can affect the environment.

1.7 Scope of the Study

The scope of this research was limited to head teachers, students, contractors and policymakers in the Sagnarigu District – Tamale. This includes; the definition of maintenance forms of maintenance, nature of maintenance, importance of maintenance and laws and regulations of maintenance, social significance of maintenance, just to mention few.

1.8 Organization of the study.

The study has been organized under five chapters. Chapter one, covers the introductory part and it include the problem statement, research questions, objectives, significance of the study, and the scope. The second chapter deals with the review of relevant literature on the subject, thus ideas of some researchers and authors have been reviewed.

Chapter three focuses on the methodology adopted in undertaking the research, the analysis of the data gathered is dealt with in chapter four, whilst in chapter five presents a summary of the key findings conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter attempts to bring out important opinion that people have shared on the topic, in this regard, the researcher gathered various views through books, journals, and useful material, and it will guide the reader to fish out relevant data in the literature review about the study stated in various paragraphs.

The literature review will cover the following areas**,** definition of maintenance, forms of maintenance, nature of maintenance, importance of maintenance, the role of maintenance in the building process, defined preventive maintenance, philosophy of preventive maintenance, purpose of preventive maintenance, scope of preventive maintenance, process of investigation, facility planning, management and operation, economic and social significance of maintenance, laws and regulations of maintenance, the importance of maintenance and repairs, and preventive measures, supervising maintenance works and other sub-topics to mention but few.

Integrity and quality building management is essential to up keep the values of the building and protect the interest of property owners and tenants.

Thus owner's corporations, other building management bodies and their services providers should take firm action to uphold the integrity of their staff and adopt good practices to prevent corruption.

According to the British Standard 3811 (1974), as cited in Cobbinah (2010), maintenance is defined as work undertaken in order to keep or restore every facility (i.e. every part of the site, building and content) to an acceptable standard and cost:

- To keep here means that defects are prevented from developing.
- To restore means that minor defects, if they allow to occur, are then corrected.
- Acceptable standard and acceptable cost indicate that maintenance work is tailed to suit individual needs and conditions.

2.2 Concept of Building.

i. Definition Of Building;

A building is an architectural fabric erected, and fixed upon the soil, composed of stone , brick, wood or other proper substance connected together, and designed for used in which it is so fixed. (http:/wiktionary.org.)

ii. Lives of buildings.

According to Seeley (1987), the lives of existing buildings are difficult to assess as all properties from the date of their erection, have been the subject of their varying amounts standards of maintenance, besides being constructed with the intention that they should last at least sixty (60) years and many exceed this period.

2.3 Public Residential Houses Type in Ghana.

According to stone (1983), Detached Bungalow: these are houses designed or built to be occupied by a household, they are regarded as bungalows, because they stand detached on individual plot of vary sizes. The dwelling unit is organized into specific rooms for receiving visitors and relaxation (living room), eating, carrying out other indoor family activities, cooking (kitchen), ablutions (bathroom and toilet) and sleeping (bedrooms). In addition to these basic rooms, one finds spaces such as garages, store rooms, terraces etc. in some of these house types.

Semi-Detached Houses: it is basically two houses put together with a common partition wall. Similar to the bungalow type, the dwellings are self-contained.

Blocks of flats: this type of houses provide self-contain dwelling units of different sizes for single households placed on multi- levels without any defined private courtyard space. Balconies bare provided on the ground floor for the occupying households. In some case, lockable garages and storeroom are provided on the ground floor for the occupying houses.

According to Seeley (1987), asserts that are even cheaper buildings generally have a substantial lifespan of fifty (50) to sixty (60) years. And that this possible physical life is often much greater but may be demolished before the end of this period to permit a more profitable use of site, or because it is found more economical to clear and rebuild rather than to adapt the building to meet changed requirements, because of physical or technical obsolescence.

The life of a building can be categorized into "structural life" and "economic life", the structural or physical life is the period which expires when it ceases to be an economic proposition to maintain the building, while economic life is concerned with earning power and it is that period of effective life before replacement; replacement taking when it will increase income absolutely. However the actual physical life of a building is frequently much greater than its economic life, but buildings are often demolish before their physical life is expired in other to permit a more profitable use of the site, or because it is found cheaper to clear and rebuild rather than to adapt the buildings to the change requirement. Seeley (1983) also state that, a general rule of capital asset of a building is so valuable and is often appreciating, so that in practice maintenance is directed to prolonging effective life.

Laws and Regulations

Understanding and abiding by the relevant laws and regulations is the first step to integrate in quality management and is essential for the protection of the interest of all stakeholders, including owners/tenants, owners corporation their management committee members, service providers such as property management construction companies and their staff.

2.4 Definition of Maintenance.

According to British standard 3811: Part 2 (1994), maintenance is defined in as "a combination of all technical and associate administrative action intended to retain an item in, or restore it to a state in which it can perform its required function" To retain implies that, the defects are prevented from developing by carrying out work in anticipation of failure.

The actions referred to are those associated with initiation, organization, and implementation. It is envisage two processes 'retaining' i.e. work carried out in anticipation of failure, referred to as 'corrective maintenance' there is also the concept of an 'acceptable standard ` which 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 for enforcing minimum standards. Additionally it can also be construed widely as acceptable to the public at large or to specific sections of the public. Clearly however, are no absolute standards or which will be equally acceptable to everybody or which would remain acceptable to the same group of people over a period of time?

The standard acceptable at the time of undertaking the work may be higher or lower than the initial design standards. In many cases, the standard deemed acceptable would be higher than that originally provided and the work would include an element of

improvement. Buildings, however with the passage of time are modified to accommodate new uses it becomes increasingly unrealistic to think in terms of keeping or restoring initial standards. The standard would be related to safety and efficiency, and determined by the amount of money allocated rather than a result assessing the benefit obtained from maintaining the building for a particular use.

According to the British Standard (3811) (1974), as cited in (Afrinie and Osei 1999, Jude 2010),defined maintenance as work undertaking to keep or restore every facility (i.e. every part of the site, buildings and content) to an acceptable standard and cost:

- To keep here means that defects are prevented from developing
- To restore means that minor defects, if they are allowed to occur, are then corrected
- Acceptable standard and acceptable cost indicate that maintenance work is tailed to suit individual needs and conditions.

Seeley (1993), defined maintenance as the combination of all technical and associated administrative action intended to retain an item or restore it to a state in which it can perform its required functions to an acceptable standard.

According to Collins, English Dictionary, (2003) maintenance has also been defined as 'all actions taken to retain material in or to restore it to a specified condition, it includes inspection, testing servicing and classification as to serviceability, repair, rebuilding, and reclamation.

It include the routine recurring work required to keep a facility (plant, building structure, ground facility, utility system, or other real property) in such a condition that may be continuously utilized, at its original or design capacity and efficiency, and for its intended purpose (Dictionary of Military and associated Terms, U.S Department of defense 2005).

A more functional definition proposed by White (1969), is that, maintenance is synonymous with controlling the condition of a building so that its pattern lies within specified regions' the word 'control' suggest a positive activity which is planned so as to achieve a defined end result while the term 'specified region' presumably has similar meaning to 'acceptable standard'. His definition envisages a range of acceptable with upper and lower limits between which the condition of the building must be maintained.

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

- Day to day repairs leaking taps electrical effects;
- Periodic up-keep such as painting; and
- Major repairs requiring heavy expenditure and the services of technical expects, for example foundation works re-roofing. (Afranie and Osei 1999).

2.5 Forms of Maintenance.

Maintenance therefore is all the necessary combination of all technical administrative and managerial actions to preserve a building with it furnishes and fittings, or restore to a state in which it can perform the required function.

According to Burgees and White, (1979) maintenance work can be group in to two categories that is planned and unplanned maintenance.

Planned maintenance is sub-divided into two categories that is, preventive maintenance and corrective maintenance.

2.5.1 Types of Maintenance (source: BS 3811 1984):

BS 3811 Categorizes building maintenance by mean of the following terms and definitions.

a. Planned Maintenance:

"The maintenance organized and carried out with forethought and the use of records to a predetermined plan".

b. Unplanned maintenance:

"The plan carried out to no predetermined plan. "It refers to work necessitated by unforeseen breakdown or damages. For example, the ripping off of a building, through the action of storm, and its remedial action constitute unforeseen damages, unexpected, unavoidable maintenance.

c. Preventive Maintenance:

This type of maintenance is carried out periodically to ensure that device or facility continuously provides services without failure.

It is also a very important cost saving method when it comes to keeping a plant running optimally.

d. Corrective Maintenance:

Corrective maintenance is done to restore equipment or device to a standard acceptable for production or providing service.

These are actual repair that keep the property functioning normally and usually need to be done as soon as possible. The repair is usually done in response to something breaking or not working properly anymore, this type of maintenance include; replacing a broken

air condition unit fixing a dropping faucet, unclogging drain, replacing light bulbs, or repairing a non-functioning.

e. Routine Maintenance:

This is the most frequently done activity of all and it is done by performing routine and schedule maintenance of the property, changing equipment filters, cleaning gutters, removing debris from roof drain, office cleaning, window cleaning, and repairs and parking lot care are just a few of the many item that require schedule maintenance.

f. Deferred Maintenance:

This happened when the other types of maintenance are not performed, it is replacements and improvements that should have been done but weren't, later have become larger problems with larger repair cost.

These items are sometimes the most expensive to fix and many times they could have been taken care of at far less expense, if they have been first noticed.

It is also called "the controlled self-destruction of your property" and it should be pretty obvious that you want to avoid deferred maintenance as much as possible.

Everyone in a triple not lease need protection against expenses that occur as building age component wear.

Having lease property, inspect prior to occupancy can help avoid the potential cost and hassle of lease dispute possible litigation. After all no one wants to pay for something they are not responsible for.

g. Emergency maintenance: "the maintenance which is necessary to put in hand immediately to avoid serious consequences" this is referring to as day-to-day maintenance, resulting from such incidents as gas leaks and gale damage.

h. **Condition based maintenance:** "the preventive maintenance initiated as a suit of knowledge of the condition of an item from routine or continues monitoring".

i. **Schedule maintenance:** "the preventive maintenance carried out to a predetermined interval of time, number of operations, mileage, etc."

j. **Running maintenance: "**maintenance which can be carried out whilst an item is in service" etc.

Another approach to maintenance classification has been adopted by Speight (1982), as subdivided maintenance into three categories:

1. **Major repair or restoration:** such as reroofing or rebuilding defective walls and often incorporating an element of improvement.
2. **Periodic maintenance:** a typical example being annual contracts for decorations and the like.
3. **Routine or day by day maintenance:** this largely of the preventive type, such as checking rainwater gutters and serving mechanical and clerical installations.

2.5.2 The value of preventive maintenance:

A well-planned preventive maintenance is advocated for its effects on improving equipment's operating efficiency, preventing premature replacement components, and avoiding interruptions for building occupants. Preventive maintenance is widely thought to reduce long-term cost by maximizing the operating capacities of equipment, minimizing downtime, and avoiding breakdowns that would otherwise lead to higher repair cost later.

Successful preventive maintenance programs should achieve these goals;

1. **Preserve taxpayers` investment in public buildings:** Preventive maintenance can extend the life of building components, thus sustaining buildings` value and significant tax cedi they represent.
2. **Help buildings function as they were intended and operate at peak efficiency, including minimizing energy consumption:** Because preventive maintenance keeps equipment functioning as designed, it reduces inefficiencies in operations and energy usage.
3. **Prevent failure of building systems that would interrupt occupant's activities and the delivery of public services:** Buildings that operate trouble free allow public employees to do their jobs and serve the public.
4. **Sustain a safe and healthy environment by buildings and their components in good repair and structurally sound:** Protecting the physical integrity of building components through preventive maintenance preserve a safe environment for employees and the public.
5. **Provide maintenance in a way that is cost effective:** Preventive maintenance can prevent minor problems from escalating into major system and equipment failures those results in costly repairs.

2.5.3 Components of maintenance.

Maintenance involves a considerable amount of work as cited in (Afranie and Osei, 1999) has been categorized into three components namely; servicing, Rectification, and Replacement.

- **Servicing.**

Servicing is essentially a clearing operation undertaken at regular intervals of varying frequency 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 confiscated is 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.

- **Rectification.**

According to Lee (1987) (p. 23), 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 good in transit or installation 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 correctly installed. Rectification work could be reduced by the development and use of performance specifications code of installation. Rectification is the response to inherent defect in design, construction or installation stages of the building process. This provides an opportunity to "trade off" current capital expenditure against future maintenance cost.

- **Replacement.**

According to Seeley, (1987) replacement occurs 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 elements as 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 varies not been resolved whilst the capacity of elements of the buildings in withstanding changes and different intensities of the weather vary. These therefore become necessary as a result of material decay due to these differential rates of weather conditions, physical breakdown of materials or 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 be classified as improvement. However, it is logically 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 extension to the original building.

2.5.4 Technology of maintenance.

According to Dave (2002), the technology of maintenance is concerned with all the factors that influence and cause the need for maintenance work. The occurrence of defects in the fabric of a building can result from many unrelated design decision unsuitable material, incorrect assessment of exposure. Exposure is influenced by rainfall,

direction of prevailing winds, microclimate, atmospheric pollution and aspect and height of building.

The durability of the building material has also influenced by most frost action, crystallization of salts, sunlight, biological agents, abrasion and impact, chemical action, corrosion and incompatibility of modern building material. Cracking in building normally result from failure or defective construction and are invariably insightful and unacceptable to occupants, if sever, they may result in loss of stability. Furthermore, cracks frequently give rise to air infiltration, heat loss and reduce sound insulation all of which cause reduced efficiency in buildings. Cracking generally caused by tensile stresses in excess of the tensile strength of the material, produced by externally applied loads or internal movements arising from temperature moisture change, other important concept of the maintenance can be illustrated by reference to roof construction. A good roof which is well maintained should last the life of a building and it is false economy to save money on roof during construction, because if it ever requires replacement, it will cause serious dislocation of production, occupancy or other activities within the building. A leaking roof apart from causing considerable inconvenience to users can lead to accelerated deterioration of other parts of the building such as ceiling, floors and walls and can cause serious damage to decorations and electrical installation. Traffic over a roof should be kept to a minimum and where it is essential, appropriate walkways and access ladders must be provided. To ensure that roofs are adequately maintained, they should ideally be inspected every three (3) years or alternatively one-third each year.

2.6 Economic and Social Significance of Maintenance.

Frequent maintenance of the built environment brings such benefit as comfort and satisfaction to its inhabitants, maintaining the physical structure of a building ensures

that the investment made does not only yield the highest possible returns over the life of the property but also fulfill the ultimate responsibility of providing the needed human satisfaction and comfort.

A house, according to Dave (2002), is regarded as economic assert, which must be maintained to ensure that it appreciates in value and results in a return, either socially or economically to the owner, in effect the primary aim of maintaining a building is to reserve it in its original state as practicable as possible so that it effectively serves that purpose. As a rule, the capital assert of a building is so valuable and so appreciating so that in practice, maintenance should frequently be directed to prolong effective life. Therefore the purpose of maintaining buildings are; retaining the value of investment, maintaining the building in a state in which it continue to fulfill its function and presenting good appearance. No wonder many writers on economic and social significance of maintenance contend that the building environment expresses in physical for the complex social and economic factors, which give structure and life of the community. As a result, the condition and quality of buildings reflect public pride and indifference, the level of prosperity of the area, social values and behavior and all the many influences both past and present, which combine to give a country its unique characteristics.

2.6.1 Aims of maintaining buildings.

The primary aim of a building is to ensure that the building continues to serve the purpose for which it was put up. The purpose for which maintenance is undertaken includes:

1. **To maintain the value of building:-** a better maintain building normally has a greater value, however, increase value may be marginal as location and size of site all play an important role in the determination of value (Afranie and Osei, 1999).

2. **To ensure optimum use of buildings:** - good maintenance should allow buildings to be used to their full potential.
3. **To create or maintain suitable appearance:** - came like a positive contribution to external environment and social conditions. Dilapidated building can contribute to social deprivation and badly maintained services and facilities, waste energy and resources and can affect the environment.
4. **To maximized the life of main components and materials:** - maintenance can reduce cost of subsequent maintenance by extending periods between repairs and replacements.
5. To ensure that buildings do not detract from surroundings and also maintain a suitable appearance.

2.6.2 Factors influencing decision to undertake Maintenance.

Miles and Syagga (1987), identify the following factors as influencing the decision to carry out maintenance on a building:

a. Inadequate finance: - it generally acknowledges that inadequate finance is a major constraint on effective property management, partly because maintenance budgets are the easiest cut when money is scarce. According to Miles (1987), maintenance expenditure can be adsorbed more easily in commercial and industrial organization where it may account for as little as 0.5% turnover, but even in this case maintenance is taken for granted except when it threatens production or profitability. However, the situation is more serious in the public sector where damaging effect of poor maintenance is less immediately obvious. Also in the case of housing estate, it is common for organizations to emphasize the provision of new houses, with title funding provided for maintaining existing stock.

b. Bad management: - refer to the idleness and wastes among maintenance personnel.

c. Poor building design: - it is uncommon to find that buildings inherently are expensive to maintain because of inappropriate priorities applied during the design phase. Poor detailing and the specification of unsuitable components and materials are common complaints. In addition, construction error arising from inadequate drawings and specifications, couple with poor workmanship because of contracts awarded to incompetent contractors are frequent causes of rapid physical deterioration in buildings.

Good design should allow accessibility and adequate working space for essential maintenance such as cleaning, and minor repairs to pipes, ducts and cables.

Stapleton (1994), relate that, the decision to carry out maintenance is affected by many factors among which are:

a. **Cost:-** investors will want to have the most economic method for carrying out maintenance work whether, corrective or preventive, thus they look at ;
   - Actual cost of maintenance of the cost of maintaining similar buildings.
   - Consideration of money spends to achieve acceptable standard at present.
   - Cost of maintaining some standard in future and economics of replacing facilities and
   - Amount of work available and priority of work to be executed.

b. **Availability of physical resources: -** affects decision in that, when suitable materials for maintenance are not available, it becomes difficult to undertake maintenance.

c. **Urgency of work:** – this also affects decisions on maintenance in that investors consider whether delay work in the short run will require more expensive work at a later stage.

   This usually takes into account,

   - Safety of building users; and
   - Possible damage to structure and finishes used in the building.

d. **Interference with activities carried out in the building:**

According to Seeley (1993), 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.

2.6.3 Maintenance Policy

According to BS 3811, define maintenance policies as a strategy within which decisions on maintenance are taken, alternatively, it may be defined as the ground rules for the allocation of resources (men, materials and money) between the alternative types of maintenance actions that are available to management. In order to make a rational allocation of resources the benefit of those actions to the organization as a whole must be identified and related to the cost involved. Issues under consideration in a policy include; objectives, benefits, policies.

2.6.4 Physical causes of maintenance in residential buildings.

The physical causes of maintenance problem refer to all the natural/physical factors that negatively affect the durability of the building, the durability of a built facility is a measure, in an inverse sense, of the rate of deterioration of a material or component.

According to Afranie and Osei (1999), the British Standard Institution (BSI) Code of practice defines durability as the quality of maintaining a satisfactory appearance and performance of required functions. The code measures this parameter in terms of the minimum number of year's satisfactory life. The three major causes of deterioration and hence maintenance problems are age, or period of construction, environment and location factor.

Newly constructed houses are observed to be in relatively better condition as compare to older houses, environmental factors such as extreme moisture content (too high and too low), high and fluctuating temperature salt laden

Maintenance policy

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In order to make a rational allocation of resources the benefits of those actions to the organization as a whole must be identified and related to the cost involved. Issues under consideration in a policy include; objectives, benefits and policies.

2. 7 Nature of Maintenance.

According to Sowden (1990), the proper maintenance of building covers many aspect of the building which may be divided into four categories.

1. There is the planning and execution of day to day maintenance, which include such activities as servicing and clearing, and the inspection of facilities and components.

2. The frequency of cleaning varies, for example, floors are usually swept daily and polished weekly and painting done every three to four years.
3. Rectification may be needed quite early in the life of the building, because of design shortcomings, inherent fault in the use of materials or faulty construction.
4. This shortcoming often affects the performance of the components.
5. There is the need to consider the replacement of costly items in a building, i.e. the flat covering to the apartment block may be laid or the air condition system in a hotel may be replaced once every ten years.
6. Maintenance may also embrace aspect of retrofitting or modernization, this section of the market is concern with alteration addition and enlacement to existing building on both small and large scale.
7. Retrofitting work includes all work designed either to expand the capacity of the facility or to enable the facility to perform some new functions.

2.7.1 Organization of Maintenance Department.

The maintenance department in an organization is managed by a maintenance manager; the maintenance manager is responsible for the planning and control of maintenance operations, in a small firm the functions may be undertaken by a member of staff in addition to his order duties, whiles in a larger firm there would be a separate group of people solely responsible for maintenance.

2.7.2 The function of the maintenance department.

The maintenance department among other things performs the following basic functions:

1. **Advisory function:** this involves liaison with occupants and users and consultation with upper management on such matters as;

- The standard to be maintained and the effect on user activities of deviations from these standards.
- The relative merits of alternative maintenance policies and the extent to which it would be advantageous to employ operatives directly for executing the work.
- Classification of any constraints in relation to limit of expenditure, desirable cash flow patterns, acceptable delay times or restrictions on the time and method of carrying out work.
- Estimate maintenance expenditure both long and short term, including, where appropriate, cost of initially bringing up to the required standard and the possibility of phasing any such backlog over a period of years.
- Provision of cost and other data to assist upper management in deciding whether to repair or renew.
- Technical requirements for minor works involving alterations or small additions to the building; although not strictly maintenance, it is usual for the maintenance organization to assume full responsibility for this type of work.
- Advise on the maintenance implications of designs for proposed new buildings.

2. **Organizational function:** this may be in relation to the central administrative and supervisory system or to the execution system whether by direct labor contract.

3. **Control function:** the control functions are dependent on the timely receipt of accurate information areas:

- **Work input:** identifying the extent of work necessary to achieve the required standards within the constraints laid down, the processes involved would include planned inspections, appraisal of user requests assignment of priorities.

- **Time execution:** programming the workload so that the carrying out of the work is timed in accordance with the needs of the user and the available labor force.
- **Quality**: supervision of work during execution and by subsequent control inspections to detect latent defects.
- **Cost**: budgetary control system including estimating resource requirements in cost and performance terms for later comparison with actual cost and performance achieved.
- **Feedback**: this inherent feature of all the control functions and involves keeping such records as are necessary for the proper control of the operations.

4. **Miscellaneous functions:** the maintenance organization may have responsibility for other matters such as: safety and security, principally in relation to compliance with statutory fire precautions and the maintenance of firefighting equipment, refuse disposal, cleaning, grounds etc.

2.8 Importance of Maintenance.

Wainwright and Wood (1991) argue out that, it is an established economic fact that existing buildings must be maintained and repaired were possible in reference to demolishing and rebuilding, this type of work is very common and is important part of the work load of the building industry. Seeley (1983) stated the main purpose of the building as;

- To retain the value of investment.
- Maintaining the building in a condition in which it will continue to fulfill its function.
- Presenting a good appearance.

From the above it could be seen that without maintenance the investment of an investor of money invested in building and if this building do not last to its estimated life, the developer cannot retrieve the amount invested let alone gain profit, no one will like to rent or reside in building which has been deteriorated to an extend that it cannot provide the requirement of the user nor meet the functional requirements.

When such a situation arises, the building will be uninhabitable, unsafe and even not attractive, but with maintenance work being carried out in a building, they are kept in a state whereby it will provide the investor, the occupant and even the environment the necessary requirement.

Without maintenance, buildings will have to be abandoned and it will be uneconomical sound to put up new buildings all the time without carrying out repair work to the existing ones.

2.9 The Role of Maintenance in the Building Process.

The performance of any building according to High Field, (1997) can be affected by decision taken actions perform at any stage of a building project from its initial conception to its final demolition.

This reflects the importance of maintenance throughout of the life of a building, the building process start when a brief is provided to the designer, stating his requirements and constraints.

The client should determine his maintenance objectives such as economy and efficiency, a maintenance policy is then formulated to allow the objective to be achieved.

A skillful design can reduce the amount of maintenance and also make easier to carry out the work, major decisions at this stage includes among other things, selection of materials

forms part of the construction, control of materials, and movement of materials, strategic planning, and orientation of building and user requirements.

The construction stage is the most vulnerable to the occurrence of defects, it requires therefore, a high level of supervision to ensure good standard of materials and workmanship as well as correct detailing and specification.

Maintenance is needed throughout the entire period the building maybe used or occupied, so that the various facilities are kept to standard consistent with overall policy.

Feedback is important to indicate success or otherwise of design, in terms of facility user requirements and maintenance objectives.

2.9.1 Construction equipment and plant: according to Kheni (2014), construction equipment and plant refer to the instruments, machinery, and other mechanical implements required in the performance of construction work. Plant and equipment constitute a significant input in the construction process.

While it is well acknowledged that construction is a labor-intensive industry, particularly in developing countries, construction companies cannot do without plant and equipments usage on many contracts.

Contractor and registration and classification scheme requires that construction businesses have some basic equipment holding, the plant and equipment/equipment cost is either the cost of owning and operating the plant or hiring the equipment from hire firms. The use of construction plant and equipment can be acquired through two ways by;

2.9.2 Owning or hire: the construction firm should have sufficient funds or have access to funds to be able to embark on the former decision. Funds in this case can be obtained through retain earnings, floating shares or by loan arrangements with financial institutions, some capital will be locked up if the construction business decided to own an item plant or equipment. For this reason, the following factors will have to be taken into consideration;

- Will the item of equipment generate sufficient turnover to provide sufficient return on capital employed?
- Is it absolutely necessary to own the item of plant or equipment rather than obtain it through other means?
- Is outright purchase the only way to acquire it?

Increasingly, many maintenance businesses acquire plant by hire the main driving factor has been the phenomenal growth of the independent hire firm in recent times.

In Ghana plant hire firms are located in metropolitan cosmopolitan centers many of which started operating the year 2000.

2.9.3 Financing the Cost of Acquisition of plant:

The purchasing rather than hire of plant and equipment involves commitment of substantial financial resources of funding have to be explored. The main sources of the funding include;

- Cash or outright purchase,
- Hire purchase, and
- Leasing.

2.9.4 Outright Purchase of plant:

This method involves immediate payment for the plant or equipment for which ownership transferred to the construction firm. To conclude such a transaction means the construction firm has access to cash to pay for the plant or equipment.

Retained earnings shares and bank borrowing are sources of funding that the construction firm could rely on.

2.9.5 Hire Purchase:

Acquisition of plant by his method involves a hire purchase between the construction firm and the equipment or plant hire firm for payment in installment over a stated period of time. At the end of the time the ownership title of the equipment is transferred to the construction firm.

2.9.6 Leasing:

A lease is contract whereby in return for payment specified rentals, the construction firm obtains the use of a capital asset (plant or equipment) owned by another party (the lesser).

- The title never passes to the lessee (the contraction firm).
- There several varieties of lease to suit the parties.

There are two types of leasing;

- Financial Lease And,
- Operating Lease

2.9.7 Financial Lease

Financial lease is generally arranged by financial institutions, the rental charges cover the plant equipment' s capital cost, except for its residual value. Rental charges also cover

overheads, interest charges, cost of servicing and profits. The lease will normally be divided into two periods; the primary period (3-5years) and secondary period (continues). The lease contract cannot be cancelled in the course of the secondary period.

2.9.8 Operating Lease

Operating lease is generally arranged by manufacturers or suppliers of the plant or the equipment, the lease will normally be divided into two periods; the primary period and secondary period.

- The primary period not cancellable and charges are frequently lower than those required by financial lease because the item or plant have a good second hand value.
- Profit required by the lesser will come from services provided, e.g. servicing maintenance charges.
- Servicing may continue into a secondary period of the leases.

2.9.9 Systematic Plant Selection:

The decision to buy an item plant or equipment must take into consideration all the important complex factors. Some of these factors include the following;

- Economic considerations ,
- After sales services,
- Technical capabilities,
- Scientific necessities, and
- Human and social considerations.

Finally, decision to be regarding the future of the building depends very much on its condition. A survey is carried out to determine the cost of repair, an adaptation before the building is demolished and redeveloped.

2.10 Definition of Preventive Maintenance.

Preventive maintenance, according to Tomlinson (1998), facility inspection and testing is to avoid premature facility failures, and lubrication, cleaning, adjusting and minor part replacement to extend facility life.

Maintenance includes test measurements adjustment and parts replacement, performed specifically to prevent faults from occurring.

The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment; this may be by preventing the failure before it actually occurs which planned maintenance and condition base maintenance help to achieved.

It is design to prevent and restore equipment reliability by replacing worn components before they actually fail, preventive maintenance activities include partial or complete over hauls at specified period, oil change, lubrication and so on.

In addition, workers can record equipment deterioration so they will know to replace or repair worn parts before they cause system failure.

The ideal preventive maintenance program would prevent all equipment failure before it occur, it include the evaluation of particles in suspension in a lubricant sound in situation analysis of a machine e.g. An individual bought an incandescent light bulb, the manufacturing company mentioned that the life span of the bulb is 3 years. Just before the 3 years, the individual decided to replace the bulb with new one.

This is called preventive maintenance; On the other hand, the individual has the opportunity to observe the bulb operation daily.

After two years the bulb starts flickering, the individual predicts at that time that the bulb is going to fail very soon and decide to change it for a new one, this is called predictive maintenance.

The individual ignores the flickering bulb and only goes out to buy another replacement light bulb when the correct one fails. This is called corrective maintenance.

2.11 Philosophy of Preventive Maintenance.

Rondo, (1996) at the outset of preventive maintenance Programme inspection will identify many needed emergency repair because a special effort is being made to find problems before equipment fails.

If the emergency repairs are made properly, their volume will soon diminish, then, as inspection continues, the nature of the deficiencies will gradually change, there will now be more unscheduled repairs and fewer or larger job, which could be both planned and scheduled repair.

Many such jobs will meet the criteria for being preventive maintenance; inspection will be dependent on consistent inspection testing together with the establishment of an effective planning staff.

2.12 Purpose of Preventive Maintenance.

According to Ching, (2001) preventive maintenance has the following objectives;

1. **Reduction of Emergency Repairs;** equipment inspection and testing ensure that maintenance staff is aware of equipment condition and can act to prevent premature failure, by uncovering problems early emergencies are averted and more deliberate repairs can be conducted.
2. **Reduction of Unscheduled Repairs;** the incidence of unscheduled repairs reduced, timely preventive maintenance inspections identifies problems sooner while they are correctable as adjustment or minor component replacement.

3. **More Plan Schedule Work;** successful preventive maintenance inspections yield more lead-time for planned; as a result more work can be planned.
4. **Better Manpower Utilization;** as result more planned work productivity on the job is increased because the work was better organized beforehand.
5. **Reduction in Repair Cost;** emergencies and unscheduled repairs deplaned with more planned work, because work was organized in advance, labor used is more productive and less labor required, therefore labor cost reduced.
6. **Reduced Downtime Cost;** Downtime is three time the cost of performing the maintenance work that could have been avoided, effective planning and scheduling the job can realize for about 6% reduction in elapsed downtime, the ability to plan derives from preventive maintenance.
7. **Prevention of Assets;** well care for equipment, buildings and facilities last longer.

2.13 Scope of Work and Specifications

According to Rondo (1996), whenever you enter into an agreement for maintenance and repair work services whether it is a building employee performing work that goes beyond his or her normal duties, or with a side contractor, it is every important you develop a clear and complete scope of work, and in some cases detail specifications for the project.

A scope of work is a description of the work for which the contractor is being hired, including the materials to be used, guarantee, and permit other relevant information, specification leaves nothing up to the discretion of the contractor, and whiles it is not always necessary to develop a specification.

A full specification is recommended for complex and costly work where precise instructions are require assure that the job is done properly, your tenant association to propane the scope of work and specifications.

2.13.1 Hire outside contractors:

Before hiring any outside contractor the maintenance and repair committee should first refer to article xi of the association's by-laws specific guidelines to use when finding, selecting and hiring contractors.

The committee can then begin to solicit bids for work. For simple, inexpensive jobs, contractors' bids may be solicited through telephone conversations. A committee member can simply call several contractors describe the job that needs to be done ask for the following information:

- The contractors price for the job
- A general schedule for completing the job, with starting and ending dates.
- Understanding of who will be responsible for obtaining any permit required to do the work in question.
- Evidence that the contractor has the necessary license and insurance to do the work.
- Schedule for payment.

To solicit written bids, a member of the maintenance and repair committee should call several qualified contractors and ask them to visit the building to review the project.

After they have carefully inspected the work to be done, they should submit a bid in written to the association, written bid should include all of the information above, as well as a list of the names, addresses and phone numbers of references, a specific "scope of work" and possibly a " specification" for the job.

2.13.2 Project biding guidelines

In order to comply with the by- laws and to protect yourselves, the following guidelines should be used by committees and officers when soliciting contractors to do work in their building.

2.13.3 Job costing under $500

- The committee should get telephone bids from at least two different contractors,
- TIL by-laws allow the maintenance and repair committee to authorize repairs,
- Before work begins the contractor should provide the committee with a satisfactory scope of work,
- At least two references must be called for each contractor whose bid is being considered
- A satisfactory scope of work must be submitted with each bid specification may be required if the work to be performed complicated or costly.
- TIL by- laws empower the maintenance and repair work committee to bids and interview contractors, but they must submit they recommendation to the association's officers for final authorization.

2.13.4 Jobs costing more than $ 2000

- A minimum of three written bids each including at least a detailed scope of work, must be obtained.
- At least two references shall be called for each contract whose bid is being considered.
- A written "specification" may be required for complications or costly jobs.
- TIL by-laws allow the maintenance and repair committee to solicit bid and interview contractors, but they must submit their recommendations to the officers for final recommendation to the officers for final authorization.
- Before hiring any contractor, jobs costing more than $2000 must be approved by a majority of the tenants at a general meeting.

- After selecting a contractor to do a job, the officers and committee should prepare and sign a formal contract. A contract is a written agreement between your association and the contractor that protects your association from misunderstanding about the work schedule price.

Every job should have at least a simple contract; the contract should include the following;

- A scope of work.
- Specification if needed. A schedule for the job including start and completing dates.
- A payment schedule, with a "hold back" provision enabling you to withhold part of the contract's payment (usually 10% of the total fee) until after the job has been satisfactory completed.
- A detail breakdown of cost showing both materials and labor costs.
- An inventory and description of the material to be used, their cost, and stimulation as to who will take possession any leftover materials.
- The number of people the contractor expects to have working on the job.
- Evidence that all necessary permits have been obtained.
- On complications jobs, provision for cost overruns, time delays, and changes (called charge orders) should be written in to the contract issues cover should include whose in the association authorized to approve charges, and the contractor must notify the association of a proposed charge.

2.14 Process of Investigation

According to chow, (1996) investigation is necessary for the life of every building having established the purpose and extends of the investigation and agreed on a basis for

professional fees, a plan of action had to be drawn up to make sure that the investigation process can progress without unnecessary inconvenience to the occupants of the building; this normally entails several steps such as preliminaries visual inspection.

Site investigation as the term implies, is the preliminary for new construction work carried out to establish the suitability of a proposed site for new construction works, to enable adequate and economic design to be prepared for the foundations and to attempt to foresee and provide against difficulties that may arise during construction due to ground or other local conditions it involves on investigation of:

- The topography of the site.
- The state of buildings on and adjoining the site.
- The location of buried services.
- Previous history and use of the site, including information about defects attributable to foundation condition.
- The likely-hood of earth quakes, flooding seasonal ground movement and soil erosion.
- Underground mining activities (proposed, present, past).
- The availability and quality of local materials and labor.
- Information relating to tides, river levels and the velocity and direction of water flow (for river and waste works only).
- The general geology of the area, with particular reference to the major geological formations underlying the site.
- The soil and rock strata together with ground water conditions.
- Soil and rock samples in respect of their strength and chemical composition as they might affect the foundation design.

Also the methods of investigation of soil samples are as follows:

a. **Trial Pit &Auger Hole:** trial Holes, these allow a visual inspection of the strata and the taking of hand –out soil samples which have a minimum disturbance factor thereby enabling more accurate laboratory test results to be obtained.

   They are also more economical for shallow depths of 2mto 2.5m below ground level and enable in-situ load testing to be performed, it is excavated by hand or by mechanical excavator or auger.

b. **Shallow Bore Holes:** these are carried out using an auger suitable for depths of up to 7m in soft to firm soil which will stand unsupported.

c. **Deep Bore Holes:** these are carried out using either mechanical auger or a shell percussion bore and are used for depths of up to 30m,the shell boring tool consist of a cylindrical steel which is dropped in to the soil, causing soil to be forced into the cylinder which then withdrawn for removal of the soil.

d. **Percussion Boring:** is the oldest form of boring and consist of breaking up the soil formation by repeated blows a chisel or bits, friction and heart are reduced by introduction of water into the holes as the work proceeds. At intervals the broken materials is removed from the hole by a shell auger or by flushing using pressurized water jets, samples of soil obtain by this method are not very reliable, due to their extremely disturbed nature.

2.15 Understand the Need For The Control Of Building Activities By A Central Body Or Government Sponsored Body.

Desirability of Plant Controls.

According to Dictionary of Military and Associate terms, U. S Department of Defense (2005), any situation where progress is to be made, some forms of plan must be laid down

for others to follow at the end of an allotted time, be it day, week or year, the check of the estimated target against the actual performance achieved will indicate the measure of control.

2.15.1 Resources for Preventive maintenance checklist.

Roof:

- Clean drains keep them clear.
- Replace and repair loose or missing coping stones.
- Check for cracks blisters in the roofing, and repair as needed.
- Sweep off any standing water after rains.

Windows and doors:

- Keep all wooden parts freshly painted.
- Check putty and replaces needed.
- Lubricate all hinges and lock mechanisms frequently, especially in wet or cold weather.
- Check larches and locks, and repair and replace immediately.

Plumbing:

- Repair leaky faucets as they are reported.
- Check for plumbing leaks and repair immediately.
- Clean out sink traps and building traps (in basement) if draining is slow.

Electricals:

- Check operations of appliances and lighting.
- Inspect tenants wiring periodically and eliminate any fire hazards.
- Make sure there is easy access to meter and switches.

- If your building has fuses rather than circuit breakers, replace fuses as needed and keep a good supply available.
- Make sure that correct amperage fuses are being used.
- Keep meters clean as well – lit.
- Make sure that cables and conduits are firmly attached to walls or beams, and that nothing is hanging from them.

Exterior Walls:

Maintain gutters and down spouts to keep water off exterior walls.

- Check condition of mortar between bricks, repair as needed.

  Check condition of caulking and weather seal around windows, doors and skylights, repairs as needed.

Heating:

- Check fuel and water level of boiler daily.
- Keep boiler room neat and clean.
- "Blow-down" the water in the boiler once a week.
- Clean or replaced the boiler oil filter once a month or whenever you get a fuel delivery during the hearing season.
- Drain the heating riser annually (just prior to the heating season begins).
- Have the thermostat (heat timer) recalibrated annually.
- Check the low water shut-off valve for proper operation security and fire safety.
- Replace burn-out bulbs immediately.
- Check smoke detectors and replace batteries annually.

- Check to see that all valves an meters are marked for easy identification in an - emergency and keep all keys handy for the same purpose.
- Know the locations of all "service shut-offs in our building's basement: heat, water, gas, electricity, etc.
- Check and maintain security of front real doors locks.
- Repair cracks in path and side walls.
- Schedule of Superintendent's responsibilities.

Regular Cleaning:

Clean the side walls, mop the entrance and vestibule daily, sweep the stairs and halls daily.

Keep The Basement Clean:

Do not permit rubbish, garbage, furniture or debris to accumulate, keep the basement locked at all times.

Garbage Collection:

Instruct tenants to put garbage in proper bags cans, keep cans covered and bags closed, move cans or bags to street on pick –up days. Refer problems to the TA Officers.

Inspect All Lights:

Ensure that light are turn on and off at proper times, immediately replaced, burnt out bulbs in public areas and basements.

2.16 Organization of Maintenance Department.

The maintenance department in an organization is managed by a maintenance manager. The maintenance manager is responsible for the planning and control of maintenance operations. In a small firm, the functions may be undertaken by a member of staff in addition to his other duties, while in a larger firm there will be a separate group of people solely responsible for maintenance.

2.17 The functions of the maintenance department.

As cited in Afrani and Osei (2005), the maintenance department among other things performs the following basic functions.

1. **Advisory function:** this involves liaison with occupants users and consultation with upper management on such matters as;

- The standards to be maintained and the effect on user activities of deviations from these standards.
- The relative merit of the alternatives maintenance policies and extend to which it would be advantageous to employ operatives directly for executing the work.
- Clarification of constraints in relation to limits of expenditure, desirable cash flow patterns, and acceptable delay times restrictions on time and method of carrying out work.
- Estimate of maintenance expenditure both long and short term, including where appropriate, the cost of initially bringing up to the required standard and the possibility of phasing any such back log over a period of years.
- Provision of cost and other data to assist upper management in deciding whether to repair or renew.

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- Advise on the maintenance implications of designs for proposed new buildings.

2. **Organizational functions:** this may be in relation to the central administrative and supervisory system or to the execution system whether by direct labor or contract.
3. **Control functions:** the control functions are dependent on the timely receipt of accurate information relating to the state of the system.

The control functions operate in the following areas;

- **Work input:** Identifying the extend of work necessary to achieve the required standard within the constraints laid down, the processes involve would include planned inspection, appraisal of user request and assignment of priorities.
- **Time of execution:** Programming the work load so that the carrying out of the work is timed with the accordance of the user and the available labor force.
- **Quality:** Supervision of work during execution and by subsequent control inspections to detect latent defects.
- **Cost:** Budgetary control system including estimating resource requirements in cost performance terms for later comparison with actual cost and performance achieved.
- **Feedback:** This is an inherent of all the control functions involves keeping such records as the necessary for the proper control of the operations.

4. **Miscellaneous functions:** the maintenance organization may have responsibility for other matters such as: safety and security, principally in relation to compliance with statutory fire precautions and the maintenance of fire fighting equipment, refused disposal, cleaning, grounds etc.

2.18 Reasons Why Maintenance Is Important.

According to PPS5 Planning for historic Environment Practice Guide (2008), the importance of preventive maintenance cannot be over – emphasized, there are many reasons for maintaining your place of work, which may be summarized as follows:

1. **Preserving our heritage.**

Preventive maintenance keeps up a buildings appearance and extends its life. It also prevent the loss of original fabric, as less material is lost in regular, minimal and small scale work then extensive restoration projects.

2. **Preventing large repair bills.**

Preventive maintenance make economic sense as it may reduce or potentially eliminate the need for, and the extend of major repair projects. Repairs can be disruptive and costly in terms of fabric and finances, so extending the period between repair campaigns by carrying out maintenance places less of a burden on community resources. A small but regular investment in task such the routine cleaning of gutters and drains can be much cheaper and less inconvenient than having to cope with a serious outbreak of dry rot timber roof trusses following years neglect.

"Good conservation of heritage is founded on appropriate routine management and maintenance, such as approach will minimized the need for larger repair or other interventions and will usually represent the most economical of sustaining an asset." (PPS5 Planning for the Historic Environment: Practice Guide) (1985)

3. **Preserving resources.**

Preventive maintenance is an inherently sustainable activity, all buildings contain embodied energy (the amount of energy that was required to extract the material and construct the building). If we allow old buildings to deteriorate all this energy will go to

waste. It therefore better to keep our existing buildings in used and in a good state of repair, this will reduce our need for new materials, which in turn reduce processing and transport requirements as well as reducing waste and energy use. It may also reduce the demand for new Greenfield development.

4. Promoting guidance ship.

Preventive maintenance ensures that our places of work will be in fit state to be handed over to future generations; many people believed that historic buildings enrich our quality of life. They help to preserve our sense identity and character to the places we live in, they might even be said to form physical and tangible link between our generation and those of the past, providing a sense of continuity. We are only guidance of our historic buildings and if we want to be able to hand them over to future generations to enjoy we need to make sure that we look after their fabric. The easiest and most cost–effective to do this to implement an active maintenance regime, "it is for all these buildings, therefore, of all times and style, that we plead, and call upon those who have to deal with them, to put protection in the place of restoration, to stave of decay by daily care, to prop a perilous wall or mend leaky roof … thus, and thus only can we protect our ancient buildings, and hand them down instructive and venerable those that come after us." (Morris, Manifesto, 1877)

5. Providing employment.

Preventive maintenance can provide opportunities for employment as some maintenance task such as cleaning high-level gutters may require specially trained personnel and specialist equipment. The cyclical nature of maintenance is therefore a steady source of all year round work (SPAB, 2010).

2.18.1 Causes of Maintenance Problems in Public Buildings

Government since independence have put up buildings for use by public institutions some of these properties even date to the colonial administration, public institutions are therefore expected to have natural tendency to preserve, protect and maintain these properties. This is however not the case as revealed by this study. Respondents listed five factors as having combined to create the maintenance problems of public institutions:

1. The age of the buildings.
2. Lack of maintenance culture.
3. Inadequate funds and high maintenance cost.
4. Pressure on building facilities by number of user and
5. Poor construction work and maintenance work done by maintenance personnel of the institutions.

- **Age of buildings.**

From the survey 22.2 percent of buildings of schools are below 30 years, all the other house types of tenement and single unit are over 50 years.

Houses deteriorate with age, since the lifespan of most buildings are constructed to last at least (60) years, but may exceed this period if the building is well maintained over time. Above 60 years most houses exhibit serious maintenance problems which demand at least major renovation, rehabilitation, replacement or repair. The present state of the buildings surveyed has been attributed to the age of the buildings since they are over 50 years

- **Lack of Maintenance Culture.**

Respondents pointed out that the institutions after having acquired these property, authorities or management do not show much eagerness toward the maintenance of

them. According to them, estate and maintenance managers do not undertake regular inspections of the buildings to ascertain its condition neither do they undertake routine and periodic maintenance on the buildings.

- **Inadequate funds and high maintenance cost.**

Personnel occupying public buildings have contributed to the deterioration of the buildings citing lack or inadequate funds and high maintenance cost resulting from high cost of building materials as the main reason. Discussion with respondents in single-unit houses were poor and has resulted in deterioration of facilities and elements of the buildings reveal that poor conditions of service in terms of low salaries is the major cause of the inability to play their role in the maintenance of the buildings. There are people living in poorly maintained buildings with respect to bungalows and tenement whose income defies this logic. In addition to low remuneration, the survey also reveal that occupants inability to maintain their buildings is being attributed to high cost of maintenance in respect of cost of materials such as cement , wood, paint, nails, etc and labor. As a result of this, respondent felt reluctant to sacrifice in spending towards the proper maintenance of their buildings which at the end of the day creates a lot of problems for the occupants in terms of their comfort and safety. Moreover, what is less considered is that maintenance problems become more expensive when not attended to in time.

- **Pressure on building facilities by number of users.**

The number of people occupying or living in a house is also seen to have a bearing on the maintenance conditions. Generally, the higher the number of people in a house, the more there is pressure on the use of the facilities which are in common use such as water, bathroom, toilet, and kitchen facilities. From the survey, it came out that maintenance seems to suffer especially with single unit houses where the facilities are shared between

two housing units. In some cases the larger number of occupants living in this house type breeds apathy and competition which all go to affect maintenance practice.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter presents the methods used in collecting data, which involved the research design, population , sampling techniques and sampling size, it also involved data collection techniques like; questionnaire, interview and observation.

3.2 The Research Design

The researcher adopted a case study approach for this research work, to investigate the conditions of maintenance as applied in public institutions in Ghana. The reason is to bring to fore the economic values of maintenance for future references and also serve as an eye opener to stakeholders.

3.3 The population

The area of the study is the Sagnarigu District of the Northern Region of Ghana, the population of the study consists of five head teachers, twenty –one teachers, sixty-four students, five contractors, and five policymakers.

3.4 Sampling techniques and sample size

Because the population is quite large, the researcher used random sampling method, the method involves selecting at random from a list of the population the require number of people for the sample. The researcher then, selected subset of the population observed and collected data used the observation to make inferences about the entire population.

As a result, hundred people were randomly selected from the circuit which includes; five head teachers, twenty-one teachers, sixty –four students, five contractors, and five

policymakers were also randomly selected to be part of the sample. The sample size sis selected from the group mentioned in the population (head teachers, teachers, students, contractors and policymakers).Therefore, the researcher ensured that the views of each group were represented in the study.

3.5 Data collection techniques

The techniques used in the data collection of this research work involved questionnaire, interview, and observations.

3.5.1 Questionnaire:

Five set of questions were developed for the study, one set of the questionnaires for each of the five categories of respondents (head teachers, teachers, contractors, students and policymakers).

The issues involved in the questionnaire among others were related to the deteriorating rate, age of the building and the seriousness of the maintenance problem, lack of maintenance culture on the part of institutions and occupants, and also the problem of over-centralization of decision and enforcement of maintenance policies by managers and stakeholders.

3.5.2 Interview

Those interviewed were: head teachers, teacher, students, contractors and policymakers. The issues involved in the interview were related to the obstacles to maintenance of public institutions, funding of maintenance projects, and the pressure on building facilities by number of users, effective maintenance policies, and also laws and

regulations to compel managers to undertake maintenance, development of multiple-levels of educational strategies to address the problems of maintenance.

3.5.3 Observation:

The researcher observed critically the buildings of Bagabaga Demonstration J. H. S, Ghana Education Service and Buildings of Policymakers.

❖ **Observation at BDJHS Tamale**

At the BDJHS in Tamale the researcher observed the following:

- The conditions of the foundation in terms of depth and level of exposure due to erosion.
- The conditions of the roofs in relation to the strength of wooden members and materials used.
- The conditions of the floors in terms of development of cracks and deflection, exhibiting dust due to construction malpractice.
- The conditions of the walls in relation to development of cracks, and peeled- offs due to malpractice.
- The conditions of the paintings in terms of brands of paints used and their lifespan due to the faded coats of the surfaces as well as peeled- offs.
- The conditions of the windows and doors in relation to its strengths and seasonal rate as well as coated surfaces of the members.

❖ **Observation at G. E. S Tamale**

At Ghana education service the researcher observed the following;

- The conditions of the foundations in relation to depth and exposed of reinforcements.

- The conditions of roofs in terms of leakages of ceilings and defects of the construction methods used.
- The conditions of the floors in relation to development of cracks and peeled- offs due to deflection.
- The conditions of the walls in terms of its rendering and plastering.
- The conditions of windows and doors in relation to the defect of the members and the nature of the coated surfaces.
- The conditions of the paintings in relation to cracks and peeled- offs due to construction malpractice.

❖ **Observation of Buildings of Policy makers at Tamale**

At buildings of policymakers the researcher observed the following;

- The conditions of the foundations in relation to depth exposure due to erosion and construction malpractice.
- The conditions of the roofs in relation to leakages, rotten members due to penetration of water.
- The conditions of floors in terms of development of cracks and peeled-offs.
- The conditions of paintings in relation to the quality of the coated surfaces, durability due to the faded surfaces.
- The conditions of the windows and doors in relation to moisture penetration rate, strength of the members and warping.
- The conditions of walls in relation to durability, the rate of peeled-offs and cracks due to building settlement.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter discusses the results obtained from questionnaires, interview, and observations, table 4.1 shows the category of respondents (teachers, students, policymakers, and contractors), a total of forty- one (41) respondents were used, ten (10) were students, five (5) policy makers, five (5) contractors and twenty- one (21) were teachers, below are details of the respondents and responses on the low level of maintenance.

Table4.1 shows the total agreement that; there is the need to improve on the level of maintenance of the buildings in Ghana.

		Responses					
Respondents	No	Frequency	%	Frequency	%	Frequency	%
Policy Makers	5	4	9.75	1	2.44	0	0
Contractors	5	5	12.19	0	0	0	0
Teachers	21	20	48.78	1	2.44	0	0
Students	10	6	14.63	4	9.74	0	0
Total	41	35	85.35	6	14.62	0	0

Sources: Author's Field Survey, May 2015

4.2 Results and discussion of questionnaire from BDJHS at Tamale

4.2 .1 Results of questionnaires from students of BDJHS Tamale.

The results of the questionnaires were obtained from students, out of ten (10) students, eight (8) agreed that, there are low level of maintenance on our school buildings, two were not sure of the assertion of the level of maintenance of the buildings. Some of the issues discovered among others were that; there has been complains from students number of times about the condition of the school buildings, but yielded no results, parent teacher association (P.T.A) convened meeting and estimated for the buildings to be maintained, change of leadership halted the process which even resulted into misunderstanding between a member and the P.T.A chairman over moneys paid. The school environment is not comfortable for academic work; reptiles and other insect's parade through the classrooms coursing drops of particles of dust, unfriendly odour and noise distracting academic work. The structural defects also causes embarrassment when their colleagues visit the school, the school have gained recognition in terms of academic performance and other achievements, but now things are almost getting out of hand because of the nature of the buildings, which indicate that the buildings need urgent attention.

4.2.2 Results of questionnaires from Teachers of BDJHS Tamale.

Out of twenty-one (21) teachers, nineteen (19) agreed that, there are low levels of maintenance on our school buildings, two (2) teachers were not sure on the assertion**.** Looking at the deteriorating and deplorable rate of the buildings, through the views of respondents it was realized that the buildings were not properly built and under poor supervision, inadequate batching of materials affecting the strength of the buildings, which resulted into that stage and also the attitudinal behavior of "it is not mine or family

property" and not caring for the investments that have gone into the buildings. Recommendations have been made by institutions or group of persons about the low level of maintenance in the country, according to respondents.

The issues involved in the questionnaires among others were related to the deteriorating rate, the problem of ageing of the buildings, the buildings of public institutions deteriorate with age, buildings between the age of fifty and sixty years and above exhibiting serious maintenance problems and requiring replacement of some building elements or at least rehabilitation. The seriousness of the maintenance problems, lack of maintenance culture on the part of the institutions and occupants, resulting in deferred maintenance of buildings of public institutions. From the research discussions the problem of over-centralization of maintenance decision; building maintenance decisions are always taken at the management level at the headquarters and the regional offices of the institutions surveyed. Reinforcement of maintenance policies by government, managers and stakeholders and failure of which sanction can be applied, the lack of maintenance culture, inadequate funds and also high maintenance cost, pressure on building facilities by users, poor construction work and ineffective work of some maintenance personnel of the institutions indicates that the buildings need attention.

4.2.3 Results of questionnaires from Contractors.

Five (5) contractors were also administer with questionnaires; the entire contractors agreed that, the rate of maintenance of buildings are actually very low in this country, Ghana, therefore rating the number of contractors to be hundred percent, (100%) all agreed making it hundred (100%).

If the meaning of building maintenance is actually known to be intended to retain an item in, or restored it to a state in which it can perform its required function, to retain implies

that the defects are prevented from developing by carrying out work in anticipation of failure. The types of maintenance which can be grouped into two categories that is planned and unplanned maintenance, the importance of maintenance which is basically to retain the value of investment, maintaining the buildings in a condition in which it will continue to perform it function, presenting a good appearance, buildings would not have deteriorate to the extent of which we see in our country. Also when maintenance is recommended to restore the buildings, and save the investments that we put into the buildings the country will be much advance than we see today. There is also negligence, political instability, and lack of maintenance budget to draw funds for maintenance activities. There is the need to set up a National Maintenance Funds similar to that of the road fund to mobilized adequate funds to meet maintenance needs of institutions, some of the issues among others was that;

- Personnel occupying public buildings contribute to the deterioration of the buildings citing lack or inadequate funds and high maintenance cost resulting from high cost of building materials as the main reason, the relative merit of alternative maintenance policies and the extent to which it would be advantageous to employ operatives directly or indirectly for executing the work must be adhered.
- There is also classification of any constraints of the buildings in relation to the limit of expenditure, desirable cash flow patterns of maintenance work and acceptable delay times, restrictions on time and method of carrying out maintenance work.
- Also estimate of maintenance work expenditure both long and short term, including appropriate cost of initially bringing up the required standard and the possibility of phasing any such backlog over a period of years delay work progress.

4.2.4 Results of questionnaire from Policymakers.

Five policy makers were also assessed, three (3) from ministry of works and housing, two (2) from Ghana education service when assessed agreed that, the level of maintenance in this country is really low.it also shows that, the policy makers are aware of the state of deterioration of the buildings, defectiveness of wooden elements of buildings, shoddy works and porosity of materials being used and moisture penetration rates of the building facilities, if the people in control of affairs in this country are aware of this problems, then why can`t they solve this problem?

Also the construction agenda, development of the construction industry Singapore (1990), made a thorough research into the life expectancy span of selected materials and their renewal cycles and suggested that no government can overlook the laid down principles and succeed as far as building maintenance is concerned. Some of the issues discussed among others were that;

- A skilful design can reduce the amount of maintenance and also make easier to carry out the work, major decisions at this state includes among other things, selection of materials form part of the construction, control of materials, strategic planning, and orientation of building and user requirements.
- The relative merit of alternative maintenance policies and the extent to which it would be advantageous to employ operatives' directly or indirectly for executing the work must be principal aimed.
- The construction stage is the most vulnerable to the occurrence of defects, it requires therefore, a high level of supervision to ensure good standard of materials, and workmanship as well as correct detailing and specification.
- Maintenance is needed throughout the entire period, the building may be used or occupied, the various facilities are kept to standard consistent with overall policy,

and feedback is also important to indicate success or otherwise of design, terms of facility user requirements and maintenance objectives.

Lastly, from chow`s statement, it explained that, the decision of our policy makers usually affect the level of maintenance on buildings in the country and that, its highly economical to strictly adhere to the principles of materials life renewal cycle to avoid them.

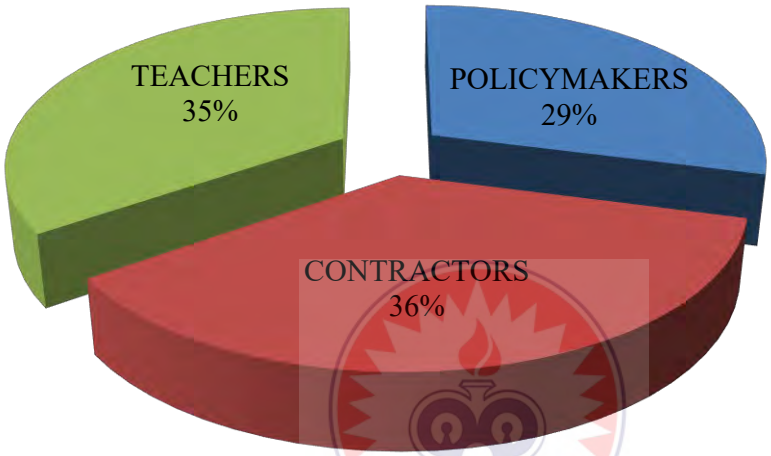

Figure 4.4 Assertion on low level of maintenance.

4.3 Results and discussion of interview at Tamale.

4.3.1 Results of interview from Contractors.

When the contractors were interviewed, out of five (5), two agreed to the statement of assertion representing forty percent (40%), two (2) disagreed representing forty percent (40%) one (1) not sure representing twenty percent (20%). According to the contractors, maintenance is extra cost incurring as viewed by some of the contractors, the profit margin is less compared to the forms of contracts, the responses of the contractors' through the interview shows that, the builder or the contractors do not know the benefit of good buildings and good environment.

Even though table 4.2 show a greater percentage of the respondents, who agreed to the assertion threatened, it is therefore highly economical to strictly adhere to the principles of maintenance and renewed cycle of buildings than to neglect them, also the policy makers should be barest with information and make it possible for maintenance to be conducted on buildings, especially state buildings.

Due to the fact that the respondents do not really see to the need for maintenance work, stakeholders and contractors only adhere to the used of materials, to them it has the exact aesthetic beauty they want without considering the durability and life span of that material. This high level of ignorance on the part of contractors, a contractor change all the wooden blades of the institutions to glass louvers, which were destroyed by rain within sixteen (16) months of replacing them, the ceilings were change from slate to plywood not properly seasoned allowing termites to destroy the ceiling within eighteen (18) months of replacing them.

If the contractors who construct most of our structures in this country show such ignorance, then there is the need for more education in the building industry, this support Reginald (1996), state that, building environment expresses in physical form the complex social and economic factors, which give structure life to a community.

Some of the issues among others were that;

- Lack of funds and political instability, and the decision being taken by the political leaders in this country are not helpful, typical example is the refusal or abandoning of government projects by another government when in office.
- The role of maintenance in the building process state that the performance of any building can be affected by the decision taken and action performed at any stage of a building project from its initial conception to its final demolition.

- The provision of estimate of cost and other data to assist upper management in deciding whether to repair or renew buildings or facilities is very important, the information will clearly specify the details of a particular building and the decision to either repair or renew then be made.
- The technical requirement for minor works involving alteration or small additions to the building, although not strictly maintenance, it is usually for the maintenance organization to assume full responsibility for this type of work.
- The inherent features of all the control functions involve in keeping records of buildings as much as necessary for proper control of operations of building maintenance.

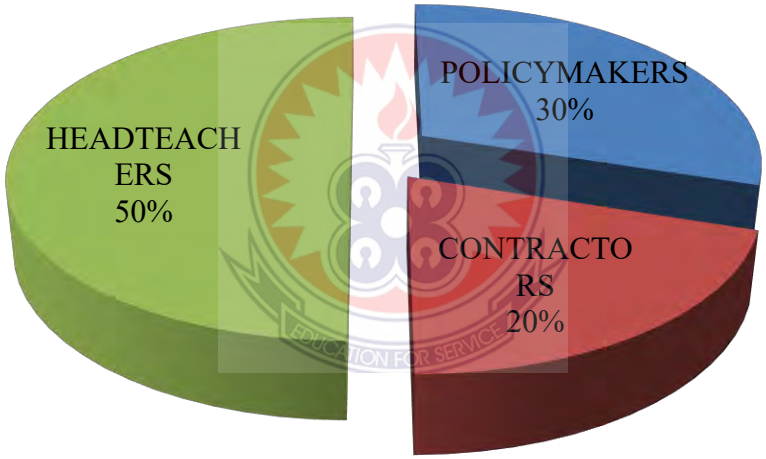

Figure 4.5: Assertion on investigation of building before maintenance.

4.3.2 Results of interview from Head teachers.

When the head teachers were interviewed, they also agreed to the statement that, good school building with serene environment have great influence on academic performance they added that, in 1995out of two hundred and fifty (250) candidates presented for the junior high certificate examination only one hundred and eighty (180) had good passes.

But when the classroom and environment was improved, their results changed and that in 1997 the school had hundred percent (100%) in the junior high certificate examination, the statement is in accordance to (Reginald, 1996). Wrote that, there could be a little daunts that dilapidated and unhealthy building in a decaying environment depress the quality of life and contribute in some measures of anti-social behavior, the issues involved in the interview among others were that;

- Servicing is essentially a clearing operation undertaken at regular interval varying frequency is sometimes termed day-to-day maintenance. Daily sweeping of floors, monthly washing and cleaning of windows and regular painting for decoration and protection over four years are examples of servicing.
- Rectification is also helpful when it occur fairly in the life of a building, but it can also occur sometime within the life span of the building, it arises from shortcomings in design, inherent fault in or unsuitability of components, damage of goods in transit or installation incorrect assembly.
- Replacement occurs too at all cost 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 materials or elements as deterioration of the appearance.
- The organization must have responsibility for other matters such as; safety and security, principally in relation to compliance with statutory fire precautions and the maintenance of fire equipment, refuse disposal, cleaning grounds etc.

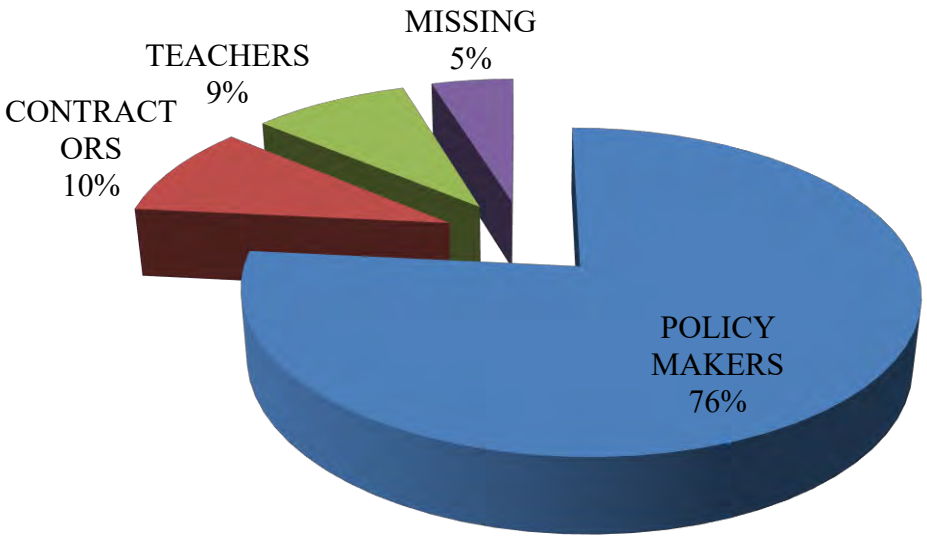

Figure 4.6: Assertion on good school building with serene environment.

4.3.3 Results of interview from Policymakers.

All the five policy makers, three (3) from Ministry of works and housing, two from Ghana education Service when interviewed agreed that, the level of maintenance in this country is really low.

Table 4.1 shows the total agreement that, there is the need to improve on the level of maintenance of building in Ghana, it is also that, the policy makers are aware of the problems happening to the facilities, if the people in the control of affairs in this country are aware of this problem, then why can't they solve this problem.

Some of the issues involved in the interview among others were that;

- Occupants of government buildings should also shed off their apathy in terms of ownership and maintenance of such property and exhibit high sense of patriotism. This can be done through public education and sensitization and strict application of sanctions such, exchanging occupants with cost of damage caused as well as eviction from the premises.

- There is the need for government to set up a maintenance budget from which all maintenance activities will be drawn. There is the need to set up a National Maintenance fund to mobilized adequate funds to meet maintenance needs of public institutions.
- There is also the need for the view of the current paid by tenant of public buildings to reflect current economic trends and to generate enough funds to undertake maintenance work.
- There is the need for regular maintenance of public buildings put up to protect the huge investment put into it. The investment of materials, human resources, time and labor to enforce the maintenance processes for effective work to be done.

4.4 Results and discussion of Observation at Tamale.

4.4.1 Results of Observation at BDJHS Tamale.

The observation made by the researcher shows that, Bagabaga Demonstration School has large crack walls and floors which paved way for reptiles to parade the classroom, day and night which put the safety of students at very high risk. Leakage in the roofs of classroom, this picture is exactly what Reginald is referring to?

The institution surveyed had the full complement of the following public facilities services: toilet, water, electricity, and bath. The public buildings however, have their toilet, water, and bathroom separated from the main buildings. In addition each of these public facilities and services are shared by Bagabaga Demonstration J.H.S, Ghana Education Service and Policymakers. Pipe is the main source of water supply to the School, G.E.S and Policymakers also the toilet facility use was water closet and KVIP.

Figure 4. 1 Floor cracks at BDJHS Tamale.

Table 4.2below shows details of the facilities and services in the institution, the result of the survey of the state of the facilities the institution are as follows;

Table 4.2 State /Condition of Public Facilities and Services by the institutions

Institution	Water							
	Good		Fairly Good		Bad		Total	
	No	%	No	%	No	%	No	%
BDJHS	58	42.6	58	42.6	20	14.7	136	100
G. E. S	0	0	2	7.7	24	92.3	26	100
Policymakers	58	42.6	60	50.3	44	10.7	16.2	100
Total	116	85.2	120	100.6	88	117.7	178.2	100

Source: Author's Field Survey, May 2015.

4.4.2 Condition of Facilities and Services

The institution surveyed had the full complement of the following facilities services: toilet, water, electricity and bathroom. The public buildings however, have their toilet, water and bath separated from the main buildings. In addition each of these facilities and services are shared by the public, pipe borne water is the main source of water supply and the toilet facility used was water closet and KVIP respectively.

Table 4.3: Details out the conditions of these facilities and services in the various institutions.

Bathroom								
BDJHS	62	45	42	30.9	32	24.5	136	100
G. E. S	8	30.8	14	53.8	4	15.4	26	100
Policymakers	7.0	7.5	5.6	8.4	3.6	3.9	162	100
Total	**77**	83.3	61.6	93.1	39.6	43.8	324	100
Toilet								
BDJHS	62	45.6	54	39.7	20	14.7	136	100
G. E. S	8	30.8	14	53.8	4	15.4	26	100
Policymakers	7.0	7.6	6.8	9.3	24	30	162	100
Total	77	84	74.8	102.8	48	60.1	324	100
Electricity								
BDJHS	16	11.8	90	66.2	30	22.1	136	100
G. E. S	2	7.7	22	84.6	2	7.7	26	100
Policymakers	18	19.5	11.2	150	32	29.8	162	100
Total	36	46.7	123.2	300.8	64	59.6	324	100

Source: Author's Field survey, May 2015.

The state of water, bathroom, toilet, and electricity shown by table 4. 4 depict that 35.2 percent, 39.8 percent of the water facility among the public institutions surveyed were in good, fairly good and bad condition respectively. This means that about 65 percent of the water facility of the school surveyed requires some form of maintenance.

In terms of institutions, there is the need for the entire water facility of the Policymakers to be maintained since none was in good condition.

4.4.3 Results of observation at G. E. S Tamale.

The situation is however better with G. E. S which had about 43 percent of the water facility in good condition, with about 57 percent in fairly good and bad condition, policymakers which had none of its surveyed buildings with its water facility in good condition, the situation is gloomy and needs some maintenance attention. The condition of the facility has been associated with the following problems according to the various institutions. The school has its water facility broken down and as such water has not flowed through the taps for the past 6 months, there is irregular flow of water and frequent breakdown of the taps especially with the public buildings where pressure on the facility is high due to the number of users.

For a house to become a home for man there is the need for a bathroom to be incorporated in the main design, this facility should have a smooth floor and wall to prevent water from seeping through into the foundation. It was essential to take a look at the state of the classrooms, public buildings and others. Therefore about 58 percent of the public buildings surveyed require some maintenance; however a look at the facility according to institutions revealed that 45.6 percent, 30.9 percent of buildings surveyed in the school have their classrooms in good, fairly good and bad condition respectively.

A look at the condition of the G. E. S facility according to house type indicated that 15.0 percent of the buildings, 12.5 percent, and 31.7 percent of the buildings have their facility in a bad condition. The major maintenance problems with the buildings are: presence of cracks on the floor and wall, peeling- off of the plastered walls, slippery floors and too many users particularly in the case of the policymakers.

Figure 4.2 Floor cracks at G. E. S. Tamale.

Figure 4.3 Floor cracks at G. E. S. Tamale.

The study revealed that the toilet facility used in G. E. S is the water closet and KVIP, from Table 4.4 about 45 percent of the toilet facility is in good condition, while 40 percent fairly good and 15 percent in bad condition respectively. The state of the toilet facility in the institution shows that about 54 percent of the facilities of the institution had their facility in fairly good and bad condition, the state of the condition of the toilet facility for the institutions emanates from the problem of leakages from the sewerage system, thus emitting very bad odour and cracks in the water closet due to the age of this facility and large number of users particularly with the public buildings. According to the teachers the water closet has been in existence for decades dating back to the 1960,s when the building was put up.

4.4.4 Results of observation at Sagnarigu District Tamale.

However, the situation with the policymakers show a relatively greater number of respondents' i.e. about 54 percent describing it as being in bad condition, electricity was available in all buildings surveyed. The electrical facilities in the buildings were also analyzed to establish the functionality of the entire wiring system of the building, the state of the fixtures (sockets, switches), fans/air-conditions in available and provided by the institution. Respondents complained of frequent power cuts due to the wiring system which had not been changed since the building was put up. The fans and fluorescent fittings are faulty, rusty and non- functioning.

The electricity facility was described as being in bad condition by about 12 percent of respondents, while about 69 percent and 19 percent responded that the facility was fairly good and bad respectively. However, 11.8 percent, 66.2 percent and 22.1percent of respondents from the institutions indicated that the electrical facility was good, fairly good and bad respectively.

The survey results in table 4.4 indicate that, about 70 percent, 75 percent and 89percent of all the buildings flats respectively surveyed had problems with their electricity facility and therefore needed urgent attention to protect the building and property of occupants.

Figure4. 4Electrical wires hanging on buildings at Tamale.

Figure 4.5 Electrical wires hanging on buildings at Tamale.

4.5 Condition of Building Elements

General:

Among all the building elements of the buildings surveyed paintings, walls, windows, and doors, the roof, the foundation and floor had the most maintenance problems whist the roof had the least of problems. About 90 percent of paintings, 78 percent of walls 61percent of windows and doors, 55 percent of foundation and 42 percent of all roofs had problems.

Foundation:

The institutions with the worst foundation problem was Bagabaga Demonstration School with approximately 40 percent of their foundation exposed , public buildings had the most foundation problem with 38.3 percent of the foundations exposed and hanging, posing health risks.

Figure 4. 1 Foundation exposed on buildings of policy makers at Tamale.

Figure 4. 2 Foundation exposed at BDJHS Tamale.

Figure 4.3 foundation exposed / hanging at G. E. S Tamale.

Roofs:

Leaking roof was most pronounced in buildings of policymakers with 42.9 percent of its building with roofs leaking, however, 17.6 percent of roofs of Bagabaga Demonstration School had the same problem.

In the buildings of G. E. S, suffer the most with 25 percent of the buildings having leaking roofs. Leaking roof has resulted in damage to building materials or furnishings; it is a prime source of microbial contamination that affects indoor air, posing health risks**.**

Figure 4. 1 Peeled – offs/cracks of roof at G. E. S Tamale.

Figure 4.2 leakages of roof at BDJHS Tamale.

Walls:

Cracking is the major problem affecting walls with 42 percent of buildings of public institutions having developed cracks. Peel- offs and partly broken down walls are the other problems affecting 21.6 percent and 14.8 percent of all buildings surveyed, Bagabaga Demonstration School had the least of wall problems with 48.5 percent of buildings developing cracks.

G. E. S and Policymakers had the worst wall problems with about 88 percent having problems with the wall (46.7 percent cracks, 31.7 percent peel- offs and 10 percent partly broken down).

Figure 4.1 Broken down walls at G. E. S Tamale.

Figure 4.2 Broken down walls of buildings of policymakers at Tamale.

Windows and Doors:

The major problems with the wooden members of the buildings surveyed are that, they are either partly or completely broken down as a result of the wooden members being rotten due to penetration of water resulting from lack of coating and poorly treated wood. The problem of wooden members is most prominent in buildings of BDJHS, it has accounted for 69.2 percent of the buildings surveyed respectively.

In the institutions, the problem is most prominent in public buildings affecting 72.7 percent of all surveyed buildings. However the school buildings have the most

completely broken down windows and doors, policymakers have the worst windows and doors problems with about 88 percent having problems with (46.7 percent faded coats, 31.7 percent peel-s offs and 10 percent partly broken down).

Figure 4.1 Broken window of buildings of Policymakers at Tamale.

Figure 4.2 Broken door at G. E. S Tamale.

Paintings:

Painting protects walls as well as serving aesthetic purpose, but as high as 89.8percent of all buildings surveyed had problem with painting, the problem of painting is more pronounced in buildings of Bagabaga Demonstration School where 92.3 percent of all their buildings surveyed being dirty, faded, and no painting.

The problem of painting is least prominent in G. E. S and least in buildings of policymakers affecting 75 percent, 85 percent and 93.3 percent of the buildings surveyed respectively.

Figure 4. 2 Paintings dirty, faded /peeled-offs at Sagnarigu District Tamale.

Figure 4. 3 Paintings dirty, faded/peeled-offs at Sagnarigu District Tamale.

4.5.1General maintenance condition of buildings.

Haven assessed the maintenance condition of some facilities in the buildings as well as individual elements a good assessment of the buildings surveyed was carried out in order to establish an overall picture of the maintenance conditions of houses of public institutions in Tamale– (Sagnarigu District). The buildings were classified into good, fair and bad, houses were classified as being in good condition if:

Components are structurally sound with no defects (no cracks, peel-off, tilted, broken down, leakages etc.) and requires only general maintenance and major repairs; little or no defect maintenance exists, few building systems fail and they allow uninterrupted daily use of the facilities.

Those in fair condition had the following characteristics;

Components show signs of slight deterioration and require some corrective maintenance and major repairs: some deferred maintenance exists. Building systems fail occasionally, causing some interruption in daily use of the facilities.

Those in bad condition had the following characteristics;

Components show signs sever deterioration and require corrective maintenance and emergency repairs; deferred maintenance is extensive. Building systems fail frequently, causing ongoing interruption in daily use of facilities.

The survey results of the general maintenance condition of buildings by institutions are presented in table 4.4.

Table 4.4 General maintenance of buildings.

Institution	Good		Fair		Bad		Total	
	No	%	No	%	No	%	No	%
G. E. S	22	16.2	58	42.6	56	41.2	136	100
BDJHS	2	14.2	10	71.4	2	14.3	14	100
Policymakers	24	30.4	68	14.4	58	55.5	150	100
Total	48	60.8	136	128.4	116	121	300	100

Sources: Author's Field survey, May 2015.

The survey indicates that only 17 percent of all buildings of public institutions surveyed are in good condition and well maintenances. 45.5 percent are in fair condition while 37.5 percent are in bad state due to poor maintenance. This situation demands that those buildings in fair condition need to be maintained before they deteriorate into worse situation with time. Institutional wise G. E. S had a good maintenance practice compared to other institutions since only about 14 percent of its buildings were in bad condition.

Finally, the research findings show clearly that the policy makers and contractors are aware of the problems happening to the buildings in Ghana and as a result of that they intentionally act as if they are not aware just to avoid any attack, if this nation want to produce functional literate, the facilities at our training institutions should be improved upon and well maintained.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION

5.1 Introduction

This chapter highlights and discusses the summary of findings, conclusion, and recommendations of the study.

5.2 Summary of Findings.

The following are summary of the findings of the study;

- The study revealed that, the faded and dirty surfaces of the buildings were due to lack of preventive maintenance plan by public institutions for their buildings.
- The study also revealed that, occupants exhibit apathy toward maintaining their buildings holding the view that it is government property and that whatever the state is no business of their, hence the deterioration of the buildings.
- The study further revealed that, the channel of through which decision are brought to local levels are in most cases, too long resulting in delay of released of funds for maintenance.
- Estate and maintenance managers to develop a multiple – level of educational strategy to address the differing information needs of their various levels of employees in terms of maintenance of buildings. E.g. food poisoning resulting from falling paint particles.
- The study also revealed that, the channels through which decisions are brought to local levels are too long resulting in delay of released of funds for maintenance.
- The study also revealed that, some of the buildings deteriorate with age, materials, and usage.

5.3 Conclusion

The study has established that housing maintenance is a real problem among public institutions in Ghana.

Building maintenance problems are more pronounced in public buildings than single unit houses, this came about as a result of two main factors:

Pressure on public buildings are due to larger number of occupants and the preference to maintenance of bungalows and flats except in emergency situations, because the bungalows and the flats are occupied by senior and middle level management respectively, while that of the single units are occupied by the lower level personnel.

In addition, maintenance culture is relatively higher among occupants of bungalows and tenement buildings than single unit occupant, due to the differential in income level.

The most widespread maintenance problems according to the study are cracks in walls, faded painting, partly broken windows and doors, exposed foundation and leaking roofs.

The maintenance problems the study observed had been influenced by the age of the buildings, lack or absence of a national maintenance policy, inadequate funds and high cost of maintenance, low capacity of maintenance staff, apathy and lack of patriotism on the part of occupants, and pressure on buildings due to the number of users among others.

The study concluded by enumerating a number of recommendations aimed at addressing the problem of non- maintenance of public buildings in the country.

Finally, it enable Heads, contractors and policy makers to know the need for keeping buildings strong by applying the principles of preventive maintenance and also build a serene environment for academic activities.

5.4 Recommendations

The following are recommendations as a way of dealing with maintenance problems of public institutions in Ghana:

- There is the need for public institutions to embrace preventive maintenance practice as a high priority rather than ad hoc maintenance.
- To gain optimum benefits from preventive maintenance, building managers should incorporate preventive maintenance tasks into a work-order system and keep systematic maintenance records, either by computer or manually. Managers should evaluate the preventive maintenance program to improve it over time.
- Public institutions should ensure that their maintenance department is adequately staffed with the requisite manpower and that employees have appropriate training to competently and safely undertake and complete the maintenance tasks expected of them.
- Estate and maintenance managers should oversee periodic inspections of buildings' conditions and create an inventory of buildings components and equipment, to ensure effective maintenance schedule.
- There should be plan for building inspection, since proper planning of inspection is a sure way to reduce cost of maintenance in general.
- Estate and maintenance managers should develop a multiple- level educational strategy to address the differing information needs for their various levels of employees in terms of maintenance of buildings.
- Occupants of government buildings should also shed off their apathy in terms of ownership and maintenance of property and rather exhibit high sense of patriotism. This can be done through public education and sensitization and strict application of sanctions such as surcharging occupants with cost of damages cause as well as eviction from the premises.

- There is the need for government to set up maintenance budget from which all maintenance activities can be drawn, thereby setting up a national maintenance fund similar to that of the road fund to mobilized adequate funds to meet maintenance needs of public institutions.

Finally there is the need for government to put up more public buildings in view of the present national deficit in housing which stand at one million(http/www.ghanaweb.com).

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APPENDIX I

Fig 1 Broken Walls at Sagnarigu District Tamale.

Fig 2 Broken windows at Sagnarigu Tamale.

APPENDIX II

QUESTIONNAIRE FOR CONTRACTORS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondent…….

SECTION A

Questionnaire on buildings

1. What is the role of SHC/PWD in provision of buildings for institutions?

……

2. Government should make a policy on maintenance?

Yes ( ) No ( )

3. What building types do you put up for public institutions?

……

……

4. What is the lifespan of these buildings put up?

……..

5. Stakeholders see no need for maintenance?

Strongly agree ( ) Agree ( ) Disagree ( ) strongly disagree ( ) Not sure ( )

SECTION B

Questionnaire on state Policy

6. Government should maintain state property?

Yes ( ) No ( )

If yes state your reasons……

……

……

If no why?.....

……

……

7. Preventive maintenance should be recommended?

Yes ( ) No ( )

If yes state your reasons……

……

……

If no why?.....

……

……

8. Routine maintenance should be encouraged?

Yes ( ) No ( )

If yes state your reasons……

……

……

If no why?.....

……

……

9. The lifespan of buildings should be at least sixty years?

Yes ( ) No ( )

If yes state your reasons……..

……

……

If no why?.....

……

……

10. The components of all buildings need regular attention and maintenance?

Yes ( ) No ( )

If yes state your reasons……

……

……

APPENDIX III

QUESTIONNAIRE FOR HEADTEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION A

<u>Questionnaire on school buildings</u>

1. The school environment is comfortable?

Yes ( ) No ( )

If yes state your reasons……..

……

……

If no why?

……

……

2. The classroom is well maintained for academic work?

Yes ( ) No ( )

If yes state your reasons…….

……

……

If no why?

……

……

3. It is comfortable to learn in dilapidated classrooms?

Yes ( ) No ( )

If yes state your reasons……

……

……..

If no why?

……

……

4. The poor nature of the school buildings affects academic work?

Yes ( ) No ( )

If yes state your reasons……

……

……

If no why?

……

5. How do you fell when other students visit the school?

Good ( ) bad ( ) very bad ( )

Why?.....

.....

.....

SECTION B

Questionnaire on maintenance practices

6. State the causes of non-maintenance of school buildings?

……

……

……

6. What policies and practices will you recommend and why?

….....

.....

8. It is comfortable to lean in dilapidated classroom?

Yes ( ) No ( )

If yes state your reasons……

If no why? .....

8. Will you recommend routine maintenance practices?

If yes state your reasons……?

If no why? ……

9. What are the causes of low levels of maintenance?

State.....

……

……

SECTION C

Questionnaire on effects on academic work

1. The poor nature of the school building affects academic work……?

Strongly agree ( ) Disagree ( )

2. I feel proud to tell others about my school……..……?

Strongly agree ( ) Disagree ( )

3. How do I feel when other students visit the school……..……..?

Good ( ) Very bad ( )

4. More students wait to be admitted into the school……?

Strongly agree ( ) Disagree ( )

5. The school environment promote leaning…….……?

Strongly agree ( ) Disagree ( )

APPENDIX IV

QUESTIONNAIRE FOR TEACHERS.

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION A

Questionnaire on school buildings

1. How long does it take for maintenance request to be responded? Less than a mouth ( ) 1-3 mouths ( ) more than 12 mouths ( ) others please specify…….

2. In your own opinion is the building well maintained? Yes ( ) no ( ) please specify…….

3. Is academic work moving on well? Yes ( ) no ( ). If yes state your reason(s)……..

If no why? .....

4. Please indicate in your opinion the causes of the state of the building?

……

5. How much do you spend annually if any maintenance works occur?

……

APPENDIX V

QUESTIONNAIRE FOR TEACHERS.

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION B

<u>Questionnaire on effects of maintenance on academic work</u>

1. What are the enrolment now, compare to the good days of the school?.....

2. Is the enrolment satisfactory for academic work? Yes ( ) no ( )

If yes state your reasons……

If no why.....

3. What measures will you recommend to improve upon the enrolment situation?

State reasons……..

……

……

4. In your own opinion I you satisfy with the effect of the building?

Yes ( ) no ( )

If yes give reasons……

If no why?.....

5. How is the performance of students compare to the good days of the school?

Good ( ) fairly good ( ) bad ( ) very bad ( )

SECTION C

Questionnaire on emotions during climate change

1. How many climate changes do you experience in a year?

Once a year ( ) twice a year ( ) thrice a year ( )

2. Which of the season is academic work effective?

State ……

…….

3. How do you fell when it begins to rain?

Very happy ( ) happy ( ) bad ( ) very bad ( )

4. How do the students fell during academic work?

Good ( ) fairly good ( ) bad ( )

5. Is attendance encouraging during climate change?

Yes ( ) no ( )

If yes state……

If no why?.....

APPENDIX VI

QUESTIONNAIRE FOR STUDENTS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION A

Questionnaire on nature of school buildings

1. How will you classify your school building's existence? Old above 50 yrs ( ) medium age (20- 50yrs) ( ) below 20 yrs ( )

2. Does the school have maintenance policy?

Yes ( ) no ( )

If yes give reasons…….

……

……

If no why?.....

……

3. How do you fell when other students visit your school?

Good ( ) fair good ( ) bad ( ) very bad ( )

4. It is comfortable to lean in dilapidated classroom?

Yes ( ) no ( )

If yes give reasons……..

If no why?.....

……..

……

……..

5. How many times do you attend classes during raining seasons?.....

……..

……

……

APPENDIX VII

QUESTIONNAIRE FOR STUDENTS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION B

Questionnaire on emotional effect on academic work

1. How do fell when it is raining?

Very happy ( ) happy ( ) bad ( ) very bad ( )

2. Do you feel like attending lessons when raining and the class leaking?

Yes ( ) no ( )

If yes give reasons ……..

……

……

If no why?.....

……

……

3. Is your performance improved?

Yes ( ) no ( )

If yes state……

……

……

If no state……

……

……

4. What is the school's highest score in the terminal exams?

Excellent ( ) average ( ) poor ( ) very poor ( )

5. Are you happy to be part of the school?

Yes ( ) no ( )

If yes give reasons ……

……

……

If no why?.....

……

……

APPENDIX VIII

QUESTIONNAIRE FOR STUDENTS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION C

Questionnaire on performance of the school

1. What is the performance of the school, compare with the good days?

Good ( ) fair good ( ) bad ( ) very bad

2. What was the school's performance in sports for the year?

Good very ( ) good ( ) fairly good ( ) bad ( ) very bad ( )

3. How is the school's social relation compare with other school?

Good ( ) bad ( ) very bad ( )

4. What is the highest grade of the school in B.E.C E?

100 % ( ) 80% -50% ( ) 50%- 35% ( ) 35% - 0% ( )

5. Are you happy with the grade?

Yes ( ) no ( )

If yes state ……

……

……

……

If no state……

……

……

……

APPENDIX VIII

QUESTIONNAIRE FOR POLICYMAKER

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION A

Questionnaire on maintenance

1. Who is responsible for the maintenance of the school?

Self ( ) institution ( ) PWD ( ) others please specify…….....

……

……

2. Do maintenance department carryout work the building without request?

Yes ( ) no ( ) if yes give reasons……

……

……

3. How long does it take for maintenance request to be responded? Less than a mouth

( ) 1-3 mouths ( ) b6- 12 mouths ( ) more than 12 mouths ( )

4. State in your own opinion the reasons for the present state of the buildings?

……

……

……

.....

5. How much do you spend annually if any, on maintenance of your building?

……

……

……

……

APPENDIX VIII

QUESTIONNAIRE FOR POLICYMAKER

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION B

Questionnaire on building elements

Please tick appropriate how you consider the state of the following elements of your buildings.

1. Condition of foundation? Strong ( ) weak ( ) no problem ( )

2. Roof of the buildings?

Leaking ( ) rusty ( ) partly ripped ( ) completely ripped off ( )

3. Floor screed?

Cracks ( ) peeled off defects ( ) no defects ( )

4. Windows and doors?

No problem ( ) partly broken ( ) completely broken ( )

5. Electrical installations?

Partly broken down ( ) completely broken down ( )

APPENDIX VIII

QUESTIONNAIRE FOR POLICYMAKER

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

DEMOGRAPHY OF RESPONDENTS

Your frank and honest response will contribute a lot to the success of the study.

Information provided will be handled with confidentiality.

Please tick (√) where appropriate

Sex Male ( ) Female ( )

Age 18 – 25 ( ) 26 – 30 ( ) and above ( )

Name of school……

Name of community…….

Position of respondents…….

SECTION C

Questionnaire on facilities of buildings

1. What type of toilet facility do you use? Water closet ( ) KVIP

( ) pan latrine ( ) others please specify

2. Toilet sewerage? No problem ( ) leakage ( ) broken down ( ) nonfunctioning ( )

3. Electrical installation? Well maintained ( ) poorly maintained ( ) not maintained ( )

others specify.

4. Conditions of the facilities?

Please how do you consider the conditions of these facilities in the buildings?

- Water, toilet, electricity. Etc.

APPENDIX X

INTERVIEW GUIDE FOR HEADTEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

The series of questions in this interview schedule are designed to obtain institutional responses on maintenance of public buildings. The information is for academic purpose only and will be treated with the strictest confidentiality. Thank you.

SECTION A

1. When was your school built?
2. Do you have record of any maintenance work carried out?
3. Do you have maintenance officer in your school?
4. Have you ever requested money for maintenance work?
5. Who should be responsible for maintenance work in your school?
6. Have receive report from students verbally or writing concerning maintenance work in the school?
7. Do parents like the state of the school building?
8. What impact is your school building on academic performance?

APPENDIX XI

INTERVIEW GUIDE FOR HEADTEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

The series of questions in this interview schedule are designed to obtain institutional responses on maintenance of public buildings. The information is for academic purpose only and will be treated with the strictest confidentiality. Thank you.

SECTION B

Interview guide on maintenance

1. What is maintenance?
2. How many types of maintenance are known?
3. Which of the maintenance will you recommend and why?
4. What has accounted for the low level of maintenance?
5. Will you recommend investigation to be carried out on buildings to be maintained and why?
6. When should maintenance on buildings commence?

APPENDIX XII

INTERVIEW GUIDE FOR HEADTEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

RESEARCH WORK ON

ASSESSING THE IMPORTANCE OF MAINTENANCE IN THE BUILDING INDUSTRY CASE STUDY - BAGABAGA DEMONSTRATION JUNIOR HIGH SCHOOL.

The series of questions in this interview schedule are designed to obtain institutional responses on maintenance of public buildings. The information is for academic purpose only and will be treated with the strictest confidentiality. Thank you.

SECTION A

Interview guide on importance of maintenance

1. What is maintenance?

2. Is maintenance of school building important?

If yes, why?

3. Do you have maintenance department at the ministry of education?

I. if yes what role do they play?

II. If no why?

4. Who should be responsible for maintaining school buildings?

5. Have you had reportfrom heads requesting money for maintenance of buildings?

6. Does the school include maintenance in their budget?

APPENDIX XIII

INTERVIEW GUIDE FOR TEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

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SECTION A

Interview guide on maintenance budget

1. Is the allocation for maintenance work satisfactory? And why?

2. What measures will you recommend in terms of maintenance budget?

3. In your opinion, will you enforce the budget of maintenance of buildings?

Yes and why?.....

4. How long does it take for maintenance budget to be responded?

5. Please, indicate in your opinion the factors responsible for the present state of the budget.

APPENDIX XIV

INTERVIEW GUIDE FOR TEACHERS

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SECTION B

Interview guide on maintenance

1. Please, what is termed as maintenance?

2. How many forms / types of maintenance exist?

3. Have you ever enforce / encourage implementation of policies of maintenance?

4. In your opinion is the buildings well maintained please?

5. Who is responsible for the maintenance of the buildings? And why?

6. Will you recommend maintenance? And why?

7. What is your stand in terms of maintaining buildings?

APPENDIX XV

INTERVIEW GUIDE FOR TEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

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SECTION C

Interview guide on effects of non- maintenance on academic work

1. What effects has the state of the building on academic work? And how will you remedy that?

2. What measures have you taken to solve the problem? (The effects).

3. Does the physical features encourage you to perform your academic duties?

4. How do you manage the class when reptiles and other insets begin to parade during lessons?

5. The effects, has it one way or the other got psychological effects on your delivery?

If yes how? And if no why?

APPENDIX XVI

INTERVIEW GUIDE FOR CONTRACTORS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

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SECTION A

Interview guide on maintenance budget

1. Is the allocation for maintenance work satisfactory? If yes, why?

2. Who is responsible for the enforcement of maintenance budget? If yes, why?

3. What measures will you recommend for maintenance budget? If yes, why?

4. In your opinion will you contribute to enforce the policies of maintenance?

If yes, why?

5. Indicate in your own opinion factors that have contributed to present state of our maintenance budget?

APPENDIX XVII

INTERVIEW GUIDE FOR CONTRACTORS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

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SECTION B

Interview on maintenance

1. What are your position, job description/ qualification pleased?

2. What are the ages of your buildings? Specify?

3. What is maintenance in your own opinion?

4. Have you ever maintain a building before, as a contractor?

5. How many types of maintenance are known?

6. Can you mention the types of maintenance?

7. How often have you carried out maintenance?

8. Do you work alone or with others and why?

9. What is the cost for maintaining a room?

10. What measure will you recommend and why?

APPENDIX XVIII

INTERVIEW GUIDE FOR CONTRACTORS

UNIVERSITY OF EDUCATION, WINNEBA

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SECTION C

Interview guide on efforts to remedy the non-maintenance of buildings

1. What are remedies to situations?

2. What efforts have you put inn to solve the problem of the non-maintenance?

3. Will you be willing to donate when the needs arises to arrest the situation? If yes, which way? And how?

4. Would you be willing to fore go luxury and then remedy non-maintenance problems?

5. What advice would you give to your colleagues /the public in terms of non-maintenance of buildings?

APPENDIX XVIIII

INTERVIEW GUIDE FOR POLICYMAKERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

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SECTION A

Interview guide on maintenance

1. What is termed as maintenance?

2. Please can you mention some of the forms of maintenance?

3. Do you support the idea of enforcing maintenance work in every sector?

If yes, why?

4. In your own opinion should public buildings maintained?

If yes, why?

5. Will you be willing to contribute for maintenance work to carry out?

If yes, why?

APPENDIX XX

INTERVIEW GUIDE FOR POLICYMAKERS

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INTERVIEW GUIDE FOR POLICYMAKERS

SECTION B

Interview on maintenance budget

1. Is allocation of maintenance budget for work sufficient?

Why?

2. Who is responsible for maintenance work in Ghana?

Why?

3. Will you support the idea of individuals contributing to carryout maintenance work?

Why?

4. Can you mention some of the factors that contribute to the delayers' of maintenance work?

5. What measures will you recommend for effective maintenance work?

APPENDIX XXI

INTERVIEW GUIDE FOR POLICYMAKERS

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY- KUMASI CAMPUS

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3. Will you be willing to donate when the needs arises to arrest the situation?

If yes, which way? And how?

4. Would you be willing to fore go luxury and then remedy non-maintenance problems?

5. What advice would you give to your colleagues or the public in terms of non-maintenance of buildings?