UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

ENSURING SUSTAINABLE CONSTRUCTION PROJECTS THROUGH EFFECTIVE PERFORMANCE SPECIFICATION ON CONSTRUCTION SITE (NEW JUABENG MUNICIPALITY AS CASE STUDY)

ALBERT KWADZO AKOETEY

NOVEMBER, 2017

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

ENSURING SUSTAINABLE CONSTRUCTION PROJECTS THROUGH EFFECTIVE PERFORMANCE SPECIFICATION ON CONSTRUCTION SITE (NEW JUABENG MUNICIPALITY AS CASE STUDY)

ALBERT KWADZO AKOETEY

7151190010

A project report 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 fulfilment of the requirements for the award of Master of Technology (Construction Technology) degree

NOVEMBER, 2017

DECLARATION

STUDENT'S DECLARATION

I, ALBERT KWADZO AKOETEY, 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:

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.

NAME OF SUPERVISOR: MR. MICHAEL TSORGALI

SUPERVISOR'S SIGNATURE: ……

DATE: ……

ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to the following persons who in diverse ways helped me throughout the programme as well as this study.

Firstly, I am grateful to God Almighty for his mercies and Guidance throughout this programme. I would like to express my sincere gratitude to my Research Supervisor, Mr. Michael Tsorgali, for his supervision, direction, guidance and valuable advice during the study period. The successful completion of this work depended significantly on his suggestions. God richly bless him.

I am grateful to Dr. P. K. Yalley HoD and all staff and members of the Department of Construction and Wood Technology (UEW-K) for their support and assistance during the programme. Special thanks goes Yilo Krobo Municipal Assembly staff most especially, Mr. Elias Kwaku Mensah former Municipal Coordinating Director Mr. Seth Devine Nuworgbor and My sister Peace Akotey for their helpful comments and encouragement.

I am also grateful to my loving wife, Ms Yvonne Deh and my children for their continuous love and support during my studies.

My final appreciation goes to my course mates, for their encouragement and advices offered during the course of the study. God richly bless you all.

DEDICATION

This Dissertation is dedicated to my wife Yvonne Deh and my children Juanita Seyram, Enoch Klenam, Albert Elikem Akoetey and my younger sister Peace Akotey. Also to my brother from different mother Mr. Divine Seth Nuworbor for their prayers and support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

CDA	-	Construction Value Added
GDP	-	Gross Domestic Profit
SWOAT	-	Strength Weakness, Opportunity and Treat
CDOT	-	Construction Directives Organisation Technology
FIPI	-	Findings in Public Interest
AAASHTO	-	American Association of State Highway and Transportation Officials
ASTM	-	American Society for Testing and Materials
QC	-	Quality Control
QA	-	Quality Assurance
FHWA	-	Field Health Workers Association
HoD	-	Head of Department

ABSTRACT

The construction is one of the oldest industries in almost every nation. Its importance made it possible for undeveloped countries to rise up to becoming developed Countries. Lately, there have been an undesirable adherence to performance specification in most construction sites in most developing countries. This study seeks to reveal how best sustainable construction projects can be attained through performance specification. A cross – sectional and descriptive survey was used identify factors influencing quality of projects and sustainability of construction projects. The sample was comprised of 35 owners of construction companies, 50 employees of construction companies and 50 stakeholder involved in the construction industry. All the owners of the construction firm agreed to have construction specification on their site. A major issues on some areas of adherence is the maintenance of management plan. The major performance indicators use by most of the construction companies were the completion of the project within schedule, completion of the project within budget and achieving required quality since most of them agreed to this when interviewed. It was concluded from the study that supervising of ongoing projects is a major way they can contribute to effective performance. Stopping the construction work and ensuring specification is met, non-payment of contractors and reporting to the appropriate authorities are measures clients/users agreed they would go when they realize that an effective performance specification are not met.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The construction industry has been one of the oldest industries in almost every nation. Its necessities made it possible for undeveloped countries to rise up to becoming developed Countries. It is impossible to call a place developed without the presence of good constructions especially in relation to roads and other projects like infrastructure. In Africa practically narrowing it down to West Africa with reference to countries like Ghana, Construction has become the major hall mark for the development of a particular location. Lately with reference to knowledge as well as the increase in the number of human beings on the face of earth, there is high demand on construction projects to be in a close alignment with specific needs of the environment in which it is taking place (Ephon, The Construction Sector Continues to Be the Engine for growth, 2017) Moreover construction projects have the obligation to meet their intended needs without posing negative side effects to their environment as well as the beneficiaries of the project. Discontent with the state of their construction industries, governments in developed countries are supporting various initiatives for improvements. (Ofori, 2000). Most citizens and governments are showing signs of dissatisfaction with the construction projects since most of them are not meeting the standards of the expectation of the beneficiaries. This study is mainly to reveal how best sustainable construction projects can be attained through performance specification. That is to make sure that, before, during and after projects, the end user safety and satisfaction as well as lasting outcome is considered. With regard to the global concern of the development of the construction industry,

the use of performance measures to achieve this aim by most developed countries has been underscored (Gyadu-Asiedu, 2009). Performance specification has to do with.

Sustainable construction is a term generally used to describe the application of sustainable development to the construction industry. The industry is defined as all who produce, develop, plan, design, build, alter, or maintain the built environment, and includes building materials, manufacturers and suppliers as well as clients and end use occupiers. Clients, end users, and occupiers also have key roles to play in delivering sustainable construction (BRE, Garston, Watford WD25 9XX). This moreover has to do with more efforts that must be put in action before and during projects in order to enhance effective practices like; planning your building supplies, using the best materials for the project, sorting and disposal of waste, using cheap and best materials, etc. Notwithstanding, sustainable building aims for no overall net environmental burden by considering a building's total economic and environmental impact and performance, from raw material extraction and product manufacture to building design, construction, operations and maintenance, and building reuse or disposal. Although sustainable building practices have, so far, been primarily voluntary it is anticipated they will become more prominent, and be reflected more strongly in procurement analysis (Geneva/London, Peter Boswell, Lorna Walker, 2004)

Performance specification is an express statement which defines the requirements that must be fulfilled by a particular equipment, product or material. It is more concerned with the necessary specific requirements needed to complete a project. In the construction industry, performance specification deals with the establishment of requirement needed to for a sustainable construction. For example in road construction, the type of cars that will use the road must be considered when

selecting the type of materials to use in constructing the road. In Ghana for instance, many of the roads couldn't stand the test of time because during the time they were being planned for, many factors were not taken into consideration. Many a times when heavy tracks passes through the road for a period of time the road gets damaged. Most frequently, many roads and other bigger government facilities turn to become nuisance to the environment in reference to making noises in the environment, producing dust in the environment, causing preventable traffics etc. Many a times too ineffective surveys gives way for wrong siting of projects, which goes a long way to wasting of construction materials. These things go a long way to suppress sustainable development in general.

1.2 Statement of the Problem

Lately, there has been an undesirable adherence to performance specification in most construction sites in most developing countries. Most specifically during and after construction. Sustainable development is highly affected since most of the industries that constitute a complete sustainable development are not in full sustainable states. The construction industry is one of the major industries that is exhibiting inconsistency in sustainability. This is one of the main problems affecting Construction industries. In most developed Countries, efforts are being made to ensuring sustainable construction projects through effective performance specification on construction sites, ensuring sustainable project performance assessment is to monitor and control projects to ensure favourable outcomes. Yet, it date, there has been little, if any, studies in developing countries aimed at promoting improvements in project performance through assessment. However, in order to determine the most effective and realistic application of the existing models in any

developing country, it is imperative that a study be done to determine to what extent these models are relevant in each country. In addition, it is important to determine what extent these models can be useful in addressing the specific problems confronting the construction industry of each country.

Those processes required to track, review, and regulate the progress and performance of construction project site and to identify any areas in which changes to the plan and monitoring of construction site are required, and initiate the corresponding sustainable performance standard specification in construction site.

1.3 Purpose of the study

The purpose of the study is to ensure sustainable construction project through effective performance specification on construction firms in Ghana

1.3.1 Objectives of the study

The objectives of the study are to

- Examine issues of sustainable construction project through effective performance specification on construction firms in Ghana
- Identify the factors that affect effective performance specification on construction firms in Ghana.
- Devise strategies to enhance effective performance specification on construction firms in Ghana

1.4 Significance of Study

- The study outcome will enable construction industries to give full attention to effective performance specification as a means to attain sustainable construction.
- It is therefore envisaged that the study will bring to bear awareness of sustainable construction projects through effective performance specifications on construction sites in Ghana,
- The results and findings would guide Policy Makers and other actors in the construction industry in ensuring sustainable construction projects.

1.5 Scope of Study

The study is focusing on ensuring sustainable construction projects through effective performance specification on construction site in New Juabeng municipality in the Eastern Region of Ghana. The key elements addressed are clients' perspective and practitioners' perspective of project performance specification in Ghana. The clients' perspective has to do with the owners or stakeholders of the property whose projects are ongoing. Examples of such construction projects are the Government, private companies who award construction contracts, etc. The practitioners' side generally refers to the stakeholders of the construction companies.

CHAPTER TWO

2.0 LETERATURE REVIEW

2.1 Introduction

This chapter is to find out and discuss related literature from the internet, reports from libraries, books, journals and other information centres relevant for this particular study, and moreover get a standing point for this research to be carried out.

The Chapter reviews the state of the Global and Ghanaian construction industry, its strength, weakness, opportunities and threats (SWOT ANALYSIS). This is followed by a detailed discussion on the construction industry in Ghana, a case study of New Juabeng Municipality. The chapter also discusses on Project as a Temporal Organization. It also elaborates on ensuring Sustainability in Construction Sites in Ghana more importantly in the New Juabeng Municipality. It also discussed about Performance Specification on Construction Sites, and the reasons why poor Performance Specification is leading unsustainability in the Construction Industry.

2.2 Overview of the Construction Industry

The construction industry is a sector of national economy engaged in preparation of land and construction, alteration, and repair of buildings, structures and other real properties (Glen, n.d.). The combination of rapid population growth, urbanization and economic development are putting the African continent at risk with regards to meeting the increasing demands for housing and urban planning (De, 2013), Even though the construction industry could form the bedrock for possible solutions to the developmental challenges. Most importantly with regards to how poor most of the structures are built especially in terms of efficient performance specification, which

accounts for more than 60% of the Gross National Capital in Ghana. (George Hove, Adewale Banjo, 2015) (Kwaku Ahmed, Lamiah Hatira, 2014)

Moreover, micro construction firms, which normally employ less than 10 people account for 90% of construction workers, whereas small and medium enterprises (SMEs) constitute 97% of all construction firms globally.(George Hove, Adewale Banjo, 2015) This sentiment is true of developed countries such as France and Germany, where there are fewer than 10 large national contracting firms who employ thousands of employees (Adjei, 2012). Furthermore, Schmeimann, (2009) indicates that statistics of the European Union show that 99.8% of all registered enterprises in the non-financial sector were regarded as SMEs, employing two thirds of the total work force in Europe and generating approximately two-thirds of all value added. Generally, the built environment is known to constitute more than half of the national capital investment, account for the consumption of more than half of all the raw material taken and consumes between 40% and 50% of a country's energy (Plessis, 2009). This has a realistic indication that, the construction industry is an industry that could either save our future existence or destroy it based on how its short comings today are treated. Contributing to the debate, Lopes et al. (2000) provided evidence, based on a study on data from 15 countries spanning 22, 11 years, that "there is a critical level of construction value added (CVA)/GDP at 4-5% below which a relative decrease in construction volume corresponds directly to a decreasing growth in GDP per capita"(Flybase, 2017). Commenting on the socio-economic significance of infrastructure projects, Zadie and Langford (2000) observes that good infrastructure projects can help enhance growth process by raising productivity, alleviate poverty by responding to the needs of the poor for better health, education, housing, transport, water and power supply services.(Gyadu-Asiedu, 2009). Few researchers have studied

in this particular area of study, but with reference to the updates on our current news especially in Ghana, there are still more lapses that need to be covered in other have a more matured construction industry. The argument then goes that if specification documents are well adhered to during construction, why do we still have poor sustainability on the construction site?

2.3 The Construction Industry in Ghana

Most recently, the rapid growth in Ghana's oil and gas sector, investments in infrastructure, rapid urbanization and a growing housing deficit continue to place demand on the country's construction sector. Most importantly, the rising prices of both electricity and building materials pose long and short-term challenges. Despite setbacks, the construction sector has continued to grow (Ephon, The Construction Sector Continues to Be the Engine for growth, 2017) According to the Ghana Statistical Service, a government body tasked with compiling economic data and indicators, construction was the largest subsector of industry as at 2015, with a growth rate of 30.6% and a 14.8% share of GDP. It has grown consistently over the past five years, up more than 70% since 2010 and employing around 320,000 people.(Ephon, 2017). More importantly, the fact that a sector is being demanded for, doesn't really mean that its wings are strong. In as much as the demand for Construction in growing, it must grow alongside with some features that could make the sector more reliable. One of these features is performance specification. Not quite long ago we read in the Ghanaian news that, a storm has removed part of the roofing of the Ghanaian parliament house. The Majority leader also suggested that reroofing of the building may not have been done well. (Delali-Bessa, 2017). According to news, the Chamber of Parliament was renovated in 2014 after the Members of Parliament complained of

congestion, resulting from an increase of parliamentary seats from 230 to 275. The argument then holds that if the structure was renovated in 2014 and after two years it couldn't stand the storm.

Figure 2.1: Parliament House of Ghana (that was striped off by rain storm)

The Ghanaian Construction industry which looks like the engine for development still have lapses that must be well covered.(Anvuur, Kumaraswamy, 2006).

2.4 Performance specification

Performance specification express in terms of an expected outcome or acceptable performance standard. Often used in design-build criteria to articulate the owner requirement, it also defines what the system being designed must do, and not how it must do it. The general concept behind performance specification is for the architect or engineers to describe what they need, and the contractor to determine the best way to get there. The performance specification focuses on the outcome and shifts the selection of the materials and methods, as well as a portion of the design work, onto

the shoulders of the contractors. This approach can provide incentives for innovation and flexibility in the construction site. (https/www.archtool.com)

2.5 Challenges of ensuring performance specification

Problems militating against the Performance of Ghanaian Construction Industry (Based on Anvuur and Kumaraswamy, 2006) are;

Table 2.1: Problems militating against the Performance of Ghanaian Construction Industry

Authors	Problem	Causes
Westring (1997)	Delays and cost Overruns	Extensive post-award negotiations, delays in the preparation of technical specifications and drawings, delays in evaluation, an extensive system of controls, reviews and approvals, and land ownership disputes,
Westring, 1997; World Bank, 1996;2003	poor quality	Service providers cutting corners to limit losses or abandoning the work altogether
Eyiah and Cook, 2003; Westring, 1997	Delays	Long process of payment to contractors and suppliers – "over thirty Steps from invoice to receipt of payment cheque", over-centralized.

World Bank, 1996; 2003	Insecurity funding Project	Fiscal constraints and poor procurement practices resulting in delayed payments and arrears to contractors and consultants; accumulated interest on late payments and the frequent price changes due to extensive renegotiation; difficulties by contractors and consultants in processing claims
Dansoh, 2005; Westering, 1997.	Contractual and procurement Issues	Lack of respect for contract with neither party expects contracts to be fully binding; ad hoc approaches to economic-sizes project; difficulties in long-term strategic planning by contractors; poor monitoring and Control of procurement.

Source: Anvuur and Kumaraswamy, 2006

2.6 Contribution of performance to sustainability of construction in the Ghanaian industry

Sustainable construction as discussed earlier is the role the construction industry play to contribute to the totality of sustainable development. (BRE, Garston, Watford WD25 9XX). Sustainable construction realistically refers to that stage of maturity in the construction of a country which could lead the country to become a developed country. By observation, in Ghana currently, one of the popular structures in Ghana and Africa as a whole are Church auditoriums, Dance Halls, Night Clubs and other functional halls. (Boadu, 2017) You could see that most of them are not really built with specifications to keep noise within the building. This has eventually caused a

developing country like Ghana to be losing fight against noise pollution. (Parliament, 1992)

2.6.1 Performance Specification in the Ghanaian Construction Industry

A performance specification is a document that specifies the operational requirements of a component or installation. Simply put, a performance specification tells the contractor what the final installed product must be capable of doing (Michael J. Baker, Esq). A specification is a document that describes in words what cannot be visualized or explained on a drawing or model. More importantly has to do with what is expected out of the whole construction. By observation, many a times, design seems to cover the actual performance specification. Especially in most of the less developed countries or societies. In an African community the construction industry cannot actually flourish if its speculations are only based on design specification alone without much focus on performance specification. This research will help us realize where unsustainability in emanating from, which stakeholders are really responsible, and how best to use effective performance specification to make the industry more reliable.

2.7 Concept of performance specification in construction technology

Definition of specification

Specification is a general term which applies to all directions, provisions, and requirements pertaining to the performance of the work and payment for the work (Construction Specifications, 2005).

2.6.2 The Manual of Standard Building Specifications

It has always been one of the objectives of the administration and the staff representative bodies to produce a detailed description of the type of building which

best meet the needs of the Commission and its departments. This document reflects those needs. It is a complex document that can serve a wide variety of purposes, viz.: – a manual for the use of the various departments of the Commission, – a directory for general use, and – a reference document for use in formulating tender specifications (Manual of standard building specifications, 2011).

The goal of this document is to lay down the level of technical performance to be attained and define the minimum comfort of buildings intended to house the Commission's departments. The technical methods applied to achieve those goals are a matter of choice, but the requirements themselves are mandatory. The complexity of buildings policy derives from the need to reconcile four different factors: 1. economic interests, looked after by administrators and executives who must ensure that budgetary procedures are correctly followed, 2. technical interests, the responsibility of specialists, who must correctly assess the quality of technical services and conformity with technical and safety standards, 3. the interests of the users for whom the building is intended, who are entitled to an acceptable level of comfort and safety, 4. environmental interests. One aim of this document is to help reconcile conflicts arising from this complexity. A.I.2 (Manual of standard building specifications, 2011).

Conformity Assessment

Assessing a building's conformity with the descriptions in the Manual of Standard Building Standards makes it possible to determine whether or not that building meets the needs of the Commission's departments (Manual of standard building specifications, 2011).

Legislation and Standards

Any building selected to house Commission departments must conform in every respect to the public-buildings legislation in force in the country where it is located. If such legislation has less binding force than a European directive, then the building must comply with the directive. Buildings legislation can be categorised according to the various stages of the building process from planning to use, namely: – urban development legislation (planning permission and environmental licences), – architectural legislation (architectural design, structural calculations for the building shell), – legislation governing technical installations (dimensions, energy consumption), – legislation on health and safety at work, – environmental legislation. Standards are categorised according to the issuing body and the technical domain to which they relate. For the purposes of safety legislation, buildings occupied by the Commission's departments are treated as private buildings. By contrast, premises which are specifically intended to receive the public, such as info-points, reception offices and the like, are treated as public buildings. Any building site within a building must comply with the safety regulations (Manual of standard building specifications, 2011).

2.7.1 Concepts

Acceptance of Work

All work required by the Contract Documents will be considered accepted upon official action by the City Council of the City of Springfield. In order to qualify for acceptance, all work specified in the Contract Documents must be completed unless specifically deleted by Contract change orders (Manual of standard building specifications, 2011).

Acts of God

An act of God is to be construed to mean an earthquake, flood, cloudburst, tornado, hurricane or other phenomenon of nature of catastrophic proportions or intensity.

Addenda

Supplemental written Specifications or Drawings issued prior to execution of the Contract which modify or interpret the Contract Documents by addition, deletion, clarification or correction.

Advertisement

This is a public announcement inviting bids for work to be performed or materials to be furnished.

Approved Equal

A product, component or process whose use in or on a particular project is specified as a standard for comparison purposes only. The "equal" product, component, or process, shall be the same or better than that named in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Engineer, pursuant to Subsection 106.07. Whenever a manufacturer's name brand or model is mentioned, it is to be understood that the phrase "approved equal" is assumed to follow thereafter, whether it does in fact or not (Manual of standard building specifications, 2011).

Attorney

The City Attorney of the City of Springfield, Oregon.

Bid Bond

The bond required to be submitted with each Proposal, as described in Subsection 102.05 as a Proposal Guaranty, which assures that the Bidder will enter into a Contract if his Proposal is accepted.

Bidder

Any individual, firm, co-partnership, corporation, or combination thereof, submitting a Proposal in response to the advertisement calling for Bids on the work contemplated either directly or through a duly authorized representative.

Change Order

A written order, issued by Engineer to the Contractor, covering changes in either the Plans, Specifications or quantities within the scope of the Contract after award and as further described in Subsections 104.05 and 104.06.

City

The City of Springfield, Lane County, Oregon, acting through its legally constituted City Council.

Contract

The written agreement covering the performance of the work and the furnishing of labour, materials, tools and equipment and construction of the work. The Contract shall include the Proposal, Plans, Standard Specifications, Special Provisions and Contract Bond; also any and all supplemental agreements amending or extending the work completed which may be required to complete the work in a substantial and acceptable manner. Supplemental agreements are written agreements covering alterations or amendments or extensions to the Contract and include Contract change orders. These general conditions are an integral part thereof. Contract Item A specific unit of work for which a price or basis of payment is provided in the Contract. Contract Price: Either the unit prices or lump sum price or prices named in the Proposal or in properly executed change orders. Contract Review Board: The City of Springfield Common Council is the Contract Review Board pursuant to ORS 279.055

and Chapter 1, Article 14, Section 1 of the Springfield Code. Contract Time: The number of days stated in the Contract Documents for the completion of the work.

Contractor

Any individual, firm, co-partnership, corporation or any combination thereof, who has or have entered into a Contract with the City for a particular project. Day: Unless otherwise designated, days as used in these specifications will be understood to mean working days. A working day is any and every day shown on the calendar, excluding Saturdays, Sundays and legal holidays. Department of Public Works The Department of Public Works of the City of Springfield, Oregon, acting directly or through properly authorized officials, employees and agents limited to the particular duties entrusted to them.

Plans

The official project Plans and Standard Plans, profiles, cross-sections, elevations, details and other working supplementary detail drawings or reproductions thereof approved by the Engineer which show the location, character, dimensions, and details of the work to be performed. Plans may either be bound in the same book as the balance of the Contract Documents or bound in separate sets and all are a part of the Contract Documents regardless of the method of binding. In the above definitions, the following terms are defined: A) Standard Plans - the Standard Plans of the City of Springfield, Oregon. B) Project Plans - the Project Plans are specific details and dimensions peculiar to the work and are supplemented by the Standard Plans insofar as the same may apply. Pre-qualification Process for pre-screening Contractors to assure that they have the ability to perform certain types of work pursuant to ORS

279. Project General term encompassing all Phases of the Work to be performed under the Contract and is synonymous to the term improvement.

Proposal

The offer of a Bidder, which is the basis of the Contract submitted on Owner's official. Proposal form, to perform stated work at the prices quoted. Proposal Guaranty (Bid Bond) The security furnished with a Proposal to ensure that the Bidder will enter into the Contract if his Proposal is accepted. Provide: When related to an item of work, the word `provide' shall be understood to mean furnish and install the work complete in place. Reference Specifications Bulletins, standards, rules, methods of analysis or test, codes and specifications of other agencies, engineering societies or industrial associations referred to in the Contract Documents.

2.6.3 Importance and Characteristics of Well-Written Specifications

Well-written specifications are essential to the efficient construction of a successful project. Well-written specifications inform the Contractor of the work to be performed, the conditions and restrictions on performance of the work, the expected quality of the work, and the manner in which the work will be measured for payment. With the increased complexity and specialization in modern construction and the need for the Project Engineer to focus on legal requirements and administration, use of the phrase “as directed by the Engineer” should be minimized. Work requirements must be clearly stated in the specifications (Construction Specifications, 2005).

Well-written specifications:

- Are clear, concise, and technically correct.
- Do not use ambiguous words that could lead to misinterpretation.
- Are written using simple words in short, easy to understand sentences.

- Use technically correct terms, not slang or "field" words.
- Avoid conflicting requirements.
- Do not repeat requirements stated elsewhere in the Contract.
- Do not explain or provide reasons for a requirement.
- State construction requirements sequentially.
- Avoid the use of awkward phrases such as "and/or" and "him/her" (Construction Specifications, 2005).

These should be used only when the Engineer will actually accept or approve the work. In such phrases, "approved" and "accepted" are synonymous; there is no difference in the responsibility taken by the Engineer. Basic Specification Policy Some of CDOT's established policies for the development and use of construction specifications are described below. These policies are based on Federal and State laws and regulations, CDOT Policy and Procedural Directives, directions from the Chief Engineer, and established CDOT practice (Construction Specifications, 2005).

2.6.4. Standards and Specifications Unit

The Standards and Specifications Unit in the CDOT Project Development Branch is charged with overseeing the development and implementation of construction specifications (Construction Specifications, 2005). This unit writes and revises the CDOT Standard Specifications for Road and Bridge Construction (1) (commonly called the Standard Specifications) and CDOT Supplemental Specifications, issues Standard Special Provisions, and prepares or reviews Project Special Provisions.

CDOT Procedural Directive 513.1 - Construction Project Specifications (2), states that the Standards and Specifications Unit is to review and approve all new Project Special Provisions and newly revised Project Special Provisions that contain significant changes, and initiate a formal review process when necessary. The

Standards and Specifications Unit should be given at least two weeks to review proposed Project Special Provisions before they are incorporated into the construction project documents for advertisement. The Specification Committee [described in Procedural Directive 513.1 (2)] assists the Standards and Specifications Unit with the review and development of formal specification changes that may be controversial or have a significant impact on the highway construction industry (Construction Specifications, 2005).

2.6.5 Liquidated Damages, Penalties, and Incentives

Do not use specifications that assess penalties to the Contractor. The only deductions that can be made from monies due the Contractor are:

- Liquidated damages based on additional engineering costs to the Department. • Incentives/disincentives based on either the quality of the work or incurred road user costs.
- Price adjustments based on the quality of the work. In each case, the deduction amount included in the specification must be accurately calculated and documented in the project file (Construction Specifications, 2005).

Remediation specified for non-specification work should not be harsh or punitive, but should accurately represent the actual loss of value to the Department or to the road user (Construction Specifications, 2005).

Uniformity CDOT strives to achieve state-wide uniformity in the use and application of specifications. Frequent changes to specifications and differences in specifications from project to project and Region to Region lead to misinterpretation, inconsistent enforcement, higher bid prices, and Contractor claims. As much as possible, the Standard Specifications (1), Standard Special Provisions and formally issued sample

Project Special Provisions and Special Provision Work Sheets should not be changed (Construction Specifications, 2005).

Warranties and Guaranties Warranty provisions for specific construction products or features are allowed contingent upon the FHWA Division Administrator's advance approval [23 CFR Part 635.413 (3)] (Construction Specifications, 2005). CDOT has experimented with short-term warranties on pavements and continues to work toward development of warranty specifications. Unless approved by the FHWA Division Administrator, federal funds cannot be used for warranties that extend beyond standard manufacturers' warranties. When an extended warranty is used without FHWA approval, a non-federal aid pay item should be created for the cost of the warranty (Construction Specifications, 2005).

Proprietary Items Federal regulations prohibit specifying a proprietary (brand name) product unless justified through a Finding in the Public Interest (FIPI) 23 CFR Part 635.411 (3). A FIPI must be obtained if there are fewer than three products available that will fulfil the Contract requirements. Brand-name products approved in a FIPI can be specified with or without the phrase "or approved equal." Project and corridor specific FIPIs must be approved by the Resident Engineer on CDOT oversight projects and by the FHWA Operations Engineer on FHWA oversight projects (i.e. projects on the Interstate Highway System) (Construction Specifications, 2005).

Region wide and state wide FIPIs must be approved by the FHWA Division Administrator. The FIPI shall be retained in the project file. A FIPI is not required if at least three brand-name products and the phrase "or approved equal" are be listed. For additional information see Design Bulletin 2004-2 (4) (Construction Specifications, 2005).

Materials-Methods Vs. End-Result Specifications Materials-methods and end-result are the two basic types of construction specifications. Materials-methods specifications describe in detail the materials, workmanship, and processes the Contractor is to use during construction. Materials-methods specifications restrain contractor innovation and obligate the owner to accept the work if the specified materials and processes are used. End-result specifications describe the desired result or quality of the final product to be achieved (Construction Specifications, 2005).

End-result specifications encourage contractor innovation and allow the owner to accept or reject the final product. Current CDOT specifications include both types and, in some cases, a combination thereof. End-result specifications are preferred. Quality Control/Quality Assurance (QC/QA) is a type of end-result specification. QC/QA specifications require the Contractor to perform all testing necessary for control of production while the owner (CDOT) performs the testing necessary to determine acceptance, rejection, or price adjustment of the product (Construction Specifications, 2005).

Acceptance/rejection/price adjustment is usually based on a statistical analysis of the test results. CDOT currently uses QC/QA specifications for pavements. 16-4 October 2005 Construction Specifications 16.1.3.7 Pay Items The specifications establish the pay items under which the Department will pay the Contractor for work completed. Readily identifiable and measurable items of work should not be made subsidiary to other items, but should be paid for under separate pay items (Construction Specifications, 2005).

Use of lump sum pay items should be minimized. Pay items with subsidiary items and lump sum pay items are difficult for contractors to bid and difficult for the Project

Engineer to administer during construction, especially in cases of changed conditions or changed quantities. Payment for work by force account should be minimized. Force account work involves additional paperwork and often has a higher cost than if the work had been paid for under a bid item.

Reference Specifications AASHTO (American Association of State Highway and Transportation Officials) is the preferred reference for citing (Construction Specifications, 2005). Other national standard references such as ASTM (American Society for Testing and Materials) may be used when there is no AASHTO specification available (Construction Specifications, 2005).

Laws, Statutes, and Regulations Subsection 107.01 of the Standard Specifications (1) require the Contractor to be fully informed of, and comply with, all applicable laws and regulations. Generally, specifications that apply, interpret, or enforce laws and regulations should not be used (Construction Specifications, 2005).

Specifications for Innovative Contracting Practices CDOT have experimented with innovative contracting practices such as design-build projects and warranties. Other innovative contracting practices that have gained acceptance on appropriate CDOT projects are cost-plus time bidding and lane rental specifications, which are designed to encourage the Contractor to minimize road-user impacts during construction. Samples of these specifications are available on the CDOT Design and Construction Project Support website and should be used only upon approval of the Innovative Contracting Unit (Construction Specifications, 2005).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter focuses on the research methodology. It describes the methods used to collect data for the study, it included areas like research design, study location, population, sampling Techniques and sampling size. It also involves data collection instrument like questionnaires, interviewed and field study.

3.2Research Design

A cross – sectional and descriptive survey was used as the design for the research. This was appropriate to elicit information from a sample of participants in the population, through the use of standard self-administered questionnaire. The research study used quantitative techniques in order to achieve the objectives of the study. Also, the researcher sought to look at the situation as it was and did not attempt to changes or modify the situation under study. Such study seeks to describe how some aspects of the population on an existing situation or problem by selecting unbiased sample of individuals to fill questionnaire and take part in interviews to elicit information from a broad section of people to generalize the problem or situation, (Cohen and Manion, 1994). According to Alonga (1995), the descriptive survey method involves elements of comparison, finding interpretation or significant of what have been described among others. Moore (1991) confirmed that descriptive survey is used when the researcher's aim is to depict accurately, and state one or more variable to describe a specific problem of human experience. It is therefore used to discover the incidence and the distribution of, and the inter-relations among variables. Finally, it is a formed procedure of obtaining information that is more or less resulted from a sample.

Study Location /Area

The study was conducted at New Juabeng Municipality in the Eastern region of Ghana. Koforidua the capital of the New Juabeng Municipality, popularly known as K-dua or koftown, is a city and capital of Eastern Region in southern Ghana. The city was founded in 1875 Koforidua has a settlement central city population of 127,334 people. More than 90 percent (93.3%) of the population in the Municipality live in urban localities. The Municipality has a sex ratio of 93, implying that to every 100 females there 93 males. The Municipality has a youthful population with about one third (30.8%) of the population below 15 years.

Figure 3.1: Map of Koforidua

Study Variables to be measured

The dependent variable of the study was sustainability of construction projects. The independent variable(s) or exposure variable(s) that can influence the outcome variable were the background characteristics of the respondents, effective performance specification on construction.

3.3 Population

The population for the study comprised owners of construction companies, engineers, artisan, clients/users in the construction industry and employees working in construction companies.

3.4 Sampling Technique and Sample Size

A systematic sampling technique was used to select 35 construction companies within the New Juabeng Municipality. Owners of the selected construction companies were then interviewed. This technique was used so that each construction companies within the New Juabeng Municipal area had a known chance of being selected for the sample. A simple random sampling techniques was also used to select employees within each construction company. This technique was also used so that employees in construction companies within the municipality had a known chance of being selected for the sample. In all 50 employees were selected across the construction companies. A purposive sampling technique to select use to select users/clients of construction companies with various employment status in the study area. This was used because people needed for the study had special features, and can be handpicked. In all 50 clients of construction companies were selected. The individuals who were willing to participate and met the sampling criteria were chosen as respondents in the study.

Sample Size

The sample size (n) was calculated using the Cochran Formula

$$n_0 = \frac{Z^2pq}{d^2}$$

Where;

n_0 = sample size

Z = Standard normal set at 95 % confidence interval equivalent to 1.96

p = unknown prevalence set at 0.2

q = 1- p = 0.8

d = margin of error (5%)

Inserting the above numbers into Cochran's formula,

$$n_0 = \frac{1.96^2 \times 0.2 \times 0.8}{0.05^2}$$

$n_0 = 246$

Since population size will be used in this study, a finite population correction factor was used to determine the exact population size;

Therefore, for this study:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where,

n = final sample size

N = population size.

n_0 = sample size calculated using Cochran's formula = 246

$$n = \frac{246}{1 + \frac{(246 - 1)}{300}}$$

Therefore, n = 135

The sample was dived into of 35owners of construction companies, 50 employees of construction companies and 50 users/clients of construction companies.

3.5 Data Collection and Instruments

The collection of data was done through a field survey, administration of questionnaire and interview.

3.5.1 Field Survey

There was a visit to new Juabeng Municipal Assembly's Works Department Koforidua, where enquiries were made about their knowledge of understanding of ensuring sustainable construction project through effective performance specification. Based on the interaction with the Head of the Works of the Department, the interviewer was taken to some of the ongoing projects sites and abandoned projects in the Municipality. In totality, twelve (12) sites were visited including Government Affordable Houses, National Communication Authority new office under construction at Koforidua, Eastern Premier Hostel where the contractors and project managers and Engineers were interviewed. The Maintenance unit of Koforidua Technical Institute was also visited and questionnaires administered on the Site Engineer on his level of understanding of sustainable construction project through effective performance specification on construction site. The interviewer observed during his field visits that the Project Managers at both Eastern Premier and Government Affordable Houses though not on site, have instituted feedback procedures through their site Engineers where they receive daily update on the progress of work. This affords them the opportunity to quickly resolve issues that arise with the tendency of delaying the project. Nevertheless, at Koforidua Technical Institute, the Site Engineer daily

monitors the progress of work to ensure conformity to the project design. Structural defect detected were rectified. At the National Communication Authority site, the Architect was on site to monitor the progress of work and to also ensure that the project design were been followed according to performance specification.

3.5.2 Questionnaire

The questionnaire is preferred because it yields a high response rate. A set of questionnaires were administered to project managers, engineers, general foremen and clients.

The questionnaire focused on the issues such as: method put in place by managers for ensuring sustainable construction projects through effective performance specification on construction sites.

3.5.3 Interview

A structured interviewed were conducted, 35 owners of the construction companies in the new Juabeng municipality were interviewed, 6 contractors of New Juabeng Municipal Assembly were interviewed,15 contractors and sub-contractors from Eastern premier Hotel were also interviewed, 5 contractors from State Housing companies and 4 contractors and sub-contractors, 50 construction workers including engineers, project managers, artisans, users/clients of the construction projects in the new Juabeng municipality were interviewed.

Among the issue the interviewed focused were what roles do the project managers, engineers , Artisans, project owners clients and users adopt for ensuring sustainable construction projects through effective performance specification on construction sites. The researcher was guided by the interviewed schedules, (appendixes 1&2)

CHAPTER FOUR

4.0 RESULT AND DISCUSSIONS

4.1 Introduction

This chapter present the results and discussions as obtained from the questionnaire, interviewed and observation

4.2 Results of Questionnaires

4.2.1 Results of questionnaires from Owners of construction companies

Background characteristics of owners of construction companies

The background information on the owners of the construction companies revealed that majority of the owners of the construction companies were males (96.8) % although a few females were engaged in the construction industry as can be seen in Table 4.1. The majority of the owners of construction companies were found to be within the age group 41-50 years (54.8) % although a few of them were above the age 50+ years (Table 4.1). The dominant religion among the owners of construction companies was the Christian religion (87.1) % (Table 4.1). The highest level of education for the majority of the owners of the construction companies was tertiary (96.8) % although a significant number of them had the SHS/Vocational as their highest level of education as can be seen in Table 4.1.Majority of the owners (41.9) % also said they had had over 10 years' experience in the construction industry with just a few having less than a year experience (Table 4.1).

Table 4.1: Background characteristics of owners of construction companies

Gender (N=35)	**Frequency**	**Percentage**
Male	30	96.8
Female	5	16.1
Age group (N=35)		
25-30	4	12.9
31-40	12	38.7
41-50	17	54.8
50+	2	6.5
Religion (N=35)		
Christian	27	87.1
Muslim	8	25.8
Level of education (N=35)		
SHS/Vocational	5	16.1
Tertiary	30	96.8
Experience in the construction industry (N=35)		
< 1 year	4	12.9
2-5 years	7	22.6
6-10 years	11	35.5
> 10 years	13	41.9

4.2.1.2 Owners of Construction Companies View of Performance Specification in Construction

4.2.1.3Owners of Construction Companies View Performance Specification

The owners of the construction companies were interviewed on their specification within their construction company. When asked about their years of operation, majority of them (41.9) % said they had been in operation for over 10 years with a few being in operation for less than 5 years as seen in Figure 4.1. Regarding the department that exist in their construction firm, majority of them said agreed the human resource, estimating and health and safety departments were the common departments found in their firm with a few indicating the quality assurance department as a common department in the firm (Figure 4.2). All the owners of the construction firm agreed to have construction specification on their site as shown in Figure 4.3. Regarding issues on some areas of adherence by firm to performance specification, majority of the respondents (17.6) % mentioned maintenance management plan as an areas of adherence by firm to performance specification with a few indicating Strategic marketing policy and Quality management plan as areas of adherence by firm to performance specification as can be seen in Table 4.3. On techniques practiced by firm to achieving project objectives most of the owners interviewed (17.1) % agreed project design evaluation helped in achieving project objectives with a few agreeing Seminars on quality management helped them in achieving project objectives (Table 4.3).

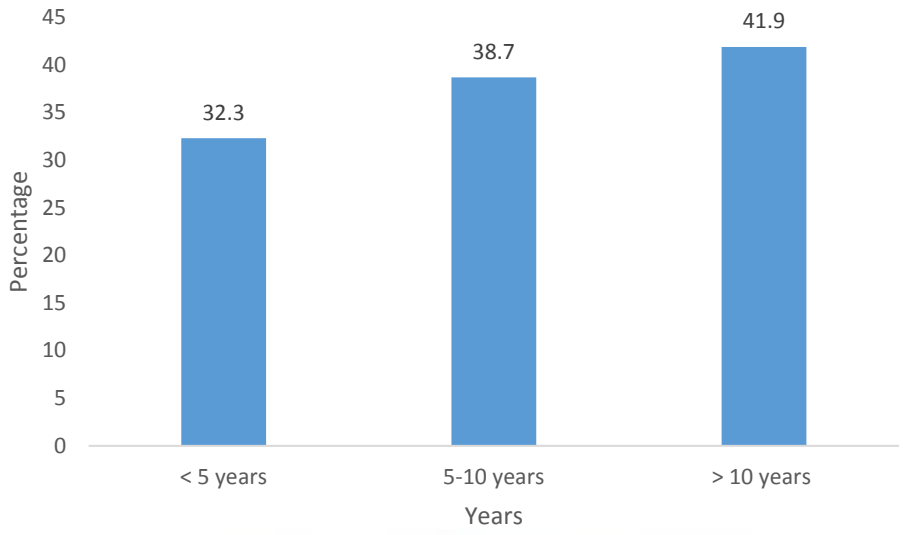

Figure 4.1: Firm's years of operation

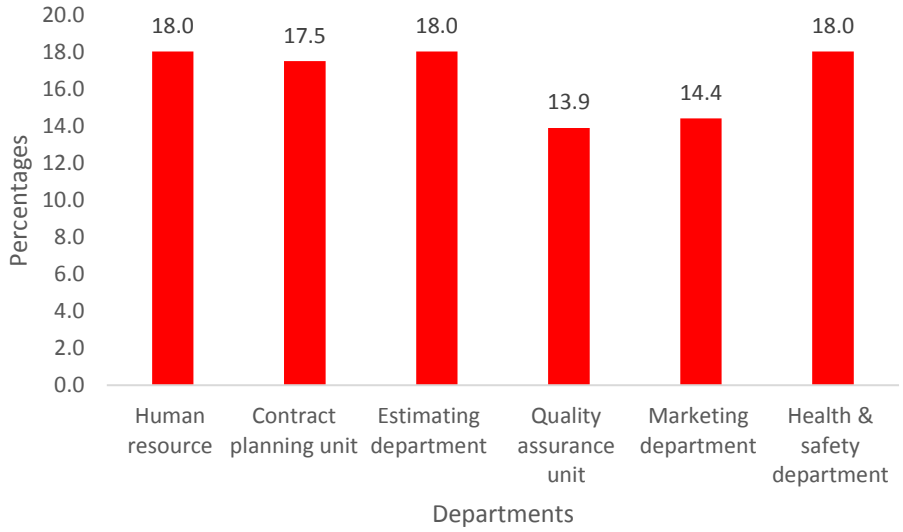

Figure 4.2: Department that exist in your construction firm

Figure 4.3:Construction specification on owners of construction companies site

Table 4.2: Owners of construction companies view on adherence to performance specification in Construction companies

(N=34)	**Frequency**	**Percentage**
Area of specialization		
Strategic marketing policy (n=30)	30	16.0
Information management plan (n=32)	32	17.0
Organizational sales guidelines (n=31)	31	16.5
Maintenance management plan (n=33)	33	17.6
Quality management plan (n=30)	30	16.0
Product evaluation report (n=32)	32	17.0
Techniques Practiced by Firm to Achieving Project Objectives(N=35)		
Project design evaluation (n=34)	34	21.1

Quality manual (n=30)	30	18.6
Seminars on quality management (n=24)	24	14.9
Short courses (n=22)	22	13.7
Newsletters (n=20)	20	12.4
Training Programs (n=31)	31	19.3

4.2.1.4 Owners of Construction Companies View oF Project management performance

The respondents were asked rank the level of some indices with the project management performance frameworks of firm. On the timely development of project charter, most of the respondents (45.7) % agreed it was very high as shown in Table 4.4. Concerning the effectiveness of knowledge integration, most of the respondents (45.7) % agreed it was high

Table 4.4. Regarding efficiency of process integration, majority of the respondents (31.4) % agreed it was very high as observed in in Table 4.4. Concerning effectiveness of staff integration, majority of the respondents (28.6) % agreed it was very high (Table 4.4). On the effectiveness of supply chain integration, most of the respondents (28.6) % agreed it was very high (Table 4.4). Concerning the effectiveness of incorporation of changes, most of the respondents (25.7) % agreed it was high as can be seen in Table 4.4.

Table 4.3: Owners of construction companies view on project management performance frameworks of firm

Timely development of project charter(N=35)	**Frequency**	**Percentage**
Very low	0	0.0
Low	2	5.7
Medium	7	20.0
High	10	28.6
Very high	16	45.7
Effectiveness of knowledge integration(N=35)		
Very low	0	0.0
Low	2	5.7
Medium	14	40.0
High	16	45.7
Very high	3	8.6
Efficiency of process integration(N=35)		
Very low	0	0.0
Low	6	17.1
Medium	10	28.6

High	8	22.9
Very high	11	31.4
Effectiveness of staff integration(N=35)		
Very low	3	8.6
Low	5	14.3
Medium	9	25.7
High	8	22.9
Very high	10	28.6
Effectiveness of supply chain integration(N=35)		
Very low	3	8.6
Low	5	14.3
Medium	9	25.7
High	8	22.9
Very high	10	28.6
Effectiveness of incorporation of changes(N=35)		
Very low	2	5.7
Low	5	14.3
Medium	11	31.4

High	9	25.7
Very high	8	22.9

4.2.1.5 Owners of construction companies view on performance indicators of construction companies

The respondents were also were asked rank the level the Performance indicators of their companies. Concerning the completion of the project within schedule, most of the respondents (42.9) % agreed it was very high as shown in Table 4.5. Concerning the completion of the project within budget, most of the respondents (40.0) % agreed it was high Table 4.5. Regarding achieving required quality, majority of the respondents (37.1) % agreed it was high as observed in in Table 4.5. Concerning the achieving required safety, most of the respondents (34.3) % agreed it was high Table 4.5. Regarding satisfying the client, majority of the respondents (34.3) % agreed it was high as observed in in Table 4.5.

Table 4.4: Owners of construction companies view on indicators of construction companies

Complete the project within schedule (N=35)	**Frequency**	**Percentage**
Very low	0	0.0
Low	0	0.0
Medium	11	31.4
High	9	25.7

Very high	15	42.9
Complete the project within budget (N=35)		
Very low	0	0.0
Low	0	0.0
Medium	9	25.7
High	14	40.0
Very high	12	34.3
Achieve required quality(N=35)		
Very low	0	0.0
Low	0	0.0
Medium	10	28.6
High	13	37.1
Very high	12	34.3
Achieve required safety(N=35)		
Very low	0	0.0
Low	2	5.7
Medium	11	31.4
High	12	34.3

Very high	10	28.6
Satisfy the client(N=35)		
Very low	0	0.0
Low	0	0.0
Medium	14	40.0
High	12	34.3
Very high	9	25.7

4.2.1.6 Owners of construction companies view on factors influencing quality of projects

The respondents were also interviewed on the factors which influences the quality of their projects. Majority of the respondents (32.2) % opined that contract documents was a major factor which influences the quality of their projects with a few indicating the training of their craftsmen as a factor influencing the quality of their projects as indicated in Figure 4.4. On the challenges encountered during quality assurance implementation, majority of the respondents (27.7) % indicated quality control measures used as the major challenge with the minority agreeing the lack of motivation is the challenge (Figure 4.5). Regarding the factors that affect project quality in the firm /organization, most of the respondents (31.2) % agreed that lack of effective supervision affected project quality in the firm /organization more with a few of them indicating negligence as a factor (Table 4.6).

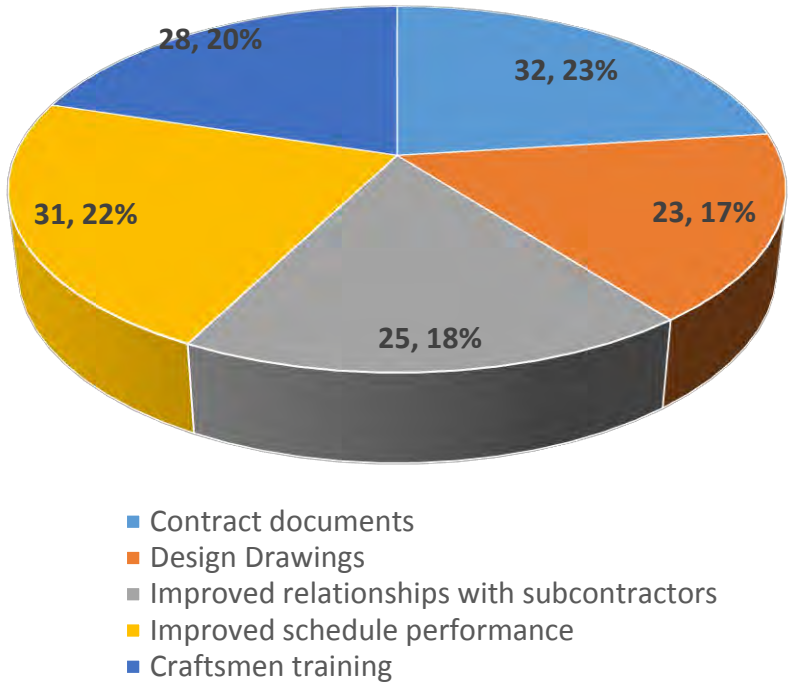

Figure 4.4: Owners of construction companies view of some factors influencing quality of projects of the firm

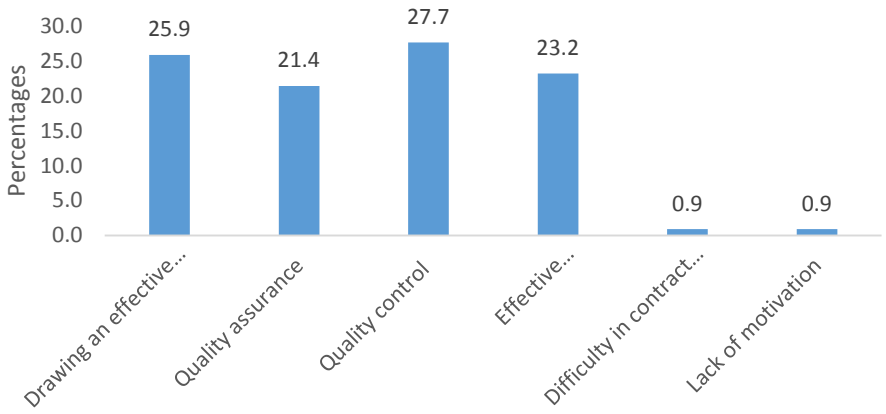

Figure 4.5: Owners of construction companies view on challenges encountered during quality assurance implementation

Table 4.5: Owners of construction companies view on factors that affect project quality in the firm /organization

What are some factors that affect project quality in the Firm organization? (N=35)	Frequency	Percentage
Lack of effective supervision (n=35)	35	13.2
Lack of effective communication (n=32)	32	12.1
Lack of management's commitment to Quality Assurance (n=31)	31	11.7
Lack of proper equipment available for use (n=34)	34	12.8
Lack of a Quality Assurance team to lead the process (n=31)	31	11.7
Setting unrealistic deadlines (n=34)	34	12.8
Working with new people/employees most often (n=33)	33	12.5
Lack of skilled workers available (n=32)	32	12.1
Negligence (n=3)	3	1.1

4.2.1.7 Owners of construction companies view on sustainability of construction projects

The opinions of owners of the construction companies were sort on the sustainable construction project through effective performance specification in construction site. Majority of the owners of the construction companies (11.9) % agreed that

management commitment is the most important to the sustainable construction project although a significant number of them also thought that employee involvement, regular inspection and audit of quality report and regular meetings of project participants as can be seen in Table 4.7.

Table 4.6: Owners of constructions companies' opinion on sustainable construction project

What measures can ensure the sustainability of construction projects (N=35)	**Frequency**	**Percentage**
Management commitment (n=35)	35	11.9
Communication between managers and employees(n=32)	32	10.9
Employee Involvement (n=34)	34	11.6
Regular inspection and audit of quality report (n=34)	34	11.6
Review/analysis used to improve performance(n=31)	31	10.6
Well-defined roles and responsibilities of project participants (n=32)	32	10.9
Clearly defined goals and objectives (n=31)	31	10.6
Incentives for good performance (n=31)	31	10.6
Regular meetings of project participants (n=33)	33	11.3

4.2.2 Result of questionnaire form employees of construction companies

Background information on the employees of the construction companies

The background information on the employees of the construction companies revealed that majority of the owners of the construction companies were males (64.0) % although a few females were engaged in the construction industry as can be seen in Table 4.8. The majority of the employees of construction companies were found to be within the age group 25-30years (46.0) % although a few of them were above the age 31-40 years (Table 4.8). The dominant religion among the employees of construction companies was the Christian religion (86.0) % (Table 4.8). The highest level of education for the majority of the employees of the construction companies was tertiary (58.0) % although a significant number of them had the SHS/Vocational as their highest level of education as can be seen in Table 4.8. On the position of the employees of the construction companies, majority of them (44.0) % said they were the artisans although other position some occupied were site managers and architect with a few being site engineers as shown in Table 4.8. Majority of the employees (48.0) % also said they had had over 10 years' experience in the construction industry with just a few having less than a year experience as indicated in table 4.7

Table 4.7: Background characteristics of employees of construction companies

Gender (N=50)	**Frequency**	**Percentage**
Male	32	64.0
Female	18	36.0
Age group (N=50)		
25-30	23	46.0
31-40	18	36.0

41-50	5	10.0
50+	4	8.0
Religion (N=50)		
Christian	43	86.0
Muslim	12	24.0
Level of education (N=35)		
SHS/Vocational	21	42.0
Tertiary	29	58.0
Position in your organization (N=50)		
Manager (Project manager/Architect/Planning officer/Engineer)	13	26.0
Administrative officer (Secretary/PA/Accountant/Dive)	15	30.0
Artisan (Mason/Plumber/Carpenter)	22	44.0
Experience in the construction industry (N=50)		
< 1 year	6	12.0
2-5 years	7	14.0
6-10 years	24	48.0
> 10 years	13	26.0
What is your firm's years of operation? (N=50)		
< 5 years	9	18.0

5-10 years	17	34.0
> 10 years	24	48.0

SW

4.2.2.2 Employees of construction companiesview on performance specification in construction

4.2.2.3 Employees of construction companiesview on performance specification

The employees of the construction companies were interviewed on specification within the construction company in which they work., majority of them (44.0) % said they had been in operation for over 10 years with a few being in operation for less than 5 years as shown in Figure 4.6when they were asked about their years of operation. Regarding the department that exist in their construction firm, majority of them said agreed the human resource, estimating and health and safety departments were the common departments found in their firm with a few indicating the quality assurance department as a common department in the firm Figure 4.7. Majority of the employees 88.0% in the construction firm agreed to have construction specification on their site as shown in Figure 4.8. Regarding issues on some areas of adherence by firm to performance specification, majority of the employees17.7 % mentioned maintenance management plan as an areas of adherence by firm to performance specification with a few indicating Strategic marketing policy and Quality management plan as areas of adherence by firm to performance specification as shown in Table 4.9. On techniques practiced by firm to achieving project objectives most of the employee interviewed 17.8 % agreed training helped in achieving project objectives with a few agreeing Seminars on quality management helped them in achieving project objectives Table 4.9.

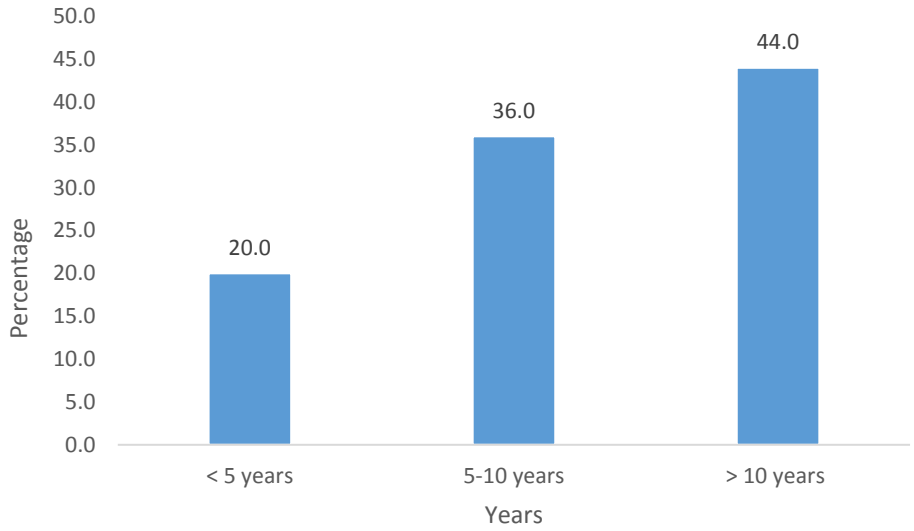

Figure 4.6: Employees view on firm's years of operation?

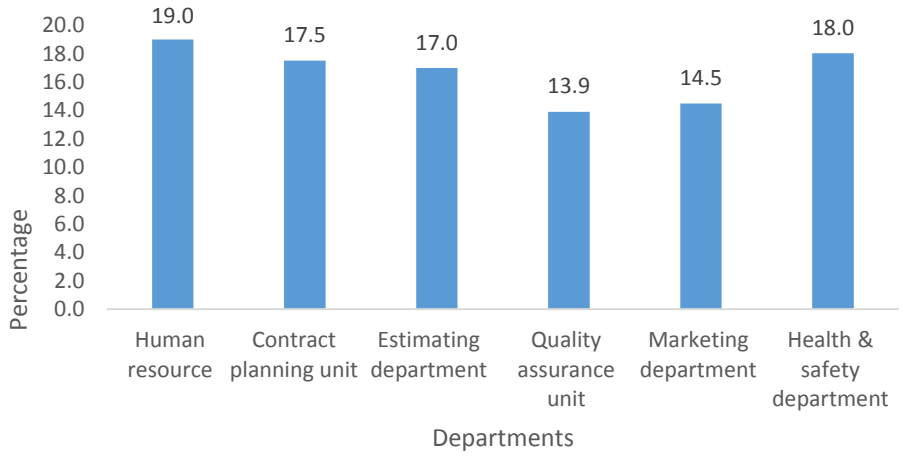

Figure 4.7: Employees view on the department that exist in the construction firm they work in

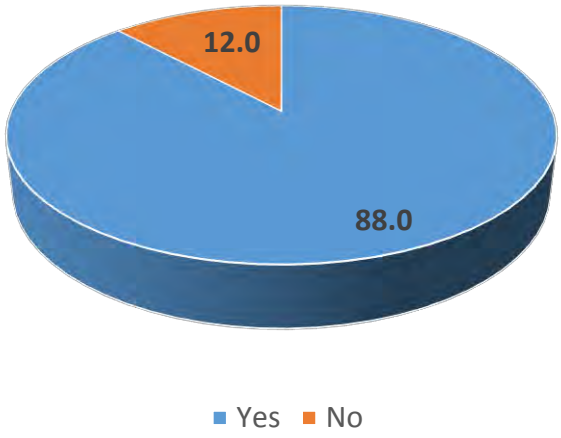

Figure 4.8: Employees view on construction specification on their companies' site

Table 4.8: Employees view onadherence to performance specification in their construction companies

What are some areas of adherence by firm to performance specification(N=49)	**Frequency**	**Percentage**
Strategic marketing policy (n=46)	46	17.0
Information management plan (n=45)	45	16.6
Organizational sales guidelines (n=40)	40	14.8
Maintenance management plan (n=48)	48	17.7
Quality management plan (n=47)	47	17.3
Product evaluation report (n=45)	45	16.6
Techniques Practiced by Firm to Achieving Project Objectives (N=35)		
Project design evaluation (n=43)	43	15.6
Quality manual (n=48)	48	17.5
Seminars on quality management (n=47)	47	17.1

Short courses (n=42)	42	15.3
Newsletters (n=46)	46	16.7
Training Programs (n=49)	49	17.8

4.2.2 Employees of construction companies view on project management performance

The employees of construction companies were asked rank the level of some indices with the project management performance frameworks of firm. On the timely development of project charter, most of the respondents (32.0) % agreed it was very high as shown in Table 4.10. Concerning the effectiveness of knowledge integration, most of the respondents (40.0) % agreed it was high

Table 4.10. Regarding efficiency of process integration, majority of the respondents (30.0) % agreed it was high as observed in in Table 4.10. Concerning effectiveness of staff integration, majority of the respondents (26.0) % agreed it was high (Table 4.10). On the effectiveness of supply chain integration, most of the respondents (30.0) % agreed it was very high (Table 4.10). Concerning the effectiveness of incorporation of changes, most of the respondents (32.0) % agreed it was medium as can be seen in Table 4.10.

Table 4.9: Employees of construction companies view on project management performance frameworks of firm

Timely development of project charter (N=50)	**Frequency**	**Percentage**
Very low	4	8.0
Low	5	10.0
Medium	15	30.0
High	10	20.0
Very high	16	32.0
Effectiveness of knowledge integration (N=50)		
Very low	3	6.0
Low	4	8.0
Medium	16	32.0
High	20	40.0
Very high	7	14.0
Efficiency of process integration (N=50)		
Very low	5	10.0
Low	6	12.0
Medium	13	26.0
High	15	30.0
Very high	11	22.0
Effectiveness of staff integration (N=50)		
Very low	6	12.0

Low	10	20.0
Medium	9	18.0
High	13	26.0
Very high	12	24.0
Effectiveness of supply chain integration (N=50)		
Very low	4	8.0
Low	5	10.0
Medium	10	20.0
High	13	26.0
Very high	15	30.0
Effectiveness of incorporation of changes (N=50)		
Very low	4	8.0
Low	5	10.0
Medium	16	32.0
High	14	28.0
Very high	11	22.0

4.2.2.5 Employees of construction companiesview on performance indicators of construction companies

The employees were also were asked rank the level the performance indicators of their companies. Concerning the completion of the project within schedule, most of the employees (40.0) % agreed it was very high as shown in Table 4.11. Concerning the completion of the project within budget, most of the employees (38.0) % agreed it

was high Table 4.11. Regarding achieving required quality, majority of the respondents (40.0) % agreed it was high as observed in in Table 4.11. Concerning the achieving required safety, most of the employees (44.0) % agreed it was high Table 4.11. Regarding satisfying the client, majority of the respondents (38.0) % agreed it was high as observed in in Table 4.11.

Table 4.10: Employees of construction companiesview on performance indicators of construction companies

Complete the project within schedule (N=50)	**Frequency**	**Percentage**
Very low	0	0.0
Low	5	10.0
Medium	11	22.0
High	14	28.0
Very high	20	40.0
Complete the project within budget (N=50)		
Very low	0	0.0
Low	3	6.0
Medium	11	22.0
High	19	38.0
Very high	17	34.0
Achieve required quality (N=50)		
Very low	0	0.0
Low	5	10.0

Medium	13	26.0
High	20	40.0
Very high	12	24.0
Achieve required safety (N=50)		
Very low	0	0.0
Low	4	8.0
Medium	14	28.0
High	22	44.0
Very high	10	20.0
Satisfy the client (N=50)		
Very low	2	4.0
Low	3	6.0
Medium	17	34.0
High	19	38.0
Very high	9	18.0

4.2.2.6 Employees of construction companies view on factors influencing quality of projects

The employees were also interviewed on the factors which influences the quality of their projects. Majority of the employees (21.2) % opined that training of their craftsmen was a major factor which influences the quality of their projects with a few indicating the improved schedule performance as a factor influencing the quality of their projects as indicated in Figure 4.9. On the challenges encountered during quality assurance implementation, majority of the employee (27.7) % indicated quality

control measures used as the major challenge with the minority agreeing the lack of motivation is the challenge (Figure 4.9). Regarding the factors that affect project quality in the firm /organization, most of the employees (12.5) % agreed that Lack of effective communication affected project quality in the firm /organization more with a few of them indicating negligence as a factor (Table 4.12).

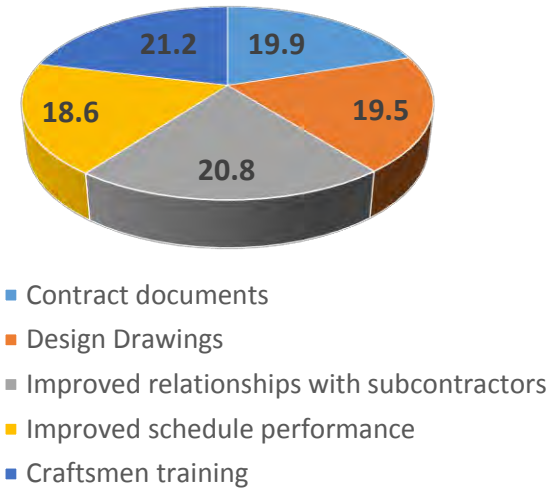

Figure 4.9: Employees of construction companies view on some factors influencing quality of projects of the firm

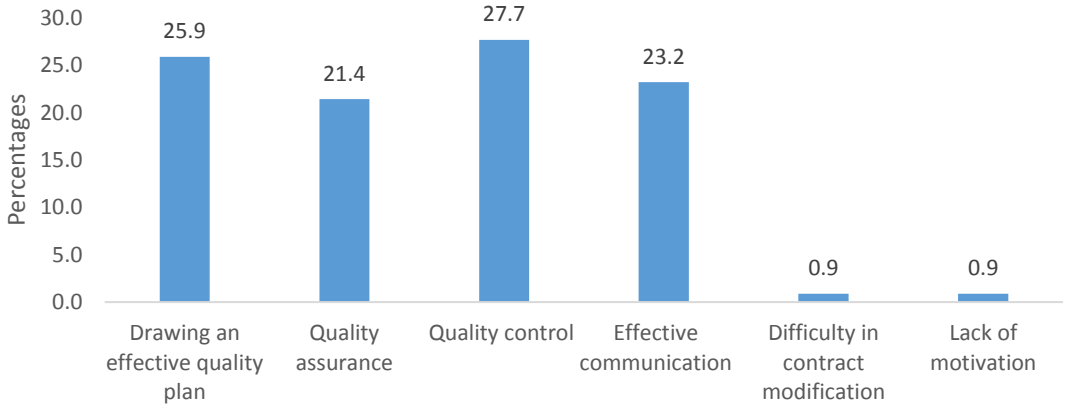

Figure 4.10: Employees of construction companies view on challenges encountered during quality assurance implementation

Table 4.11: Employees of construction companies view on factors that affect project quality in the Firm /organization

What are some factors that affect project quality in the Firm organization? (N=50)	**Frequency**	**Percentage**
Lack of effective supervision (n=46)	46	11.5
Lack of effective communication (n=50)	50	12.5
Lack of management's commitment to Quality Assurance (n=47)	47	11.8
Lack of proper equipment available for use (n=44)	44	11.0
Lack of a Quality Assurance team to lead the process (n=45)	45	11.3
Setting unrealistic deadlines (n=42)	42	10.5
Working with new people/employees most often (n=46)	46	11.5
Lack of skilled workers available (n=48)	48	12.0
Negligence (n=32)	32	8.0

4.2.2.7 Employees of construction companies view on the sustainability of construction projects

The opinions of employees of the construction companies were sort on the sustainable construction project through effective performance specification in construction site. Majority of the employees of the construction companies (11.7) % agreed that management commitment is the most important to the sustainable construction project although a significant number of them also thought that employee involvement, regular inspection and audit of quality report and regular meetings of project participants as can be seen in Table 4.13.

Table 4.12: Employees of construction companies opinion on sustainable construction project

What measures can ensure the sustainability of construction projects (N=50)	Frequency	Percentage
Management commitment (n=45)	45	11.7
Communication between managers and employees (n=42)	42	10.9
Employee Involvement (n=44)	44	11.5
Regular inspection and audit of quality report (n=43)	43	11.2
Review/analysis used to improve performance (n=42)	42	10.9
Well-defined roles and responsibilities of project participants (n=43)	43	11.2
Clearly defined goals and objectives (n=41)	41	10.7

Incentives for good performance (n=41)	41	10.7
Regular meetings of project participants (n=43)	43	11.2

4.3 Result of Interview

4.3.1 Result of Interview from clients of construction companies

Background Characteristics of clients of construction companies

The background information on the clients/users of projects, majority of the respondents (72.0) % were male as compared to females as was observed for the owners of the construction companies interviewed as shown in Table 4.14. Most of clients/users of projects interviewed were within the age group 41-50years (35.0) % with a few of them being between the age group 25-30 year as can be seen in Table 4.14. Majority of the clients/users of projects (86.0) % were Christian as compared to Muslims similarly to what was observed for the owners of the construction companies (Table 4.14). The highest educational level for most the clients/users of projects interviewed was the tertiary level (40.0) % although a significant number of them had SHS/Vocational as was observed for the owners of the construction companies (Table 4.14). Majority of clients/users of projects interviewed (54.0) % were self-employed with a few being in government workers as can be seen in Table 4.14. Most of the clients/users of projects (30.0) % had 2-5 years' experience in the construction with a few having less than one year experience (Table 4.14).

Table 4.13: Background characteristics of clients/users of projects

Gender (N=50)	**Frequency**	**Percentage**
Male	45	72.0
Female	5	28.0
Age group (N=50)		
25-30	1	8.0
31-40	8	11.0
41-50	27	35.0
50+	14	46.0
Religion (N=50)		
Christian	46	86.0
Muslim	4	14.0
Level of education (N=50)		
No education	6	12.0
Primary	3	6.0
JHS	8	16.0
SHS/Vocational	13	26.0
Tertiary	20	40.0
Employment status (N=50)		

Self employed	27	54.0
Government worker	10	20.0
Private worker	13	26.0
Experience in the construction industry (N=50)		
< 1 year	12	24.0
2-5 years	15	30.0
6-10 years	13	26.0
> 10 years	10	20.0

Clients/users of projects view on Sustainability of Construction Projects

Most of the clients/users of projects were interviewed on ways their work contribute to effective performance on construction sites. Most of them (42.0)% said they supervising of ongoing projects was a major way they contribute to effective performance whiles a few opined ensuring maintenance of the project was a way of contributing to effective performance as shown in Table 4.15. Again all the clients/users of projects agreed to having control of performance specification on their construction site (Table 4.15). When asked on what they will you do as a client's when they realize that an effective performance specification is not followed, majority of them (32.0) % said they would stop the construction work and ensuring specification is met with a significant number of them indicating non-payment of contractors and reporting to the appropriate authorities as a way to go when they

realize that an effective performance specification is not followed as can be seen in Table 4.15.

Table 4.14: Clients of projects opinion on sustainable construction project through effective performance specification in construction site

In what way does your work as a client contribute to effective performance on construction sites(N=50)	**Frequency**	**Percentage**
Supervising of ongoing projects	21	42.0
Ensuring the use of quality materials which meet specification	19	38.0
Ensure maintenance of project	10	20.0
Do you have any control of performance specification on your construction site? (N=50)		
Yes	50	50.0
No	0	0.0
What will you do as a client when you realize that an effective performance specification are not followed (N=50)		
Payment is not made to contractors	10	20.0
Demolishing and reconstruction to meet specification is done	6	12.0

Stop the construction work and ensuring specification is met	16	32.0
Draw the consultant of the projects attention	7	14.0
Report to the appropriate authorities	9	18.0
Orient workers	2	4.0

4.4 Results of Observations

Observations on the field were done for buildings which conformed to construction specifications as well as those which did not.

Standard performance specification

Observation on site for some buildings were seen to conform to the construction specification, the commencement and completion date were met, budgetary allocation and standard performance were archived as can be seen in figure:4.1-4.5

Figure 4.1: On-going Eastern Premier Hotel.

Figure 4:2: Completed Eastern Premier Hotel

Figure 4.3 Four bedroom for Koforidua Technical Institute

Figure 4.4: National Communication Authority Project at Koforidua

Figure 4.5: Municipal Assembly Project for Supermarket at Koforidua

non-performance specification projects

There was evidence of buildings which did not meet construction specifications requirement. The project commencement and completion date were not met, sites were deserted, and materials were exposed to the weather conditions. These building included both private and government buildings under construction as can be seen in figures.4.6-49

Figure 4.6: 6 unit classroom Koforidua Technical Institute

Figure 4.7: 12 unit Dormetary for Kotech Institute in Koforidua

Figure 4.8: Affordable Houses in Koforidua

Figure 4.9: Affordable House in Koforidua

Monitoring Of Sustainable Construction Project Through Effective Performsnce Specification On Construction Sites

The results of the study imply that most of the people owning and are involved in construction companies are males since this was observed for both the owners and users/clients of constructions. Those who own construction companies or are engaged in construction projects in the Koforidua area are in the youthful age. This could be due to the fact that the construction sector is an energy intensive area and thus require people with a lot of energy. The dominant religion among the people of the area is the Christian religion since this was observed as the majority religion for both the owners of and clients of construction projects. Most of the people engaged in the construction sector either a clients or operators have higher education. This suggest that they have adequate basic knowledge and thus they would better understand some challenges at may arise from the sector. The owners of construction within the Koforidua have adequate skill to run their businesses since most of them indicated they positions were project managers, site managers and architects. They also have adequate years of experience in the construction industry. Similarly the client of construction projects in the Koforidua area also have been engaged in the construction industry for some time and thus have adequate knowledge in the field.

The owners of the construction companies also have adequate department to ensure construction specification on their site are met since departments such as the human resource, estimating and health and safety departments were the common departments found in their firm. Construction companies in the Koforidua are have construction specification on their site since all of them interviewed agreed to it. They however agreed that there were issues on some areas of adherence by firm to performance specification. A major issues on some areas of adherence is the maintenance of

management plan. They however apply techniques such as project design evaluation as a major way to achieve their project objectives since most of them interviewed mentioned this as they way of achieving their project objective.

Among the project management performance frameworks used by owners of the construction company to ensure that specification are met, timely development of project charter, effectiveness of knowledge integration, and effectiveness of staff integration are the major framework used by the owners of construction companies.

The major performance indicators use by most of the construction companies were the completion of the project within schedule, completion of the project within budget and achieving required quality since most of them agreed to this when interviewed.

The kind of contract documents used in the projects is a major factor which influences the quality of projects. The use quality control measures is the major challenge the also face in their operation with the lack of effective supervision being a major factor affecting project quality in their organization.

The owners of the construction companies and their employees opine that the sustainable construction project through effective performance specification in construction site could be achieved through management commitment, employee involvement, regular inspection and audit of quality report and regular meetings of project participants as a way forward.

Supervising of ongoing projects by the clients/users of projects on the other hand is a major way they can contribute to effective performance. Clients/users of projects within the Koforidua area usually control of performance specification on their construction site. Stopping the construction work and ensuring specification is met, non-payment of contractors and reporting to the appropriate authorities are measures clients/users agreed they would go when they realize that an effective performance

specification are not met. The Koforidua area has buildings which either conform to specifications or not. These buildings are made up of both private and government buildings.

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

Following the analysis and discussion of the survey data in chapter four, this chapter summarizes the major findings from the study. Based on the obtained results, conclusions were drawn from the causes of ensuring sustainable construction project through effective performance specification on construction site and recommendations for the study were outlined.

5.2 Summary of findings

The following are the findings:

- The study reveals that Construction Companies in the New Juabeng municipality although have construction specifications on their site as demanded there was no adherence to the performance specifications in the execution of the projects.
- The Study shows that most of the Construction Companies ignored the strict adherence to their project maintenance plan which made them deviate from achieving the performance specifications.
- Irregular inspection and auditing of projects during the execution stage was identified by the researcher as a major cause of not achieving sustainable construction projects.
- The researcher discovered that lack of proper budgeting allocation affected the completion of projects on schedule.
- The non-commitment on the part of successive governments to implement projects initiated by their predecessors was also a major challenge for ensuring adherence to performance specification as discovered by the researcher.

- Unnecessary delays in honouring Payment Certificates by funding agencies were a major contributing factor to the failure of most construction firms in meeting their performance specifications on construction sites.
- Over design of projects by architects and sponsors was yet another factor chanced on by the study as a factor affecting sustainable effective projects.
- Undue delays in project execution attracts cost variations which effects most of the construction companies and project sponsors seems to be ignorant of.

5.3 Conclusions

It was concluded from the study that: the construction industry in the New Juabeng Municipality have enough knowledge about construction specification on their sites since all of them interviewed agreed to it. There are however, issues on some areas of adherence by firm to performance specification.

A major issue on some areas of adherence is the maintenance of management plan. Construction companies apply techniques such as project design evaluation as a major way to achieve their project objectives.

The major performance indicators use by most of the construction companies are the completion of the project within schedule, completion of the project within budget and achieving required quality since most of them agreed to this when interviewed.

Among the project management performance frameworks used by owners of the construction company to ensure that specification are met, timely development of project charter, effectiveness of knowledge integration, and effectiveness of staff integration are the major framework used by the owners of construction companies.

The owners of the construction companies opine that the sustainable construction project through effective performance specification in construction site could be achieved through management commitment, employee involvement, regular inspection and audit of quality report and regular meetings of project participants as a way forward.

Supervising of ongoing projects by the clients of projects on the other hand is a major way they can contribute to effective performance.

5.4 Recommendations

The Researcher recommends the following measures for implementation.

- Construction firms should ensure both the availability and strict adherence to performance specifications in the execution of projects
- Construction companies in order to achieve performance specifications should religiously implement their project management plans.
- Regular inspection and Auditing of projects should be carried out to enhance sustainability in construction projects.
- Every project should be clearly budgeted for by carefully listing every expense upfront. If unbudgeted expenditure takes place, the client should be informed as soon as possible to avoid complications down the truck.
- Successive governments should ensure the completion of ongoing projects before initiating new ones to ensure value for money and performance specification.
- Payments Certificates raised by Construction firms should be promptly honoured to ensure project continuation and avoid undue delay in the completion projects.

- Architects and project sponsors should be modest in their project design to help enhance effective project performance.
- Project Sponsors and Construction Companies should be sensitized on the cost implications of unduly delaying the execution of construction projects.

REFERENCES

Adjei, D. S. (2012, February). Anvuur, Kumaraswamy. (2006). Problems Militating against the Performance of Ghanaian Construction Industry.

Pheng, L. S. & Shiua, S. C. (2000). The Maintenance of Construction Safety: Riding on ISO 9000 Quality Management Systems. *Journal of Quality in Maintenance Engineering, 6*(1), 28-44.

Boadu, K. A. (2017, May 31). We are losing fight against noise pollution. *Graphic*.

BRE, Garston, Watford WD25 9XX. (n.d.). *sustainable construction – simple ways to make it happen.* ENGLAND.

De, B. (2013).

Haimes, (2009). *Risk Modeling, Assessment, and Management*, (3rd Edition) John Wiley and Sons, Ney Jersel Canada.

Bureau of Labor Statistics (2000 - 2009): Injuries, Illnesses, and Fatalities: U.S. Department of Labor: Retrieved from [http://www.bls.gov/iif/home.htm] in October 2010.

Construction Industry Institute (2003): Safety Plus: Making Zero Accidents A Reality: Research Summary 160-1.

Delali-Bessa. (2017). Retrieved from http://www.citifmonline.com

Ephon, B. (2017, May). Retrieved from http://www.benephson.com/article/overview-of-the-construction-industry-in-ghana

Gyekye, A. S. (2005). Workers' perceptions of workplace safety and job satisfaction. *International Journal of Occupational Safety and Ergonomics* (JOSE); 11:291–302.

Haimes, (2009). *Risk Modeling, Assessment, and Management*, (3rd Edition) John Wiley and Sons, Ney Jersel Canada.

Hallowell, M. R. (2011). *Safety Knowledge Management in American Construction Organizations.* J Manage Eng 28, 203–11.

Health and Safety Executive (HSE), 2002, Revitalizing health and safety in construction (HSE

Behm, M. (2005). Linking Construction Fatalities to the Design for Construction Safety Concept. *Journal of Safety Science*, *43*(8), 589-611.

Ephon, B. (2017, May). The Construction Sector Continues to Be the Engine for growth. Gibb, A.G.F., Haslam, R.A., Hide, S., Gyi, D.E. and Duff, A.R. (2006). Why accidents happen, Civil Engineering, Proceedings of the Institution of Civil Engineers, Vol. 159, November 2006, pp. 46-50, ISSN 0965 089 X – ICE Gold Medal Winner 2007

Flybase. (2017, June). Retrieved from FlyBase Reference Report: Lopes et al., 2001, Biochem. Biophys. Res. Commun. 284(4): 1004--1010

Hinze, J. and Teizer, J. (2011). *Visibility-related fatalities related to construction equipment.* Saf Sci 49, 709–18.

Behm, M. (2005). Linking Construction Fatalities to the Design for Construction Safety Concept. *Journal of Safety Science*, *43*(8), 589-611.

Cotton A. P., Sohail, M., & Scott, R. E. (2005). Towards improved labour standards for construction of minor works in low income countries. *Engineering, Construction and Architectural Management, 12*(6), 617-632.

Geneva/London, Peter Boswell, Lorna Walker. (2004). *Procurement and process design.*

George Hove, Adewale Banjo. (2015, April 14). Performance in the Construction Industry.

Glen, J. (n.d.). Retrieved from http://www.businessdictionary.com/definition/construction-industry.html

Gyadu-Asiedu, W. (2009). *Assessing Construction Project Performance in Ghana: Modelling Practitioners' and.* Asamankese, Ghana.

Briere, J., Chevalier, A & Imbernon, E. (2010). Surveillance of Fatal Occupational Injuries in France: 2002-2004. *American Journal of Industrial Medicine*, *53*, 1109-1118.

Kwaku Ahmed, Lamiah Hatira. (2014). The Construction Industry in Ghana, West Africa.

Michael J. Baker, Esq. (n.d.). *Performance Specification.*Rowel, W.D. (1982). *Corporate Risk Assessment, Strategies and Technologies: How to Limit the Risk in Industry.* New York: Dekker

KPMG (2008). Potential Opportunity for Investors Kumasi, Ghana, pp. 1-15. House. PVT. LTD.

Erbil, Y. & Akıncıtürk, N. (2010). An Exploratory Study of Innovation Diffusion in Architecture Firms, *Scientific Research and Essays,* Vol. 5(11), Pp. 1392-1401

Krippendorff, K. (2004). Content Analysis: An Introduction to Its Methodology (2nd ed.). Thousand Oaks, CA: Sage.

International Labour Organization (*Construction: a hazardous work*, 15 June 2009) http://www.ilo.org/safework/info/WCMS_124597/lang–en/index.htm. Accessed June 17, 2012.

Ofori. (2000).Ahadzie, D. K. (2007). Model for Predicting the Performance of Project Managers at the Construction Phase of Mass House Building Projects, http://wlv.openrepository.com/wlv/bitstream/2436/15393/2/Ahadzie_PhD%20thesis.pdf, Accessed on 12th November 2009.

Parliament. (1992). 1992 Constitution Of Ghana. Accra.

Plessis, D. (2009).

APPENDICES

APPENDIX 1

SUSTAINABILITY OF CONSTRUCTION PROJECTS THROUGH EFFECTIVE PERFORMANCE SPECIFICATION ON CONSTRUCTION

INTRODUCTION

This questionnaire forms part of an MTech. Research project which aims to examine how sustainable construction can be achieved through effective performance specification in construction sites.

A: BACKGROUND INFORMATION

1 Gender

1. Male ☐ 2. Female ☐

2 Age group

1. 25-30 ☐ 2. 31-40 ☐ 3. 41-50 ☐ 4. 50+ ☐

3 Religion

1. Christian ☐ 2. Muslim ☐ 3. Traditionalist ☐

4 Level of education

1. No education ☐ 2. Primary ☐ . JHS ☐ 4.SHS/Vocational ☐

5. Tertiary ☐

5 Position in the company

1. Project manager ☐ 2.Site manager 3. S☐ engineer 4. ☐

Architect ☐

6 Experience in the construction industry

1. < 1 year ☐ 2. 2-5 years ☐ 3. 6-10 years ☐ 4. > 10 years ☐

B: PERFORMANCE SPECIFICATION OF CONSTRUCTION

7 What is your firm's years of operation?

1.< 5 years ☐ 2. 5-10 years ☐ 3. > 10 years ☐

8 What are the department that exist in the firm

1. Human resource ☐
2. Contract planning unit ☐
3. Estimating department ☐
4. Quality assurance unit ☐
5. Marketing department ☐
6. Health & safety department ☐

9 Do you have construction specification on your site?

1. Yes ☐ 2. No ☐

10 What are some areas of adherence by firm to performance specification?

1. Strategic marketing policy ☐
2. Information management plan ☐
3. Quality management plan ☐
4. Organizational sales guidelines ☐
5. Maintenance management plan ☐
6. Product evaluation report ☐

11 Techniques Practiced by Firm to Achieving Project Objectives

	Extent ıt ıs realized by the company				
	Very low 1	Low 2	Medium 3	High 4	Very high 5
1. Timely development of project charter					
2. Effectiveness of knowledge integration					
3. Efficiency of process integration					
4. Effectiveness of staff integration					
5. Effectiveness of supply chain integration					
6. Effectiveness of incorporation of changes					

1. Project design evaluation ☐ 4. Seminars on quality management ☐

2. Quality manual ☐ 5. Short courses ☐

3. Newsletters ☐ 6. Training Programs ☐

12 Project management performance frameworks of firm

13 Performance indicatorsof firm

	Extent it is realized by the company				
	Very low 1	Low 2	Medium 3	High 4	Very high 5
1.Complete the project within schedule					
2.Complete the project within budget					
3.Achieve required quality					
4.Achieve required safety					
5. Satisfy the client					

C: FACTORS INFLUENCING QUALITY OF PROJECTS

14 What are some factors influencing quality of projects of the firm

1. Contract documents ☐ 4. Craftsmen training ☐

2. Design Drawings 5. ☐ proved relationships with subcontractors ☐

3. Improved schedule performance ☐

15 Challenges Encountered During Quality Assurance Implementation

1. Drawing an effective quality plan ☐

2. Quality assurance ☐

3. Quality control ☐

4. Effective communication ☐

5. Other specify……

16 What are some factors that affect project quality in the Firm /organization?

1. Lack of effective supervision ☐

2. Lack of effective communication ☐

3. Lack of management's commitment to Quality Assurance ☐

4. Lack of proper equipment available for use ☐

5. Lack of a Quality Assurance team to lead the process ☐

6. Setting unrealistic deadlines ☐

7. Working with new people/employees most often ☐

8. Lack of skilled workers available ☐

9. Other specify……

D: SUSTAINABILITY OF CONSTRUCTION PROJECTS

17 What measures can ensure the sustainability of construction projects

1. Management commitment ☐
2. Communication between managers and employees ☐
3. Employee Involvement ☐
4. Regular inspection and audit of quality report ☐
5. Review/analysis used to improve performance ☐
6. Well-defined roles and responsibilities of project participants ☐
7. Clearly defined goals and objectives ☐
8. Incentives for good performance ☐
9. Regular meetings of project participants ☐
10. Other specify……