UNIVERSITY OF EDUCATION, WINNEBA

IMPROVING QUALITY PERFORMANCE OF PUBLIC SECTOR CONSTRUCTION PROJECTS USING QUALITY PERFORMANCE INDICATORS (QPIs): THE CASE OF GHANA EDUCATION AND HEALTH SERVICES

AIKINS AYIM

2016

UNIVERSITY OF EDUCATION, WINNEBA

IMPROVING QUALITY PERFORMANCE OF PUBLIC SECTOR CONSTRUCTION PROJECTS USING QUALITY PERFORMANCE INDICATORS (QPIs): THE CASE OF GHANA EDUCATION AND HEALTH SERVICES

AIKINS AYIM

A Dissertation in the Department of Construction and Wood Technology Education, Faculty of Technical Education, submitted to the School of Graduate Studies, University of Education, Winneba in partial fulfilment of the requirements for award of the Master of Philosophy (Construction Technology) degree.

OCTOBER, 2016

DECLARATION

STUDENT'S DECLARATION

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

SIGNATURE: ……..

DATE: ……

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: NONGIBA ALKANAM KHENI (PhD)

SIGNATURE: …….....

DATE: ….....

ACKNOWLEDGEMENT

I thank God for the grace and mercy that has brought me this far, in starting and successfully completing this Master's programme. I will forever be grateful to him. I owe a special debt of gratitude to my supervisor, Dr. Nongiba Alkanam Kheni for his patience, commitment, guidance, encouragement, support and critical way of supervision, which contributed to the successful completion of this work. Also, to all my lecturers in Department of Construction and Wood Technology Education who facilitated various courses, I say profound thanks. I wish to express my deepest gratitude to my family, personalities, friends and course mates who offered me wonderful assistance in diverse ways throughout my education.

My appreciation further goes to the construction professional executing Ghana Education service and Ghana Health Service projects in the Eastern Region who took time off their busy schedules to answer my questionnaire without which I could not have completed this work. Finally, my thanks go to Mercy Obesebea Asare for her effort and support. May Almighty God bless you all and your descendants!

DEDICATION

I dedicate this work to my late wife Patricia Wiafe and our two boys Samuel Graham Kofi Aikins and Awesome Nhyiraba Kwasi Aikins.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

ABSTRACT

There is lack of universally accepted measurement framework for project performance, particularly in developing countries including Ghana. This brings to the fore the need for performance indicators for projects. It is essential that such performance indicators do not merely focus on the needs of project implementing agencies but also address the needs of beneficiaries. The aim of the study was to explore the use of quality performance indicators in improving quality performance of public sector projects in Ghana. The specific objectives of the study included to; identify key quality performance indicators for measuring quality performance of public sector construction projects, identify the critical constraints to effectively managing quality of public sector projects in Ghana, identify the benefit of key quality performance indicators, and make recommendations for improving quality management of public sector projects in Ghana. Quantitative research design was adopted involving the development and administration of questionnaires to a sample of 127 construction professionals and consultants involved in the execution of Ghana Education Service and Ghana Health Service projects in the Eastern Region. The findings of the study revealed that completing work on time, ensuring efficient and optimum use of resource, doing the right job first time, efficiently and effectively managing construction project, and providing own resources were the key performance indicators of Ghana Education Service and Ghana Health Service projects in the study setting. It was evident that difficulties in quantifying cost of quality, poor information and communication channels, difficulties in implementing quality measures, poor monitoring and controlling construction processes, high cost of developing and utilizing a quality management system, and low project team capability were the

dominant critical constraints to effectively and efficiently managing quality. The study recommended that quality performance indicators should be introduced to monitor and evaluate construction the industry in Ghana to ensure systematic and quality performance of public sector construction projects, the key client entities and professional bodies should develop quality performance indicators to enable entities assess and rate the performance of each contractor on each project. Client entities should institute training procedures or refresher courses in quality performance as part of their annual plan for the architects, constructors, engineers, project managers and surveyor who spearhead public sector construction projects.

CHAPTER ONE

1.0 INTRODUCTION

This chapter presents the background of the study emphasizing upon the importance of performance measurement of public sector construction projects in Ghana, the contribution of construction in the public sector to the economy and the challenges it faces in developing countries. Subsequently, the chapter discusses the research problem, research objectives, scope of the study and the significance of the study. It also outlines the organization of the dissertation in terms of its chapters and the contents contained in each chapter.

1.1 Background to the Study

Great expenditures of time, money and resources, both human and material, are wasted each year because of inefficient quality management procedures. According to Arditi and Gunaydin (1997), attainment of acceptable levels of quality in the construction industry has long been a problem. The last three decades have witnessed innovative studies on improving quality performance of construction projects. Lee and Arditi (2006) emphasized that the management of quality is an important issue in the delivery of construction projects. Delgado-Hernandez and Aspinwall (2008) reported that the construction industry in the UK has begun to take up the challenge of quality issues; as a result, companies have won repeat business, increased their market shares and improved their customer satisfaction levels. Quality of performance and negative perceptions of Ghanaian Contractors has become a great concern to the Government and general public (Taskforce Report, 2007). In this regard, a five person taskforce was therefore set up by the Ministry of Finance and Economic Planning (MOFEP) on October 10, 2007 to study the situation, make recommendations and submit its findings.

The Taskforce Report recommended a rating and ranking scheme to contractors to encourage them to strive for excellence. The Report also proposed an Award Scheme for contractors which they believe would immensely improve the construction in Ghana. This will subsequently remove the negative perception about local contractors and enable them to compete favorably with international contractors.

According to Martin (2004), as a results of the increase in technological, financial and development process of design and production, construction industries all over the world are being forced to improve its performance to be in line like the manufacturing industry. Martin (2004) further indicated that the magnitude of investment in the construction industry encouraged different governments to undertake initiatives to improve the performance of the construction projects and the construction industry overall. To add to this, it must be noted here that, the construction industry suffers broadly from fragmentation, which reduces the effectiveness of projects management. Indeed, Egan (1998) argued that there were a deep concerns regarding the construction industry in terms of underachievement of performance, where it suffered from low profitability, minimal capital investment and under-funded research, development and training. Improving project performance in the construction industry poses several challenges for stakeholders. However, it is not an easy task to sustain radical improvement in a diverse environment such as the construction industry (Egan, 1998).

It requires the identification and implementation of suitable improvement programmes subjected to the construction business cycle (Tang & Ogunlana, 2003). This is important since the integration of improvement programmes in construction may incur high cost and yet the benefit can only be realized after some time delay (Takim, 2005). However, there is a need for new improvement programmes and initiatives at various stages of a project life-cycle in order to enhance construction project

performance and target changing trends especially, in the public sector construction project (Tang & Ogunlana, 2003). Quality management systems can contribute to the mitigation and elimination of rework/non-conformances; enhance client satisfaction; performance, and provide the catalyst for the synergy relative to the project parameters such as client satisfaction, cost, quality, and time (Smallwood & Rossouw, 2008). Smallwood and Rossouw (2008) further mentioned that establishing the project requirement for quality begins at project inception. A careful balance between the owners requirement of the project costs and schedule, desired operating characteristics, materials of construction and the design professionals' needs for adequate time and budget to meet those requirements during the design process is essential. According to Lee and Arditi (2006) the owner will come closest to its desired quality by selecting firm based on the totality of the firm's quality performance including the quality of its corporate service, project service and constructed facility. The contractor is responsible for the means, methods, techniques, sequences and procedure of construction as well as safety precautions and programmes during the construction (Pheng & Teo, 2004). Project requirements are the key factors that define quality in the process of construction (Pheng & Teo, 2004).

Criticism of performance with the construction industry is not new. Concerns were voiced through two significant reports – Constructing Team: Latham (1994) and Rethinking Construction: Egan (1998). Other independently commissioned reports not only reflected six decades of concern with performance and project out turns place within a public sector context, but also recognized difficulties experienced from contractors in achieving such goals. Post (1980) report seeks to elevate the construction industry and propose adoption of team values. The importance of relationships within the team are highlighted in Egan's Report and emphasized further in Modernizing

Construction (National Audit Office, 2001), together with a call for effective use of investment, training and innovation in projects.

In order to engage with recommendations offered by Latham and Egan, public sector organizations made changes to their contractor selection processes whilst retaining the need to comply with statutory requirements. Construction Frameworks are a relatively new idea. Although a number of frameworks have been concluded, there is very little analysis regarding project outcomes. A 'gap in professional knowledge' has arisen due to the long periods required to compile data and the transient nature of the organizations being measured. Construction projects, by their nature, involve teams being assembled for specific projects which are then disbanded upon completion. The lack of available data was recognized as a hindrance to studying construction industry performance by Dainty (2008).

Project success-specific studies have identified time, cost and quality as the three most important indicators to measure construction project performance (Meng, 2001). According to Lee, Ledbetter, and Hui, (2012), project performance is measured on the basis of completion within budget and on schedule, compliance with quality standard, and satisfaction of the owner. This research aims to assess, through a study of a framework, ways for improving quality performance of public sector construction projects in Ghana. Further, parts of the research will concentrate on the results in significant improvement in the performance outcomes in respect of quality, cost and time. The impact of frameworks on the overall project cost, including production cost and transaction cost, forms a separate area for research.

1.2 Statement of the Problem

Construction companies in Ghana and the increasing competitiveness in the construction sector, it is important that clients deploy appropriate quality performance indicators (KPIs) to increase value/quality of public sector construction projects. For any institutions, Quality Performance Indicators (KPIs) is to set metrics to quantify both the competence and effectiveness of any projects. The primary purpose of KPIs is to achieve excellence in customer satisfaction through improvement of products and processes by the total involvement and dedication of each individual who is part of that product process (Ahmed, 1993). Nonetheless, in most developing countries such as Ghana, the principles of KPIs are not employed leading to low quality works, high construction costs and dissatisfied clients. There is a major problem in obtaining acceptable levels of quality projects in the Construction Industry. From both Contractor and Consultant point of view, some of the challenges in the Ghanaian Construction Industry include poor workmanship, inadequate workmanship, low productivity and lack of trained workforce (Ofori, 2012). In view of this, the clients of construction projects needs proactive performance indicators such as KPIs in order to improve quality of works, reduce re-work and the cost of construction. KPIs is essential for long-term survival in all projects including the construction projects (Harris, McCaffer, & Edum-Fotwe, 2006).

Construction projects include those projects that aim at providing infrastructures, such as; educational facilities, health care facilities and many others, in order to enable the community derive the benefits of the projects. However, these projects have so far been evaluated mostly on the basis of traditional quality performance indicators (KPIs) of time, cost and quality which are found to be relevant for commercial projects. This indicators, though captures the economic aspects, ignores other important elements of

public sector construction projects and hence makes it difficult to attain the main purpose for which the projects were conceptualized.

Therefore, the problem facing public sector construction projects in developing countries seems to be the lack of an appropriate performance measurement framework that does not merely focus on the needs of the project implementing agency, but also addresses the needs of the actual beneficiaries. Without such a framework, project implementing agencies will not be able to assess the performance of public sector construction projects on economic, social and environmental dimensions, which are considered important for these kinds of projects.

1.3 Research Objectives

In view of the background to the research problem, the aim of this study is to explore the use of quality performance indicators in improving quality performance of public sector projects in Ghana. The specific objectives of the study are as follows:

- to identity key quality performance indicators for measuring quality performance of public sector construction projects;
- to identify the critical constraints to effectively managing quality of public sector projects in Ghana;
- to identify the perceived effects of key quality performance indicators; and,
- to make recommendations for improving quality management of public sector projects in Ghana

1.4 Research Questions

The following research questions were developed to guide the study.

- What are the key quality performance indicators appropriate for measuring performance of public sector construction projects?
- What are the critical constraints to effectively managing quality of public sector projects in Ghana?
- What are the perceived effects of key quality performance indicators?
- What are the relationship between quality performance indicators and the quality of public sector construction projects?

1.5 Significance of this Study

The outcome of the current study will be of benefit to several stakeholders that implement public sector construction projects as well as future researchers. The project monitoring and evaluation agencies will use the developed framework to evaluate performance of public sector construction projects. Other than merely declaring a project as successful or not, they will be able to describe performance in terms of how "good" it is on different performance indicators. The set of key quality performance indicators and critical success factors identified will enable the project implementing agencies to assess, monitor and report the progress of the project as construction takes place. Further, the project implementing agencies can use the performance evaluation framework for allocation of appropriate resources to the critical success factors with a view to realizing desired performance on specific key performance indicators.

The performance evaluation framework in the current study also provides direction to the government and donor agencies that they should not merely focus on economic measures of performance but also consider project outcome in terms of

providing appropriate services to the society while taking care of adverse environmental impact. Further, on the basis of findings of the current study, the beneficiaries of the project will have an idea of whether the intended benefits are actually being delivered by the project as conceptualized. Therefore, the study provides a basis through which the services delivered can be compared with the intended benefits.

Further, literature review has revealed that there is hardly any empirical research on performance evaluation of construction projects with reference to Ghana. Given that this study could be the first of its kind to develop a performance evaluation framework. The future researchers will also gain insights as to how apparently intangible measures of performance are operationalized in order to capture all relevant project objectives.

1.6 Scope of Study

In pursuing this research, the focus of attention was on the public sector construction projects in Ghana. The kinds of projects analyzed in this study were mainly the construction projects pertaining to Education and Health. These are the main projects upon which governments funds are allocated to, for purposes of improving socio-economic wellbeing of the country. The study targeted those projects which were funded by government in Eastern Region of Ghana, in the financial years between 2006/2007 to 2014/2015.

For the purpose of analysis, the study sough perception of consultants and construction professionals involved in the construction of the above mentioned public sector projects. This was necessary because all the stakeholders had different roles to play on construction project but they all had an ultimate goal of delivering a project successfully (Wang & Huang, 2006).

1.7 Organization of Study

The dissertation is organized into six chapters. Chapter One discusses the overview of the study by highlighting the background of the study, the contribution of public sector construction projects and the challenges they face, research problem, research objectives, scope of the study and significance of the study. The chapter further outlines the organization of the thesis. Chapter Two focuses on the literature review and provides an overview of public construction projects in terms of their definition, classification and phases involved in project construction. The chapter also discusses the performance of construction projects in general and the performance of public sector construction projects in particular. Further, the chapter reviews relevant literature on key performance indicators and critical success factors of public sector construction projects. Base on the review, literature gaps are identified and highlighted in this chapter. It further provides a brief overview of construction sector in Ghana, early government initiatives to develop the sector and nature of construction projects.

Chapter Three describes the research methodology employed in carrying out this exploratory research. This chapter discusses the design of the survey instrument, reliability of the survey instrument, study site and identification of target population and data collection procedure. The aim of the chapter is to identify the key quality performance indicators and critical success factors in construction projects in Ghana with a view to developing scales for performance measurement and project success. It further describes study site and the target projects.

Chapter Four analyzes the data of exploratory study. The chapter reports the characteristics of the projects and respondents' demographic profile in terms of their experience and role on the project. It further deals with factorability of performance measurement variables and project success variables and the validation of the scales for

the key quality performance indicators and critical success factors. The chapter also presents theoretical frameworks for the key quality performance indicators and critical success factors scales separately and finally describes the conceptual framework for assessment of performance of public sector construction.

Chapter Five discusses the analysis to come out with appropriate findings. The aim of this chapter is to confirm the validity of the key quality performance indicators and critical success factors identified and its inter-related characteristics with overall project performance and success.

The final part of the dissertation, Chapter Six, describes the summary of results, managerial implications, recommendations, limitations and direction for future research.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviewed related literature on improving quality performance of public sector construction projects using quality performance indicators (KPIs). This chapter also attempted to look at the quality management concept in construction industry, quality performance measurement in construction Industry and key quality performance indicators for measuring quality performance. It further concentrated on the constraints of managing quality, impact of Implementing Quality Performance Indicators and quality improvement

2.2 Quality Management Concept in Construction Industry

Quality is one of the critical factors in the success of construction projects (Oaklan & Marosszeky, 2006). Quality construction projects, as well as project success can be regarded as the fulfillment of expectation of the project participation. According to Chua, Kog and Loh (1999) indicated that quality management is concerned with moving the focus of control from outside the individual within, the objective being to make everyone accountable for their own performances and to get them committed to attaining quality in a highly motivated fashion (Oaklan & Marosszeky, 2006).

Dainty, Cheng and Moore (2003) viewed that quality of a product or a complete building or other constructions is the totality of its attributes that enable it to perform a stated task or to fulfill a given need satisfactorily for an acceptable period of time. For a building and civil engineering work, a satisfactory product, although essential in itself, is not on its own sufficient. It must be incorporated in the design and construction in a correct manner. In buildings, more defects and failures arise from inadequacies in the

treatment of products in design and construction than from shortcomings in the products themselves (Atkinson, 2005). Quality Management (QM) has been widely implemented throughout the world. Many construction companies have arrived at the conclusion that effective QM implementation can improve their competitive abilities and provide strategic advantages in the marketplace (Anderson, Formell & Lehmann, 1994). Several studies have shown that the adoption of QM practices can allow firms to compete globally (Easton, 1993; Handfield, 1993; Hendricks and Singhal, 1996, 1997; Womack et al., 1990; American Quality Foundation and Ernst & Young, 1991).

Several researchers also reported that QM implementation has led to improvements in quality, productivity, and competitiveness in only 20-30% of the firms that have implemented it (Benson, 1993; Schonberger, 1992). A study conducted by Rategan (1992) indicated that a 90% improvement rate in employee relations, operating procedures, customer satisfaction, and financial performance is achieved due to QM implementation.

The concept of Quality Management (QM) has existed for many years, but its meaning has changed and evolved over time. Before the early twentieth century, quality management meant inspecting products to ensure that they met specifications (Reid & Sanders, 2007 cited by Sabah, 2011). This is evident in the Egyptian wall painting circa of 1450BC which showed evidence of measurement. Stones used in the pyramids which were cut so well that a knife could not go between them (Evans & Lindsay, (2008) cited by Sabah 2011). According to (Reid & Sanders, 2007 cited by Sabah (2011) around 1940s, during World War II, quality became more statistical in nature. Statistical sampling techniques were used to evaluate quality, and quality control charts were used to monitor the production process. In the 1960s, with the help of so-called "quality gurus," the concept took on a broader meaning.

Quality began to be viewed as something that encompassed the entire organization, not only the production process. All functions were responsible for product quality and shared the costs of poor quality. However, in the 1970s and 1980s many U.S. industries had to make changes to their quality policies when they lost market share to foreign competition particularly in the auto industry. Many hired consultants and instituted quality training programs for their employees (Reid & Sanders, 2007 cited by Sabah, 2011). Hoonakker (2006) established in his study that many of the management practices used to support construction organizations are being challenged. The industry's clients are moving forward. Clients demand improved service quality, faster buildings and innovations in technology. In Kaufmann and Wiltschko (2006), Quality Management Concept is said to be structured in general according to the "International Organization for Standardization" ISO 9000-series and the "Plan, Do, Check, Act" PDCA-cycle.

Idris, McEwan and Belavendram (1996) affirmed that properly implemented, formal quality management systems provide a vehicle for achieving quality (i.e. conformance to established requirements). As defined by Arnold (1994) quality system is "the organizational structure, responsibilities, procedures, processes, and resources for implementing quality management". In other words, Quality management systems refers to the set of quality activities involved in producing a product, process, or service, and encompasses prevention and appraisal (Burati, Farrington & Ledbetter, 1992). It is "a management discipline concerned with preventing problems from occurring by creating the attitudes and controls that make prevention possible" (Battikha, 2002). Quality activities include the determination of the quality policy, objectives, and responsibilities and implementing them through quality planning, quality control, quality assurance, and quality improvement, within the quality system (Battikha, 2002).

Cooke-Davies (2002) emphasized that Quality Management (QM) in the construction industry is a management technique used to communicate to employees what is required to produce the desired quality of products and services and to influence employee actions to complete tasks according to the quality specifications. In like manner, Culp (1993) also explained quality management as a set of coordinated activities to direct and control an organisation in order to continually improve the effectiveness and efficiency of its performance. These activities interact and are affected by being in the system, so the isolation and study of each one in detail will not necessarily lead to an understanding of the system as a whole. The main thrust of a QMS is in defining the processes, which will result in the production of quality products and services, rather than in detecting defective products or services after they have been produced. According to Culp (1993) revealed that a fully documented QM ensures two important requirements

- The customers' requirements – confidence in the ability of the organisation to deliver the desired product and service consistently meeting their needs and expectations.
- The organisation's requirements – both internally and externally, and at an optimum cost with efficient use of the available resources – materials, human, technology and information.

2.2.1 Purpose of Quality Management in the Construction Industry

Construction Quality Management (CQM) is the performance of tasks, which ensure that construction is performed according to plans and specifications, on time, within a defined budget, and a safe work environment. Quality work in the construction industry is conformance to properly developed requirements. For a construction project,

quality begins with requirements carefully developed, reviewed for adherence to existing guidance and ultimately reflected in criteria and design documents which accurately address these needs. The designer establishes the quality standards and the contractor in building to the quality standards in the plans and specifications, controls the quality of the work. The purpose of CQM is the Government's efforts, separate from, but in coordination and cooperation with the contractor, assure that the quality set by the plans and specifications is achieved. CQM is the combined effort of the contractor and the Government. The contractor has primary responsibility for producing construction through compliance with plans, specifications, and accepted standards of the industry

Many authors argue that quality management in the construction industry can be a solution for the problems (that is costs, productivity, occupational safety and health) that the construction industry is facing (Burati & Oswald, 1993; Kuprenas & Kenney, 1998; McKim & Kiani, 1995; Schriener, Angelo, & McManamy, 1995). Kuprenas and Kenney (1998) conducted two studies regarding the status of quality management implementations in engineering and construction. They found that the overall motivation for implementing quality management remained essentially the same over a period of three years, and that most firms understood the benefits of quality management implementation.

2.2.2 Methods of Quality Management

Methods and effectiveness of implementing quality management, however, did vary substantially between companies over the three years (Lahndt, 1999). Some firms completely abandoned Quality Management (QM) implementations while others achieved award-winning results (Lahndt, 1999).Quality management is based on three fundamental principles (Evans & Lindsay, 2008). These are:

- Focus on customer and stakeholders;
- Participation and teamwork by everyone in the organization
- A process focus supported by continuous improvement and learning (Evans and Lindsay, 2008).

Most of the literature concludes that it is necessary to transpose and translate the principles, practices and techniques used for quality management in manufacturing to construction (Formoso & Revelo, 1999; Lahndt, 1999; McCabe, 1996; Soares & Anderson, 1997). Lahndt (1999)concluded that Quality Management (QM) techniques have been used extensively and beneficially in the areas of manufacturing and industrial engineering to control process and prevent defects before they happen, ultimately saving millions of dollars. The construction industry needs the same types of tools and for the same reasons, but due to the dissimilarity between the industries, cannot apply them as they are'. Formoso and Revelo (1999) conducted a study aimed at developing a method for improving the materials supply system in small-sized building firms using quality management principles. The study involved three companies from the Brazilian building industry, which worked cooperatively through several stages of QM implementation. The proposed method was based on simple well-known quality techniques for problem identification, analysis and solving, such as flowchart, brainstorming, checklist and Pareto diagram. The results showed that it is difficult to apply such techniques and principles in small-sized building firms. The same conclusion can be drawn from the results of a study in Hong Kong (Tam, Deng, Zeng, & Ho, 2000).

In 1992, the Housing Authority in Hong Kong made implementation of the ISO 9000 quality system mandatory for contractors who wanted to place a bid on housing development. Furthermore, they developed and introduced an objective quality measure: the Performance Assessment Scoring Scheme (PASS). Results of the study by Tam et al.

(2000) showed that seven years later, the general level of quality had not improved and that the expected continuous improvement in construction quality had not been realised. The authors concluded, based on additional analysis of data, that the biggest barrier to quality implementation is the culture of the construction industry. Others have also tried to tie a TQM approach to other, existing management systems, such as project management, partnership, Quality Assurance Plan (QAP), Quality Function Deployment (QFD), Jobsite Quality Planning (JQP) and/or to the ISO 9000 and14000 standards, with mixed results (Bubshait & Al-Atiq, 1999; Gamsby, Mize, & Reid, 1996). TQM implementation in the building and construction industry is not an easy matter. One of the reasons is 'the transient nature' of building and construction, the lack of standardization and the many parties (occupations, professions and organisations) involved. Another reason is the conservative nature of the construction industry. For example, Lansley characterised the UK industry's behaviour in this way:

This process suggests that, for most of the time, construction industry attempts to borrow solutions from past experiences or from others. It does not innovate. Development is incremental. The bulk of the industry waits to see whether those few firms, which are renowned for pioneering of new ideas, can make a particular system or method work, and then only if conditions require that they should do so, will they consider the value of that innovation. If it looks useful then the idea can be copied with low risks but with all benefits (Lansley, 1983).

Hoonakker (1999) encountered the same attitude while conducting a study on measures taken by construction firms in the Netherlands to improve the quality of working life. Only one out of 20 building and construction firms interviewed had adapted TQM principles, including teamwork. The other companies knew about this attempt to innovate, but chose to 'lean backwards' and watch the results, making

comments such as 'This will never work in the construction industry'. Hartmann (2006) mentioned the same attitude in his study on the role of organisational culture in motivating innovative behaviour construction firms: 'The main tendency [in construction industry] is to implement innovations that have already proven themselves on the market' (Hartmann, 2006, p. 165). These examples show how difficult it is to implement change in the building and construction industry, but also the importance of best practices. If building and construction companies see that an idea actually works, they are more willing to adopt it, especially if it will reduce costs. In addition, providing companies with a roadmap for implementing TQM will increase their confidence and motivation to implement change.

2.3 Quality Planning

Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy them (Griffith, 1990). Harris and McCaffer, (2001) defined quality planning as a set of activities whose purpose is to define quality system policies, objectives, and requirements, and to explain how these policies can be applied, how these objectives can be achieved, and how these requirements can be met. Construx, (2003) on the other hand, stressed that quality plan is different from a test plan. The study continued that quality plan defines the quality goals, is realistic about where defects come from, Selects appropriate detection and prevention methods, and has means not to "go dark". The Project Management Book of Knowledge "PMBOK"4 addressed quality planning from a different position to enhance the thoughts earlier expressed. It said that quality planning has a process input generated by predecessor processes referred to as the Project Scope Statement and Project Management Plan.

These processes are introduced by external units like Enterprise Environmental Factors and Organizational Process Assets.

Project Management Body of Knowledge "PMBOK Guide" (2008) further defined quality planning as the process for "identifying which quality standards are relevant to a project and determining how to satisfy them": In other words, it means planning how to fulfill process and product (deliverable) quality requirements: "Quality is the degree to which a set of inherent characteristics fulfill requirements". By planning the quality one has to respect some principles, and these are:

- **Customer satisfaction comes first**: Quality is defined by the requirements of the customer.
- **Prevention over inspection**: It's better to avoid mistakes than to inspect the result and repair the defects.
- **Management responsibility**: Costs of quality must be approved by the management.
- **Continuous improvement**: Becoming better is an iteratively structured process.

2.4 Quality Assurance

In recent years, increasing concern has been expressed at the standards of performance and quality achieved in building works. The need for structured and formal systems of construction management to address the aspect of performance, workmanship and quality has arisen as a direct result of deficiencies and problems in design, construction, materials and components (Griffith, 1990). Many of the problems experienced in building appear as a range of inadequacies from minor technical and aesthetic aspects to major building defects. Irrespective of their degree of severity, such problems are known to cost the industry so much annually, yet, many difficulties might

be alleviated through greater care and attention to standards of performance and quality at the briefing, design and construction stages of the building process (Griffith, 1990). If buildings are to be trouble-free, more attention needs to be given to applying quality assurance principles to design and site-work, including project selection and specification, and to supervision of the handling and protection on site (Atkinson, 2005).

Harris and McCaffer (2001) defined quality assurance as a set of activities whose purpose is to demonstrate that an entity meets all quality requirements. Quality Assurance activities are carried out in order to inspire the confidence of both customers and managers, confidence that all quality requirements are being met. According to EuroRoadS, (2006) the main objective of quality assurance measures in information processes is to fulfill a required quality level. By using described probabilistic model, cause and effect diagram, one is able to analyse existing processes and to detect existing quality gaps within these processes. According to Khan, Azhar and Mahmood (2008) quality requirements should be clear and verifiable so that all parties in the project can understand them for conformance. Harris and McCaffer, (2001) continued that Quality assurance (QA) emphasizes defect prevention, unlike quality control that focuses on defect detection once the item is produced or constructed. It was further established that quality assurance concentrates on the production or construction management methods and procedural approaches to ensure that quality is built into the production system.

2.4.1 Quality Assurance in Construction

The importance of Quality Assurance is based on the principles of getting things right first time. By implementing, maintaining, reviewing and continually improving a Quality Assurance System, a construction company can achieve and reap the benefits of having such a system in place. Quality Assurance exists because of the degree of

dissatisfaction experienced by the industry's clients over a long period, combined with a growing impatience by some of their advisers to achieve value for money (Harris & McCaffer, 2001). An increasing number of building companies are also frustrated by the inadequacy of a system which however valiantly they try, leaves their efforts lacking in some regards. A revolution has occurred in the assembly of buildings from what was a craft process to one where the critical work of connecting interdependent units is done in the main by semi-skilled labour from a multiplicity of separate employers. This makes great demands upon supervision and management systems (StudyMode.com, 2008).

A Quality System is designed to provide an assurance to Clients, which can be supported through documented records, that all contracts will be completed in accordance with the agreed time, cost and specification. It should also further ensure that the company personnel, sub-contractors and key suppliers are aware of customer requirements and that they are fully met. Conformance with requirements of the detailed procedures developed in accordance with the Quality Manual has to be mandatory for all staff employed in the company. It is essential to the system that encouragement is given to each employee to develop and maintain an attitude of continuing quality improvement and customer satisfaction. Quality Assurance is concerned with developing and planning the necessary technical and managerial competence to achieve desired results. It is also about attitudes, both of management and of all those for whom they are responsible (StudyMode.com, 2008).

2.5 Quality Control

Quality Control is a process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated (Scatterfield, 2005). Quality control requires the business to create an

environment in which both management and employees strive for perfection. This is done by training personnel, creating benchmarks for product quality, and testing products to check for statistically significant variations. A major aspect of quality control is the establishment of well-defined controls. These controls help standardize both production and reactions to quality issues. Limiting room for error by specifying which production activities are to be completed by which personnel, reduces the chance that employees will be involved in tasks for which they do not have adequate training. Quality Management Systems (2013) stated that, quality control is the process of evaluating whether construction projects adhere to specific standards. The main objective of quality control is safety. Additionally, quality control is also meant to ensure that buildings are reliable and sustainable.

The ISO definition also states that quality control is the operational techniques and activities that are used to fulfill requirements for quality. This definition could imply that any activity whether serving the improvement, control, management or assurance of quality could be a quality control activity. What the definition fails to tell us is that controls regulate performance. They prevent change and when applied to quality, it regulates quality performance and prevents undesirable changes in the quality standards. It continued that quality control is a process for maintaining standards and not for creating them. Standards are maintained through a process of selection, measurement and correction of work, so that only those products or services which emerge from the process meet the standards. In simple terms quality control prevents undesirable changes being present in the quality of the product or service being supplied. Quality control can be applied to particular products, to processes which produce the products or to the output of the whole organisation by measuring the overall quality performance of the organisation.

Quality assurance serves prevention and quality control detection but a control installed to detect failure before it occurs serves prevention such as reducing the tolerance band to well within the specification limits. So quality control can prevent failure. Assurance is the result of an examination whereas control produces the result. Quality Assurance does not change the product, Quality Control does. Harris and McCaffer (2001) defined quality control as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problem are solved. Scatterfield (2005) in other words said quality control is critically important to a successful construction project and should be adhered to throughout a project from conception and design to construction and installation. Inspection during construction will prevent costly repairs after the project is completed. The inspector, engineer, contractor, funding agency, permit agency, and system personnel must work together to inspect, document, and correct deficiencies.

2.6 Quality Performance Measurement in Construction Industry

Sabah, (2011) considered performance in different dimensions depending on the context in which it is being used. "Traditionally, it has been used to measure the effectiveness (doing the right thing) and efficiency (doing the right thing right)" (Sabah, 2011). Neely (1999) viewed performance measurement system (PMS) as the set of metrics used to quantify both the competence and effectiveness of an activities. Artley (2001) stressed that, "Performance measures may address type or level of program activities conducted (process), the direct products and services delivered by a program (outputs), and/or the results of those products and services (outcomes). Also, Cordero, (1990) classifies performance measurements on the basis of method of measurement and

areas of measurement. Cordero (1990) classified performance measurement as technical performance, commercial performance and the overall performance. In furtherance, he proposed a model of performance measurement in terms of output and resources to be measured at different levels. Cordero (1990) measured outputs to determine whether they help to accomplish objectives, and resources were measured to determine whether a minimum amount of resources is used in the production of outputs. However, Cordero, (1990) in his model failed to recognize the interest of stakeholders; their needs and expectation. For this reason and others, Love and Holt (2000) proposed that if construction organizations are to remain competitive in the long run, they need to develop and understand their relations with their customers, suppliers, employees, lenders and the wider community in which they operates. This means that, performance assessment cannot be comprehensive when the interest of the stakeholders is neglected. Love and Holt, (2000) on the other hand, proposed a model known as Stakeholders Perspective Measurement (SPM) that considered relations with customers, suppliers, employees, financiers and the wider community. In an attempt to determine who an efficient contractor is, Zavadskas and Kaklauskas (1996) identified estimated cost of project, duration of construction, quality of final building product, standard of workmanship, ability to formulate practical programs, employee development relations with sub-contractors and statutory authorities, degree of co-operation with stakeholders, among others as the criteria for determining efficient contractor.

In the construction projects, work progress is managed with process factors while the monitoring is based on the result factors. The managers on the lower level are interested in the process factors, while the upper management places more emphasis on the measures showing results. In this sense, quality performance can be regarded as the process measures, compared to the financial measures mainly demonstrating the cost

status in the construction project. Construction industry is an important part of every economy and that performance measurement holds the key to its achievement of national socio-economic goals. In the construction industry's present scenario, the systematic ways of performance measurement have influenced many construction firms, government sectors, public and private clients and other project stakeholders (Takim, 2003). Performance measurement has been used in collecting and reporting information about inputs, efficiency and effectiveness of construction projects. Again, construction firms use performance measurement to judge their project performances, both in terms of the financial and non-financial aspects and to compare and contrast the performance with others in order to improve programme efficiency and effectiveness in their organizations (Kagioglou, Cooper, & Aouad, 2000).

According to Chan (2001), performance measurements are needed to tract, forecast and ultimately control variables that are important to the success of a project, and this has been agreed by many researchers and practitioners (Sinclair & Zairi, 1995; Mbugua, Harris, Holt, & Olomolaiye, 2000). Ward, Watson, and Wateridge (1991) mentioned that in assessing the performance of contractors, 'a common approach is to evaluate performance on the extent to which client objectives like cost, time and quality were achieved'. On the international scene, especially in the well advanced countries such as the UK, USA and Japan those are seen as the three traditional indicators of performance (Moshsini & Davidson, 1992). The traditional measures have become so popular and entrenched due to the objectivity and simplicity surrounding their measurement. Again, in today's construction environment, timely completion within budgetary allocations

2.7 Key quality performance indicators for measuring quality performance

Key Quality Performance Indicators (KQPIs) are a relatively simple exercise, their implementation requires consideration of a wide number of issues (Egan Report, 2004). The key issue is to ensure good communication with all relevant stakeholders, particularly those who will have to collect the data. KQPIs are not just about collecting data and any system will use the data to drive good communications with project team members and clients. KQPIs need to be used to drive action otherwise the system is seen as a data collection exercise (Egan Report, 1998).According to Arditi and Lee, (2004) a Key Quality Performance Indicator (KQPIs) is the measure of performance that is critical to the success of an organisation. The construction industry KQPIs allow the benchmarking of the organisation against industry standard data published by the Construction Best Practice Programme. The construction industry KQPIs were first published in 1999, and are updated annually (Egan Report, 2004). The Headline Key Performance Indicators are derived from the 5-4-7 model first put forward in the Egan Report (1998) "Rethinking Construction". These improvement targets formed the basis for the national Headline KQPIs, which were designed to show how improvement would be demonstrated. These KQPIs are now widely used within industry to measure performance and drive improvement (Egan Report, 2004).

Contractor quality performance indicators have been divided into corporate level as adapted from manufacturing industries by Yasamis, Arditi and Mohammadi, (2002) and project level indicators which consist of the most common tools used in project management (PMI,1996). Yasamis et al, (2002), Arditi and Lee, (2003, 2004), Ling and Chong (2005) and Lee and Arditi, (2006) conducted their researches corroborating this division of corporate level quality performance and project level quality performance. Corporate level quality performances are processes an organization uses to achieve the

following attributes of leadership; employee empowerment, partnership development information and analysis, continuous improvement, client focus. These attributes have been identified as critical success factor in achieving total client satisfaction for construction firms (Yasamis et al., 2002). By using these corporate-level processes it may be possible for owners to predict whether they will be satisfied with the quality performance of the construction firm (Yasamis et al., 2002). Project level quality performance is tools, techniques and processes an organization uses to achieve product quality and service quality attributes (Arditi & Lee, 2003). Lists of product and service attributes with their definitions were found in literature (PMI, 1996; Yasamis et al, 2002; Arditi & Lee 2004). Product quality attributes include: performance, reliability, conformance, durability, serviceability, aesthetics and perceived quality. The service quality attributes include: time, timeliness, completeness, courtesy, consistency, accessibility and convenience, accuracy and responsiveness. According to Yasamis et al (2002), such a dissection of construction activity facilitates developing strategies to define, operationalize, measure and improve construction quality. Their study established a framework for the assessment of a contractor's quality performance from a list of contractor quality performance indicators that are derived from various quality-related practices of the contractor at the corporate and project level. Ling and Chong (2005) found that design and build contractors did not meet clients' expectations in service quality. Smallwood and Rossouw (2008) reported that majority of general contractors do not implement written documented quality management systems.

The UK working groups on Key Performance Indicators (KPIs) identified ten (10) parameters for benchmarking projects in order to achieve a good performance in response to Egan's report (1998). However, most of these indicators, such as construction cost, construction time, defects, client satisfaction with the product and

service, profitability and productivity, promote result-orientated thinking, whereas predictability of design cost and time, and predictability of construction cost and time, and safety can be regarded as process-orientated thinking. There are no suggestions for performance indicators in benchmarking projects at the project selection phase i.e., analysis stage, when the client and end-user's requirements need statements and the delivery strategy are determined. In addition, the perspective of the 'project' and 'supplier' is not clearly indicated. None of the measures mentioned in this section could identify the performance of suppliers in a project environment.

According to Ling and Chong, (2005), the output of the requirements at the analysis stage most likely determines the output of the entire development process. They indicate that the origination and initiation phase, in which major decisions are made, such as decisions on the project's objectives and planning the project's execution, has the most influence on the project's success. The issue is much more serious when the kind of activities that should be undertaken depends on the outcome of earlier activities. It is therefore important to identify parameters (performance indicators) for benchmarking projects at the project selection phase in order to achieve good project performance. Posten (1985) found that 55% of all defects in R&D projects occur during requirement analysis and specification, earlier documented this position, whereas 43% of all defects are not found until after the testing stage. It is not surprising that the same situation is applicable to construction projects. Since performance is an individual contribution to the execution of the task required in completing the construction project (Liu & Walker, 1998), the performance of each participant should be measured, evaluated and prioritized at every stage of the project phases in order to determine the extent to which a project has been successful.

Rose (1995) asserted that performance indicators are the objective standards developed based on the management policies and the critical success factors to assess the accomplishment of the policies in the companies. Rose (1995) suggested the attributes of good metrics, and they are summarized as follows.

- Good metrics are customer centered and focus on indicators that provide value to customers.
- They measure performance across time, which shows trends rather than snapshots.
- They provide direct information at the level at which they are applied, and no further processing and analysis is required to determine meaning.
- They are linked with an organization's mission, strategies, and actions.
- They are collaboratively developed by teams of people who provide, collect, process, and use the data.

According to Sinclair and Zairi (1995), before any effective performance measurement can be undertaken there is the need to develop an objective and consistent measureable criteria. Previous studies have classified these measurable criteria into performance measures and indicators. Mbugua et al, (1999); Love et al, (2001) have identified a distinction between performance indicators; performance measures and performance measurement. According to Mbugua et al, (1999) performance indicators specify the measurable evidence necessary to prove that a planned effort has achieved the desired result. In other words, when indicators can be measured with some degree of precision and without ambiguity they are called measures. However, when it is not possible to obtain a precise measurement they are usually referred to as performance indicators.

Sinclair and Zairi (1995) on the other hand, viewed that performance measures are the numerical or quantitative indicators and performance measurement is a systematic way of evaluating the inputs and outputs in manufacturing operations or construction activity and acts as a tool for continuous. In response to calls for continuous improvement in performance, many performance measurement measures have emerged in management literature. Some examples include the financial measures (Kay, 1993), client satisfaction measures (Kometa, 1995; Chinyio, Weiner & Griffith, 1998), Employee measures (Bititci, 1994; Shan & Murphy, 1995), Industry measures (Latham, 1994; Egan, 1998). Cordero, (1990) classifies performance measurements based on the method of measurement and areas of measurement. The methods of performance measurement can be in terms of the technical performance, the commercial performance and the overall performance (Cordero, 1990). Furthermore, Cordero (1990) proposed a model of performance measurement in terms of output and resources to be measured at different levels. Outputs are measured to determine whether they help to accomplish objectives and resources are measured to determine whether a minimum amount of resources is used in the production of outputs. The model of Cordero failed to reflect the interest of stakeholders, their needs and expectation. That is, if construction organizations are to remain competitive in the long run, they need to develop and better understand their relations with their customers, suppliers, employees, lenders and the wider community. Thus; performance measurement has to incorporate the interest of the stakeholders.

Love et al., (2000) proposed a model known as Stakeholders Perspective Measurement (SPM) that adequately considers relations with customers, suppliers, employees, financiers and the wider community. In Zavadskas and Kaklauskas (1996) bid to determine who an efficient contractor is, identified estimated cost of project,

duration of construction, quality of final building product, standard of workmanship, ability to formulate practical programmes, employee development relations, with sub-contractors and statutory authorities, degree of co-operation with stakeholders among others as criteria for determining efficient contractor. Furthermore, Xiao and Proverbs, (2003) defined contractor performance as embracing construction cost, construction time, construction quality and sustainable development, the philosophy being that the achievement of one aspect of performance should not be at the expense of another.

Table 2. 1: Indicators of contractor performance

Aspect	Performance Indicator
Cost indicator	• Construction Cost • Cost Certainty • Client satisfaction on cost
Time indicator	• Construction Time • Time Certainty • Client satisfaction on time
Quality indicator	• Defects • Liability Period • Client satisfaction on Cost
Sustainable Development indicator	• Profitability • Partnership • Investment in R & D and training • Environment Protection • Health and Safety

Source: Xiao and Proverbs (2003)

2.7.1 Good Performance Measurement System

According to Flint (2005), if the right things are not measured or measured accurately, the data using may misled and bad decisions are likely to follow. Flint (2005) further highlighted on the following as some of the characteristics of a good performance measurement system:

- it should be results oriented i.e. focused primarily on desired outcomes, less on outputs;
- it should be reliable i.e. accurate, consistent information over time;

- it should provide useful information that is valuable to both policy and programme decision-makers and also provide feedback on performance.
- the measures should be quantitative i.e. expressed in terms of numbers or percentages;
- the measures should be easy to interpret i.e. do not require an advanced degree in statistics to use and understand;
- the measures should be credible i.e. users have confidence in the validity of the data;
- it should be comparable such that it can be used to benchmark against other organizations internally and externally;
- it should be realistic such that the measures set can be calculated.

2.8 Constraints to Managing Quality

According to the Scholars (Oakland & Marosszeky, 2006; Pheng & Teo, 2004; McCabe, 1996) quality management is a minimum goal requirement for any business organization to attain a marketplace in the competitive environment. Quality management has failed to deliver the result on its promises. Its long-term success depends on the lessons drawn from industry. However, quality management requires a significant period of time in the process of practicing as it involves a long process of training the employees. This can affect the business on a loss of short-term operating cost. When aiming to improve operational performance, it is essential to recognizes and understand the obstacles that may hinder the success of quality management programs before and during implementation (Tamimi & Sebastianelli, 1998). Quality Management (QM) barriers show up in all sectors (manufacturing, construction and government) and avoided these barriers both before and during QM implementation (Masters, 1996). QM

without certain components will fail, or will not offer many real benefits. Several authors have identified different sets of barriers based on their experience (Al-Khalifa &Aspinwall, 2000; Sebastianelli & Tamimi, 2003; Al-Zamany, Hoddell & Savage, 2002).

The primary barrier to quality management implementation success seems to be the nature of the construction process: the projects are often very large, labour intensive and seldom situated in the same location; the workforce tends to be transient; and demand fluctuates, subject to the client's perception of the value of the construction project (Sommerville, 1994). The 'nature' of construction is a complex system in which several participants, each with their own perspectives and interests, are brought together to complete a project plan that typically changes several times during construction, while each tries to minimise the effects of weather, occupation hazards, schedule delays, and building defects. The many changes can lead to delays in completion of the construction project, complaints about quality, and rework, which in turn can lead to further delays and so forth. In short, the industry is characterised by confrontational instead of cooperative relationships between the different parties involved, with claims by the different parties as a result (Kanji & Wong, 1998).

Kanji and Wong (1998) emphasized that another barrier to quality management implementation is the many parties involved in the construction process, all of whom try to protect their own interests. The construction industry consists traditionally of three primary participants: the owner (or customer), the architect/ designer/engineer, and the (general) contractor. The basic construction process occurs like this: the owner hires an architect/engineering firm to design the project and place the project out for bid to contractors (in a competitive bidding process), and the contractors perform the actual construction work. Even though a common project goal is shared (completion of the

plan), participants differ in what they hope to gain from the construction process. The typical owner would probably agree that they would like to spend as little as possible to get their desired project completed. Designers are in business to provide a service to the owner; however, their relationship with the contractors is often unclear. The contractors attempt to provide the product as drawn by the designer as efficiently as possible, in order to maximise their profit. Apart from the three primary participants, there are many other parties involved in the construction process: a variety of sub-contractors and suppliers. The many sub-contractors (ironworkers, carpenters, masons, plumbers, electricians, roofers) are a particularly important factor, and company size is a related factor that explains the difficulty in implementing quality. Construction companies vary greatly in size. In the US, over 80% of all contractors have less than nine employees (Center to Protect of Workers' Rights, 2002). General contractor companies are mostly large, but sub-contractor companies are often very small.

Rowlinson and Walker (1995) on the other hand viewed non-standardisation as a barrier to quality implementation is. During construction, general contractors want to ensure quality throughout the project. However, according to Rowlinson and Walker (1995) the construction industry is characterised by its non standardisation. Very often, products are one-offs and the production processes are to some extent different from each other. Hence, no universal standard or specification can be applied to the product, which leads to difficulties in quality assurance. Also, changes to the details of the design of a project are typical and may be frequent throughout the construction process. Quality is often at risk when a plan is changed during construction. Koh and Low (2010) asserted that an important barrier to quality implementation and management is the bidding process. The typical construction bidding process starts with the release of a project description for public review by contractors. The details of the project can vary, but

typically specify enough detail so that experienced contractors can create a fairly accurate bid for the job. Some contract bidding is open only to general contractors, who are required to do the hiring of subcontractors after they are awarded the contract. Both contractors and researchers are concerned about 'competitive bidding' for construction projects. For example, a contractor may try to reduce allotted resources towards safety or quality management in order to maintain a healthy profit margin for the job. Attempts to reduce involvement in safety and/or quality management can be very costly to a contractor, if they encounter accidents during the project. They may also experience schedule delays for many reasons: weather, labour shortage, late delivery of equipment or materials, and other events beyond the control of the contractor (Carty, 1995).

McCabe (1996) affirmed that lack of leadership for quality affects quality management. Excess layers of management quite often lead to duplication of duty and responsibility. This has made the lower employees of an organization to leave the quality implementation to be a management's job (McCabe, 1996). According to Culp (1993) quality has not been taken as a joint responsibility by the management and the employees. Coupled with the notion that management is infallible and therefore it is always right in its decisions, Cooke-Davies (2002) asserted that employees have been forced to take up peripheral role in quality improvement. As a result employees who are directly involved in the production of goods or delivery of services are not motivated enough to incorporate quality issues that have been raised by the customers they serve since they do not feel as part of the continuous process of quality improvement (Cooke-Davies, 2002).

Every organization has its own unique way of doing things. According to Arditi and Gunaydin (1997), deficiency of cultural organization influences quality management. This is defined in terms of culture of the organization. The processes, the

philosophy, the procedures and the traditions define how the employees and management contribute to the achievement of goals and meeting of organizational objectives. Indeed, sticking to organizational culture is integral in delivery of the mission of the organization. In adequate cultural dynamism has made total quality implementation difficult because most of the top level management of many organizations are rigid in their ways of doing things (Hoonakker, Carayon & Loushine, 2010).

Hoonakker et al. (2010) further mentioned that inadequate resources for quality management influences quality implementation. Since most companies do not involve quality in their strategic plan, little attention is paid to QM in terms of human and financial resources. Much of the attention is drawn to increasing profit margins of the organization with little regard as to whether their offers/ supply to customers is of expected quality (Dale, 2003). Dale (2003) posited that employee training is often viewed as unnecessary cost which belittles the profits margins which is the primary objective for the existence of businesses and as a result QM has been neglected as its implementation "may not necessarily bring gains to the organization in the short term". Elghamrawy and Shibayama (2008) indicated that most strategic plans of organizations are not customer driven. They tend to concentrate much on profit-oriented objectives within a given time frame. Little market research is done to ascertain the product or service performance in the market relative to its quality. Such surveys are regarded by most organizations as costly and thus little concern is shown to quality improvement for consumer satisfaction (Elghamrawy & Shibayama, 2008).

According to Naidu, Babu, and Rajendra (2006) lack of effective measurement of quality improvement impede continuous implementation of Quality Management (QM). Naidu et al. (2006) asserted that QM is centered on monitoring employees and processes, and establishing objectives that anticipate the customer's needs so that he is surprised and

delighted. This has posed a considerable challenge to many companies. According to Naidu et al. (2006), measurement problems are caused by goals based on past substandard performance, poor planning, and lack of resources and competitor-based standard. Worse still, the statistical measurement procedures applied to production are not applicable to human system processes.

The absence of a sound strategy often contributed to ineffective quality improvement. Duran noted that deficiencies in the original planning cause a process to run at a high level of chronic waste. Using data collected at the recent seminars, Duran (1987) reported that although some managers were not pleased with their progress on their quality implementation agenda, they gave quality planning low priority. As Oakland (1989) said, the pre-planning stage of developing the right attitude and level of awareness is crucial to achieving success in a quality improvement program. Newell and Dale (1990) in their study observed that a large number of companies are either unable or unwilling to plan effectively for quality improvement. Although many performed careful and detailed planning prior to implementation, not one of the firms studied or identified beforehand the stages that their process must endure. Perhaps the root cause of poor plans and specifications is that many owners do not understand the impact that poor drawings have on a project's quality, cost, and time. Regardless of the cause, poor plans and specifications lead to a project that costs more, takes longer to complete, and causes more frustration than it should. Companies using QM should always strive towards impressing upon owners the need to spend money and time on planning. If management took reasonable time to plan projects thoroughly and invest in partnering to develop an effective project team, a lot could be achieved in terms of product performance as these investments in prevention- oriented management can significantly improve the quality of the goods or services offered by an organization (Besterfield, 2003).

A quality implementation program will succeed only if top management is fully committed beyond public announcements. Success requires devotion and highly visible and articulate champions. Newell and Dale (1990) found that even marginal wavering by corporate managers was sufficient to divert attention from continuous improvement. Additionally, Schein (1991) reported that the U.S. Quality Council is most troubled by the lack of top management commitment in many companies. Lack of commitment in quality management may stem from various reasons. Major obstacles include the preoccupation with short-term profits and the limited experience and training of many executives. Duran, for example, observed that many managers have extensive experience in business and finance but not in quality improvement. Similarly, Bothe (1988) pointed out that although the CEO does not have to be a quality expert, programs fail when the CEO does not recognize the contribution these techniques make toward profitability and customer satisfaction.

Anderson et al., (1994), top management should, therefore, embrace quality improvement programs no matter how far reaching the programs may appear the monetary implications therein. Competition alone should not be considered as the single factor that drives managers into implementing quality initiatives. A workforce is often unwilling to embrace QM for a variety of reasons. Oakland, (1989) explained that a lack of long-term objectives and targets causes a quality implementation program to lose credibility. Keys (1991) warned that an adversarial relationship between management and non-management should not exist, and he emphasized that a cooperative relationship is necessary for success. A QM project must be supported by employee trust, acceptance and understanding of management's objectives. Employees therefore, should be recognized by the management as vital players in the decision making processes

regarding to quality improvement as involving them would have motivating effect on implementation of quality programs.

According to Schein (1990) there is evidence that lack of understanding and proper training exists at all levels of any organization, and that it is a large contributor to worker resistance. Schein (1990) for example, mentioned that business school failure to teach relevant process skills contributed to manager ineffectiveness. TQM requires a well-educated workforce with a solid understanding of basic math, reading, writing and communication. Although companies invest heavily in quality awareness, statistical process control, and quality circles, often the training is too narrowly focused. Frequently, Duran's warning against training for specific organizational levels or product lines is unheeded. This has also been underscored by Newell and Dale who argue that poor education and training present a major obstacle in the development and implementation of a quality program. For a company to produce a quality product, employees need to know how to do their jobs. For QM to be successful, organizations must commit to training employees at all levels. QM should provide comprehensive training, including technical expertise, communication skills, small-team management, problem-solving tools, and customer relations.

Masters (1996) found eight barriers, occurring to varying degrees and with varying frequency, that plague organizations most often: an inability change the organizational culture; lack of permanent training and education; lack of commitment on the part of the management, improper planning for implementation; lack of access to data and results; unsuccessful measurement technique; isolated individuals and departments and incompatible organizational structure; paying insufficient attention to external and internal customers; and insufficient use of teamwork and empowerment.

A study in Yemen found three major categories of quality management barriers; the first category was related to government decisions in appointing managers in public organizations and lack of appointing programs necessary to support quality activities; the second category was a lack of knowledge of new techniques and a shortage culture and inappropriate managerial traditions and habits (Al-Zamany, Hoddell & Savage, 2002). In Quarter mine barriers were found; the existence of strict hierarchical and authoritative top directors; resistance from both employees and middle management; a negative work climate; lack of resources to implement changes; lack of knowledge and skills in senior management; wrong people in the wrong positions; promotion for employees on the basis of race rather than on achievement and experience; and complications linked with empowerment at lower employees levels (Al-Khalifa & Aspinwall, 2000). A survey in USA conducted for the American Society for Quality (ASQ), found that five barriers exist; insufficient human resources management and development; lack of quality leadership; lack of planning for quality; lack of customer focus; inadequate quality management resources (Sebastianelli & Tamimi, 2003). Other research in USA studied the barriers facing quality management and non-quality management organizations and showed that three barriers faced quality management organizations; insufficient time, poor communication and lack of employee authorization. For non-quality management organizations, barriers were insufficient time, lack of strategic planning for change and lack of motivation (Salegna & Fazel, 2000).

A study in Indonesia also revealed eleven factors considered to hinder the successful implementation of quality management. These factors are linked to human resources; organizational culture; management; inter-departmental relations; attitude toward quality, materials, machines and equipment; information; method and training. A study in Singapore found the main difficulties encountered during the implementation of

quality management are manager's unwillingness to take responsibility, initial managerial difficulties, a short-term view of quality management and employee resistance to change (Salenga & Fazel, 2000).

In India, three barriers were found in industrial companies, namely no benchmarking of other companies practices, employees resistance to change and lack of resources (Bhat & Rajashekhar, 2009). The different and similar findings obtained have been reviewed and became evident that lack of resources, lack of involvement of management and employees and lack of management commitment are the main constraints to quality management.

2.9 Impact of Implementing Quality Performance Indicators

Osborne and Gaebler (2005) mentioned that failure to measure results means that a distinction cannot be made between success and failure, and if success is not appreciated, it cannot be rewarded. This means that, if success is not rewarded, then, probably failure is being rewarded and the inability to recognize failure means it cannot be corrected. But if results can be demonstrated, then, improvement can be achieved. Neely (1999) highlighted seven reasons why performance management has now become so important.

- the changing nature of work;
- increasing competition;
- specific improvement initiatives;
- national and international awards;
- changing organizational roles;
- changing external demands and
- The power of Information Technology

Neely (2002) was of the view that the use of performance measurement is to establish accountability so that stakeholders in the construction industry can assess what programmes have been achieved with the resources provided and also help stakeholders develop and justify budget proposals in support of strategic planning and goal-setting. Another major use is to help stakeholders develop and then justify budget proposals i.e. supports strategic planning and goal-setting. Performance measurement also helps or assists stakeholders in determining effective use of resources (Neely, 2002). Public and private managers often say that performance information will not help them because their problem is too few resources to do what needs to be done. Performance measurement also assists in the improvement of customer service (Hatry, 2006). According to Greiner (2007), performance measurement gives a basis for rating the outcomes and competitiveness of programmes or activities. The importance of performance measurement in the construction industry is believed to accrue to the major stakeholders in the industry, that is, the client, consultant and the contractor (Nassar, 2009). To the client, Nassar, mentioned that best value for money will be achieved since the project stands the chance of being delivered on schedule to and to quality standards as spelt out in the specifications. Also, performance measurement provides the client with an objective and consistent means of implementing pre-qualification process since performance information of different contractors would be available for comparison and selection (Nassar, 2009). Kovacic (2009) posited that key performance indicators promotes internal quality control, promotes transparency and accountability, assists in the identification of risk levels of activities undertaken and supports the minimization of compliance costs.

There are few studies that examined the effects of quality performance indicators on construction projects. On the basis of a large study among 1500 construction firms in the mid-western US, McIntyre and Kirschenman (2000) concluded that substantial benefits can be attained through quality performance indicators. Chase concluded, in the

construction industry, application of quality performance indicators to the jobsite has been proven to speed-up projects while increasing profitability (Chase, 1998). Torbica and Stroh (1999) examined how the use of Quality Performance Indicators (QPI) in construction affects customer satisfaction. They concluded that: 'For the first time an empirical study has confirmed that QPI is positively associated with home-buyer satisfaction'. Results of a study by Liu (2003) on the use of quality performance in public housing projects in Hong Kong showed increased customer satisfaction. Furthermore, the average number of defects in housing projects built by companies with ISO 9000 certification was significantly less than the number of defects in housing projects built by companies without ISO 9000 certification. Thus, although there are few studies that have examined the effects of quality Performance Indicators (QPI) in construction industry, the results show that both customers and contractors can benefit from it.

2.10 Quality Improvement

The Heath Foundation (2009) indicated that there no single definition of quality improvement and no one approach appears to be more successful than another. However, there are a number of definitions that describe quality improvement as a systematic approach that uses specific techniques to improve quality. The most important ingredient in successful and sustained improvement is the way in which the change is introduced and implemented. According to ISO 9000:2000 Quality improvement is "Part of quality management focused on increasing the ability to fulfill quality requirements." Quality improvement (QI) consists of systematic and continuous actions that lead to measurable improvement in health care services and the health status of targeted groups (Boaden &

Dale, 1992).The quality improvement process is grounded in the following basic concepts:

- **Establishing a culture of quality in the practice.** The practice's organization, processes, and procedures should support and be integrated with QI efforts. This "QI culture" looks different for every practice, but may include establishing dedicated QI teams, holding regular QI meetings, or creating policies around the QI goals (Burati, Matthews & Kalindi, 1992).
- **Determining and prioritizing potential areas for improvement.** There is a need to identify and understand the ways in which the practice could improve. Examining the patient population (e.g., to identify barriers to care, frequently diagnosed chronic conditions, or groups of high-risk patients) and your practice operations (e.g., to identify management issues such as low morale, long patient wait times, or poor communication). Or, use already established QI measures ((Burati et al., 1992).
- **Collect and analyze data.** Data collection and analysis lie at the heart of quality improvement. The data will help in understanding how well the systems work, identify potential areas for improvement, set measurable goals, and monitor the effectiveness of change (Burati, et al., 1992).
- **Communicating the results.** Quality improvement does not exist in a bubble-the QI efforts will affect the employees (Burati et al., 1992). As QI project is planned and implemented, project needs, priorities, actions, and results should be communicated to the entire practice (Burati et al., 1992).
- **Commit to ongoing evaluation.** Quality improvement is an ongoing process (Burati et al., 1992). A high-functioning practice strives to continually improve

performance, revisit the effectiveness of interventions, and regularly solicit patient and staff feedback (Burati et al., 1992).

An organization wishing to support, develop and improve quality needs to use quality management tools and techniques. Burati et al. (1992) viewed Check-sheet, Histogram, Pareto Diagram, Cause-and-Effect Diagram (Fishbone Diagram), Scatter Chart and Flowchart as quality management tools and equipment.

- **Check-sheet:** Check-sheet is used to record events, or non-events (non–conformances). They can also include information such as the position where the event occurred and any known causes. They are usually prepared in advance and are completed by those who are carrying out the operations or monitoring their progress. The value of check-sheet can be retrospective analysis, so they help with problem identification and problem solving.
- **Checklist:** Checklist is used to tell the user if there is a certain thing, which must be checked. As such, it can be used in the auditing of quality assurance and to follow the steps in a particular process
- **Histogram:** Histogram provides a graphical representation of the individual measured values in a data set according to the frequency of occurrence. It helps to visualize the distribution of data and there are several forms, which should be recognized, and in this way they reveal the amount of variation within a process. It should be well designed so that people who carry out the operation can easily use them
- **Pareto Analysis:** It is a technique employed to prioritize the problems so that attention is initially focused on those, having the greatest effect. It was discovered by an Italian economist, named Vilfredo Pareto, who observed how the vast majority of wealth (80%) was owned by relatively few of the population

(20%). As a generalized rule for considering solutions to problems, Pareto analysis aims to identify the critical 20% of causes and to solve them as a priority.

- **Cause and Effect Diagram (Fishbone Diagram):** Cause and Effect Diagram, which was developed by Karoa Ishikawa, is useful in breaking down the major causes of a particular problem. The shape of the diagram looks like the skeleton of a fish. This is because a process often has a multitude of tasks footing into it, any one of which may be a cause. If a problem occurs, it will have an effect on the process, so it will be necessary to consider the whole multitude of tasks when searching for a solution
- **Scatter Diagram:** The relationship of two variables can be plotted in the scatter diagrams. They are easy to complete and obviously linear pattern reveals a strong correlation.
- **Flowcharts:** Flow chart is used to provide a diagrammatic picture using a set of symbols. They are used to show all the steps or stages in a process project or sequence of events. A flowchart assists in documenting and describing a process so that it can be examined and improved. Analyzing the data collected on a flowchart can help to uncover irregularities and potential problem points.

Empirical studies on quality management in construction have shown that various quality improvement practices are common among non-residential builders and developers. Most of these practices have been collectively grouped under a successful management philosophy termed, “Total Quality Management” or TQM. (Shofoluwe et al., 2012)

2.11 Conceptual Framework

According to Cooke-Davies (2002), key quality performance indicators affect performance of construction projects. In order to identify the KQPI that affects construction projects, Cooke-Davies highlighted the importance of the KQPI in relation to the construction project performance. This corroborates Pinto and Slevan's (1994) argument that a project is only successful to the extent that it satisfies the needs of its intended user. They identify the fact that the element of performance in a project refers to efficiency and effectiveness measures. Efficiency measures correspond to the strong management and internal organisational structures (adhere to schedule, budget and specification) and effectiveness measures refer to user satisfaction and the use of the project. In addition, efficiency would only be achieved through having standard, systems and methodology. Figure 2.1 shows the relationship between KQPI and quality performance of construction projects.

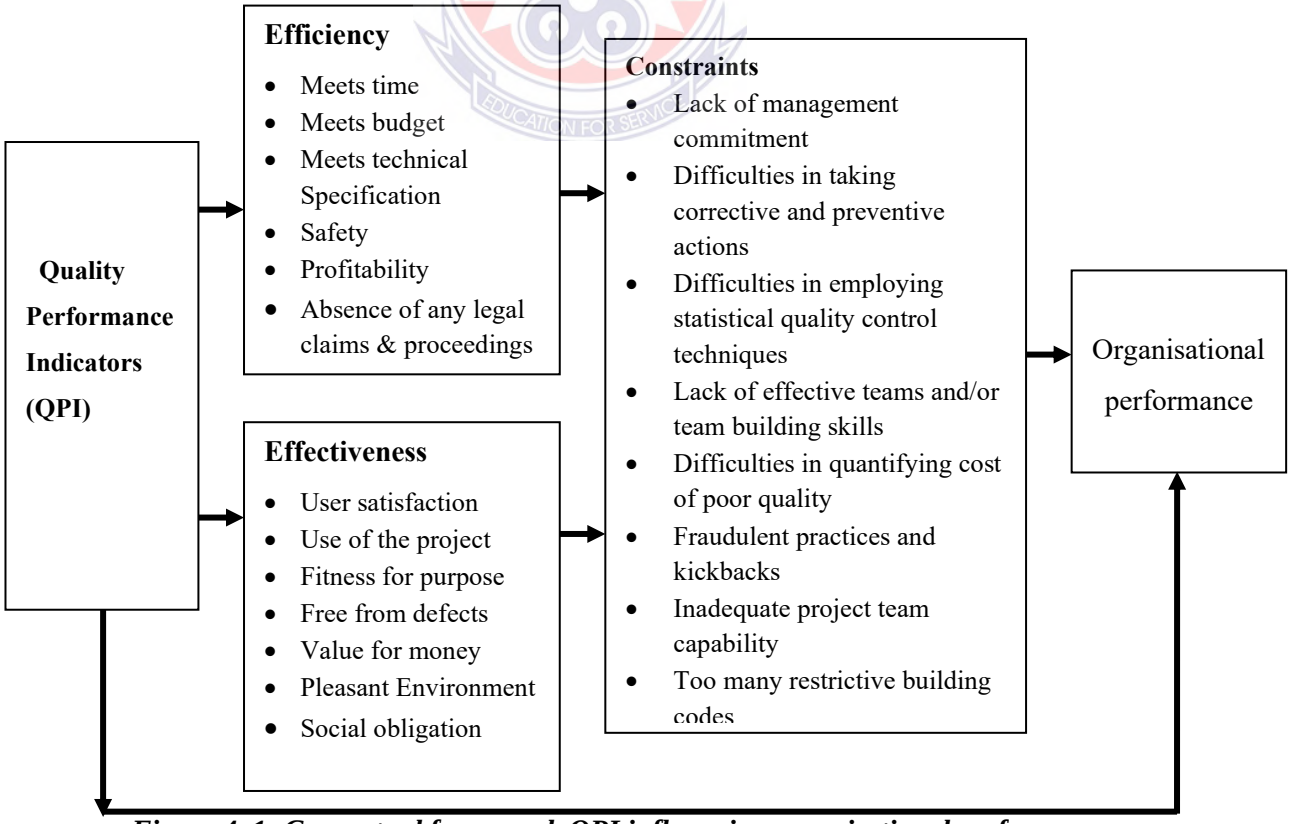

***Figure 4. 1**: Conceptual framework QPI influencing organizational performance*
Source: Researcher Construct, 2016

The conceptual framework was used to help focus on the variables in the study. The Key Quality Performance Indicators (QPI) is a function of independent variables such as efficiency and effectiveness variables. Dependent variables are the organisational performance. Efficiency variables such as meeting time schedule, meeting budget, meeting technical specification and ensuring safety improves public construction projects. Again, effectiveness variables such as user satisfaction, fitness for purpose, free from defects and value for money ensures quality performance of construction projects. Research conducted by Atkinson, et al., (1997) reveals that clients will not be satisfied if the end product fails to meet their price, quality, time frame, functionality and delivery performance standard.

Given the relationship between key quality performance indicators and quality performance of construction projects, it is possible to propose a conceptual model for successful construction projects' performance incorporating these issues as shown in Figure 2.1. The conceptual framework adopts the approach suggested by Love et al., (2000) in the Stakeholders Perspective Measurement (SPM) model and Pillai et al., (2002) in the Integrated Performance Index (IPI) framework. Both of these approaches focus on the project performance.

2.12 Conclusion

The chapter attempted to review the relevant and related literature in the areas of improving quality performance of public sector construction projects. The section commenced with the review of quality management concept in construction industry, quality performance measurement in construction Industry and key quality performance indicators for measuring quality performance. The section then continued to consider the constraints of managing quality, impact of Implementing quality performance Indicators

and quality improvement. The importance of performance measurement and evaluation were looked at as a catalyst for improving quality performance of public sector construction projects.

In this regard, researchers indicated that quality construction projects, as well as project success can be regarded as the fulfillment of expectation of the project participation. According to Chua, Kog and Loh (1999) indicated that quality management is concerned with moving the focus of control from outside the individual within, the objective being to make everyone accountable for their own performances. In furtherance, the review of performance measurement in the construction industry generally has reaffirmed the need to have an objective rather than a subjective technique of measuring contractor performance.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research approach, research design, population, sample and sampling technique, instruments, procedure for data collection, data analysis and data procedure.

3.2 Philosophical Underpinning of the Study

From literature point of view, the philosophical queries of existence, knowledge, and value, have significant influences in the research design (Koetting, 1996; Christou, *et al*., 2008). Thus, such philosophical matters of ontology, epistemology, axiology and methodology assumptions need to be addressed explicitly since they shape the choice of research instruments (Christou *et al*., 2008). Epistemology is the concerned with how individuals determine what is right. Epistemology is grouped into: positivism and interpretivism (Streubert & Carpenter, 1999). This research follows the positivists approach to knowledge. For the positivists, through the accumulation of verified facts, scientific knowledge is established (Bryman, 1992; Osei-Hwedie, 2010). The research was of the opinion that assessing the non-use of off-site construction methods in Ghana can be replicated.

At the ontological level, the position adopted for this research is objectivism. Ontology refers to enquiring the existence of a 'real' world that is sovereign of knowledge; it is a theory of living being (Marsh & Stoker, 2002). Improving quality performance of public sector construction using quality performance indicators are beyond the reach and influence of the researcher, thus, in answering the research

question; what are the key quality performance indicators that improve performance of construction projects? The objectivism ontological position was followed.

3.3 Research Design

A research design is a strategic framework for action that serves as a bridge between research questions and the execution or implementation of the research (Durrheim, 1999). Research design refers to the decisions a researcher makes in planning the study (Fouché, 2005). The study adopted a quantitative research approach. Quantitative research explains a phenomenon by gathering numerical data that are analysed using statistically based methods (Creswell, 1994). The use of quantitative research hinges on a positivist paradigm which is based on the assumption that knowledge is an objective reality (Greene et al., 2009).

According to Leedy and Ormrod (2005) quantitative research encompasses several approaches to research, yet all have two things in common. The first is that they focus on the phenomena that occur in natural setting and the second involves studying those phenomena in all their complexity. For the purpose of this research, survey research design was adopted for this study. This is a more appropriate research design for the study. A survey research design was used because it being fact finding in nature. This helped the researcher to analyse and interpret the current state of the people involved in the study, provides analyses and helped in the interpretation of data for the guidance of the future course of action. This method (survey) was supported by Newman (2000) who holds believe that a survey research uses a smaller group of selected people but generalizes the results to the whole group from which the small group was chosen.

3.4 Population

Gorard (2001) stated that, population consists of group of individuals whom one wishes to obtain results to generalize one's selected sample. Further, Polite and Hangler, (1996) cited by Avoke (2005) defined population, as the entire aggregate of cases that meet the designated set of criteria. The target population of the study is all construction professionals and Consultants involved in the execution of Ghana Education and Health Services projects in the Eastern Region. Currently, there are 26 Districts/Municipal Assemblies in Eastern Region. The operationalized definition of construction professional adopted for the study was persons whose educational qualification was a minimum Higher National Dipolma (HND) in construction related discipline or Construction Technician Course Part III (CTC III). Consultants were defined as a person with full professional membership of Ghana Institute of Surveyors' (GhIS), Ghana Institute of Engineers (GhIE), Ghana Institute of Architects (GIA), Ghana Institute of Contractors (GIOC) and Institution of Engineering and Technology Ghana (IETGh). Table 3.1 gives the numbers of construction professionals working with contractors and consultants involved in Ghana Education Service and Ghana Health Service projects in the 26 districts. A total number of one hundred and ninety-two (192) consultants and construction professionals involved in the execution of projects of Ghana Education service and Ghana Health Service in each District/Municipal in Eastern Region was the target population.

Table 3. 1: Constructions Professionals and Consultants Involved in Executing Ghana Education and Ghana Health Services Projects in Eastern Region

S/N	Name of Dist/Muni. Assembly	Edu. Projects	Health Projects	Total Projects	Const. Professionals	Consultants
1	Akuapem North	2	2	4	7	1
2	Akuapem South Municipal	3	2	5	5	3
3	Akyemansa District	2	1	3	4	0
4	Asuogyaman District	2	2	4	4	1
5	Ayensuano District	2	1	3	4	0
6	Atiwa District	3	2	5	6	3
7	Birim Central Municipal	3	1	4	7	2
8	`Birim North District	3	1	4	4	1
9	Birim South District	3	1	4	5	1
10	Denkyembour District	2	2	4	4	1
11	East Akim Municipal	3	3	6	8	4
12	Fanteakwa District	3	2	5	6	2
13	Kwaebibrim District	3	2	5	6	1
14	Kwahu Afram P North District	2	2	4	5	1
15	Kwahu Afram P. South Dist	3	2	5	7	1
16	Kwahu East District	2	1	3	4	1
17	Kwahu South District	3	3	6	7	1
18	Kwahu West Municipal	3	2	5	9	2
19	Lower Manya District	3	2	5	5	1
20	New Juaben Municipal	6	3	9	10	5
21	Nsawam Adoagyiri District	2	2	4	6	1
22	Suhum District	3	2	5	6	1
23	Upper Manya District	3	3	6	7	1
24	Upper West Akim District	2	1	3	5	1
25	West Akim Municipal	3	2	5	8	2
26	Yilo Krobo District	3	2	5	4	1
	Total	**72**	**50**	**122**	**153**	**39**

Source: Researcher's Field Survey, 2016

3.5 Sample and Sampling Technique

Creswell (2005) stated that, sample refers to a sub-group of target population that the researcher plans to study for the purpose of making generalization about the target population. Sample as a small group of larger and identifiable groups, Avoke (2005) continued that, samples usually reflect subset of the entire population of interest to the researcher. The sampling interval was determined as the ratio of the population to the sample size. The sample size was determined from a table developed by Krejcie and Morgan (1970). Based on this table the sample size determined was one hundred and twenty seven (127) (refer to Appendix A).

Simple random sampling was adopted in the questionnaire survey of the construction professionals as it ensures sample accuracy by selecting the respondents at random while considering all elements in the population. Simple random sampling ensures that every possible element of the population has an equal chance of being selected for the study. It is the type, which does not select people based on their skills or background (Kumepkor, 2002). Data gathering was limited to the key construction professionals such as managing director, architects, quantity surveyors and engineers. Amedahe (2010) in his study viewed that the larger the sample, the better the result of the study and fairness in generalization.

3.6 Data Collection Instrument

Questionnaire was used for collecting the necessary information. The questionnaire was designed for the selected one hundred twenty seven (127) respondents executing public projects with the Ghana Education and Health services in Eastern Region; the items were related to the research questions raised in the study. Avoke

(2005) narrated that, questionnaire are the instruments used to collect data for decision making in research. Creswell (2005) further described questionnaire as, a form used in survey design that participants in a study complete and return. It is a mechanism which information is gathered by a researcher, asking forms of questions to respondents on a topic being researched. In addition, Kaul (2001) stated that, questionnaire serves as a device that consist of series of questions comprising, psychological, social and educational topics given to an individual or groups of individuals with the objective of obtaining data required with regards to some problems under investigations.

There are many types of questionnaire, example open ended, close ended, mixed and likert scale and it has been widely used as one of the educational research instruments to gather data of particular issues and to inquire into opinions and attitudes of individual (s) or group (s). Awanta and Asiedu-Addo, (2008) explained likert scale, as a type of scale that measures the difference between individuals and effectively asking respondents to indicate their level of agreement with statements of interest, opinions and/or attitudes.

The researcher divided the questionnaire into two (2) sections A and B. The section A consisted of bio data of respondents, while, B reflected the constituents of the likert scale of which consultants and construction professionals were expected to respond to statements raised. Respondents were expected to tick (√) the created boxes of columns where they strongly agree; agree; disagree and strongly disagree to the given statements. In this study, the likert scale which had five (5) columns from number five (5) to zero (0) in a requisite order attached to various columns. On the scale the rating was arranged in five (5) columns. The likert scale provides the basis for neutral response, as well as ranking highest and lowest responses of respondents in the study. Here, the weight attached ranges from five (5) to one (1) with responses coded 1-5. Responses were ticked

(√) in the available boxes with correspondents boxes attached. The likert scale indicated the following: Strongly Agree (SA) - (5); Agree (A)-(4); Undecided (U)-(3); Strongly Disagree (SD) – (2); and Disagree (D) - (1).The strongly agree (SA) exhibits the most powerful weight of five (5) to the issue of discussion.

- The questionnaire items were based on research questions raised in the study, here, series of questions was raised under key themes such as key quality performance indicators appropriate for measuring performance of public sector construction projects, identify the critical constraints to effectively managing quality of public sector projects in Ghana, explore the benefit of key quality performance indicators . The questionnaire consisted of sections A and B. The section A consisted of bio data, whilst section B comprised the key themes for the study as stated above, an overall number of sixty four (64) statements were raised (Refer to Appendix C).

3.7 Validity and Reliability of Instruments

To ensure validity and reliability, questionnaire items were shown and discussed at length with colleagues in the school, lecturers and finally shown to the supervisor of the study. Items which seem similar were deleted and restructured to make sure the questions were authentic. Creswell (2005) said that, the goal of a good research is to maintain measures that are valid and reliable. Cohen, Marion and Morrison (2003) stated that, validity must be based upon the particular instrument used to determine the purpose to which it is put.

Reliability of research instrument is much concerned with consistency where stable responses are generated to build confidence in further planning and decisions in the study to provide good results. Taale and Ngman-Wara (2003) explained that,

reliability refers to the consistency that measures test items from one period to another over a period of time, situations and examiners. Normally, if results obtained seems similar, from the same test across situations, time and period, high degree of reliability is produced. Sometimes, reliability is seen when consistent or stable responses are generated. Cohen et al., (2003) reiterated that, reliability has to do with measuring the consistency and reliability over time, type of instrument, and group responses. The questionnaire obtained satisfactory Cronbach Alpha of .773.

3.8 Procedure for Data Collection

The researcher obtained official permission from the construction professional before administering questionnaire. The permission was obtained through an introductory letter, given to the researcher from the Department of Construction and Wood Technology, University of Education, Winneba - Kumasi Campus. The questionnaire was personally administered by the researcher to one hundred and twenty seven (127) consultants and construction professionals who are involved in executing Ghana Education and Health Services projects in the Eastern Region. The questions were explained to respondents to further establish better rapport. The respondents were required to ticked (√) within the appropriate columns, with columns structured in likert scale based on research questions raised in the study. The rationale for likert scale was to create a platform where respondent's attitude, opinions and interests were subject to investigations; with aggregate scores identified in the strength of the agreement and disagreement. Furthermore, the researcher gave the respondents few weeks to respond to the statements, and later collected all the questionnaires for further analysis.

3.9 Data Analysis

Creswell (2005) expressed that, data analysis consist of "taking the data apart'' to determine individuals response and "putting them together" and to summarize it (p.231-237). Creswell stated that, analyzing and investigating data refers to taking up the response from respondents and drawing final conclusions about it, where conclusions could be clearly seen and explained to any reader, how the conclusions were arrived in words, to provide answers that benefit each research questions raised. Best and Khan, (1995) reported that, possible report percentages responses are obtained by combining two outside categories, if likert scales are used, which indicated that, strongly agree and agree will merge; and strongly disagree and disagree will also be merged for easy analysis.

Furthermore, Awanta and Asiedu-Addo, (2008) stated that, data analysis is a systematic approach of finding evidence to support an idea raised in the study with relationship between two or more variables. In the study, Statistical Product for Scientific Solutions (SPSS) was used in analysing the data, and to find out the statistical significance of different variables made by respondents in the questionnaire.

The data was summarised using frequencies, percentages and mean score and presented in tabular form. Awanta and Asiedu-Addo (2008) refer to mean as "average'', the overall responses or views of different respondents based on the information gathered (p.158). The 95% confidence interval (CI) for the mean was calculated to examine the cut-off point for the determination of the key quality performance indicators (KQPI), identify the critical constraints to effectively managing quality of public sector projects in Ghana and the benefit of key quality performance indicators.

Exploratory factor analysis was employed as a statistical tool to bring insights regarding the relationship among numerous correlated, but seemingly unrelated variables

in terms of relatively few underlining factors (Overall & Klett, 1972). In order to ascertain the relationship between Quality Performance Indicators (QPI) and performance of construction projects, regression analysis and Pearson correlation analysis were used. The Pearson correlation test was adopted at 5% (0.05) significance level. The results generated from the quantitative analysis were presented in tables.

3.8 Ethical Consideration

All professions are guided by ethics and so is research. Research has code of ethics which govern the way research is conducted. Ethics means accordance with principles of conduct the addressing of the question of right and wrong in research (Fraenkel & Wallan, 2006). Prior to the study, approval was sought from appropriate authorities and institution who were involved in the study. According to Kumar (1999) it is unethical to collect information without the knowledge of participants, their informed willingness, and expressed consent. For this reason respondents were given prior notice before the data was collected. For instance their permission was sought before recording their voices. The information collected was treated with strict confidentiality.

CHAPTER FOUR

4.0 PRESENTATION AND ANALYSIS OF RESULTS

4.1 Introduction

The chapter presents the analysis of field data in relation to the research objectives and research questions. The chapter is organized into seven main sections namely; an introduction, response rate, demographic characteristics of the respondents, key quality performance indicators for measuring quality performance, critical constraints to effectively managing quality, perceived effects of quality performance indicators on public sector construction projects and the association between QPI and quality performance of public projects.

4.2 Response Rate

The sample size from the Table (refer to Appendix A) was 127. Therefore the total was covered, that is 127 questionnaires were distributed to the respondents. Fifty nine (59) questionnaires were returned completed. The response rate achieved was therefore 46.5%. According to Mugenda and Mugenda (1999) at least a response rate of 30.0% is acceptable in research.

4.3 Demographic Characteristics of Respondents

The demographic characteristics of respondents concentrates on their age category, gender, current job title and the number of years they have been working in the construction industry.

4.3.1 Age Category of Respondents

In this study, the survey was conducted from a population of 192 consultants and construction professionals in the Eastern Region. There were 59 usable responses to the survey. Among the respondents, the highest proportion (61.0%) came from the '31-40years' age group; 23.7% and 10.2% responded '21-30years' and '41-50 years' age group respectively, while the smaller section (5.1%) of the respondents was within the age group of 51-60years (Table 4.1).Age category of the respondents was captured in the study to help the researcher assess the different age categories of the respondents. The results also suggests that majority of the respondents were matured and therefore could be captured in an academic study such as this.

Table 4. 1: Age of Respondents

Age category	Frequency (N)	Percentage (%)
21-30years	14	23.7
31-40years	36	61.0
41-50years	6	10.2
51-60years	3	5.1
Total	59	100.0

Source: Researcher's Field Survey, 2016

4.3.2 Gender of Respondents

Both male and female were captured in the study as shown in Table 4.2. The result of the analysis shows that around 93.2% of the respondents were males as against 6.8% who were females. This underscores the dominance of male professionals in the construction industry in the study areas. This is an indication of the fact that the construction works is preserve for a particular sex as men are seriously engaged in it.

Table 4. 2: Gender of Respondents

Gender	Frequency (N)	Percentage (%)
Male	55	93.2
Female	4	6.8
Total	59	100.0

Source: Researcher's Field Survey, 2016

4.3.3 Job Title of Respondents

The respondents of the survey represented consultants and construction professionals undertaking projects of Ghana Education Ghana Health Services in Eastern Region. The area of specification included the Managing Director, architect, engineer, quantity surveyor and site managers/supervisor. Inferring from Table 4.3, 32.2% of the respondents were managing director, 6.8% each of the respondents were architect and engineer. Moreover, 11.9% of the respondents were quantity surveyors, 42.4% were also site supervisors/manager.

Table 4. 3: Job titles of Respondents

Job title	Frequency (N)	Percentage (%)
Managing Director	19	32.2
Architect	4	6.8
Engineer	4	6.8
Quantity Surveyor	7	11.9
Site manager/supervisor	25	42.4
Total	59	100.0

Source: Researcher's Field Survey, 2016

4.3.4 Experience of Respondents in the Construction Industry

Table 4.4 shows the distribution of the respondents according to number of years of site experience. Most (50.8%) of the respondents had 6-10 years of experience, 22.0% of the respondents had been in the working field for 1-5years. Moreover, 18.5% of the

respondents had 11-15years experience and only 8.5% had 15years and above of professional site experience. The minimum and maximum years of respondents at post captured by the survey were 5 years and 15 years respectively with the mean years of 2.15 with a Std. Dev. of 0.899 (Appendix B). The average years of respondents in the construction industry gives a clear indication that the respondents have vast experience in and could be in the best position to give responses for this research work.

Table 4. 4: Working experience of Respondents

Working Experience	Frequency (N)	Percentage (%)
1-5years	13	22.0
6-10years	30	50.8
11-15years	11	18.5
15years and above	5	8.5
Total	59	100.0

Source: Researcher's Field Survey, 2016

4.3.5 Quality Management System

In Table 4.5, the respondents were asked to indicate whether their institution have quality management system in place. Statistically, majority (n=42) of the respondents representing 71.2% gave a response to "Yes" whereas 6 of them representing 28.8% cited "No" to the question. This implies that the construction firms executing public projects in Eastern Region have quality management system in place to address the aspect of performance, workmanship and quality of public sector construction projects. According to Griffith, (1990) many problems experienced in building is as a result of poor quality management system. Atkinson, (2005) mentioned that if buildings are to be trouble-free, more attention needs to be given to applying quality assurance principles to design and site-work, including project selection and specification, and supervision of the handling and protection on site.

Table 4. 5: Quality management system in place

Response	Frequency (N)	Percentage (%)
Yes	42	71.2
No	17	28.8
Total	59	100.0

Source: Researcher's Field Survey, 2016

4.4 Key Quality Performance Indicators for Measuring Quality Performance

Public Sector Construction Projects

Table 4.6 summarises the responses of the consultants and construction professionals working with construction firms regarding the key quality performance indicators for measuring quality performance of public sector construction projects. The analysis was based on the respondents rating for the key performance indicators of each item in the questionnaire, with a rating of; "1" = strongly disagreed, "2" = disagreed, "3"= uncertain, "4"= agreed, "5"= strongly agreed.

Table 4. 6: Responses of Respondents on Key Quality Performance Indicators

Quality performance indicators	Mean	Std. Dev	Rank
Contractors ability to complete work on time	3.89	1.223	**1st**
Contractors ability to ensure efficient and optimum use of resource	3.80	1.250	**2nd**
Contractors ability to do the right job first time	3.61	1.379	**3rd**
Contractors ability to efficiently and effectively manage construction project	3.54	1.193	**4th**
Contractors ability to provide their own resources	3.52	1.161	**5th**
Contractors ability to provide safe and healthy working environment	3.50	1.194	**6th**
Contractors ability to identify problems and deficiencies and take necessary action	3.41	1.267	**7th**
Contractors ability to keep up to date records on progress of projects	3.31	1.061	**8th**
Contractors ability to handle hazardous materials	3.28	1.420	**9th**

Contractors adoption of quality assurance systems that meets internationally recognised standards	3.22	1.192	**10th**
Contractors ability to quickly correct deficiencies	3.15	1.393	**11th**
Contractors ability to adapt to requirements of sustainable construction	2.91	1.248	**12th**
Contractors adoption of environmentally sustainable construction	2.83	1.370	**13th**
Contractors ability to adopt innovative methods of work	2.81	1.245	**14th**
Contractors provides adequate and quality training for employees	2.61	1.172	**15th**
Contractors ability to manage project risk and uncertainties	2.46	1.177	**16th**
Contractors ability to work as team players	2.35	1.261	**17th**
Contractors ability to establish good commercial relationship with consultants, clients, subcontractors, suppliers and other supply chain actors	2.17	1.161	**18th**
Contractors ability to restore operations after system an emergency situations	2.09	1.103	**19th**

Source: Researcher's Field Survey, 2016, Mean > 3.0, accepted

The data in Table 4.6 indicates that eleven (11) items are the key quality performance indicators for measuring quality performance of public sector construction projects. Statistically, the study indicated that the highest 5 ranked key quality performance indicators are: contractors ability to complete work on time ($\bar{x}$=3.89), contractors ability to ensure efficient and optimum use of resource ($\bar{x}$=3.80), contractors ability to do the right job first time ($\bar{x}$=3.61), contractors ability to efficiently and effectively manage construction projector ($\bar{x}$=3.54), contractors ability to provide their own resources ($\bar{x}$=3.52). Considering the 95% confidence level, contractors provision of adequate and quality training for employees ($\bar{x}$=2.61), contractors ability to manage project risk and uncertainties ($\bar{x}$=2.46), contractors ability to work as team players ($\bar{x}$=2.35), contractors ability to establish good commercial relationship with consultants, clients, subcontractors, suppliers and other supply chain actors ($\bar{x}$=2.17), and contractors

ability to restore operations after system an emergency situations ($\bar{x}$=2.09) were the least 5 rated key quality performance indicators.

4.4.1 Factor Analysis of Quality Performance Indicators (QPI)

The KMO value was .695 exceeding the recommended value of .6 (Kaiser 1974). The Bartlett's Test of Sphericity with a significance level of .023 ($p < .05$) indicated that the relationship between variables were sufficiently large for PCA. The significant result for Bartlett's test supports the factorability of the correlation matrix (Pallant 2011). Table 4.7 presents the results of these preliminary analyses for PCA.

Table 4. 7: Principal Component Analysis Results for the QPI Variables (N=59)

Item	Factor	Variables included in the factor	Factor Loading	Eigenvalue	Variance %	Cumulative %
1	Quality service and time	Contractors ability to do the right job first time	.776	1.692	15.380	15.380
		Contractors ability to complete work on time	-.501			
		Contractors adoption of quality assurance systems that meets internationally recognised standards	.874			
2	Control project activities	Contractors ability to keep up to date records on progress of projects	-.720	1.533	13.934	29.314
		Contractors ability to efficiently and effectively manage construction project	.704			
		Contractors ability to identify problems and deficiencies and take necessary action	.752			
		Contractors ability to handle hazardous materials	-.413			
3	Optimum utilization of resources	Contractors ability to ensure efficient and optimum use of resource	.772	1.465	13.314	42.628
		Contractors ability to provide their own resources	.832			
		Contractors ability to keep up to date records on progress of projects	-.310			
4	Safety practices at workplace	Contractors ability to provide safe and healthy working environment	-.594	1.323	12.026	54.654
		Contractors ability to handle hazardous materials	.530			

	Contractors ability to quickly correct deficiencies	.752

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 5 iterations
Note. Factor loadings < .30 are suppressed

Table 4.7 contains the final results of the PCA. The variables grouped on the same factors suggest that: Factor 1: represents quality service and products. Factor 2 represents the effectively and efficiently control project activities. Factor 3 represents optimum utilization of resources. Factor 4 represents safety practices at workplace. In summary, the four factors which accounted for 54.7% of the total variance are considered to be the four most important factors in the factor model. These factors shaped the patterns of response of current QPI implementation. These factors (quality service and products, effectively and efficiently control project activities, optimum utilization of resources, generating clients' satisfaction) and the associated variables in each factor thereafter, are further developed to determine as fundamental performance indicators for improving quality performance of public sector projects.

4.5 Critical Constraints to Effectively Managing Quality Performance Public Sector Construction Projects

The second research question survey was designed to evaluate the major critical constraints to effectively managing quality of public sector projects in Eastern Region. A list of the most critical constraints was sourced from an extensive literature review, and some of the more typical constraints were confirmed in a series of interviews with several general managers, architects, site managers/supervisors, engineers, and quantity surveyors executing public projects of Ghana Education and Health services in Eastern Region, during a preliminary study. In the questionnaire, the respondents were asked to

identify the critical constraints to effectively managing quality of public sector projects, based on their experience, using a rating of "5" as being strong agreed, "4" agreed, "3" as uncertain, "2" as disagreed and "1" as strongly disagreed.

Table 4. 8: Responses on Critical Constraints to Effectively Managing Quality Performance Public Sector Construction Projects

Constraints	Mean	Std. Dev.	Rank
Difficulties in quantifying cost of quality	3.74	1.185	**1st**
Poor Information and communication channels	3.59	1.252	**2nd**
Difficulties in implementing quality measures, poor monitoring and controlling construction processes	3.57	1.354	**3rd**
High cost of developing and utilizing a quality management system	3.44	1.254	**4th**
Inadequate project team capability	3.43	1.268	**5th**
Difficulties in mapping processes and developing standardized procedures	3.41	1.281	**6th**
Poorly defined quality aspects of projects in conditions process	3.39	1.323	**7th**
Difficulties in employing statistical quality control techniques in construction process	3.33	1.346	**8th**
Lack of management commitment to continual quality improvement	3.30	1.355	**9th**
Too many restrictive building codes	3.19	1.347	**10th**
Inadequate early and continual client/consultant consultation	3.15	1.309	**11th**
Overly dependence on foreign standards and building codes which are often not well understood	3.00	1.530	**12th**
Difficulties in quantifying cost of poor quality	2.98	1.281	**13th**
Lack of effective teams and/or team building skills	2.96	1.387	**14th**
Difficulties in developing quality information systems in the construction process	2.83	1.178	**15th**
Unethical and corrupt practices in contractor selection process	2.76	1.302	**16th**
Difficulties in finding workers, who can claim to be experts in both construction and quality	2.76	1.529	**17th**
Fraudulent practices and kickbacks	2.56	1.327	**18th**
Difficulties in taking corrective and preventive actions	2.43	1.283	**19th**

Source: Researcher's Field Survey, 2016, Mean > 3.0, accepted

As depicted in Table 4.8, the mean rating of the critical constraints to effectively managing quality were difficulties in quantifying cost of quality (mean=3.74), poor Information and communication channels (mean=3.59), difficulties in implementing quality measures, poor monitoring and controlling construction processes (mean=3.57), high cost of developing and utilizing a quality management system (mean=3.44), and inadequate project team capability (mean =3.43). The lowest rated critical constraints to effectively managing quality was identified as difficulties in taking corrective and preventive actions (mean=2.43), followed by fraudulent practices and kickbacks (mean = 2.56). However, difficulties in finding workers, who can claim to be experts in both construction and quality (mean=2.76), unethical and corrupt practices in contractors selection process (mean=2.76) and difficulties in developing quality information system in the construction process (mean =2.83) were rated the least critical constraints to effectively managing quality projects.

4.6 Perceived Effects of Quality Performance Indicators on Public Sector Construction Projects

In order to examine the perceived effects of quality performance indicators on public sector construction projects, respondents were asked to rate the level of how quality performance indicators impact public sector construction projects with "5" as being strong agreed, "4" agreed, "3" as uncertain, "2" as disagreed and "1" as strongly disagreed. Table 4.9 presents the means, standard deviations and performance levels of each impact.

Table 4. 9: Responses on the perceived effects of Quality Performance Indicators

Impact	Mean	Std. Dev.	Rank
Promotes internal quality control	3.78	1.313	**1st**
Assists in determining effective use of resources	3.72	1.352	**2nd**
Establish accountability to the stakeholders	3.70	1.253	**3rd**
Improved schedule performance	3.69	1.113	**4th**
Promotes transparency and accountability	3.67	1.009	**5th**
Assist in the identification of risk level of activities untaken	3.59	1.190	**6th**
Provides the objective and consistent means of implementing pre-qualification process	3.56	1.298	**7th**
Reduced nonconformities	3.56	1.369	**8th**
Reduced cost of poor quality	3.52	1.209	**9th**
Reduced rework	3.52	1.285	**10th**
Improved job satisfaction	3.43	1.312	**11th**
Improved supply chain management	3.41	1.381	**12th**
Improved relationships with architects /engineers / subcontractors	3.37	1.391	**13th**
Improved projects quality for clients	3.33	1.318	**14th**
Improves customer relation	2.63	1.233	**15th**
Reduced waste of resources (e.g., labor, material, money, etc.)	2.48	1.411	**16th**
Supports the minimization of compliance costs	2.37	1.391	**17th**
Gives the basis for rating the outcomes and competitive of workdone	2.37	1.391	**18th**
Improved budget performance	2.20	1.203	**19th**

Source: Researcher's Field Survey, 2016, Mean > 3.0, accepted

The result in Table 4.8 show that the dominant perceived effects of quality performance indicators on public sector construction projects promotes internal quality control (mean=3.78), assists in determining effective use of resources (mean=3.72), establish accountability to the stakeholders (mean = 3.70), improved schedule performance (mean = 3.69), promotes transparency and accountability (mean = 3.67), and assist in the identification of risk level of activities untaken (mean=3.59). On the other hand, the least rank perceived effects of quality performance on public sector

construction projects improves customer relation (mean = 2.63), reduced waste of resources (e.g., labor, material, money, etc.) (mean = 2.48), supports the minimization of compliance costs (mean = 2.37), gives the basis for rating the outcomes and competitive of workdone (mean = 2.37) and improved budget performance (mean = 2.20)

4.6.1 Factor Analysis on Performance of Public Sector Projects

Exploratory factor analysis with varimax rotation was performed on the performance of public sector projects in order to extract the dimensions underlying the construct. The factor analysis of the 14 variables yielded four factors explaining 51.573% of total variance. In this case the value of the test statistic for sphericity is not too large (Barlett test of sphericity = 125.479) and the associated significance level is small (p=0.010), suggesting that the population is not an identity matrix. Observation of the performance of public sector projects indicates that they all have significant correlation at the 5% level, indicating that there would be no need to eliminate any of the variables for the principal component analysis. The value of the KMO statistic is 0.566, which according to Pallant (2005); Guar and Guar (2009) is satisfactory for factor analysis. In a nutshell, these tests show that factor analysis is appropriate for the factor extraction. These 14 items are shown in Table 4.10.

Table 4. 10: Principal Component Analysis of Performance of Public Sector Project

Item	Factor	Variables included in the factor	Factor Loading	Eigenvalue	Variance %	Cumulative %
1.	Keeping work schedule	Improved schedule performance	.364	2.004	14.317	14.317
		Provides the objective and consistent means of implementing pre-qualification process	.326			
		Reduced nonconformities	-.317			
		Reduced rework	.571			
		Improved job satisfaction	.765			
		Improved supply chain management	.314			

		Improved relationships with architects /engineers / subcontractors	.675			
2.	Assuring work quality	Establish accountability to the stakeholders	-.395	1.959	13.994	28.311
		Promotes transparency and accountability	-.398			
		Provides the objective and consistent means of implementing pre-qualification process	.662			
		Reduced nonconformities	.618			
		Reduced cost of poor quality	.681			
		Improved projects quality for clients	.442			
3.	Consistency in estimating and risk identification	Assists in determining effective use of resources	.719	1.786	12.755	41.065
		Establish accountability to the stakeholders	.688			
		Improved schedule performance	-.379			
		Assist in the identification of risk level of activities untaken	-.614			
		Reduced rework	-.358			
4	Clients satisfaction	Promotes internal quality control	.733	1.485	10.604	51.669
		Promotes transparency and accountability	.600			
		Reduced nonconformities	.394			
		Improved supply chain management	.503			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 15 iterations.
Note. Factor loadings < .30 are suppressed

All the 14 items were loaded on these four factors and, based on the items loading on each factor. Factor analysis of quality performance of public sector projects was deemed to be suitable with all 14 items. Based on the items loading on each factor, the factors were labeled″ keeping work schedule" as factor I, “Assuring work quality" as factor II, " consistency in estimating and risk identification" as factor III and "clients satisfaction" as factor IV.

4.7 Association between QPI and Quality Performance of Public Projects

4.7.1 Correlation Analysis

Pearson' correlation (or Pearson's *r*) was used in the study of the relationships between quality performance indicators and performance of public project variables. This statistical tool is typically used to assess the strength and direction of the linear relationship between two or more continuous variables (Allen and Bennett 2010). The Pearson correlation analyses were conducted in SPSS 20.0. The results of the Pearson correlation analyses are summarised in Table 4.11.

Table 4. 11: Correlation Matrix of QPI and Quality Performance of Public Projects

	1	2	3	4	5	6	7	8
Quality service and time	1							
Control project activities	-.195	1						
Optimum utilization of resources	-.235	-.187	1					
Safety practices at workplace	-.143	.952**	-.332	1				
Keeping work schedules	-.574	-.548	.163	-.587	1			
Assuring work quality	.145	.110	.892**	.286	-.088	1		
Consistency in estimating and risk identification	.164*	-.061	.826	-.319	.213	-.754	1	
Clients satisfaction	.267*	-.118	.643	-.049	-.346	-.510	.245	1

**. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

There are significant positive correlation between quality service and time of delivery, and clients satisfaction (r = -.267, p < .05). In addition, optimum utilization of resources had a positive correlation with assuring work quality (r = -.892, p < .01). However, controlling project activities was significantly related to consistency in estimating and risk identification (r = .164<0.05). A significant correlation indicates a reliable relationship, but not necessarily a strong correlation. These results suggest that higher levels of the QPIs (quality service and time, optimum utilization of resources) will

have a positive relationship on performance of public projects by assuring work quality, consistency in estimating and identifying risk and meeting clients' satisfaction.

4.7.2 Regression Analysis

Regression analysis was performed to test for statistically significant relationship between dependent and independent variables (Allen and Bennett 2010). An independent variable can be a categorical or continuous variable with three or more distinct categories, while a dependent variable is a continuous variable (Pallant, 2011). The independent variable in this research is four distinct Quality Performance Indicators (QPI), while the dependent variable is the total score of the performance of quality public sector projects. This linear regression was aimed at finding out the impact of QPI on performance of quality public projects.

Table 4. 12: Regression Analysis for Predicting the Quality Performance of Public Projects

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R^2	ΔR^2	F	P-value
	B	Std. Error	Beta						
(Constant)	2.444	1.036		2.360	.022				
Quality service and time	.150	.151	.143	1.997	.061				
Control project activities	.215	.141	.214	4.033	.004	.246	.125	3.50	.032
Optimum utilization of resources	.164	.156	.153	3.050	.018				
Safety practices at workplace	.169	.152	.169	2.454	.042				

Regression model was performed with keeping quality service and time of delivery, control project activities, optimum utilization of resources, and safety practices at workplace as QPI variables. The regression model was significant ($F = 3.50$, $p < .05$), with an R^2 indicating that 24.6% of the variance in QPI can be explained by the predictor variables. Furthermore, the change in R^2 was statistically significant indicating that the QPI (predictor) variables were in and among themselves important factors. Control

project activities had a coefficient (beta) of .214 with a p-value of .004 (P<0.05), indicating that it was the best predictor of quality performance of public sector construction projects. Controlling project activities was positively related to quality performance of public sector projects. The items factored under control project activities were; contractors ability to keep up to date records on progress of projects, contractors ability to efficiently and effectively manage construction project, contractors ability to identify problems and deficiencies and take necessary action and contractors ability to handle hazardous materials.

Optimum utilization of resources was significantly related to quality performance of public sector projects, with a coefficient (beta) of .153 (p=.018<0.05), indicating that it is a QPI that affects quality of public sector construction projects. The positive direction was expected and suggests that optimum utilization of resources are necessarily and indicator of quality performance. Results indicated that optimum utilization of resources (Contractors ability to ensure efficient and optimum use of resource, contractor's ability to provide own resources and contractor's ability to keep up to date records on progress of projects) are significant predictors of performance of quality projects.

Safety practices at workplace had a coefficient (beta) of .169 (p=.042<0.05) indicating that it is a predictor of quality performance of public sector construction projects. Results indicated that safety practices at workplace (contractor's ability to provide safe and healthy working environment, contractor's ability to handle hazardous materials and contractor's ability to quickly correct deficiencies) significantly affects quality performance of public sector construction projects.

CHAPTER FIVE

5.0 DISCUSSION OF RESULTS

5.1 Introduction

This chapter of the study discusses the data collected to answer the various objectives the study set to achieve. It elaborates the key performance indicators appropriate for measuring performance of public sector construction projects and the critical constraints to effectively managing quality of public sector projects in Ghana. The study further discusses the impacts of key quality performance indicators on overall quality of public sector construction projects. The last section also assessed the relationship between quality performance indicators and the quality of public sector construction projects.

5.2 Key Quality Performance Indicators for Measuring Quality Performance

In assessing the quality performance indicators as benchmarks for measurement of performance, the study revealed that completing work on time, ensuring efficient and optimum use of resource, doing the right job first time, efficiently and effectively managing construction projects, and providing their own resources were the key performance indicators as benchmarks for measuring performance of public sector construction projects. In achieving quality of the finished product, quality performance indicators is appropriate in the construction industry (Chan & Tam, 2000).

A construction project is acknowledged as successful when it is completed on time, within budget, efficient and optimum use of resource and in accordance with specifications and in accordance to stakeholder's satisfaction (Takim & Akintoye, 2002). In the same argument, Naoum, (1991) affirmed that contractors ability to define roles,

managing construction project effectively, doing the right job, effective use of resources have been found to significantly contribute to the quality of a project.

From the analysis of the results, it was confirmed that there are a number of key indicators for measuring the performance of contractors. A deeper analysis of the emerging results suggest that the factors which should be considered for performance measurement of contractors should have a set of quality, cost, time, capacity, ethical and environmental related performance indicators. According to the study by Basheka and Tumutegyereize, (2013) in Uganda contractor's performance is judged based on their (i) ability to use resources efficiently, (ii) concern on being reasonable during contract modifications, (iii) ability to structure and work with teams, (iv) ability to continuously improve their internal employee capabilities through training, (v) do the right job at the right time, and (vi) use of high quality of supplies and materials. These are expected of all contractors despite the set of challenges such contractors may face in growing economies.

5.3 Critical Constraints to Effectively Managing Quality of Public Sector Projects

The results revealed that the critical constraints to effectively managing quality**,** included: difficulties in quantifying cost of quality, poor information and communication channels, difficulties in implementing quality measures, poor monitoring and controlling construction processes, high cost of developing and utilizing a quality management system, and low project team capability were the dominant critical constraints to effectively and efficiently managing quality of public sector projects. The study by Arditi and Gunaydin, (1998) identifies among other constraints; lack of management commitment to continual quality improvement; poor information and communication

channels, high cost of developing and utilizing a quality management system, lack of quality training of staff; management leadership; efficient team work among stakeholders as generic factors that affect the quality process.

The respondents agreeing that difficulties in quantifying cost of quality poor monitoring and controlling construction processes are critical constraints to effectively managing quality of public sector projects was supported by Enshassi et al., (2009) study of the factors affecting the performance of construction projects in the Gaza Strip, provided a useful categorization of critical performance measures for construction projects. Their analysis suggested that the factors which affect projects, included cost of quality, poor monitoring and evaluation, health and safety. Naidu, Babu and Rajendra, (2006) asserted that managing quality of projects is centered on monitoring employees and processes, and establishing objectives that anticipate the customer's needs so that he is surprised and delighted. This has posed a considerable challenge to many companies. According to Naidu et al., (2006), measurement problems are caused by goals based on past substandard performance, poor planning, and lack of resources and competitor-based standard.

Farid and El-Sayegh, (2006), gives interesting findings on the significant factors causing effectively managing quality of public sector projects in the United Arab Emirate (UAE) construction industry. The study reports shortage of skills of manpower, poor monitoring and evaluation, poor information and communication channels, unsuitable leadership, difficulties in implementing quality measures, project team capability, shortage and breakdown of equipment as some of the major causes of effectively managing construction projects.

In a study of the Thai highway contractors, Prasertrungruang and Handikusumo, (2007) observed that low project team capability affects construction project

management. Further, Day and Benjamin, (1991), contend that efficient and effective use of resource has long been considered as one of the key factors for improving contractors' capability in performing their work efficiently and effectively. However, contractors usually face difficulties in getting all the resource they need, especially capital investments, in the acquisition phase, due to financial constraints. It is estimated that the procurement of equipment constitutes up to 36% of the total construction project cost (Yeo & Ning, 2006). Research in USA studied the constraints to quality management of construction projects. The study showed three constraints to effective managing quality; insufficient time, poor communication and inadequate project team capability (Salegna & Fazel, 2000). In India, Bhat & Rajashekhar, (2009) conducted a study found that quantifying low project team affects quality management of projects.

5.4 Perceived Effects of Key Quality Performance Indicators

From the data collected, the findings shows that, promoting internal quality control, assisting in determining effective use of resources, establishing accountability to the stakeholders, improving schedule performance, promoting transparency and accountability, and assisting in the identification of risk level of activities untaken were the perceived effects of key performance indicators on the quality of public sector construction projects. The findings support the study by Neely, (1999) who highlighted seven reasons why performance indicators has now become so important.

- the changing nature of work;
- effective use of resources
- increasing competition;
- specific improvement initiatives;
- national and international awards;

- promote transparency and accountability,
- assist in identification of risk level of activities

Neely, (2002) was of the view that the use of performance measurement is to establish accountability so that stakeholders in the construction industry can assess what programmes have been achieved with the resources provided and also help stakeholders develop and justify budget proposals in support of strategic planning and goal-setting. Another major use is to help stakeholders develop and then justify budget proposals i.e. supports strategic planning and goal-setting. Performance measurement also helps or assists stakeholders in determining effective use of resources (Neely, 2002). Public and private managers often say that performance information will not help them because their problem is too few resources to do what needs to be done. Performance measurement also assists in the improvement of customer service (Hatry, 2006).

The view of the respondents that promotion internal quality control and establishing accountability to the stakeholders was supported by Kovacic, (2009) who posited that key performance indicators promotes internal quality control, promotes transparency and accountability, assists in the identification of risk levels of activities undertaken and supports the minimization of compliance costs. Torbica and Stroh, (1999) on the same issue examined how the use of Quality Performance Indicators (QPI) in construction affects customer satisfaction. They concluded that: 'For the first time an empirical study has confirmed that QPI is positively associated with client satisfaction.

The view of the respondents that quality performance indicator improves schedule performance and identify of risk level of activities was by buttress by Chin and Pun, (2002) who stated that successful to quality measurement will results improved schedule performance, more satisfied employees and customers. Greiner, (2007) on the other hand argued that performance measurement gives a basis for assisting in the

identification of risk level of activities. Again, Nassar, (2009) purported that the importance of performance measurement in the construction industry is believed to improve schedule performance. Nassar further indicated that performance measurement enhances client value for money since the project stands the chance of being delivered on schedule and to quality standards stipulated in the specifications.

5.5 Association of Key Quality Performance Indicators and Quality Performance of Public Sector Projects

The multiple linear regression revealed that quality performance indicators variables were found to have positive significant effect on the quality performance of Ghana Education and Ghana Health service construction projects in Eastern Region. The R^2 for this relationship is .246 and it is significant at 95% level of confidence. It is reported that one unit change in QPI would cause a 24.6% increase in the quality performance of public sector construction projects. The findings concludes that the quality service and time, control project activities, optimum utilization of resources and safety practices at workplace need to be achieved to in the delivery of public sector construction projects in Eastern Region. Contractors do see obvious the impact of quality performance indicators. More repeat customers and reduced rework are two of the most cited benefits. The study by McIntyre and Kirschenman, (2000) found similar results. Overall, contractors who adopt quality performance indicators reported higher customer satisfaction, improved schedule performance, improved relationships with architect/engineering firms and reduced rework (McIntyre & Kirschenman, 2000). Love et al., (1999) found that the costs associated with rework (having to redo a step or portion of construction due to poor craftsmanship or change in plan) were as high as 12% of the total project costs and required as much as 11% of the total project working hours.

The use of quality performance indicators in the construction industry brought about increased productivity, decreased product cost and improved product reliability (Arditi, & Gunaydin, 1997). As a result of successful use of QPI in the construction industry, the construction industry has turned to the manufacturing industry as a source of innovation, and endeavored to adopt and implement this concept in the construction industry. It is commonly acknowledged that using QPI promises several impact such as more repeat customers, reduced rework, improved employee job satisfaction, higher productivity, improved budget performance, improved schedule performance, better chances in bidding process with pre-qualification, increased market share, etc. (Hoonakker, Carayon & Loushine,(2010); Elghamrawy & Shibayama, 2008). Moreover, many construction companies still consider quality performance indicators programs as extra cost because of the fact that they are not totally aware of that the cost of nonconformance to quality, i.e., the cost of rework, waste, errors, customer complaints, budget deficiencies, and schedule delays, is much higher than that of operating a quality program (Elghamrawy & Shibayama, 2008).

Chase, (1998) concluded application of QPI to the jobsite has been proven to speed-up projects while increasing profitability. Torbica and Stroh, (1999) examined how the use of QPI in construction affects customer satisfaction. They concluded that: 'For the first time an empirical study has confirmed that QPI is positively associated with home-buyer satisfaction'. Results of a study by Liu, (2003) on quality implementation in public housing projects in Hong Kong showed increased customer satisfaction. Furthermore, the average number of defects in housing projects built by companies was significantly less than the number of defects in housing projects built by companies without adoption of QPI. Thus, although there are few studies that have examined the

effects of quality performance indicators (QPI) on quality performance of public sector construction projects, the results show that both customers and contractors can benefit from it.

CHAPTER SIX

6.0 SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Chapter Six focuses on the findings of the study, conclusions drawn from the main findings and finally proffer recommendations. The chapter is constituted into three main sections. The first section which deals with the summary of the main findings emanating from the data collected from the field as well as the contribution this study makes to knowledge on the phenomenon under studied. The second section concentrates on conclusions of the study with specific reference to the main findings drawn from the study. The last section has to do with the recommendations to address the issues emerging from the study and recommendation for further study.

6.1 Findings of the Study

The presentation of the main findings of the study was presented according to the specific objectives set out in Chapter One of this work.

6.1.1 Key Quality Performance Indicators for Measuring Quality Performance of Public Projects

The study revealed that completing work on time, ensuring efficient and optimum use of resources, doing the right job first time, efficiently and effectively managing construction project, and providing own resources were the key performance indicators for measuring performance of public sector construction projects.

6.1.2 Critical Constraints to Effectively Managing Quality of Public Sector Projects

It was evident that difficulties in quantifying cost of quality, poor information and communication channels, difficulties in implementing quality measures, poor monitoring and controlling construction processes, high cost of developing and utilizing a quality management system, and low project team capability were the dominant critical constraints to effectively and efficiently managing quality of public sector projects

6.1.3 Perceived effects of Key Quality Performance Indicators

The study confirmed that quality performance indicators promote internal quality control, assist in determining effective use of resources, establishing accountability to the stakeholders, improve schedule performance, promote transparency, and assist in the identification of risk level of activities.

6.1.4 Association between QPI and Quality Performance of Public Sector Construction Projects

Pearson correlation test found a significant positive correlation between quality service and time, and client's satisfaction. In addition, optimum utilization of resources had a positive correlation with assuring work quality. However, controlling project activities was significantly related to consistency in estimating and risk identification

The multiple linear regression revealed that quality performance indicators variables thus; quality service and time, control project activities, optimum utilization of resources, and safety practices at workplace were found to have positive significant effect on the quality performance of Ghana Education and Ghana Health service construction projects in Eastern Region.

6.2 Conclusion

The construction industry suffers from several problems such as low productivity, poor health and safety, inferior working conditions, and inadequate quality leading to poor quality performance of public sector construction projects. Application of QPI can be a solution to these problems. However, there are several constraints to the extensive deployment of QPI. This study investigated the potential benefits and barriers to the extensive adoption of quality performance indicators. The survey results revealed that difficulties in quantifying cost of quality, poor information and communication channels, difficulties in implementing quality measures, poor monitoring and controlling construction processes, high cost of developing and utilizing a quality management system, and low project team capability affects the extensive deployment of QPI. In addition, the architects, general managers, engineers, site managers/superviours, quantity Health who are involve in executing public sector projects of Ghana Education and Ghana Education Services in Eastern Region are aware of the benefits of QPI adoption. Quality performance indicators were found to have positive significant effect on the quality performance of Ghana Education and Ghana Health service construction projects in Eastern Region.

6.3 Recommendations

With the key findings emanating from this study and the conclusions drawn as the bases, the following recommendations are made.

- the study recommended that quality performance indicators should be introduced to monitor and evaluate construction industry of Ghana to ensure systematic and quality performance of public sector construction projects.

- the key client entities and professional bodies should adopt quality performance indicators to enable entities assess and rate the performance of each contractor on each project. It is believed that, an established indicators mechanism will provide a good reference base for future evaluations to ensure that only competent contractors are awarded contracts to ensure high quality performance of projects.
- all project stakeholders should work together and ensure that the constraints to effectively managing quality of public sector projects are mitigated during the construction period so as to avoid prolonging the planned executing construction projects.

6.4 Suggestion for Further Research

There are numerous research avenues in future as a result of this study. The following are therefore recommended for further research:

- research into the comparative analysis of construction industries that employ quality performance indicators in the Ghanaian construction industry.
- future research into the framework for predicting the failure and success of quality performance indicators in the Ghanaian construction industry.

REFERENCES

Ahmed, S. (1993). *An Integrated Total Quality Management (TQM) Model for the Construction Process.* Ph.D. Dissertation, School of Civil & Environmental Engineering, Georgia Institute of Technology Atlanta, GA, USA.

Al-Khalifa, K. & Aspinwall, E. (2000). Critical Success Factors of TQM: A UK Study. *International Journal of Productivity and Quality Management*, 3(4), 430-443.

Al-Zamany, Y., Hoddell, E. and Savage, B. (2002). 'Understanding the difficulties of implementing quality management in Yemen', *The TQM Magazine*, Vol. 14, No. 4, pp.240–247.

Amedahe, F. K. (2010). *Educational research: Lecture synopsis*. Cape Coast: University of Cape Coast.

American Quality Foundation and Ernst & Young (1991). *International Quality Study: The Definitive. Study of the Best International Quality Management Practices.* Ernst & Young, Cleveland, OH

Anderson, E. W., Fornell, C. & Lehmann, D. R. (1994). Customer satisfaction, market share, and profitability: Findings from Sweden, *Journal of Marketing*, Vol. 58, July, pp. 53-56.

Arditi, D. & Lee, D. E. (2004). Service quality performance of design/build contractors using quality function deployment. *Construction Management and Economics*, 22(1), 123–127.

Arditi, D. & Gunaydin, H. M. (1997). Total quality management in construction. *International Journal of Project Management – Pergamon*, ISSN 0263-7863, Vol. 15, No. 4, 1997, pp. 235-243.

Arditi, D. & Lee, D.E. (2003). Assessing the corporate service quality performance of design/build contractors using quality function deployment. *Construction Management and Economics*, 21(2), 175–185.

Arditi, D., & Gunaydin, H. M. (1998). Factors that affect process quality in the lifecyce of building projects. *Journal of Construction Engineering and Management, ASCE, 124(3), 194-203*

Arnold, F. (1994). TQM age versus quality: an empirical investigation. *Production and Inventory Management Journal , 37* (1), 18-23.

Artley, W. (2001). *Performance-Based Management Handbook, Establishing Accountability for Performance*: 1-11, N.p., U.S Department of Energy.

Atkinson, A.A., Waterhouse, J.H., and Wells, R.B. (1997). A stakeholder approach to strategic performance measurement. *Sloan Management Review; Cambridge*, 38 (3) pp 25-37.

Atkinson, G. (2005). *Construction Quality and Quality Standards, The European Perspective.* London: E & FN SPON

Avoke, M. (2005). *Special educational needs in Ghana: Policy practice and research.* Ghana: Special Education Books, Department of Special Education, University of Winneba, pp. 90-92

Avoke, M. (2005). *Special educational needs in Ghana: Policy practice and research.* Ghana: Special Education Books, Department of Special Education, University of Winneba, pp. 90-92

Awanta, E. K. & Asiedu- Addo, S.K. (2008). *Essential Statistical Techniques in Research, for Universities, Colleges and Research Institutions*. Published by Salt "N" Light Publishers, Accra, Ghana.

Basheka, C. B. & Tumutegyereize, M. (2013). Measuring the performance of contractors in government construction projects in developing countries: Uganda's context. *African Journal of Environmental Economics and Management* Vol. 1 (4), pp. 106-1112.

Battikha, M. G. (2002). 'Quality management practices in highway construction'. *Journal of Social Science,* 23(2), 532-550

Benson, F. (1993). '*Impediments to the adoption of TQM in Jordanian ISO 9000 series certified manufacturing companies',* Unpublished PhD thesis, University of Salford, UK.

Best, J & Khan, J (1995). *Research in education*, Englewood Cliffs (NJ), Prentice Hall.

Besterfield, D. H. (2003). *Total Quality Management*. London: Pearson Education Inc.

Bhat, E. M. & Rajashekhar, F. (2009). 'Barriers to implementing TQM in Indonesian manufacturing organisations', *The TQM Magazine*, Vol. 14, No. 6, pp.367–372.

Bititci, R. (1994). Critical Success Factors of Total Quality Management and their Impact on Performance of Iranian Automotive Industry: A Theoretical Approach European. *Journal of Economics, Finance and Administrative Sciences* (33), 25-41.

Boaden, R. & Dale, B. (1992). Total quality management in the construction industry: A preliminary analysis. *International Journal of Technology Management,* 7 (1), 224-253

Bothe, H. (1998). The Effects of Technology and TQM on the Performance of Logistics Companies. . *Journal of Physical Distribution and Logistics Management*, 36(3), 192-209.

Bryman, A. (1992). *Quantitative and Qualitative Research: Further Reflections on Their Integration, In Brannen, J. (ed.) Mixing methods*: Qualitative Research, Aldershot, UK: Avebury. pp. 57-78

Bubshait, A.A., & Al-Atiq, T.H. (1999). ISO 9000 quality standards in construction. *Journal of Management in Engineering*, 15(6), 41–46.

Burati J. L., Farrington, J.J. and Ledbetter, W.B. (1992). Cause of quality deviation in design and construction. *Journal of Construction Engineering and Management* 118: 34-49

Burati, J. L., Matthews, M. F., & Kalindi S. N. (1992). Quality management organizations and technique. *Journal of construction Engineering and Management*, 118(2), 112-128.

Burati, J.L.J., & Oswald, T.H. (1993). Implementing TQM in engineering and construction. *Journal of Management in Engineering,* 9(4), 456–470.

Carty, J.G. (1995). Construction. *Journal of Construction Engineering and Management*, 12(1), 319–328.

Center to Protect of Workers' Rights (2002). *The construction chart book* (2nd ed.). Silver Spring, MD: CPWR Publishing.

Chan, A. (2001) A Quest for Better Construction Quality in Hong Kong. *Construction Paper, 131, CIOB Construction Information Quantity*, 3(2): 9-16.

Chan, A.P.C., & Tam, C.M. (2000). Factors affecting the quality of building projects in Hong Kong. *International Journal on Quality Reliability Management.* 17(4/5):423-441.

Chase, G.W. (1998). Improving construction methods: A story about quality. *Journal of Management in Engineering*, 14(3), 30–33.

Chin, M. & Pun, F. P (2002). Successful project execution. *Project Management Journa*l, 22(4), 23-30.

Chinyio, J.A., Weiner, B.J. and Griffith, J. (1998). "Quality improvement and hospital financial performance. *Journal of Organisational Behaviour,* 27(7): 1003-29.

Christou, E., Valachis, I. & Anastasiadou, C. (2008). *Research Methodology in Hospitality Industry: The role of the Inquiry Paradigm.* Available on: [http://www.ul.edu.lb/ fthm/papers/3rd%20Axis/Methodology%20greece.doc] Assessed on [08/03/2013]

Chua, D.K.H., Kog, Y.C., and Loh, P.K. (1999). Critical Success Factors for Different Project Objectives. *Journal of Construction Engineering and Management*, ASCE,125(3):142-150

Cohen, L., Manion, L., & Morrison K. (2000). *Research Methods in Education* (5th Edition).

Construction Best Practice Programme (CBPP), (2002). *An introduction to Benchmarking* http://www.cbpp.org.uk. Access in Oct 2002

Construction Industry Development Board Malaysia (2001b). *QLASSIC (Quality Assessment System in Construction. Kuala Lumpur)*: CIDB Publications

Construction Industry Task Force (1998). *Rethinking Construction*. Department of the Environment, Transport and the Regions, London.

Construx, C. (2003). 'Defining a Quality Plan' (www.sasqag.org/pastmeetings/Quality Plans.pdf. (Accessed on 2nd September, 2016).

Cooke-Davies, T. J. (2002). The "real" success factors on projects. *International Journal of Project Management,* 20: 185-190

Cordero, R. (1990). The measurement of innovation performance in the firm: an overview. *Research Policy*, Vol. 19 pp 185-192

Creswell, J. W. (1994). *Research Design: Qualitative and Quantitative Approaches*, New Jersey: Pearson Educational Research.

Creswell, J. W. (2005). *Educational research: planning, conducting and evaluating quantitative and qualitative research.* New Jersey: Pearson Educational Research.

Culp, G., (1993). ''Implementing total quality management in consulting engineering firm.'' *Journal of Management Engineer.* 9(4): 340-355.

Dainty, A.R.J., Cheng, Mei-I., and Moore, D.R. (2003). Redefining performance measures for construction project managers: an empirical evaluation. *Construction Management and Economics*, 21, 209-218.

Dale, B. G. (2003). Managing Quality, Blakwell Publishing Ltd, Oxford, 2003.

Day, D.A., & Benjamin, N. B.H. (1991). *Construction equipment guide*, (2nd ed.). Wiley, New York, N.Y.

Delgado-Hernandez D. J. and Aspinwall E. (2008). Quality management case studies in the UK construction industry. *Total Quality Management & Business Excellence,* 19(9), 919 – 938.

Duran, P. (1987). *The impact of effective leadership on quality: the role of Leadership in managing quality initiatives in health care.* PhD thesis, UMI Number: 3397361.

Durrheim, K. (1999). *Research in practice.* Cape Town: University of Cape Town Press.

Easton, M. F. (1993). The effect of competition, just in time production and total quality management on the use of multiple performance measures: An empirical study. *Journal of economics and social research*. 10 (1):35-72.

Egan, J. (1998). *Rethinking construction: report of the construction task force on the scope for improving the quality and efficiency of UK construction*. Department of the Environment, Transport and the Region, London

Elghamrawy, T. & Shibayama, T. (2008). Total quality management implementation in the Egyptian construction industry. *Journal of Management in Engineering – American Society of Civil Engineers*, ISSN 0742-597X, Vol. 24, No. 3, July 2008, pp. 156-161.

Enshassi, E. M., Edwards, D. J. & Nicholas, J. (2009). The state of health and safety in the UK construction industry with a focus on plant operators". Struct. survey 20(2):78-87.

Evans, J. & Lindsay, W. (2008). *The management and control of quality.* Thompson South Western, Canada.

Farid, D. C. & El-Sayegh, A. N. (2006). Causes of high costs of construction. *Journal on Construction Management*. 114(2):233-244.

Flint, S (2005). An analysis of the relationship between TQM implementation and organizational performance. Journal of manufacturing technology management. 17 (6): 829-847.

Formoso, C.T., & Revelo, V.H. (1999). Improving the materials supply system in small-sized building firms. *Automation in Construction*, 8(6), 663–670.

Fouche, C. B. (2005). *Research at Grass Roots: For the Social Sciences and Human Service Professions* (3rd Ed.). Hatfield: Van Schaik.

Fraenkel, J. R. &Wallen, N. E. (2006). *How to design and evaluate research in education*.(5th ed.) New York: McGraw-Hill.

Gamsby, S. O., Mize, J.D., & Reid, R.A. (1996, October 6–9). A project management focused framework for assuring quality work process. Paper presented at the 27th Annual Seminar/ Symposium. Project Management Institute, Boston.

Gorard, S. (2001). *Quantitative methods in social science: the role of numbers made easy*, London: Continuum.

Greene, J. C., Caracelli, V. J. and Graham, W. F. (2009). Toward a Conceptual Framework for Mixed-Method Evaluation Designs, *Educational Evaluation and Policy Analysis Vol.* 11, pp. 255-274.

Greiner, R. N. (2007). Provider-perceived dimensions of total quality management in health care. *Benchmarking an International Journal.* 15 (6): 693-722.

Griffith, A. (1990). *Quality Assurance in Building,* London: Macmillan.

Guar, D. & Guar, P. (2009). Construction skills training for the next Millennium". *Construction management economics,* 16(5):569-580.

Handfield, D. A. (1993). *Critical Success Factors of Continuous Improvement in the Public Sector.* The TQM Magazine, 19(5), 497-517.

Harris, F & McCaffer, R., (2001). Modern Constreuction Management. 5th ed. London: Blackwell Publishing

Harris, F., McCaffer, R. and Edum-Fotwe, F. (2006). *Modern Construction Management.* Blackwell Publishing

Hartmann, A. (2006). The role of organizational culture in motivating innovative behaviour in construction firms. Construction Innovation, 6(3), 159–172.

Hatry, H. P. (2006). *Performance Measurement*, (2nd ed.), New Jersey: Pearson Educational Research.

Health Foundation, (2009). *A Review of the Evidence of Which Improvements to Quality Reduce Cost to Health Service Providers*. London. P.8

Hendricks, K. B., & Singhal, V. R. (1996). Firm characteristics, total quality management and financial performance. *Journal of Operations Management* 19:269-285.

Hendricks, K. B., & Singhal, V. R. (1997). Organizational culture for total quality management. The TQM Magazine 23, no. 5-6:678-692.

Hoonakker, P., Carayon, P. & Loushine, T. (2010*). Barriers and benefits of quality management in the construction industry, Total Quality Management* – Routledge, ISSN 1478-3363, Vol. 21, No. 9, pp. 953-969.

Hoonakker, P.L.T. (1999). *Welke maatregelen nemen bouwbedrijven om de stress te verminderen?* [What measures do construction firms take to reduce work stress?]. Amsterdam: Arbouw.

Hoonakker, P.L.T. (2006). The effect of safety initiatives on safety performance: A longitudinal study. *Applied Ergonomics*, 36(4), 461–469.

Idris, M.A., McEwan, W. & Belavendram, N. (1996). *The adoption of ISO 9000 and total quality management in Malaysia.* The TQM Magazine, 8(5): 65-68.

Joint Commission International, (JCI). (2013). *About Joint Commission International*, (On line) http://www.jointcommissioninternational.org/about-jci/ access date11-4-2013.

Kagioglou, M., Cooper, R., and Aouad, G. (2000). Performance management in construction: a conceptual framework. *Construction Management and Economics*, 19 pp 85-95

Kanji, B. & Wong, C. (1998). A path analytic model of quality practices, quality performance and business performance. *Production and Operations Management*, 10 (4): 494-513.

Karuppusami. K., & Gandhinathan, R. (2006). Pareto Analysis of Critical Success Factors of Total Quality Management. *The TQM Magazine*, 18(4), 372-385.

Kaul, L. (1997). Open and Distance Education. *Fifth Survey of Educational Research 1988-92, Trend Reports*. New Delhi: NCERT.

Kaul, L. (1997). Open and Distance Education. *Fifth Survey of Educational Research 1988-92, Trend Reports*. New Delhi: NCERT.

Kay, G. O. (1993). A study of the effect of total quality management (tqm) practices on organizational performance in Nigeria. *Interdisciplinary Journal of Contemporary Research in Business,* 3(7), p466

Keys, I. (1991). *The impact of total quality management (TQM) on hospital performance in the Jordanian hospitals: an empirical evidence (medical leaders' perspectives) global conference on operations and supply chain management.* Retrieved from www.globalresearch.com.

Khan, A.H, Azhar, A, & Mahmood, A. (2008). '*Quality Assurance and Control in the Construction of Infrastructure Services in Developing Countries* – A Case Study of Pakistan', First International Conference of Construction In Developing Countries (ICCIDC-1), 4-5 August, pp. 109-120

Koetting, J. R. (1996). Philosophy, research, and education. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 1137-1147). New York: Simon & Schuster Macmillan

Koh, T. Y. & Low, S. P. (2010). Empiricist framework for TQM implementation in construction companies, *Journal of Management in Engineering - American Society of Civil Engineers*, 26 (3), 133-143.

Kometa, S. (1995). Strategic performance measurement and management in nonprofit organizations. *Nonprofit Management and Leadership.* 11(3) 353-370.

Kovacic, H. (2009). The relationship between total quality management practices and their effects on firm performance. *Journal of Operations Management* 34 (2) 1 - 31.

Krejcie, R.V. & Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement,* Vol. 30, 607-610.

Kumar, R. (1999). *Research methodology: A Step by step guide for beginners*: New Delhi: Sage Publication learning: Guidelines for educators. Alexandria, VA: Association for Supervision and Curriculum Development.

Kumepkor, T. K. B. (2002). *Research Methods and Techniques of Social Research*, New York: SonLife Printing Press.

Kumepkor, T. K. B. (2002). *Research Methods and Techniques of Social Research*, New York: SonLife Printing Press.

Kuprenas, J.A., & Kenney, M.D. (1998). Total quality management implementations and results: Progress update. *Practice Periodical on Structural Design and Construction,* 3(1), 34–39.

Lahndt, L. (1999). TQM tools for the construction industry. *Engineering Management Journal,* 11(2), 23–27.

Lansley, P. (1983). *Research and construction, case studies of the constraints to the application of construction management research.* Reading, UK: Department of Construction and Engineering, the University of Reading.

Latham, M. (1994). Constructing the team. London: HMSO.

Lazar, F.D. (1997). Partnering – new benefits from peering inside the black box. *Journal of Management in Engineering*, 13(6), 75–83.

Lee, D. E. and Arditi D. (2006). Total Quality Performance of Design/Build Firms Using Quality Function Deployment. *Journal of Construction Engineering and Management*, 132(1), 49–57.

Lee, H. S., Ledbetter, W. B. & Hui, M. S. (2012). "Impact of Labor Factors on Workflow." *Journal of Construction Engineering and Management*. 130(6), 918-923.

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: Planning and design* (8th ed.). Upper Saddle River, NJ: Prentice Hall.

Ling, F.Y.Y. and Chong C.L.K. (2005). Design-and-build contractors' service quality in public projects in Singapore. *Building and Environment,* 40, 815–823. Mears, P. (1995) *Quality Improvement Tools and Techniques* New York McGraw-Hill.

Onwusonye S. I. J. (2007) Achieving Public Procurement economy in Nigeria: The role of the quantity Surveyor. *The Quantity Surveyor,* 55 (3), 3-7

Liu, A. M. M. (2003). The quest for quality in public housing projects: A behaviour-to-outcome paradigm. Construction Management & Economics, 21, 147–158.

Liu, A. M. M., and Walker, A. (1998). Evaluation of project outcomes. *Journal of Construction Management & Economics,* 16, pp 209-219.

Love, P. E. D. Mandal, P., & Li, H. (2001). "A Project Management Quality Cost Information System for the Construction Industry." *Information and Management*. 40(2003), 649-661.

Love, P.E.D., and Holt, G.D (2000). Construction business performance measurement: the SPM alternative. *Business Project Management Journal*, 6 (5) pp 408-416

Love, P.E.D., Mandal, P., & Li, H. (2000). Determining the causal structure of rework influences in construction. *Construction Management and Economics*, 17, 505–517.

Marsh D. & Stoker G. (2002). *Theories and Methods in Political Science*, (2nd Ed.). Houndmills, UK: Palgrave, Macmillan.

Martin, J. M. (2004). "That"s the way we do things around here": An overview of organizational culture. In *Electronic Journal of Academic and Special Librarianship*.

Masters, P. (1996). *Marketing Management* (5th ed.). USA: Prentice Hall.

Mbugua, L.M., Harris, P., Holt, G.D., and Olomolaiye, P.O (1999). A framework for determining critical success factors influencing construction business performance. *In: Hughes, W. (ed) Procs. 15Th Annual ARCOM Conference.* September 5-7, Reading: ARCOM. 1 pp. 255-264

McCabe, S., (1996). Creating excellence in construction companies: UK contractors' experiences of quality initiatives. *The TQM Magazine*, 8(6): 14-19.

McIntyre, C., & Kirschenman, M. (2000). Survey of TQM in construction industry in upper Midwest. *Journal of Management in Engineering*, 16(5), 67–70.

McKim, R.A., & Kiani, H. (1995). Applying total quality management to the North American construction. *Cost Engineering*, 37(3), 24–28.

Meng, E. (2001). Impact of TQM on company's performance. *International Journal of Quality & Reliability Management,* 26 (1), 23-37.

Moshsini, J. & Davidson, H.(1992). The impact of TQM on financial performance. *Measuring Business Excellence*, 6 (4): 44-54.

Mugenda, O. N. & Mugenda (1999). *Research methods: A quantitative and qualitative approach.* Nairobi: ACTS press.

Naidu, N. V. R., Babu, K. M. & Rajendra, G. (2006). *Total Quality Management*. New Dellhi: New Age International Publishers, Inc.

Naoum, S. G. (1991). Procurement and Project Performance: A comparison of Management and Traditional contracting. *Occasional paper* No.45. Ascot: CIOB.

Nassar, A. (2009). *An investigation into the relationship between total quality management practice and performance in a Taiwan public hospital.* Ph.D. dissertation. School of business and informatics, Faculty of arts and sciences, Australian catholic university.

National Audit Office (2001). *Policy Development: Improving Air Quality.* Retrieved from https://www.nao.org.uk/wp-content/uploads/2001/11/0102289.pdf

Neely, A. (1999).The Performance measurement revolution: why now and what next? *International Journal of Operations and Production management*, 19(2), 205-280.

Neely. A. (1995). "The evolution of performance measurement research: Developments in the last decade and a research agenda for the next", *International Journal Operation Production Management.* 25(12):1264-1277.

Neuman, W. L. (2000). *Social research methods: Qualitative and quantitative approaches.* Boston: Allyn & Bacon.

Newell, L. F. & Dale, M. (1990). Quality management practices and their impact on performance. *International Journal of Quality and Reliability Management,* 6(23), 625-646.

Nguyen DL,. Ogunlana SO, Xuan Lan TD (2004). A study on project success factors in large construction projects in Vietnam. *Engineering, Construction and Architectural Management,* 11(6):404-413.

Oakland, J. & Marosszeky, M. (2006). *Total quality in the construction supply chain*. Jordan Hill, Oxford: Elsevier ltd.

Oakland, J. S. (1989). *Oakland on Quality Management.* Elsevier Butterworth-Heinemann publications.

Osborne D, Gaebler T (2005). *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector*. 405 pages.

Osei-Hwedie, M. (2010). *Strategic Issues of Innovative Financing of Infrastructure Project Delivery,* Unpublished Thesis (MSc), Kwame Nkrumah University of Science and Technology, Kumasi- Ghana.

Overall, J. E. & Klett, C. J. (1972). *Applied Multivariate Analysis*, McGraw-Hill, New York.

Pallant, J. (2005*). SPSS survival manual: A step by step guide to data analysis using SPSS for Windows (Version 12)*. Maidenhead: Open University Press.

Pheng, L.S. & Teo, A.J. (2004). Implementing Total Quality Management in Construction Firms. *Journal of Management in Engineering* ASCE, 23(3), 234-262.

Pillai, A. S., Joshi, A., Rao, K.S. (2002). Performance measurement of R&D projects in a multiproject, concurrent engineering environment. *International Journal of Project Management,* 20 (2002), pp 165-177

Pinto, J.F. & Slevan, D.P (1994). Critical Factors in Successful Project Implementation. *IEE Transactions of Engineering Management*, 34(1): 22-27

Polit D.F. & Hungler, B. P. (1996). *Nursing Research: Principles and Methods*. (6th ed). Philadelphia: Lippincott

Post, M. (1980). Collaborative performance management: present gaps and future research", Int. J. Productivity Perform. Manag. 55(1):7-25.

Posten, R.M. (1985) Selecting software documentation standards. *IEEE Software*, 2 (1) pp 83-86

Prasertrungruang T, Handikusumo BHW (2007). Heavy Equipment Management practices and problems in Thai highway contractors. *Engineering, construction and Architectural management,* 14(3):228-241.

Project Management Body of Knowledge "PMBOK Guide" (2008). 4th Ed. PMI Inc.

Project Management Institute. (PMI (1996). A *Guide to the Project Management Body* of Knowledge.Upper Darby, PA: Project Management Institute.

Quality Management (2013). *Measuring Quality Performance on EPC Projects*. The Construction Industry Institute

Rategan, J. M. (1992). The impact of leadership and quality climate on hospital performance. *International Journal for Quality Healthcare,* 20(6), 439–445.

Reid, S. & Sanders, I. (2007). *Examining the Effects of Contextual Factors on TQM and Performance Through the Lens of Organizational Theories: An Empirical Study. Journal of Operations Management,* 83-109.

Rose, K. (1995). "A Performance Measurement Model." *Quality Progress*. 28(2), 63- 66.

Rowlinson, S.M., & Walker, A. (1995). *The construction industry in Hong Kong*. Hong Kong: Longman.

Sabah, M. (2011). Critical linkages among TQM factors and business results. International *Journal of Operations and Product Management,* 25 (11): 1123-55.

Salegna, A. & Fazel, A. I. (2000). A quality management model based on the deep quality concept. *International Journal of Quality & Reliability Management* , 22 (3), 278-302.

Scatterfield, G. V. (2005). TQM Constructs Development and Validation: The Philippine Experience. *Gadja Mada International Journal of Business*, 6(3), 321-349

Schein, E.H. (1990). *How culture forms, develops, and changes*. In R.H. Kilmann, M.J. Saxton, & R. Serpa (Eds.), *Gaining control of the corporate culture* (pp. 17–43). San Francisco: Jossey- Bass.

Schein, E.H. (1991). *Organizational culture and leadership.* San Francisco: Jossey-Bass.

Schonberger, J. (1992). The Relationship between Quality Management Practices and Their Effects on Quality Outcomes. *European Journal of Operational Research*, 4(34), 483–501.

Schriener, J., Angelo, J.W., & McManamy, R. (1995). Total quality management struggles into a low orbit. *Journal of ENR,* 234(19), 24–28.

Sebastianelli, M. G. & Tamimi, V. (2003). TQM Adoption and Firm Performance in the Philippines. *Philippine Management Review*, 12 (23), 23-44.

Shan, M. & Murphy, S. (1995). The effect of company size on the relationship between TQM strategy and organizational performance. *Total Quality Management* 12(2), 144-148.

Shofoluwe, M, Ofori-Boadu, A, Waller, L, Bock-Hyeng, C. (2012). 'Quality Improvement Practices of Award-Winning Residential Builders and Housing Developments', *International Journal of Industrial Engineering & Production Research.,* 23(1), 7-12

Sinclair, D. and Zairi, M. (1995). *Effective process management through performance measurement.* New Jersey: Pearson Educational Research.

Smallwood, J. & Rossouw, J. (2008). The implementation of quality management systems in South African construction. *Proceedings of the Royal Institution of Chartered Surveyors Construction and Building Research conference (COBRA),* held at Dublin Institute of Technology, Republic of Ireland, 4-5 September, 2008.

Soares, J., & Anderson, S. (1997). Modeling process management in construction. *Journal of Management in Engineering*, 13(5), 45–53.

Sommerville, J. (1994). Multivariate barriers to total quality management within the construction industry. *Total Quality Management*, 5(5), 289–298.

Streubert, H.J. & Carpenter, R.D. (1999). *Qualitative Research in Nursing: Advancing the Humanistic Imperative* (2nd Ed). Philadelphia: Lippincott Williams & Williams

StudyMode.com, (2008). *Quality Assurance in the Construction Industry.* Available: Http: //www.studymode.com/essays/Quality-Assurance-Construction-Industry-129387. html (Accessed on 2nd September, 2013)

Taale, K. D., & Ngman-Wara, E. (2003). *Methods and assessment in integrated science ISC 122*. The institute for Educational Development and Extention, University college of Education of Winneba: Graphic Design.

Taale, K. D., & Ngman-Wara, E. (2003). *Methods and assessment in integrated science ISC 122*. The institute for Educational Development and Extention, University college of Education of Winneba: Graphic Design.

Takim, R & Akintoye, T. M. (2002). Total Quality Management Practices' Effects on Quality Performance and Innovative Performance. *Procedia Social and Behavioral Sciences*, 41(3), 273 – 280.

Takim, R. (2003). Performance Management Systems in Construction. In: Greenwood, DJ (Ed), 19th Annual ARCOM Conference, 3-5 September 2003, and University of Brighton. *Association of Researchers in Construction management*, Vol. 1, 423-32

Tam, C.M., Deng, Z.M., Zeng, S.X., & Ho, C.S. (2000). Quest for continuous quality improvement for public housing construction in Hong Kong. *Construction Management and Economics,* 18(4), 437–446.

Tamimi, Y. & Sebastianelli, D. G. (1998). Implementation of TQM in china and organization performance: an empirical investigation. *Total quality management*. 18(5), 509-530.

Tang, G. & Ogunlana, D. (2003). Performance Measurement: a remedy for increasing the Efficiency of public services? *International Journal Productivity Perform. Management.* 55(6):448-465.

Taskforce Report (2007). *Improving the performance of the local construction industry*. London: Routledge Falmer.

Torbica, Z. M. & Stroh, R. C. (1999). An assessment model for quality performance control in residential construction ASC *Proceedings of the 35th Annual Conference California Polytechnic State University* San Luis Obispo California pp 363-370.

Wang, T. H. & Huang, K. A. (2006). The Malaysian Construction Industry, its trend of growth-past, present & future, *The Master Builders Journal*, pp 3-7

Ward, P A., Watson, G.H., & Wateridge, J. (1991). *Organisation and procedures in the construction industry* Great Britain, Macdonald And Evans Ltd.

Womack, J. P. Müceldilli, B. & Jones, D. T. (1999). *Beyond Toyota: How to Root Out Waste and Pursue Perfection*, Harvard Business Review, 74, (6), 234-311.

Yasamis, F. Arditi, D. & Mohammadi, J. (2002) Assessing contractor quality performance *Construction Management and Economics,* 20, 211-223.

Yeo, K. T. & Ning, J. H. (2006). Managing uncertainty in major equipment procurement in engineering project. *European Journal Operation Resources,* 171(1):123-134.

Zavadskas, N. M. & Kaklauskas, S. (1996). *The link between total quality management and organization performance in Malaysian automotive industry: the mediating role of ISO\TS16949 efforts.* Proceeding of the 2009 IEEE IEEEM, 778-1-4244-4870-8\09\$26.00 2009 IEEE.

APPENDICES

APPENDIX A

Table for determination of sample size (Source Krejcie and Morgan 1970)

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note. *N* is population size.
S is sample size.

APPENDIX B

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.695
Bartlett's Test of Sphericity	Approx. Chi-Square	80.076
	df	55
	Sig.	.005

APPENDIX C

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

DEPARTMENT OF CONSTRUCTION AND WOOD TECHNOLOGY EDUCATION

Introduction

I am a student at University of Education, Winneba. The purpose of this questionnaire is to improve quality performance of public sector construction projects using quality performance indicators (KPIs). It would be greatly appreciated if you could complete this questionnaire. The study is purely for academic purpose and nothing else. Be assured that your response will not in any way be linked to your identity. You are kindly requested to answer the questions below by indicating a tick (√) or writing the appropriate answer when needed. Thank you

Section A: Socio-demographic characteristics

1.0 What is your age?

Below 21years ( ) 21-30years ( ) 31-40years ( ) 41-50years ( )
51-60years ( )

2.0 What is your gender?

Male ( ) Female ( )

3.0 What is your job title?

General Manager ( ) Architect ( ) Engineer ( )
Quantity Surveyor ( ) Site Manager/Superviour ( )

4.0 What is your highest level of educational qualification?

Diploma ( ) First Degree ( ) Masters ( ) PhD ( )
Others (specify): .....

5.0 How long have you worked in this construction firm?

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

SECTION: B

6.0. Please indicate the extent to which you agree on the following statements about the key performance indicators appropriate for measuring performance of public sector construction projects. Please rate using a scale of 1 to 5 where 1 represents strongly disagree, 2 represents disagree, 3 uncertain, 4 represents agree and 5 represents strongly agree. *Please tick* [√] *the appropriate box below*.

S/N	Performance indicators	Score				
		1	2	3	4	5
1	Contractors ability to do the right job first time					
2	Contractors ability to adopt to changes and meet needs					
3	Contractors ability to provide their own resources					
4	Contractor ability to complete work on time					
5	Contractors ability to identify problems and deficiencies					
6	Contractors ability to quickly correct deficiencies					
7	Contractors providing adequate training to their employees					
8	Contractors ability to keep the environment clean					
9	Contractors ability to keep clients facilities clean					
10	Contractors ability to keep work place safe					
11	Contractors ability to avoid wastage of water					
12	Contractors ability to minimize interruptions of operations					
13	Contractors ability to use high quality materials					
14	Contractors ability to restore operations after an emergency					
15	Contractors ability to handle hazardous materials					
16	Contractors ability to adopt to new methods of work					
17	Contractors being reasonable in contract changes					
18	Contractors ability to provide correct documentation and invoices					

7.0. Please indicate the extent to which you agree on the following statements about the critical constraints to effectively managing quality of public sector projects in Ghana. Please rate using a scale of 1 to 5 where 1 represents strongly disagree, 2 represents disagree, 3 uncertain, 4 represents agree and 5 represents strongly agree. *Please tick* [√] *the appropriate box below*.

S/N	**Constraints**	**Rating**				
		1	**2**	**3**	**4**	**5**
1	Lack of management commitment to continual quality improvement					
2	Difficulties in taking corrective and preventive actions					
3	Difficulties in mapping processes and developing standardized procedures					
4	Difficulties in employing statistical quality control techniques in construction process					
5	Difficulties in developing quality information systems in the construction process					
6	Difficulties in quantifying cost of quality					
7	Difficulties in quantifying cost of poor quality					
8	Difficulties in implementing quality measures, poor monitoring and controlling construction processes					
9	Lack of effective teams and/or team building skills					
10	Difficulties in finding workers, who can claim to be experts in both construction and quality					
11	High cost of developing and utilizing a quality management system					
12	Inadequate early and continual client/consultant consultation					
13	Poor Information and communication channels					
14	Fraudulent practices and kickbacks					
15	Inadequate project team capability					
16	Too many restrictive building codes					
17	Poorly defined quality aspects of projects in					

	conditions process					
18.	Unethical and corrupt practices in contractor selection process					
19.	Overly dependence on foreign standards and building codes which are often not well understood.					

8.0. Please indicate the extent to which you agree on the following statements about the impact of key quality performance indicators on overall quality of public sector construction projects. Please rate using a scale of 1 to 5 where 1 represents strongly disagree, 2 represents disagree, 3 uncertain, 4 represents agree and 5 represents strongly agree. *Please tick* [√] *the appropriate box below*.

S/N	**Impact of Key performance indicators**	**Rating**				
		1	**2**	**3**	**4**	**5**
1.	Improved budget performance					
2.	Improved projects quality for clients					
3.	Reduced rework					
4.	Reduced nonconformities					
5	Improved relationships with architects /engineers / subcontractors					
6.	Gives the basis for rating the outcomes and competitive of workdone					
7.	Reduced waste of resources (e.g., labor, material, money, etc.)					
8.	Reduced cost of poor quality					
9.	Improved schedule performance					
10.	Improved job satisfaction					
11.	Provides the objective and consistent means of implementing pre-qualification process					
12.	Establish accountability to the stakeholders					
13.	Assists in determining effective use of					

	resources					
14.	Promotes internal quality control					
15.	Promotes transparency and accountability					
16.	Assist in the identification of risk level of activities untaken					
17.	Supports the minimization of compliance costs					
18.	Improves customer relation					
19.	Improved supply chain management					