UNIVERSITY OF EDUCATION, WINNEBA

IMPROVING QUALITY MANAGEMENT IN THE CONSTRUCTION INDUSTRY IN THE NORTHERN REGION OF GHANA

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BY

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MAY, 2022

DECLARATION

STUDENT'S DECLARATION

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

SIGNATURE: ……..…… **DATE**: …….

ISSAH ADAM

SUPERVISOR'S DECLARATION

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

SIGNATURE: ……..…… **DATE:** ……..……

DR. NONGIBA A. KHENI

DEDICATION

I would like to dedicate this research to my lovely mother “Mathar Alhassan” and my wives “Juweria Abubakari and Mariam Muhib”. I would also like to dedicate it to “Naazira Abdallah Sugri” for her endless support and all my brothers and sisters for their support

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My special glory and thanks go to the Almighty Allah for his grace over my life, if the Almighty Allah had not been on our side we would not be able to complete this work. My profound gratitude also goes to my selfless great supervisor Dr. Nongiba A. Kheni who guided and helped me greatly in making sure this Dissertation sees the light of day.

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ABSTRACT

In Ghana, the construction industry has witnessed several quality challenges in recent years, perhaps, heightened by resent collapse of buildings. The aim of this research is to empirically evaluate the quality management practices of construction firms in the Northern region of Ghana. The objectives of the study were; to assess the quality management practices of contractors in the Northern Region of Ghana, to determine key constraints to the adoption of proven quality management practices by contractors in the Northern Region of Ghana, to evaluate the effects (if any) of quality management practices of contractors on construction project variables in the Northern Region of Ghana and to make recommendations for improving the quality performance of construction projects in the Northern Region of Ghana. The study adopted a cross sectional survey design. The target population of the study was construction professionals employed by construction firms registered with the Association of Building and Civil Engineering Contractors of Ghana in the Northern Region. The study adopted systematic random sampling to select ninety-two (92) of the construction firms and purposive sampling to select one hundred and twenty-four (124) construction professionals. The findings of the study suggest that quality management techniques/practices are barely implemented except for those expressly required by terms of contract. The often implemented practices/techniques included; inspections with a focus on quality of works, carrying out quality audits, designs of experiments for testing concrete, and use of statistical sampling techniques on project sites. Also, the findings of the study suggest that the survey respondents' firms implement elements of quality management such as; construction project design, supplier management, process management, planning, and client focus, a finding that should be interpreted with caution due to bias. However, quality management efforts such as; teamwork, top management commitment, and employee relations are not implemented. The findings further revealed that the key constraints to implementation of management practices on construction projects in the Northern region of Ghana include; lack of adequate resources, low bid mind set, lack of adequate skilled workers, lack of top management commitment and lack of adequate training of employees. The results of this study also revealed that teamwork, employee relations, top management commitment, client focus and construction project design have significant impact on construction project quality performance. In view of these findings, the study recommends that management of construction firms should be proactive and committed to quality of construction projects and implement proven quality management techniques and tools on construction project sites in the Northern region of Ghana.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Globally, the construction industry contributes to economic growth. Past studies have shown that it is one of the largest contribution to Gross Domestic Product (GDP), and plays an important role in determining a country's economic growth (Ofori, 2012; Willar, 2012). The sector currently accounts for more than 11% of global GDP (Betts et al., 2011). Additionally, the construction industry is the bedrock of the economy of many nations. The productivity of the industry stimulates growth of other sectors and thereby goes a long way to spur growth of the national economy and also provides direct employment to the populace. The sector contributes an average of 9% of the Gross Domestic Product in Ghana (Ghana Statistical Service 2014).

It is predicted that the construction industry of Ghana will play and important role of job creation and infrastructure development and act as a stimulus for economic growth due to a recent discovery of oil in commercial quantities (Amoah, et al., 2011). Given that the industry is essential for the construction of housings, schools, hospitals, transport networks, water and energy infrastructures, prudent quality management is essential.

The demand for goods and services has largely been driven by quality issues throughout human history (Reis et al., 2014; Boljević, 2007; Rumane, 2011). The importance of quality management as established by Hammurabi, the king of Babylonia (1750-1792 BC) who codified a law, according to which builders were responsible for maintaining the quality of buildings and were given the death penalty if any of their construction collapsed and their occupants were killed (Rumane, 2011).

Effective management of quality of construction processes and product is an important consideration in modern construction. This is evident from clients' increasing use of companies' reputations for good quality work as a basis for choosing prospective contractors (Ayettey and Danso, 2018). It has long been established that Ghana's construction industry suffers from poor performance, poor quality works, and lack of innovation and professionalism (Ahadzie, 2009). Arguably, the implementation of quality management practices could help to address the stated concerns and protect it against global competition.

Effective implementation of quality management practices could result in substantial benefits by achieving customer satisfaction, improving employee quality awareness and consciousness, reducing quality cost, decreasing wastage, avoiding delays, improving organization performance and closer relationships with sub-contractors and suppliers and offer firms' competitive advantage (Khan et al., 2017; Bubshait & Al-Atiq, 1999; Love, et al. 2004).

The survey of Quality of Construction by the Federation Internationale des Ingenieurs-Conseils, (the international association of consulting engineer) (FIDIC) confirmed that failure to achieve appropriate quality of construction is a problem worldwide (Rumane, 2011). Lack of quality in the construction is manifested in poor or non-sustainable workmanship, unsafe structure, delay cost overruns, and disputes in construction contracts. Defects or failure in construction facilities can result in very high cost. Even with minor defects, reconstruction may be required and facility operation impaired (Rumane, 2011). Quality management is designed to prevent defect by doing the job right the first time by creating the attitudes and environment that make defect prevention possible.

Previous studies in Ghana reveal that, the indigenous construction companies mainly Small and Medium scale contractors are challenged with many managerial related issues such as planning, effective communication, customer satisfaction, availability of materials and equipment, health and safety consciousness, low level of skilled personnel, lack of teamwork and poor coordination and scheduling and controlling techniques (Fugar & Agyarkwa –Baah, 2010; Amoah et al., 2011; Ofori, 2012).

One of the ways of addressing quality management challenges in Ghanaian construction industry is the establishment of 'Excellence Award scheme'. The scheme was institute by Building and Civil contractors in Ghana since 2012; to motivate firms to improve their performance. The quality management program currently being practice by most registered construction firms in Ghana is Quality Assurance and Quality Control based on British and Euro guidelines (Imbeah, 2012). Paradoxically, the existence of quality documentation such as quality plan, procedures and work instructions in company head office does not necessarily reflect their implementation on site.

Many empirical studies have been conducted on the implementation of Total Quality Management (TQM) in construction industry, focusing particularly on their benefits, factors enabling and barriers to implementation both developed and developing economics (Kheni & Ackon 2015). However, globally, there have been limited studies on the effect of total quality management on the construction project performance (Hoonakker, 2010). Evidence from manufacturing and service sector clearly indicate existence of positive association between quality management practices and project/organizational performance (Reis et al. 2014). Construction contracts require projects to be executed according to stated quality standards, on time and according to budget. However, these goals are often

far from being achieved in most construction projects as studies on cost and time overrun show (Fugar and Agyakwa-Baah 2010; Amoah et al. 2011; Ogunlana et al. 1999; Elinwa & Joshua 2001; Chan et al. 2001). Improving the quality management effort of construction firms could result significant improvements in the quality of most projects.

1.2 Problem Statement

In recent times, construction industry in Ghana has been heavily criticized for its performance in terms of product quality, customer satisfaction and cost and time overrun (Ofori, 2012; GhlSEP, 2012; Buffour, 2011), Defects and failures of construction products such as building and roads are persistent problem in Ghana leading to fatal accidents. A notable example is the Collapsed of Melcom shopping center (GhlSEP, 2011; GhlE, 2011). In another incidence, three persons were killed when part of five-story hotel building under construction collapsed on some workers in Tarkwa on 31st January, 2010 (GHISEP, 2012). Many completed facilities deteriorate rapidly due to lack of implementation of effective quality management practices (Bawa, 2010; GHIE, 2011; Baffour, 2011, Dadzie & Cole, 2011; Asare-Bediako, 2013).

The present study is premised on a number of shortcomings in the literature on quality management. First, few empirical studies focus on how construction firms manage quality (quality management practices (QMP) of firms. For instance, Martin et al. (2021) conducted a study on quality management in organisations in Sweden with a focus on quality management roles and responsibilities as summarized in Table 1.1. Similar studies are rare in developing countries, particularly Ghana. A relatively large number of studies are dedicated to the adoption of contemporary quality management approaches such as TQM and Quality Managing Systems (QMS). A number of the notable studies on quality

management in developing countries including Ghana focus on the adoption of TQM as can be seen from Table 1.1.

Secondly, studies have shown that the implementation of quality management practices do not necessarily have positive effects on operational efficiency, quality of product and company performance (Negron 2020; Sfreddo et al. 2018; Milan 2014). It is important to determine what quality management practices could lead to positive effects or prove efficacious as this could lay the foundation for improving quality management practice. In construction, it desirous that projects are delivered within budget, time of completion, to certain standard of quality among many project variables. Obviously, the pertinent question that arises is; what is the effect (if any) of the quality management practices of contractors on construction project variables?

1.3 Aim and Objectives of the Study

The aim of this research is to examine quality management in construction projects by construction companies in the Northern Region of Ghana with a view to making recommendations for improving quality management of construction projects in the Northern Region. The specific objectives of the study are as follows:

- to assess the quality management practices of contractors in the Northern Region of Ghana;
- to determine key constraints to the adoption of proven quality management practices by contractors in the Northern Region of Ghana;
- to evaluates the effects (if any) of quality management practices of contractors on construction project variables (project cost, time, defects, client satisfaction, and commercial relations) in the Northern Region; and,

- To make recommendations for improving the quality performance of construction projects in the Northern Region of Ghana.

1.4 Research Questions

The major research questions to enable the researcher achieve the aim and objectives of the study are outlined as follows:

- What are the principal quality management practices of contractors in the Northern Region of Ghana?
- What are the key constraints to the adoption of proven quality management practices by contractors in the Northern Region of Ghana?
- What is the effect (if any) of the quality management practices of contractors on construction project variables (project cost, time, defects, client satisfaction, and commercial relations) in the Northern Region?
- What recommendations can be made to improve the quality performance of construction projects in the Northern Region of Ghana?

1.5 Significance of the study

The study will highlight the quality management shortcomings of construction firms in the Northern region of Ghana. Also, the results of the study would help Clients to realise their cost, quality and time objectives. The findings and the recommendations of this study will help contractors to improve upon the quality of construction projects delivery in the Northern region of Ghana; and ultimately achieve high performance. Finally, the study will serve as a literature for construction students.

1.6 Scope and Limitations of the Research

The study was confined to only the Northern region of Ghana. Hence, the generalisation of the findings to other regions in Ghana must be done in caution. Furthermore, the study used supervisors' perception. The willingness of the supervisors to reveal weakness in their respective firms was uncertain; the respondents might have given desired data, which made their firms look good. Nevertheless, supervisors' perception is frequently used in construction research (Kheni & Ackon, 2015).

1.7 Chapter Outline of the study

The study is organized under the following structure. Chapter one talks about the background of the study, the statement of the problem, aim and objectives, significance pf the study, and the limitations of the study. Chapter two is the literature review. The literature was reviewed in relation to research questions touching on issues relating to improvement in total quality of projects in the construction sector. Chapter three discusses the methodology that was employed to secure the information the research is seeking. This involved the preparation and validation and use of the instrument to collect data, and produce for data collection. Chapter four presents the analysis and discussion of the result and chapter five presents the findings, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

This chapter consists of five parts. The first part provides an overview of the construction industry in general, its significance in terms of Gross Domestic Product (GDP) in relation to the economy, challenges facing the industry. The second part provides an overview of the National Building Code (NBC), occupational health and safety system and the future prospects of Ghanaian construction industry. The third part consists of extensive review of relevant literature pertaining to quality as well as a detailed discussion of Total Quality Management Practices (QMPs), including the contributions of the Quality "Gurus". It also covers discussions on the benefits that will arise from effective implementation of total quality management and challenges experiences in the implementation of the TQM practices. The fourth part consists of the construction projects quality performance determinants.

2.1 Overview of Construction Industry in Ghana

In Ghana, the agency responsible for the registration of constructors (i.e., building or civil constructors) is the Ministry of Water Resources, Works and Housing (MWRWH). The MWRWH does this in collaboration with the Registrar General's Department under act 179 (1963) of the companies' registration code (Amoah, Ahadzie& Dansoh, 2011). The MWRWH has two main classifications for contractors: category 'D' for general building (as cited n Amoah et al., 2011), inclusion of a contractor's name in the Ministry's classifications register s not compulsory, but then it is only those who are duly registered who can tender for government contracts.

The contractors for the categories (D, K) are sub-divided into four classes, ranging from class D1, D2, D3, D4 for building contractors and K1, K2, K3, K4 for civil works. The classification is based on factors such as technical and managerial expertise, financial capacity, equipment and plant holding, previous performance and human resource capacity (Eyiah and Cook, 2003; Danso, 2010). The D1K1 class of constructors is termed as larger firms, whereas D2K2 construction firms are medium and D3K3 and D4K4 are small firms (Edmond et al, 1984 as cited in Danso, 2010; Amoah et al.,2011)

The larger firms, according to MWRWH are registered as financial class 1, capable of undertaking projects of any value, class2 (the medium firms) are capable of undertaking projects up to US$500,000 or GH₵1,500,000.00, while the small firms (financial class 3) are also capable of undertaking projects up to US$200,000.00 or GH₵600, 000.00 or class 4 to undertake projects up to US$75,000 or GH₵225, 000.00 (Danso,2010). The large and medium Ghanaian construction firms form about 10% of the total number of construction firms registered with the Ministry of Water Resources, Works and Housing and the remaining 90% are the small firms or small contractors (Egmond et al.,2007 cited in Danso,2010; Amoah et al.,2011).

2.2.1 Contribution of the Ghanaian Construction Industry

The Ghanaian construction industry holds the key to the development of the nation. The construction industry of Ghana contributes immensely to the national socio-economic development by providing significant employment at skilled or non-skilled levels which help to lift many of the citizenry from poverty and it accompanied social vices such as arm robbery and prostitution. Beyond that, the industry provides the infrastructure and facilities required for other sectors of the economy to flourish such as; schools for education and training, factories and shops for commercial and business activities, housing for basic

human needs, hospitals for health care and buildings for national communications network (Ahadzie, 2009). The construction industry in Ghana is also involved in the construction of urban and feeder roads and bridges in the country. These facilities serve as arteries for the facilitation of the productive activities by enabling goods and services to be distributed within the country and beyond.

2.2.2 Construction industry contribution to Gross Domestic Product (GDP) in Ghana.

The construction sector in Ghana also contributes significantly to the GDP of the country. The Ghana Statistical services (GSS) (2014) shows that the construction and real estate service together in 2009 contributed 3,809 million Ghana cedi (2,265m USD) to the country's GDP. The share of GDP associated with building and construction sector increased from 8.7% in 2008 to 8.8% in 2009 but declined to 8.5% in 2010. It however, improved in 2011 to 8.9% and to 10.5% in 2012. This shows that the construction industry since, 2008 to 2012 contributed an average GDP growth of 9.08%to the national economy. Above all, the sector was the second highest contributor to the national GDP in 2012 (GSS, 2014).

Figure 2.1 below indicates the contributions of the construction industry to the Ghana's GDP

Figure 2.1: Growth of Construction sector based on GDP from 2008 to 2012

Source: GSS, 2014.

2.2.3 Gender Participation in the construction Industry in Ghana

The African Development Fund (ADF) (2008: 12) reports on Ghana's employment profile by gender in the various sectors of the economy indicates that in the year 2000, 4.9 percent of the working population in urban areas were men working in the construction industry and that of women were 0.1 percent. In the rural areas. 1.9 percent of the men and 0.2 percent of the women worked in the construction industry. At the national level, the industry employs 1.4 percent. The statistics demonstrate clearly stated that the sector is male-dominated in Ghana (Owusuaa, 2012).

2.2.4 Challenges Facing the Ghanaian Construction Industry

The biggest challenge facing Ghanaian local contractors is their limited capacity (financial, logistical and technical expertise), which excludes them from winning major public infrastructure projects; such as major highways, dams, and stadia. As most construction projects require contractors to post bid bonds and the larger the projects, the higher the bid bond. Other issues relate to delays by government paying for services, weak oversight by government agencies in monitoring and evaluation, excessive bureaucratic conditions, political interference, weak material supply base and poor management practices (Amoah-Mensah, 2002 as cited in Imbeah, 2012; Sutton & Kpentey, 2012).

2.2.5 The National Building Code (NBC-L.I.1630:1996)

The aim of establishing the National Building code in Ghana in1996 was to set minimum standards on building planning, designs, construction and post-construction stages with view to ensuring quality, safety and proficiency in the building industry in line with international best practice. The provisions of the code apply to and control of all matters concerning the design and specification, construction, alteration, addition to, moving demolition, location, repair and use of any building or structure for existing or proposed building works within Ghana.

Recently, the Ministry of Water Resources, Works and Housing established an 18-number committee drawn from the Building and Road Research Institute, Ghana Fire Services, Ghana Institute of Surveyors, Geoscientists, Standard Authority and EPA to review the current national building code of 1996 (L.I.1603). According to Otabil (2013) the committee has subsequently presented the document (code) to the sector Minister to be approved by cabinet. He further indicated that the new code when approved by cabinet

would seek to address some challenges in the housing sector including development control rules and general building requirements and also support several efforts to regulate the construction industry; recognizing the effect the absence of an efficient Building code and Building Regulation is having on the way buildings are constructed in the country.

Although, the existing code recognized the various inputs of the professionals in the industry and made it mandatory for them to certify the successful completion of work at every stage of construction using the compliance framework (Building Code). Impliedly, a non-certified stage of work renders the project unsafe for use and at the same time quality may be said to have been compromised, yet, according to Dadzie and Cole (2011) the existing code has not made the necessary impact due to lack of adherence and weak enforcement by regulatory authorities. The review of the code has become necessary against the background of persistent collapse of buildings, fire outbreaks, built environment abuses and other disasters, dearth of referenced design standards for professionals, use of non-professionals, use of untested materials and products and lack of adequate regulations and sanctions against offenders. It is also expected that the new code will address these problems highlighted if the government regulatory authorities will fully implement and enforce its provision. 1970, Workmen compensation Act 1987and the National Building Regulation L.I.1630 (1996). These frameworks are based on Occupational Health and Safety in construction ratified in 1992 by International Labor Organization (ILO) Convention No,167 and its associated Recommendation No. 175 on Occupational Health and Safety and Working Environment 1992. The goals of the ILO (OHS) policies are to facilitate improvement of occupational health and safety performance by providing framework for occupational health and safety protection of workers including the most vulnerable groups, and ensure harmonization of workers'

rights protection with regional and international standards (Anosike (2011)). The policy covers the following aspects:

- Location, design, construction, testing, use and maintenance of workplaces, work environment, tools, machinery and equipment, chemical, physical and biological agents and work processes.
- Inter-relationship between the material elements of work, the worker, his supervisor,
- man-machine adaptation and adaptation of working time, rest period, organization of work processes to the physical and mental capacities of the workers.
- Occupational First-Aid and establishment of workplace emergency preparedness and response plans.
- Prevention and control of hazards including establishment of procedures for work in confined spaces.
- Medical surveillance of the health workers.
- Monitoring of work environment and worker's exposure.
- Training of workers and other personnel in the area of occupational safety and health

2.2.6 Future prospects of the Ghanaian Construction Industry

As the economy and the population explode, there is a high demand for private and public housing and other infrastructure development. According to the Ministry for Water Resources, Works and Housing, Ghana needs to develop 140,000 housing units annually but is only delivery around 40,000. This has led to a housing deficit of approximately one million units (Sultan & Kpentey, 2012). Besides, there is also strong demand of government for major infrastructure and road projects expansion such as dams,

interchanges, hospitals, schools, modern markets, factories and other programs as the nation aspires to attain the millennium development goals by 2021. It is hoped that, the revenue from the oil sector will strengthen the government budget to fund these programs. With the stage set for a golden era for development, the challenges in the Ghanaian construction industry are still higher. A cultural and behavioral shift in mind-set of all participants in the construction process especially top management is necessary if the construction industry in Ghana is to prove its performance and competitiveness. The indigenous construction companies in particular need to strategize towards competing and playing a more influential role in the much needed socio-economic development that is exploding!

2.3 Concept of Quality and Related Constructs

According to researchers one of the problems with Total Quality Management (TQM) implementation is the lack of a universally accepted definition of quality (Eng &Yousof, 2003 cited in Jaafreh and Al-abedallat, 2012). The term 'quality' has many conceptual and operational definitions. Many of the pioneers of the quality movement and gurus, such as Demind, Juran, Crosby, Feigenbaum, Oakland, and others, had their own individual definitions of quality. Edward W. Deming defines quality as a product or a service "that meets the customer's expectations to ensure customer satisfaction" (Deming, 1986, P.54 as cited in Jaafreh & Al-abedallat, 2012). Philip B. Crosby's definition of quality is "conformance to requirements" (Crosby, 1979, P.7 as cited in Jaafreh & Al-abedallat, 2012). Feigenbaum defines quality as "the total composite product and service characteristics of marketing, engineering, and maintenance through which the product and service in use will meet the expectations of the customer" (Feigenbaum,1991). Joseph an Gryna, 1993).

According to Oakland (2003), the term quality refers to "meeting the customer's requirements. The requirements may include availability, delivery, reliability, maintainability, and cost effectiveness amongst many other features". Garvin (1988 as in Imbeah, 2012) studied and investigated many quality definitions and suggested that it is possible to classify definitions of quality into five broad categories:

- Transcendent (excellence);
- Product-based (amount of desirable attribute);
- User-based (fitness for use);
- Manufacturing-based (conformance to specifications);
- Value-based (satisfaction relative to price).

According to Dahlgaard et al., (2002), Harvey and Green (1993 in Imbeah, 2012) also suggested

five discrete and interrelated definition of quality. They are

- Exceptional
- Perfection
- Fitness for purpose
- Value for money
- Transformative

According to ISO 9000:2000, the term quality means "fitness for purpose" or the degree to which a set of inherent characteristics of a product fulfills requirements or expectation that is stated". Impliedly, the product should possess attributes that enables it meet the customer's specifications. American Society for Quality control defines quality as "the total features and characteristics of a product of a service made or performed in accordance with customer's specifications to satisfy customer's specifications to satisfy customers at the time of purchase and during in use" (Talha, 2004; Rumane, 2011). According to BS

4778 (1987 as cited in Al-Musley, 2012), quality refers to "the totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs". To clarify this definition further, quality is present when the products or services produced are within the customer requirements.

2.3.1 Quality in Construction

Generally, quality is used to describe a prestigious product that meets or exceeds customer's expectations. A quality of a constructed product is one that fits the intended customer's requirements (Oakland, 2003). Impliedly, the product should possess attributes that enables it meet the customer's requirement or specification. The quality of a constructed item is determined by the quality of design, the quality of materials and components specified and the quality of materials and components specified and the quality of workmanship. Chung (1999 in Rumane, 2011) defines quality of a construction project as the fulfillment of the owner's needs per defined scope of works within a budget and specified schedule to satisfy the owner's / user's requirements.

In defining the term 'quality of project' Rumane (2011), refers to project quality as the fulfillment of project responsibilities in the delivery of products and services in a manner that meets or exceeds the stated requirements and expectations of the owner, design professionals and constructor. Responsibilities refer to the tasks that a participant is expected to perform to accomplish the project activities as specified by contractual agreement and applicable laws and licensing requirement, codes, prevailing industry standards, and regulatory guidelines. Requirements are what a team member expects or needs to receive during and after his / her participation in a project (p. xv as in Rumane, 2011, p.8). According to BS 4778: (1987), international terms stated that quality is "the

totality of features and characteristics of a product or service that bears on its ability to satisfy stated or implied needs". To clarify this definition further, quality is present when the products or service produced are within the customer requirements.

2.3.2 Quality Assurance

The earliest approach to quality management is quality control. Quality assurance evolved from quality control to remedy some of the pitfalls of quality control particularly, the lack of standard methods for implementing quality control techniques and the variability of quality control results often leading to the loss of competitive edge. Quality assurance is a managerial system that ensures quality service to predetermined parameters. Quality assurance focuses on defect prevention. Harris et al (2006:13) define quality assurance "a set of activities whose purpose is to demonstrate that an entity meets all quality requirements, and will do so when the product is finished. Quality assurance activities are performed in order to inspire the confidence of both customers and managers, that all quality requirements are being met".

2.3.3 Total Quality Management

Total quality management (TQM), has been defined as "harnessing everyone's effort to achieve zero defects at lowest cost continually satisfying customer requirements" (Turner,1994 cited in Jaafari, 1996). According to Salter (1993), the concept of Total Quality Management (TQM) was originated by Dr. W. Edward Deming in the 1940's. After World War Two, the industrial manufacturers in Japan produced poor quality items. In a response to this, the Japanese Union of Scientists and Engineers invited Dr. Deming to train engineers in quality processes. By the 1950's quality control integral part of Japanese manufacturing and was adopted by all levels of workers within an organization.

By the 1970's the concept of total quality was seen as company-wide quality control that involves all employees from top management to the workers. In the 1080's more non-Japanese companies were introducing quality management procedures that based on the results seen in Japan. The new wave of quality control became known as Total Quality Management (Murray 2012). In recent years, the level of awareness towards TQM has increased drastically. TQM has become most widely used management acronym and is considered as the buzz word in the management practices due to intense global competition, increasing consumer consciousness of quality, rapid technology transfer, and towards achieving world-class status. In response to these challenges and to facilitate the organizations in achieving higher quality levels, many companies are implementing TQM approach and quality initiatives for achieving sustainable competitive advantage and enhanced company performance (Talib et al.,2010).

Total Quality Management (TQM) is a company-wide drive initiated by top management for commitment to quality. TQM process is led by top management to obtain the involvement of all employees in the continuous improvement of the performance of all activities in a company so as to meet the needs and satisfaction of customers. TQM principles rest on commitment to quality and quality chains. Successful implementation enables all employees to be committed to quality and take pride in their work. It does not rest on a set of procedures to achieve quality but rather on a state of mind based on pride in the job. Each person is expected to be responsible for the people they deal with. The workers involved in operations that constitute a process form a chain of responsibility in which the success of each relies on the success of all of the previous persons. |Each operative maybe regarded as a customer to the previous operative and supplier to the next operative in the quality chain (Harris et al.,2006).

Garvin (1984 as in Al-Musley ,2012) indicated that TQM has moved through four major eras of development; from an initial stage of inspecting, sorting and correcting standards to an era of development quality manuals and controlling process performance. The third stage regards comprehensive manuals including areas of an organization other than production, and the use of standard techniques such as statistical process control (SPC). Martinez-Lorente et al., (1998), cited by Al-Musley,2012) summarized the evolution of contemporary approach to quality management summary in Table 2.1.

Table 2.1 Important events in the development of TQM

Year	Events
1924-32	Hawthorn's studies demonstrated the importance of the social and psychological climate in work
1924	Shewhart developed statistical process control. (SPC)
1950s	Many attempts at work improvement undertaken (e.g. job enrichment works re-design, participative management, quality of work life, worker involvement).
1951	Creation of Deming Application Prize in Japan. First edition of Juran's Quality control Handbook published
1960	Liberalization of economy in Japan with pressure to improve quality to compete with foreign companies.
1961	First edition of Feigenbaum's Total Quality Control published.
1962	The idea of quality circles appeared in the first issue of the Japanese Journal Quality Control for the Foreman
1972	QFD was developed at Mitsubishi's Kobe shipyard
1973	After the 1973 oil crisis the JIT system was adopted by a vast number of Japanese companies. A small number of US and European companies began to apply this system in the 1980's.
1974	Quality circles began to be widely introduced in the USA; the first quality circle program was launched in Lockheed in1974 and in the UK Rolls-Royce introduced the concept in 1979.
1979	First edition of Crosby's Quality is published. Publication of the BS5750 quality management series
1980	An NBC television documentary about the "Japanese miracle" proposed. Deming as a key element in this miracle

1982	First edition of Deming's Quality, productivity and competitive position published
1986	First edition of Deming's Out of the Crisis published. It became a bestseller
1987	First edition of ISO 9000 quality management system series. Publication of the Malcon. Baldrige National Quality Award

Source: Adapted from Al-Musley (2012).

According to Rumane (2011), the failure to address the culture of an organization is frequently the reason for management initiatives either having limited success or failing altogether. To understand the culture of the organization and using that knowledge to implement cultural change is an important element of TQM. The culture of good teamwork and cooperation at all levels in an organization is essential to the success of TQM. Table 2,2 describes cultural changes needed in an organization to meet Total Quality Management.

Table 2.2 Cultural changes required to meet TQM

Form	To
Inspection orientation	Defect prevention
Meet the specification	Continuous improvement
Get the product out	Customer satisfaction
Individual input	Cooperative efforts
Sequential engineering	Team approach
Quality control department	Organizational involvement
Departmental responsibility	Management commitment
Short-term objective	Long term vision
People as cost burden	Human resources as an asset
Purchase of products or services on price-alone basis	Purchase on total cost minimization basis
Minimum cost suppliers	Mutual beneficial supplier relationship

Source: Rumane (2011)

2.4 Contributions of Quality Gurus towards Quality Management

2.4.1 Deming Philosophy

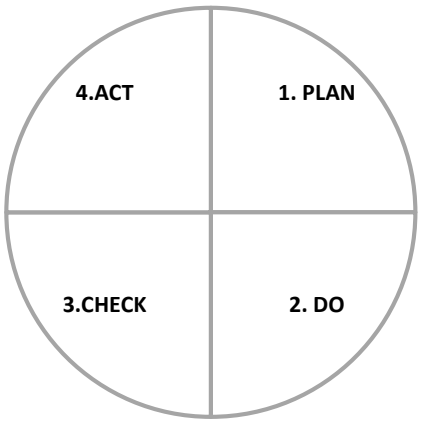
Deming is considered as the founding father of Total Quality Management (TQM). Deming (1950, cited in Al-Musley, 2012) transferred statistical process control to Japan after the First World War, and taught the Japanese the concepts and techniques of quality, that facilitated to rebuild their economy and modified the performance of whole sectors. The theoretical essence of the Deming management method concerns the creation of an organizational system that fosters cooperation and learning and facilitates the implementation of process management practices. This in turn leads not only to continuous improvement of processes, products, services but also to employee fulfillment both of which are critical to customer satisfaction and ultimately, to firm survival. Deming stated "Quality should be aimed at the needs of the customer, present and future" (Anderson at al., 1994 in Al-Musley, 2012), According to Deming, the foundation of quality management is reducing the variation in products and then improving the average. His management philosophy improved from observing how the Japanese mixed their teachings on quality control with Japanese culture to create a huge economic kingdom.

Deming placed great importance and responsibility management, at the individual and company level; believing management to be responsible for 94% of quality problems. His fourteen-point plan is a complete philosophy of management that can be applied to small or large organizations in the public, private or service sector:

- Create constancy of purpose towards improvement of product and service
- Adopt the new philosophy. We can no longer live with commonly accepted levels of delay, mistakes and detective workmanship
- Cease dependence on mass inspection. Instead, require statistical evidence that qualify is built in.

- End the practice of awarding business on the basis of price
- Find problems. It is management's job to work continually on the system
- Institute modern methods of training on the job
- Institute modern methods of supervision of production workers. The responsibility of foremen must be changed from numbers to quality
- Drive out fear, so that everyone may work effectively for the company
- Break down barriers between departments
- Eliminate numerical goals, posters and slogans for the workforce asking for new levels of productivity without providing methods
- Remove barriers that stand between the hourly worker and their right to pride of workmanship
- Institute a vigorous program of education and retraining
- Create a structure in top management that will push on the above points everyday

Deming believed that adoption of, and action on, the fourteen points was a signal that management intended to stay in business. Deming also encouraged a systematic approach to problem solving and promoted the widely known plan, Do, check, Act (PDCA) cycle. The PDCA cycle is also known as the Deming cycle, although it was developed by a colleague of Deming, Dr. Shewhart.



Plan what is needed

Do it

Check that it works

Act to correct any problems or improve performance

Figure 2.2 Deming's Cycle

Source: Al-Musley (2012)

It is a universal improvement methodology, the idea being to constantly improve, and thereby reduce the difference between the requirements of the customers and the performance of the process. The cycle is about learning and ongoing improvement, after one cycle is complete, another is started.

2.4.2 Juran's Philosophy

According to Rumane (2011). Juran's Philosophy is perhaps best summed as "Quality does not happen by accident; it has to be planned." Juran developed the quality trilogy-quality planning, quality control and quality improvement. Juran emphasized that good quality management requires quality actions to planned out, improved and controlled. The process achieves control at one level of quality performance, and then plans are made to improve the performance on a project basis, using tools and techniques such as Pareto analysis. This activity eventually achieves breakthrough to an improved level, which is again controlled, to prevent any deterioration. Juran believed quality is associated with customer satisfaction and improvement through a succession of small improvement projects carried out throughout the organization. Juran defined quality as "Fitness for purpose or use". He

concentrated not just on the end customer, but on other external and internal customers. In addition, the person will be a process, carrying out some transformation or activity.

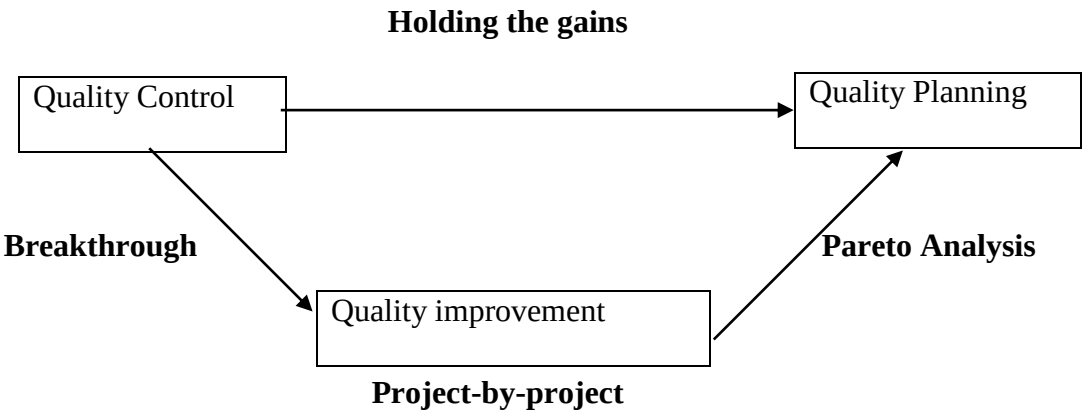


Figure 2.3: Juran's Trilogy

Table 2.3 Juran's steps for Quality planning, Quality improvement and Quality control

Quality Planning (steps)	• Identify the customers. • Identify the needs of those customers. • Analyze and prioritize customer needs. • Develop a product that can respond to customer needs. • Optimize the product features so as to meet the organization's product range as well as customer needs. • Identify process and goals. • Develop a process that is able to produce the product. • Optimize the process features and goals. • Prove that the process can produce the product under operating conditions • Identify control needs. • Transfer the process to operations.
Quality	• Identify the customers. • Build awareness of the need and opportunity for improvement

Improvement	
	• Set goals for improvement • Build a team to achieve goals by establishing a quality council, identifying problems, selecting a project, appointing teams and selecting facilitators • Train team members • Carry out projects to solve problems • Report progress • Formulate theories • Formulate remedial action • Prove that the remedies are effective • Deal with resistance to change • Incorporate improvement into the company's regular systems and processes and control to hold the gain.
Quality Control	• Choose control subject • Establish standards / objectives • Monitor actual performance • Compare objectives with achievements
• Establish the project.	• Take corrective action to reduce the differences

Source: Rumane (2011)

2.4.3 Philip B. Crosby

Crosby is also known for the concepts of "Quality is Free" and "Zero Defects", and his quality improvement process is based on his four absolutes of quality:

- Quality is conformance to requirements
- The system of quality is prevention
- The performance standard is zero defect
- The measurement of quality is the price of non-conformance
- In addition, Crosby also developed fourteen steps to quality improvement.

2.4.4 Armand V. Feigenbaum

Feigenbaum (1991) was the originator of total quality control, a concept he introduced in the 1950's. Feigenbaum saw it as a business method and proposed three steps to quality as Quality leadership; Modern quality technology; and organizational commitment. He indicated that TQM requires a high degree of effective functional integration among people, machines, and information; stressing a systematic approach to quality. Clearly defined total quality system as a powerful foundation for TQM, and Quality is the responsibility of everybody in the company (Feigenbaum, 1991). He claimed that quality means the best for customer use and selling price, and effective quality management includes of four steps:

- Setting quality standards
- Appraising conformance to these standards
- Acting when standards are exceeded
- Planning for improvements in the standards

This control process is more suitable for TQM, as it includes the improvement dimension, however, it does not incorporate the TQM culture, nor does it stress customer satisfaction and management responsibility (Al-Musley, 2012).

2.4.5 Kaoru Ishikawa

Ishikawa developed the Japanese style of Total Quality Control (TQC), Company-Wide Quality Control (CWQC) means that "Quality control consists of developing, designing, producing, marketing and servicing products and services with optimum cost-effectiveness and usefulness, which customers will purchase with satisfaction. Ishikawa made many contributions to quality, the most noteworthy being his total quality viewpoint, company-

wide quality control, his emphasis was on the human side of quality, the Ishikawa diagram and the assembly and use of the "seven basic tools of quality".

• Pareto analysis	Which are the big problems?
• Cause and effect diagrams	What causes the problems?
• Stratification	How is the data made?
• Check sheets	How often it occurs or is done?
• Histograms	What do overall variations look like?
• Scatter charts	What are the relationship between factors?
• Process control charts	Which variations to control and how?

Ishikawa considered that all staff should be trained in these techniques as they have a useful role to play in managing quality. Quality circles are Ishikawa's principal method for achieving participation, composed of 5 to 15 workers from the same area, and led by a foreman or supervisor who acts as a group leader liaison between the workers and the management. Ishikawa developed a technique of graphically displaying the causes of any quality problem. His method is called by several names, such as the Ishikawa diagram, fishbone diagram, and cause-and-effect diagram. The Ishikawa diagram is essentially an end or goal-oriented picture of a problem situation. It is based around a set of "M" causes such as Manpower (personnel), Machine (plant and equipment), Material (raw materials and parts), and Mother Nature (environment) (Rumane, 2011).

2.4.6 John Oakland

Oakland (1989) defined TQM as "a way of managing to improve the effectiveness, flexibility and competiveness as a whole" (Al-Musley, 2012). He gives absolute importance to the pursuit of quality as the cornerstone of organizational decision. He offers

his own overarching approach for TQM on the many well-established methods, tools, and techniques for achieving quality (Rumane, 2011)

2.4.7 Shigeo Shingo

Shingo is strongly associated with Just-in-Time manufacturing, and was the inventor of the single minute exchange of die (SMED) system, in which set up times are reduced from hours to minutes, and the Poka-Yake (mistake proofing) system. Just-in-Time is an integrated set of activities designed to achieve high-level volume production, with minimal inventories of parts that arrive at the workstation when they are needed. Shingo believed that statistical methods detect error too late in the manufacturing process. He suggested that, instead of detecting errors, it was better to engage in preventive measures aimed at eliminated error sources. His approach emphasizes zero defects through good engineering and process investigation and rectification. He distinguished between "errors", which are inevitable, and "defects", which result when an error reaches a customer, and the aim of Poka-Yoke is to stop errors becoming defects. Defects arise because errors are made and there is a cause and effect relationship between the two. Zero quality control is the ideal production system and this requires both Poka-Yoke and source inspections. In the latter, errors are looked at before they become defects, and the system is either stopped for correction or the error condition automatically adjusted to prevent it from becoming a defect (Rumane, 2011).

2.4.8 Genichi Taguchi

Taguchi's two founding ideas of quality work are essentially quantitative (Rumane 2011). The first idea is a statistical method to identify and eradicate quality problems. The second rests on designing products and processes to build-in quality right from the outset.

Taguchi's prime concern is with customer satisfaction and with the potential for "loss of reputation and goodwill" associated with failure to meet customer expectation. Such a failure, he considered, would lead the customer to buy elsewhere in future, damaging the prospects of the company, its employees, and society. He saw that loss not only occurred when a product was outside its specification but also when it varied from its target value. Taguchi recognized the organization as "open system" interacting with its environment. His concept of product development has three stages:

- System design stage
- Parameter stage
- Tolerance design stage

The first stage is concerned with system design reasoning involving both product and process. This framework is carried on to the second stage-parameter design. The third stage, tolerance design, enables the recognition of factors that may significantly affect the variability of the product (Rumane,2011).

2.5 Quality Management in Construction Industry

In recent years, many of the management practices used to support construction organization are being challenged (Hoonakker, 2010). Clients demand improved service quality, faster buildings and innovations in technology. It is no accident that the construction industry has turned to the manufacturing sector as a point of reference and source of innovation. Successful concepts derived from manufacturing industry, such as Total Quality Management (TQM), Statistical Quality Control (SQC), Quality Assurance (QA) and Quality Management Systems (QMS), and Lean (or Just-in-Time) Production, are slowly being adopted and integrated into the construction industry (Martin et al. 2020). Kanji &Wong (1998) as cited in Hoonakker (2010) reported the adoption of some elements

of TQM by large construction companies as an initiative to solve quality problems and to meet the needs of the final customer.

The quality management ensure that companies achieve required standards of quality and guarantee customer satisfaction (Tan & Abdu-Rahman, 2011). Quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain clients' satisfaction that would bring long term competiveness and business survival for the companies (Tan & Abdul-Rahman, 2005). Impliedly, prudent steps have to be taken in managing quality of processes, operations, and quality of product in order to maitain current construction market which is highly challenging and competitive (Love et al. 2000). Harris and McCaffer (2001) note that it is necessary to provide the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a company. The role of total quality management for a construction company is not an isolated activity, but the total involvement of all the operational and managerial processes of the company.

2.5.1 Principles of Quality Management Applicable to Construction Industry

According to Hoonakker (2010) contends that it is necessary to transpose and translate the quality management principles, practices, and techniques in manufacturing to construction. Lahndt (1999b as cited in Hoonakker, 2010) argued that while quality management techniques and tools have been used extensively in the areas of manufacturing and industrial engineering to control processes, the same cannot be said of the construction industry. However, it has long been noted while the construction industry needs the same types of tools to enhance its performance, it has profoundly difficult to apply same techniques due to the dissimilarity of the two industries (Ahaotu 2018).

Important elements of contemporary quality management that have found to be applicable to the construction industry include; top management commitment and Leadership, human resource management, customer focus, planning, process management, supplier management, continuous improvement, information analysis and evaluation, teamwork, and quality culture (Arditi &Gunaydin, 1997; Low & Teo, 2004; Metri,2004; Jha & Kumar,2010; Gherbal, et al., 2010; Imbeah,2012; Kheni & Ackon 2015).

2.5.1.1 Top management Commitment and Leadership

Tannenbaum et al. (1961) defined commitment as: "the interpersonal influence, exercised in a situation, and directed, through the communication process, towards the attainment of a specified goal or goals" (as cited in Gherbal et al., 2012). Construction company' policy should support its quality management programme (Arditi & Gunaydin 1997; Low & Teo, 2004; Jha & Kumar,2010; Gherbal et al., 2012). Management must provide policies for promoting client/customer satisfaction; actively communicate quality policies and plans to employees (internal and external) to create awareness, interest, desire and action. Management establishes clear mission, vision and plan statement regarding business objectives. Additionally, Management must as well provide the necessary resources and problem-oriented training to the employees to drive TQM agenda (Juran & Gryna,1993). Management must also actively lead and direct quality management programs and assumes responsibility for evaluating and improving quality system at pre-defined intervals.

2.5.1.2 Human Resource Management

The importance of human resource management is recognized by every quality expert. Human resource management involves how the workforce is enabled to develop and utilize their full potential with the company's objectives. According to Khan (2003), Management participation in quality activities alone is not enough to contribute to quality improvements as cost and quality is difficult to control by management alone. Employees are encouraged to show commitments to quality issues. When workers themselves are committed to delivering quality, they take greater initiative towards meeting product and process specifications; detecting and eliminating bottlenecks; improving product and process designs and setting realistic, yet challenging performance targets. This is better enhanced if resources are provided for employees for effective training and developmental activities. Training programmes attempt to chaperon encourage each employee how to perform particular activities or a specific job. Education, on the other hand, is much more general and attempts to provide employees with general knowledge that can be applied in many different settings (Rao et al., 1999). To goal is to transform organization in a manner that quality becomes everyone's responsibility and for training to target every level of the company (Arditi & Gunaydin, 1997).

Construction organizations should organize customized training plans or programmes for management, engineers, technicians, home and field office staff, support personnel and field labor in line with quality objectives and goals of the organization (Arditi & Gunaydin, 1997). The training can be in the form of in-service, external experts on quality, and seminars on quality improvement programmes. In order to have effective learning activities, a firm should continually encourage employees to accept education and training. According to Imbeah (2012) when education and training on quality become widely

accepted throughout the construction industry, workers switching from one company to another should require less training. Besides, training and education; employees must be empowered to make certain decisions on the job, to communicate with others in order to solve problems and to find their ways of doing work that will reduce wasted steps or improve quality (Eisman,1992). More so, employees must be recognized and properly motivated (i.e.: employees must be given incentives, bonuses and peaceful working environment).

2.5.1.3 Customer Focus

Customer focus can be defined as the degree to which a firm continuously satisfies customer needs (Gherbal et al., 2012). The key to the quality management is maintaining a closer relationship with the customer in order to fully determine the customer need, so the customer should be closely involved in the product design and development with valuable input to every stage (Saylor 1996as cited in Gherbal et al., non-profitable, partnerships, departments, functions, groups, or teams, therefore customer focus is very critical in quality management. Impliedly, in construction industry, quality should be customer driven. Employees should be well aware of the concept of internal and external customers. They should care about meeting and exceeding the customer expectations. There must be a focus on customer feedback and accordingly the process should be driven.

According to Juran the parties in a process (Supplier, Processor, and customer) have a "triple role" (1988 in Arditi & Gunaydin, 1997). This triple role concept is applicable to construction industry. Arditi & Gunaydin (1997) postulated that in construction, the designer is the customer of the client because the designer has to receive the project requirement of the client in to to provide a feasible design. The designer supplies plan and

specifications to the constructor; in this case the constructor is the designer's customer because the constructor the constructor uses the designers plan and specifications, then conducts the construction process, and finally supplies the completed project to the client. The client is now the constructor's customer. Quality in each face is affected by the quality in the preceding phases. Therefore, customer service e in each is essential for the overall quality performance of the process (Arditi & Gunaydin, 1997). This provides clarity of ownership and less reliance on inspection (Deming, 1986). He further indicated that in the context of construction, specific activities like planning the sequence of field tasks analysis of layout, access, temporary facilities, innovative use of materials, innovative use of materials, innovative use of construction equipment and tools, and the use of pre-assembly or pre-fabrication items are carried out. Also, constructability is included in the contract document. Pre-work, demobilization, execution is part of process management.

2.5.1.4 Strategic Planning

Strategic planning involves a company setting strategic directions, how it determines key action plans, and how actions are translated into an effectives performance management system. Strategic planning incorporates the development and deployment of plans (Lee et al., 2003), improve relationships with customers, suppliers and business partners (Prybutok et al.,2008) and helps in achieving long and short team goals through participative planning. Strategic Planning allows firms to set clear priorities and allocate resources for the most important things. It also provides specific instructions for approaching, executing and evaluating the development of strategic concepts (Metri,2004).

2.5.1.5 Process Management

Process Management refers to combination of machines methods, materials, tools and people employed production, (Jaafreh & Al- abdallat, 2012) TQM works on the believe that the overall quality of product can be enhance by improving the of process directly or indirectly related to their creation (Ahire et al.,1969). The objective of process management is to reduce process variation by building quality in to the production process (Flynn et al., 1995; Anderson et al., 1994). This thus increases the quality of output as well as decreasing the cost such as rework cost and waste cost (Anderson et al., 1994; Flyppini & Forza, 1998). The maintenance of process capability to meet production requirement is an important matter in process control and improvement (Feigenbaun, 1991; Juran & Gryna, 1993). According to Metri (2004) process management focus on managing the construction process so that it operates as expected, without breakdowns, shortage/missing material, tools, etc. It is needed to reduce rework and waste due to wrong specification of processing of parameters. This provides clarity of ownership and less reliance on inspection (Deming, 1986). Metri (2004) maintained that; in the context of construction, specific activities like planning the sequence of field tasks, analysis of layout, access temporary facilities, innovation use of materials, innovative of construction equipment and tools, and the use of pre-assembly or pre-fabrication of items are carried out. Also, constructability is included in the contract document. Pre-work demobilization, execution are a part of process management.

2.5.1.6 Supplier Management

The supplier quality is an important element of quality management in construction organization because materials purchased are a major source of quality problems (Kaynak, 2003; Metri, 2004). Supplier quality management includes fewer dependable

subcontractors, reliance on suppliers' process control, strong interdependence of supplier and customer, purchasing policy, emphasizing quality rather than price (Feigenbaum,1991; Deming ,1986 in Salter, 1997. Supplier quality control and supplier assistance in quality development are important aspects of quality management. Materials are often a major source of quality problems and affect buyer satisfaction. According to Metri (2004) instead of materials and component parts, it is preferable for constructors to purchase from a more limited number of qualified or certified suppliers.

2.5.1.7 Continuous Improvement

Continuous Improvement is the means for searching for never-ending improvements and developing processes to find new or improved methods in the process of converting inputs into useful outputs (Sdikoglu &Zehir, 2010). It helps in reducing the process variability thereby continuously improving the output performance. It is also the continuous reviewing and improving business processes, ensuring that customer requirements and statutory and regulatory requirements are met, maintained and exceeded if possible. In construction this involves: tracking cost of quality process (rework, waste rejects) for continuous improvement, Ensuring that design and construction use quality tools (check sheet) for improvement activities, practicing continual review for improvement, encourage project quality improvement discussion at subcontractor site meetings, practicing continual review of process completion time with a review of improvement, bench marking process completion in order to improve to delight customers (Black & Porter, 1996; Imbeah, 2012)

2.5.1.8 Teamwork

Teamwork refers to an increase in employees' control over their work and allowing them to work as a group (Ooi et al., 2007). It is widely accepted working in a team or group is generally more effective than working individually (Zairi et al., 2005 as cited in Gherbal et al., 2012). This practice provides an atmosphere of mutual relationship, involvement, and participation in the organization. The eventual aim of the team approach in construction project is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with quality management processes. Team work is necessary to encourage competitive activities internally among employees and externally with respect to suppliers and customers. According to Arditi and Gunaydin (1997), teamwork among construction parties such as structural, electrical, environmental, civil engineers, architects, and owners is essential to reach the quality goals for design and construction. According to Crosby (1979 in Jha & Kumar, 2010), team work is a critical element of TQM. Teamwork delivers synergistic enhancement of quality efforts. Employees must demonstrate cooperative behavior and positive attitude towards working in a team.

2.5.1.9 Information Analysis and Evaluation

According to Jha and Kumar (2010) information analysis and evaluation is the critical success factors of quality performance. This factor emphasizes that the key processes are regularly measured and quantified. According to Metri (2004) information analysis and evaluation in construction involve evaluation for various policies and strategies, quality audit, analysis of quality cost, department/function performance evaluation, and employee and supplier performance evaluation. He further indicated that if there is inferior dissemination of the generated information, quality techniques like benchmarking and

SPC tools will be rendered ineffective. To maintain a true customer focus, an organization must ensure prompt feedback of customer survey results to appropriate functional areas for effective actions.

2.5.1.10 Quality Culture

According to Gherbal et al. (2012) culture within organization is defined by Hofstede (2001), as "all the interaction that takes place between employees within an organization along with the relationships engendered by this behavior". Within the quality management culture, a co-operative and open culture has to be created by the organization management in which all the employees have to be made to feel that all of them are responsible for satisfying the organization's customers (Ahaotu 2018). They are going to feel and consider this only if they are involved in the development of the vision, plans and strategies of the organization. It is crucial for the employees to participate in all these activities. The work culture must be very conductive. There should be an activate interaction amongst the peers and support from supervisors. The critical importance of the employee's involvement in the quality process of an organization should be based on the belief that the best process innovation idea comes from the people actually doing the job (Jha & Kumar, 2010). Gherbal et al., (2012) however, opined that employees are unlikely to behave in an acceptable responsible way in the case where they see the management behaving irresponsibly and saying something or acting in opposition of it.

2.6 Benefits of Quality Management and Key Constraints

Many researchers asserted that TQM is a useful philosophy for management if effectively implemented (Oakland, 2001; Black &Porter, 1996; Fening et al. 2008; Polat et al. 2011). TQM is postulated by many researchers as an approach to improve effectiveness and a

strategic foundation for achieving sustainable competitive advantage for business organizations (Baaidoum, 2004; Terziovski, 2006; Polat et al., 2011). Table (2.4), below shows some benefits of total quality management application in the construction industry.

Table 2.4 Benefits of TQM in the construction industry/Project

Total Quality Management Benefits
Enhanced image and reputation of organization
Performance improvement and increase customer satisfaction
More repeat customers
Establishing clear documented procedures and instructions
Consistency in quality of services
Improved efficiency of operations in construction site (reduced defect, rework and waste)
Reduction of quality cost
Prevention of errors at the earliest stage of the project
Reduced claims
Achieved the legal requirement of the project
Reduced dispute
Lower employee turnover
Improve safety
Clear line of duties
Increased chances to be awarded the tenders/contracts
Facilities access to certain markets
Improved relationship and cooperation between clients, contractors, consultants and suppliers
Improve schedule performance

Source: Said et al. (2010); Hoonakker, Carayon and Loushine (2010); Polat et al. (2011); Jha and Iyer (2006).

Despite the numerous benefits of effectively managing quality, past research revealed some barriers relating to its application in the construction industry. According to Imbeah (2012) the TQM barriers encountered by practitioners in the Ghanaian construction industry include:

- Lack of expertise (skilled workers)
- Low bid mindset
- Resistance to change by project participants

- Lack of education and training to drive the improvement process
- Lack of top management commitment and understanding
- Lack of employee commitment and understanding
- Too much documentation requirement
- Lack of effective communication
- Firm's emphasis on short term objectives

These constraints are the same as those experienced elsewhere in the world (Willar, 2012; Tan &Abdul-Rahman,2011; Said et al., 2010; Polat et al., 2011; Hoonakker et al., 2010)

2.7 Determinants of Construction Project Quality Performance

Performance off construction project is measured as its ability to deliver the construction projects at the right time, cost and quality as well as achieving a high level of client satisfaction (Naoum, 1994 as cited in Olatunji et al., 2011). Quality performance in construction is results oriented, and relies on evidence of quality awareness within the operations and the output of the construction team are expected to increase the productivity, efficiency and profitability of contractors as well as increasing client satisfaction (Olatunji et al., 2011).

The quality performance of a construction team on a particular project includes the quality of the constructed facility as well as the quality of contracting service.

According to Yasamis et al., (2002) this involves:

- Product delivery performance (technical competence and conformance to specifications that the construction team demonstrates during the construction process);

- Service design performance (competence with which every member of the team carries out the construction planning activities);
- Service delivery performance (construction management and contract administration skills demonstrated by professionals and client during the construction process).

The indicators of quality performance used in this study and presented in Table 2.5 are limited to the quality performance measures developed by Eghan (1998), Construction Industry Board, (1998) as cited in Olatunji et al. (2011), Song et al. (2014) and Mbugua et al. (1999).

Table 2.5 Project Quality Performance Measures

Project Quality Performance Measures	Definition
Client Satisfaction/Perceived Quality	Client Retention (Getting repeat contracts from existing clients) / Conformance to
Construction Efficiency	Reduction in wastage; defects and rework.
Cost of Quality	Construction Cost
Project Delivery Time	Reliability and timely delivery/execution of
Project Quality Performance	Client Satisfaction, Conformance to specification, Construction efficiency, Cost

Source: Mbugua et al. (1999) , Song et al. (2014), and Olatunji et al. (2011).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter of the study gives the detail of methods and procedure followed to achieve the objective of the study. Specifically, the chapter presents and justifies approaches used in the data collection based on the research questions. The chapter is organised into nine (9) main sections comprising; an introduction, research paradigm, research design, research strategy, research approach, the target population of the study, sampling technique and sample size, data collection and data analysis. The data collection subsections include; sources of data, data collection instruments and procedure, pre-testing of questionnaire, interviews, observations and ethical considerations.

3.2 Research Paradigm

A paradigm is "a set of beliefs, values and techniques which is shared by members of a scientific community, and which acts as a guide or map, dictating the kinds of problems scientists should address and the types of explanations that are acceptable to them" (Kuhn, 1970). A researcher's world view or paradigm is essential and the first step in selecting appropriate methods to conduct a study in order to finding insightful answers to research questions the researcher seeks to address. A number of paradigms and even new paradigms have continued to evolve over time in social science research. Kuhn points out that the dominant paradigms widely accepted in social science research are the positivist, interpretive/constructivist, and critical paradigms. The phenomenon under consideration and the nature of the information required to find insightful answers to the research questions posed influence the choice of a particular research paradigm. Also, researcher's philosophical beliefs/views of the world and the range of skills a researcher may have

relating to the phenomenon under consideration are equally important aspects. Philosophical beliefs about reality/world and how knowledge is constructed and can be known may influence the choice of a particular paradigm over others. The choice of research paradigm will influence the research strategy to be adopted by a researcher. Interpretivist paradigm is associated with qualitative strategy while positivist paradigm is associated with a quantitative strategy. Other important aspects that need to be reflected upon by a research is the nature and sources of knowledge (epistemology) and how knowledge is acquired about things (ontology) (Moon and Blackman 2014).

The present study adopted a positivist paradigm since the nature of information required to answer the research questions requires objective, measurable and a realist world view. Construction organisations and for that organizational culture and construction project culture have a real existence outside human experience. Arguably these phenomena will exist or persist independent of ones' lifespan. Given that the present study involves these phenomena lends credence to adopting positivist world view. Furthermore, it can be argued that human behaviour patterns may be viewed to have real existence and therefore amenable to positivist paradigm.

3.3 Research Design

Denzin and Lincoln (2000) defines a research design as "a sets out guidelines that linkup the elements of methodology adopted for a study namely; relating the paradigm to the research strategy and then the strategy to methods for collecting empirical data". Examples of research designs in social science and management research include; experiments, surveys, ethnography, participant observations, phenomenology, hermeneutics, historical

research, and grounded theory. The study adopted a cross sectional survey design as it such a design will enable answers to the research questions posed in chapter one to be obtained.

3.4 Research Strategy

Denzin and Lincoln (2000, p.371) explain that a "research strategy connects the researcher to specific approaches and methods for collecting and analyzing data". There are three research strategies namely; qualitative strategy, quantitative strategy and multimethod strategy. A quantitative research strategy involves an objective view and the nature of the data collected may be described as tangible. Tangible data in this sense includes counts, weight, mass, and other physical measures (Fellows & Liu, 2003). Phoya (2012) asserts that "the advantage of the quantitative strategy is that it measures the reactions of a great many people to a limited set of questions, thus facilitating comparisons and statistical aggregation of the data, and so the results can be generalized".

Qualitative strategy employs an inductive and subjective view of knowledge of the society or social world. It engenders a viewpoint in which individuals or organizations are considered holistically rather than isolated constructs about which we can hypothesize (Phoya, 2012). A qualitative strategy seeks to explore the meanings, attitudes, values, beliefs people associate with phenomena in order to establish a better understanding, rather than to test to support or disprove hypotheses (Cresswell, 2003). Generally, qualitative data provide in-depth narratives and details with, often verbatim quotations and a careful description of events, people, interactions and observed behaviours.

According to Denzin and Lincoln (2000) and Creswell (2003) mixed methods strategy is a combination of both quantitative and qualitative strategies. The use of mixed methods justified by the complexity of phenomenon and nature of information required to answer research questions often involves a rich quantitative and qualitative data set. For this

reason, an increasing number of social science and management researchers have tended to adopted a mixed methods strategy. The mixed method approach involves collecting both numeric and textual data, either simultaneously or sequentially, so as to best understand research problems, with the final database representing both quantitative and qualitative information (Creswell & Clark, 2007).

The research strategy adopted for the present study was the quantitative strategy based on the primarily on the nature of the information required to answer the research questions posed in chapter one.

3.5 Research Approach

A feature frequently encountered in social science and management research is the approach to reasoning. There are three approaches which may be utilized in these fields of inquiry namely; deduction, induction and abduction. According to Thagard and Shelley (1997), deductive reasoning involves inferring that if propositions X and Y are both true, then this implies that Z is also true. Thus, deductive reasoning involves drawing inferences. A deductive approach seeks to collect data to draw generalizations in order to test theory. This involves working from observations towards an inference. Therefore, an inductive approach seeks to generate theory from data collected with no object of making any generalizations a priori. Inductive reasoning can provide extremely valuable insights. However, the chief drawbacks are that it often hinges on a set of incomplete observations. Conclusions reached by the inductive approach are not logical necessities; no amount of inductive evidence guarantees the conclusion (Thagard and Shelley 1997). Abductive reasoning is important because there is often many or an infinite number of possible explanations for a phenomenon, so you need some way to decide which possible

explanations to look at first. Abductive reasoning typically begins with an incomplete set of observations and proceeds to the likeliest possible explanation for the set. Abductive reasoning yields the kind of daily decision-making that does its best with the information at hand, which often is incomplete. Medical diagnosis is often cited is the refined example of abductive reasoning or approach. The present study adopted a deductive approach as the study sought to make attempts at generalising findings based on the study's sample to the target population of the study, albeit cautiously given the limitations of the study.

3.6 The Target Population of the Study

The target population for the study were key construction professionals employed by construction firms in Northern region of Ghana currently registered with the association of Building and Civil Engineering Contractors of Ghana (ABCECG). Construction professionals in the study refers to; architects, quantity surveyors, project managers, site engineers and site managers/supervisors. In order access the respondents, the researcher had to consider the list of construction firms belonging to ABCECG.

3.6.1 Sampling Frame

To access the survey respondents, the study relied on a sampling frame of the registered list of contractors who are members of the Association of the Building and Civil Engineering Contractors of Ghana (ABECCG) in the Northern region of Ghana. The sampling frame for the study was 195 construction firms of various classifications. These members were obtained after the list and had been screened to eliminate new members and non-active members (Imbeah, 2012; Enshassi et al., 2010).

3.7 Sample Technique and Sample Size

A sample is defined as a subset or proportion of the total population (Neumann, 2007). The sample, as Neumann (2007) indicated ought to depend on the proportions of the population that have the characteristics that the research is interested in. The adopted purposive sampling technique to select the construction professionals employed by construction firms registered with the ABCECG in the Northern Region and systematic random sampling to select the construction firms relying on the sampling frame described in Section 3.6.1. To determine the minimum sample size of the association of Building and Civil Engineering Contractors (ABCECG) members in the Northern region of Ghana, Kish (1965) equation which gives a scientific procedure for determine sample size was used (Enshssi et al., 2010). The equation is given below:

$$n= \frac{n^1}{\{1+\left(\frac{n^1}{N}\right)\}}$$

Where

n=sample Size from finite population

N = Total population

n^1 = sample size from infinite population calculated from; $n^1 = \frac{S^2}{V^2}$, where

V = Standard error of sample population equal to 0.05 for the confidence level 95%, and t = 1.96

S^2 = Standard error variance of population elements,

S^2 = p (1-p); Maximum at p = 0.5

Using Kish form ular, the sample size for the study was calculated as follows:

$$n^1 = S^2/V^2=(0.5)^2 / (0.05)^2= 100$$

n Construction firms = $\frac{100}{(1+\frac{100}{195}}$ = 66 firms

n Construction companies = 66 firms

However, this estimate represents the minimum sample size required. In order to cater for non-response associated with postal questionnaires, the sample size was increased by 40% and all those with valid telephone numbers and email addresses (92) were contacted. To access the target population (construction professionals employed by the selected construction firms), telephone calls were made to soliciting to cooperation in the study and to allow construction professionals they employed who had worked for the respective firms for not less than three years. This was criterion was necessary to ensure that the respondents possessed adequate knowledge of the quality management practices of their respective companies. A total of one hundred and twenty-four (124) professionals of the 92 companies met this criterion.

3.8 Data collection

Both primary and secondary sources of data were used in the study. The primary sources used were questionnaires. The Literature review of publications, books and journals from the internet were used as secondary sources of information. Questionnaires were the only data collection tool (Kheni & Ackon, 2015; Imbeah, 2012).

3.8.1 Questionnaires Development

The questionnaires were divided three sections. The first part sought the demographic background of respondents. This part was developed to ascertain the validity of the results obtained; the second part consisted of questions on effective quality management practices to assess the quality management practices of the respondents' firms. This section was developed to address objective one three. The third part assessed the respondents' perception on the constraints to quality management practices on sites. This section was also developed to help address objective two. The question on quality management

practices was adapted from (Arditi & Gunaydin, 199; Imbeah, 2012; Kheni & Ackon, 2015) there measures of QMP's have been widely used in a variety of literatures and are generally accepted as a good measure of perceptions of QMP.

All the questionnaires were designed to be answered using a five-point likert scale with responses ranging from '1' to '5'. The definitions for the responses for section (B) were:

1 = not practice 2 = seldom practice 3 = sometimes practice

4 = often practice 5 = every often practice

The definitions for the responses for section (C) were as follows:

1 = strongly disagree 2 = disagree 3 = neutral 4 = agree 5 = strongly agree

The definitions for the responses for section ('D') were as follows:

1 = not experience 2 = seldom experience 3 = sometimes experience

4 = often experience 5 = every often experience

3.8.2 Pilot- testing of the Questionnaires

Before obtaining the final questionnaires used in the research, draft questionnaires were designed and pre- tested to look into their effectiveness and applicability with regard to the current study. The draft questionnaires were edited by project management experts to obtain the final questionnaires. The pilot-testing of the questionnaires consisted of two phase, the first phase involving the conduct of follow-up feedback interview in relation to pilot survey respondents' thoughts. The pilot respondents were asked whether they understood the instructions for completing the questionnaire, and whether the wording and places to mark responses to each question were clear. Another issue which was addressed was the average time required to complete the questionnaire, as it was acknowledged that

if it would take a long time for respondents to complete, they might be reluctant to participate and this would have negative impact on collection numbers and nature of responses (Wilar, 2012; Kheni & Ackon, 2015). The pilot- questionnaires involved respondents who are project leaders in their construction firms: four site engineers and one architect from three registered construction firms in Tamale, the capital of Northern region of Ghana. The feedback from the respondents indicated that the average time required to complete the questionnaire was appropriate. There were however, some suggestions in relation to improving the wording in parts of the questionnaire to suit the current context.

3.8.3 Distribution of the Questionnaires and Collection

Questionnaires were distributed to the targeted respondents via e-mail. The respondents were therefore in a position to provide the necessary information required based on their practical experiences in their firms. Respondents were informed about the confidentiality of the responses. Arrangement was made with the respondents as to what time and dates were appropriate and convenient for them to return the questionnaires. The sample of question used for the survey can be found in Appendix A.

3.9 Method of Data Analysis

Completed questionnaires from the field was edited and coded appropriately to make effective meaning out of the data. Editing was done to correct errors, check for non-responses, accuracy and corrects answers. Coding was done to facilitate comprehensive quantitative analysis of the data. The data was analyzed and interpreted by using statistical package for social science (SPSS) version 16. In addition to deviation, the following inferential statistical tools; Analysis of variance (ANOVA), Parson's product moment correlation Coefficient (PMCC), and Multiple Regression Analysis were employed

(Jaafreh &Al-abedallat, 2012; Jung & wang, (2006). Before applying this analysis, the preliminary analysis was conducted to check for violations in normality, linearity and homoscedasticity. The data from the sample fulfilled all the assumptions allowing for parametric test to be conducted.

3.9.1 Correlation Analysis and Multiple Regressions Analysis

Person's correlation (or person's r) is a statistical tool typically used to assess the strength and direction of the linear relationship between two or more continuous variables (Hair et al., 2006). The person's product Moment Correlation Coefficient was computed to determine the following relationship:

- The relationship between the eight (8) Total Quality Management variables and projects Quality Performance Questionnaire (R1).

3.9.2 Multiple Regression Technique

Hair et al. (1998); Saunders et al. (2007) and Sekaran (2003) describe the multiple regressions as a statistical technique used to predict the variance in a single dependent variable caused by the effect of more than one independent variable. In other words, correlation indicates the existence of the relationship between the variables while the multiple regressions specify the most crucial variables for this relationship. Stepwise Multiple Regressions analysis was used to determine the importance of each independent variable and its contribution to the mathematical equation.

3.9.3 Analysis of Variance (ANOVA)

A one – way Analysis of Variance (ANOVA) test is used to test statistically significant differences between three or more independent sample means (Hinton et al., 2004).

ANOVA test was undertaken to determine the influence of company size on TQM application; project quality performance and QMS Barriers.

3.9.4 Content Validity of the Questionnaires

An instrument has content validity if researchers agree that the instrument is made up of a group of a group of items covering the issues to be measured (conca et al., 2004). To ensure that the instrument covered all the relevant areas of quality management practices and the whole proposed survey instrument was well worded and understood; thus, contents validity, the survey questions were refined through a series of reviews by 2 academicians and industry practitioners who had extensive background in project management. This helped to improve the content, eliminate ambiguity and ease understanding.

3.9.5 Reliability

Reliability is the extent to which a measurement procedure yields the same answer however and whenever it is carried out. Cronbach's Coefficient (α) was calculated to estimate the internal consistency reliability of the measurement scale. Cronbach's alpha is widely used in social science research to estimate the internal consistency of reliability of a measurement scale. The recommended minimum threshold of Cronbach's alpha value is 0.7 (Hair et al., 2003).

3.9.6 Ethical considerations

In the data collection, ethical issues were taken into consideration, in that respondents were made fully aware of the purpose of the study and also assured that individual respondents and firms were not going to be identified and all the responses will be analyzed together (Bailey, 2007).

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF RESULTS

In this section the results of the empirical analysis are reported and presented. The presentation proceeds with analysis of the descriptive statistics on the variable under consideration. The data was analysed and interpreted by using Statistical Package for Social Science (SPSS) Version 16. In addition to descriptive statistics such as tables, percentages, simple means and standard deviation, the following inferential statistics tools; Analysis of Variance (ANOVA), Pearson's Product Moment Correlation Coefficient (PMCC), and multiple regression Analysis were employed.

4.1 Response Rate

A total of 124 questionnaires were administered to construction professionals who were employed by contractors registered as members of ABCECG through email in early July, 2020. A total of 76 completed questionnaires were received. However, some questionnaires were not properly filled resulting in missing data. Follows through telephone calls were to help clarify some errors in the questionnaires. A total of 4 questionnaires contained errors after the follow ups resulting in the number of correctly filled questionnaire to be 72. A response rate of 58 percent was achieved (see table 4.1). The reason to discard the four questionnaires was incompleteness and invalid responses. This response rate is considered adequate as according to Imbeah (2012), kheni & Ackon (2015) a response rate of 30 percent is quite common in surveys relating to construction management in similar settings.

Table 4.1 Questionnaire response rate

Questionnaires	No.	Percentage
Total Questionnaires Sent	124	
Total Questionnaires Received	76	61%
Invalid Data	4	3%
Usable Data	**72**	**58%**

4.2 Demographic Characteristics of the Respondents

The demographic characteristics of the respondents provided descriptive information on qualification, experience, designation, as well as company inherent characteristics of respondents companies. This information was necessary to ascertain the validity of the results obtained and to develop an understanding of the background of the respondent with respect to their qualification and experience.

4.2.1 Gender Distribution of Respondents

Table 4.2, indicate that out of the seventy-two (72) respondents, sixty-eight (68) representing 94 percent were males while four (4) representing 6percent were females. This result supports the findings of Kheni and Ackon (2015) that construction industry in Ghana is male dominated.

Tables 4.2 Respondents based on Gender

Gender	frequency	percentage
Male	68	94%
Female	4	6%
Total	72	100%

4.2.2 Respondents' Educational Qualification

Table 4.3 below, indicates that most of the respondents had HND and Bachelors level of education i.e. 53 percent and 36 percent respectively: whereas a small proportion of the respondents had CTC level of education i.e.11 percent. This is an indicative that majority of the supervisors have requisite qualification required of the industry, it is also suggestive that they had a better understanding of the research instrument; thus enhancing the validity and reliability of the response.

Table 4.3 Respondents' Professional Qualification

Educational Qualification	Frequency	Percentage
CTC	8	11%
HND	38	53%
BSC	26	36%
Total	**72**	**100%**

4.2.3 Respondents' Working Experience

Table 4.4 below, indicates that majority of the respondents, thus, sixty (60) representing 84 percent have more than 5 years working experience. This is an indicative that majority of the contractors might have been involved in some recent project. Hopefully, this should provide some reasonable conviction that the respondents have credible basis for the data elicited.

Table 4.4 Respondents' Working Experience

Experience	Frequency	Percentage
Under 3-5 years	12	16%
5 -10 years	42	58%
Above 10 years	18	26%
Total	**72**	**100%**

4.2.4 Designation of Respondents

Figure 1 shows that out of the seventy-two (72) respondents, twenty-eight (28) representing 39 percent are project managers while forty-four (44) representing 61 percent are technical supervisors. Comparing the results to the qualifications of the respondents it may be deduced that the bachelor degree holders are considered as project managers on site; while the HND and CTC are considered technical supervisors.

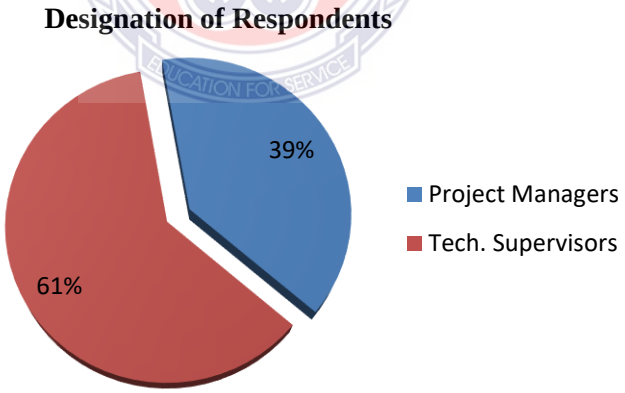


Fig 4.1: Designation of Respondents.

4.2.5 Types of Construction Work Undertaken by Respondents

Fig, 4.2 shows that eight (8) of the respondents accounting for 11 percent undertakes civil works while majority, thus, sixty-four (64) of the respondents accounting for 89 percent undertakes building works.

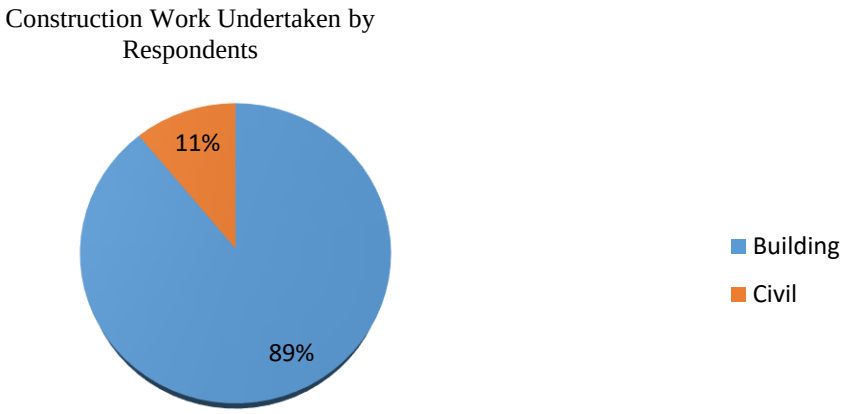


Fig.4.2: Construction Work Undertaken by Respondents

4.2.6 Respondents' Company Classification

Table 4.5 shows that fourteen (14) of the respondents representing 19.4 percent belong to large size companies. Twenty-six (26) of the respondents representing 36.0 percent belong to medium size companies while thirty-two (32) respondents representing 44.6 percent belong to small size company.

Table 4.5 Respondents' Company classification

Large (D1K1)	14	19.4%
Medium (D2K2)	26	36.0%
Small (D3)	32	44.6%
Total	**72**	**100%**

4.3 Validity and Reliability Analysis

The validity of the instrument; the researcher adopted items which were used in previous research; and sought opinion from individual such as academicians and professionals who are expect in the subject area in other to ascertain the effectiveness and applicability of the

instruments with regard to it currents used. The scale of Cronbach's coefficient alpha value is the most widely used statistics to determine the reliability of a measurement; Cronbach alpha values in this study are shown in the table 4.6. All the Cronbach alpha values of the measurement used exceeded the cut-off threshold of 0.7 (Hair et al., 2003) impliedly, all the measurement used has internal consistency.

Table 4.6 Reliability Analysis

Variable	**Mean**	**Standard Deviation**	**Rank**
Construction Project Design	3.615	0.56	1
Supplier Management	3.480	0.50	2
Process Management	3.495	0.50	3
Client Focus	3.550	0.50	4
Planning	3.510	0.57	5
Team Work	2.892	0.54	6
Top Management Commitment	2.685	0.48	7
Employee Relation Management	2.545	0.52	8

4.4 Quality Management Practice of the Respondents' Firms

The survey respondents were asked to rate the level of implementation of quality management techniques or practices on their most recent construction project. The responses are summarized in Table 4.7 below. The responses suggest that hardly do they implement; monitoring of quality of works using control charts ($\bar{x}$=1.14, σ=1.738), training of site personnel on quality management ($\bar{x}$=1.24, σ=1.625), pareto charts or analysis ($\bar{x}$=1.31, σ=1.560), flow charts in relation to quality management procedures ($\bar{x}$=1.42, σ=1.941), and trend analysis to monitor quality of works ($\bar{x}$=2.44, σ=1.455).

These techniques/practices are akin to TQM and QA and it is therefore not surprising that the survey respondents indicated that they never implement them. However, they said that they somewhat implemented cost of quality included in pricing of bills of quantities. This is expected since preamble clauses are contained in bills of quantities and as quality is embodied in each item description. Apparently, the respondents indicated they implemented other quality management practices such as (in decreasing order of ranking); inspections with a focus on quality of works ($\bar{x}$ =4.52, σ=1.082), carrying out quality audits ($\bar{x}$ =4.02, σ=0.821), designs of experiments for testing concrete ($\bar{x}$ =3.50, σ=0.980), and use of statistical sampling techniques on project site ($\bar{x}$ =3.46, σ=1.530). Many of these practices are specified in standard conditions of contract for most construction projects, thus explaining the respondents' implementation of the practices.

Table 4.7 Implementation of quality management practices of respondents' firms

QM Technique or Practice	N	Mean ($\bar{X}$)	Standard Deviation(σ)	Ranking
Inspections with a focus on quality of work	72	4.52	1.082	1th
Carrying out quality audits	72	4.02	0.821	2nd
Designs of experiments for testing concrete	72	3.50	0.980	3nd
Carrying out quality audits Using statistical sampling techniques on project site	72	3.46	1.530	4rd
Cost of quality included in pricing of Bill of Quantity	72	3.35	1.723	5th
Using trend analysis to monitor quality of works	72	2.44	1.455	6th
Using flow charts to in relation to quality management procedures	72	1.14	1.941	7th
Using pareto analysis	72	1.31	1.560	8th
Training of site personnel on quality analysis	72			9th
Monitoring quality of works using control charts	72	1.24	1.625	10th
	72	1.42	1.234	1.

The respondents were also asked if they agreed on their company's implementation of other elements of quality management in construction projects. Table 4.8 shows that the means of the QM practices variable ranged from 2.545 to 3.615. the results further indicated that construction project design has the highest mean 3.615 while employee relation has the lowest mean of 2.545 the results indicated that the respondents' firms attach high level of priority (importance) to construction project design (mean= 3.615, σ= 0.54) and supplier management (mean = 3.48, σ= 0.50); process management (3.495,σ=0.50); customer focus (mean= 3.55, σ=0.58); planning management (3.51, σ=0.57); teamwork (mean=3.55, σ=0.54) are given medium level of priority while top management commitment /leadership (mean= 2.685, σ=0.48) and Employee Relations (mean=2.545, σ=0.52) are given low level of priority. The standard deviation lies between (0.50 - 0.58), this indicates homogeneous data and less spread out or dispersed.

Table 4.8 Elements of Quality Management practices of respondents' firms

QM Aspect	N	Mean	Standard Deviation(σ)	Rank
Construction Project Design	72	3.615	0.56	1th
Supplier Management	72	3.48	0.50	2nd
Process Management	72	3.495	0.50	3nd
Client Focus	72	3.55	0.50	4rd
Planning	72	3.51	0.57	5th
Team work	72	2.892	0.54	6th
Top Management Commitment	72	2.685	0.48	7th
Employee Relation Management	72	2.545	0.52	8th

Note: level of agreement on practices 5 = Strongly agree; 4 = Agree; 3 = Neutral; 2 = Disagree, 1=Strongly disagree

4.5 Critical Constraining Factors Affecting Quality Management Practices

Table 4.9 shows that, the critical constraining factors affecting quality management practices of the respondents are lack of resources (mean = 4.22, σ = 0.54), low bid mindset (mean = 4. 06, σ = 0.56), lack of skilled labour (mean = 3.62, σ = 0.75), Lack of top management commitment/leadership (mean 3.41, σ = 0.72), Lack of training (mean = 3.48, σ = 0.58), Tight project schedule (mean = 2.79, σ = 0.56), Resistance to change (mean = 2.76, σ = 0.48), and Lack of effective communication by project participants (mean = 2.62, σ = 0.52), in that order.

Table 4.9 Critical Constraining Factors Affecting Quality Management practices

Critical Constrain Factors	N	Mean	Standard Deviation(σ)	Rank
Construction Project Design	72	4.22	0.54	1th
Supplier Management	72	4.06	0.56	2nd
Process Management	72	3.62	0.75	3nd
Client Focus	72	3.41	0.72	4rd
Planning	72	3.08	0.58	5th
Team work	72	2.79	0.56	6th
Top Management Commitment	72	2.76	0.48	7th
Employee Relation Management	72	2.62	0.52	8th

Notes: Level of Barrier (LoB): 5 = very often experience (mean = 4.20 – 5.00), 4 = often experience (3.40 -4.19) 3 = sometimes experience (2.60 – 3.39), 2 = seldom (1.80 – 2.59). 1 = not experienced (< 1.80).

4.6 Analysis of Relationship between QMP's Variables

In this section the results of the inferential statistical techniques used in the study are presented. In other to test the research hypotheses, the Pearson Product Moment

Correlation Coefficient was calculated as well as Stepwise Multiple Regression and Analysis of Variance (ANOVA)

4.6.1 Impact of Quality Management Practices on Project Quality performance

In order to determine the effect of QM practices on project performance, ten (10) of the respondent firms that were exemplars in total quality management practices were exemplars purposively selected; in order to determine the relationship between the identified QM practices and construction project quality performance. The results of correlation test between the QM variables and project quality performance is present in Table 4.10. Using correlation analysis, the results indicated that the QM variables are strongly, positively correlated with the Construction Project Quality Performance (CPQP) variable.

There was a significant, positive relationship between project quality performance, and employee relations ($r = 0.729$, $p < 0.01$) ; process management ($r = 0.486$, $p < 0.01$), planning effort ($r = 0.484$, $p < 0.01$) construction project design ($r = 0.658$, $p < 0.01$) teamwork ($r = 0.743$, $p < 0.01$), customer focus ($r = 0.714$ $p < 0.01$); top management commitment/leadership ($r = 0.698$, $p < 0.01$); supply management ($r = 0.458$, $p < 0.01$) thus supporting the hypothesis that QMP's is significantly, positively correlated to project quality performance. There was strong criterion-related validity since the bivariate correlations of the QM practices with quality performance measures were statistically significant.

Table 4.10: Association between QM variables and CPQP

	EMPL	PL	CPD	TWK	CF	LD	S M	PM
PQP Pearson Correlation	0.729**	0.484*	0.658**	0.743**	0.714**	0.698**	0.458*	0.486*
Sig (2 – tailed)	**0**.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** Correlation is significant at the 0.01 level (2- tailed). * Correlation is significant at the 0.05 level (2- tailed). **PQP:** project Quality performance; EMPL: Employee relations; PM: process management; SM: Supplier Management; CPD: Construction project design; TWK: Teamwork; CF: Customer Focus and LD: Leadership, PL: Planning.

4.6.2 Multiple Regression Analysis

Table 4.11, display the result of the multiple linear regression between the identified QM practices and construction project quality performance with standardized betas (β) and t – statistics (t) which are both indicative of the relative importance of each variable contained in the model. Table 4.10 revealed the R^2 adjusted value was 0.778. This indicates that the eight identified QM variable (employee relations, construction project design, customer focus, planning effort, supply management, team work, top management commitment/leadership, and supply management) together can explain 77.8 percent of the variation in construction project performance as a dependent variable. The F – ratio was 112.188 ($p < 0.01$). This indicates that the regression of construction project quality performance on the QMP's variable assessed, expressed through the adjusted R – squared is statistically significant. The beta coefficient, which is the standardized regression coefficient, is used as a direct comparison between coefficient as to their relative explanatory power of the dependent variable (jung & wang, 2006). Teamwork made the greatest impact on the project quality performance (dependent variable) with a beta coefficient of 0.328 ($p < 0.05$); employee relations made the second greatest influence on the project quality performance with a beta coefficient of 0.265 ($p < 0.05$); top management/leadership made the third largest impact on the project quality performance with a beta coefficient of 0.254 ($p< 0.05$).

Client focus made the fourth acceptable contribution to the project quality performance with a beta coefficient of 0.136 ($p < 0.05$); construction project design made the fifth acceptable contribution with a beta coefficient of 0.108 ($p < 0.05$). Supply management, process management, and planning effort were however, out of the regression model because of weak correlation.

Table 11: model: Summary of Multiple Regression Analysis between QMP's and CPQ

Dependent Variable	**R**	**R–Square**	**Adjusted R Square**	**Standard Error**
Subcontractors' Performance	0.838	0.789	**0.778**	2.25749

Analysis of Variance

	Sum of squares	Df	Mean	F	Significance
Regression	2858.696	1	571.739	**112.118**	**0.000**
Residual	387.316	9	5.096		
Total	3246.012	10			

Standard Coefficients

				Collinearity Statistics	
	Beta	T	significance	Tolerance	VIF
Teamwork	**0.328**	13.593	**0.000**	0.607	1.239
Employee relations	**0.265**	6.534	**0.000**	0.526	1.211
Top management/ld	**0.254**	5.909	**0.000**	0.665	1.307
Client focus	**0.136**	3.991	**0.000**	0.633	1.072
Const. proj. design	**0.108**	2.363	**0.000**	0.730	1.204

4.6.3 Influence of Company Size on QM Practices

Table 4.12 shows that there is highly significant mean difference in the application of QM based on company size ($p < 0.01$). Large firms evidenced the highest levels of QM (mean = 1.45, $\sigma = 4.85$). Followed by Medium sized firms (mean = 1.29, $\sigma = 6.03$). Small sized firms indicated the lowest (mean = 1.05, $\sigma = 8.90$). Impliedly, company size has influence on Quality Management practices. In interpreting the date however, cognizance needs to be taken of under representation of firms from the classification. Tukey's Post Hoc test was used as a it controls the overall Type 1 error rate and it is reasonably powerful tool (Hinton et al., 2004).

Table 4.12 ANOVA: Differences in QM Application Based on Company Size

Company Classification	Mean	SD	N	F	P
Large	1.45	4.85	14	26.45	0.000*
Medium	1.29	6.03	26		
Small	1.05	8.90	32		

* $P < 0.05$

4.6.4 Difference in Perception of Constraints to QMPs Based on Company Size

Table 4.13 shows that there is no significant mean difference in QM constraints experience among the respondents' firms ($p < 0.05$). However, large companies experience the lowest constraints (mean = 12.48, $\sigma = 2.32$). Followed by Medium sized companies ((mean = 14.05, $\sigma = 2.43$) with Small sized companies experiencing the highest constraints (mean =

15.02, σ = 1.36). impliedly, company size has no significant influence on QM constraints experience in the Northern region of Ghana.

Table 4.13: ANOVA: Differences in Constraints Experienced

Company Size	Mean	SD	N	F	P
Large	12.48	2.32	14	3.14	0.07*
Medium	14.05	2.43	26		
Small	15.02	1.36	32		

*** P < 0.05**

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Introduction

This chapter presents the discussion of the results of the study. It is organized into four sections. The results are discussed in the context of the literature reviewed in chapter 2, to put the findings in perspective and the regional/national context of the study.

5.2 Quality Management practices of the Respondents' Firms

The results of the study suggest that techniques implemented by the construction companies included; inspections with a focus on quality of works, carrying out quality audits, designs of experiments for testing concrete, and use of statistical sampling techniques on project site. Many of these practices are specified in standard conditions of contract for most construction projects, thus explaining the respondents' implementation of the practices. Other practices that form the core of the elements of quality management are presented in the subsections that follow. It should be noted that there can be a high likelihood of responses not being the true reflection of company practices since employees will tend to over rate or exaggerate what their companies do (Kheni et al. 2008).

5.2.1 Construction Project Design

The result of the study indicated that construction project design is ranked first among the quality management practices examined; with a mean value of (3.615). The mean response (3.615); exceeded the cut off mean (3.5) of the study. This implies that the respondents' firms attach importance to the establishment and usage of internal and external audits to ensure delivery of quality products and services. They also attach importance to reviewing of drawings and specifications prior to authorization for construction works, and document

procedure for reviewing non – conforming products. This finding is consistent with (Arditi & Gunaydin, 1999; Imbeah, 2012) assertions.

5.2.2 Supplier Management

The results revealed that supplier management (3.48) is ranked second among the quality management practices examined, by the respondents. The mean response exceeds the cut off mean (3.5). There is a closer and long – term cooperative relationship with suppliers. The respondents' firms also provide clear specifications to their suppliers. The management of the respondents' firms averagely provides technical assistance to suppliers According to the interviewed participants, although there is a close long – team cooperative relation with suppliers, this relation does not base on product quality but rather on low price and schedule; most of the firms purchased materials on credit due to their financial limitation; meanwhile, suppliers that can produce/supply high quality products always require buyers to pay immediately. Most of the medium and small scale respondents' firms did not have the financial capacity for immediate payment. This evidently affects their level of practice of supply management effort.

5.2.3 Process Management

The results further indicated that process management is ranked third among the quality management practices examined, by the respondents; with a mean score of (3.495) which is slightly more than the cut off mean (3.5). This implies that the respondents' companies averagely attach importance to the use of process flowchart, inspections and supervision of construction projects, and test plans including checklist for activities that directly affect quality; it also suggests that process instructions are given to employees, artisans and site staff (Arditi & Gunaydin, 1999, Imbeah, 2012, Kheni & Ackon, 2015). This average

performance may be attributable to the lack of financial and equipment resources of medium and small scale firms; as well as delayed payment by their clients. It may also be attributed to lack of skilled labourers and lack of training of the workers in their organization.

5.2.4 Client Focus

The results further indicated that client focus management is ranked fourth among the quality management practices examined, by the respondents; with a mean score of (3.55) which is slightly more than the cut off mean (3.5). This study revealed that the respondents' firms use clients' requirement as the basis for quality; encourage employees to satisfy clients, and averagely undertakes preventive and corrective action to delight clients, and also respond effectively to clients enquires and complaints. The respondents' firms however do not follow – up with clients on product/service to receive prompt and actionable feedback. This implies that the respondents' firms averagely pay attention to client focus effort of quality management practices. This may be attributable to lack of adequate understanding of the benefits of client focus efforts of quality management practices.

5.2.5 Planning

The results also indicated that planning element of QM is given the fifth priority by the respondent's firms. The mean response was (3.51) which is almost equal the cut off mean (3.5) of the study. This implies that the respondents' firms attach average importance to the planning effort of quality management practices. Although, most of the respondents, firms have comprehensive quality improvement plan within their organizations, develop and implement strategies, and plans based on data concerning clients' requirement and the

firm's capabilities with quality objectives for both managers and employees, they seldom; communicate their strategy and objectives to the whole staff, involve employees in the setting of objectives and plans, and does little assessment of subcontractors' ability to meet the subcontract requirement including commercial, statutory and technical aspect prior to selection and award of contract. This attitude way be attributed to lack of adequate understanding of the planning element.

5.2.6 Teamwork

The result revealed that teamwork elements were ranked sixth level of importance by the respondent's firms with mean response of (2.892) below the cut off mean (3.5) of the study. Impliedly, the respondents' companies attach low priority to specific quality committees, work teams; peer review teams and effective coordination between the various departments at projects sites. They also they attach low attention to frequent contact between parties involved in projects delivery and other functions. In most of these firm's owner of the firm is its director, and most of the employee's recommendations and views are often ignored; decisions are made individually by the top management only.

5.2.7 Top Management

The result show that top management was ranked seventh by the respondents; with a mean score of (2.685); below the cut off mean (3.5) of the study. The results revealed that although the top management of the respondents' firms provide policies for promoting customer satisfaction; establish clean vision and plan statements that define quality values; the leaders do not effectively communicate quality policies to the employees. The results also suggest that the top management of the respondents' companies do not actively lead and direct the quality management program. This may be attributable to lack of knowledge

and understanding of the concept of QM by the top management; most of the construction firms

5.2.8 Employee Relations

The results further revealed that employee relations are given the less priority among the QM elements examined; with a mean score of (2.545) which is less of the cut off mean (3.5). Implied, the respondents' firms seldom; train employees on site on quality principles, tools and techniques demanded by the project build quality awareness among employees, empower and involve their employees in decision making and also provides less technical and managerial training to sub – contractors to enhance their project quality performance. This may be attributed to lack of understanding of the concept and benefits of employee relations effort of QMP's by the management of the construction firms.

5.3. Critical Constraints to Quality Management Practices

The results of the study revealed that the five most critical constraints affecting quality management practices of the respondents are lack of resources, low bid mindset, lack of skilled labour, lack of top management commitment and lack of training in that order. These findings are consistent with (Imbeah, 2012; Kheni & Ackon, 2015) findings.

5.3.1 Lack of Adequate Resources

The results indicated that lack of resources (mean = 4.22) is the most critical constraint affecting quality management of the respondents. These resources refer mainly to financial and equipment resources. Lack of financial resources affect the effective application of quality management practices in the construction industry with regard to procurement of plant/equipment, highly skilled labour/expert, purchasing of high quality building

material, and motivation of employees to enhance the overall quality performance of the project. Lack of financial resource may be attributed to lack of adequate found or delayed payment by the client. The implication of this finding is that adequate founding should be secured before project start. Client should ensure prompt payment to contractors for both mobilization and work with done. This finding corroborates with (Ibea, 2012; Kheni & Ackon, 2015).

5.3.2 Low Bid Pressure

The result of the study revealed that in the opinion of the respondents, low bid pressure (mean = 4.06) is the second most severe constraint experience by contractors in Northern Ghana. This finding implies that low bid pressure negatively affects effective quality management of construction projects. Low bid pressure is the situation whereby the contract is awarded to lowest bidder/tender. Low bid price pressure may be attributable to the high competition in the industry as a results many contractors price their tenders low to win work and then seek ways to make profits from on-going projects by squeezing subcontractors to the lowest possible bid price. The low margins often result in poor quality work, time delays, disputes, and losses on projects. This finding corroborate with (Hoonaker et al., 2010; Kheni & Ackon, 2015).

5.3.3 Lack of Adequate Skilled Labour

The result of the study revealed that in the opinion of the respondent's lack of skilled labour (mean = 3.62) is the third most critical constraint to effective quality management practices. This implies that it is important and there is urgent need for, the improvement of local labour and site employees' competencies, including those of experts. This finding is in agreement with (Hoonaker et al., 2010 Imbeah, 2012; Kheni & Ackon, 2015).

5.3.4 Lack of Top Management Commitment

The result of the study revealed that in the opinion of the respondents lack of top management commitment (mean = 3.49) is the fourth most critical constraint to effective quality management practices. Top management is required to formulate policies and be committed to implementing a robust, effective and efficient quality management practices by providing necessary resources and training for the staffs; therefore, management commitment is a must, for without it a quality process cannot be implemented. Lack of top management commitment may be attributed to lack of understanding of the benefits of quality management practices by the management of the organization. This finding also corroborates with (Hoonaker et al., 2010; Imbeah, 2012; Kheni & Ackon,2015).

5.3.5 Inadequate Training

The result of the study revealed that in the opinion of the respondents lack of training (mean = 3.48) is the fifth most critical constraint to effective quality management practices. Construction workers always change, therefore their competence must be always evaluated and training must be provided if they do not meet the standard of competency required. However, in most construction firms in Ghana, especially the small and medium scale construction firms, training program is seen as an added cost, instead of an investment for the company. In order words, training is regarded as a burden. The lack of technical competence results in the need for training is agency that can provide program for construction workers to improve their technical skills. The training program must be based on an evaluation of staff competency or training need assessment of the company. Staff who will be promoted to higher levels must be provided with relevant training on staff who management and job competency. This finding is consistent with (Imbeah, 2012, Willar, 2012; Kheni & Ackon, 2015).

5.4 Influence of QMP's on Project Quality Performance

This section forms the bases of the interventions to improve the performance of construction project in the Northern region of Ghana. The results of the correlation test indicated that all the eight QM variable are strongly significant, positive correlated to the project quality performance; there was a significant, positive relationship between project quality performance, and employee relations ($r = 0.729$, $p < 0.01$); process management ($r = 0.486$, $p < 0.01$), planning effort ($r = 0.484$, $p < 0.01$) , construction project design ($r = 0.658$, $p < 0.01$), teamwork ($r = 0.743$, $p < 0.01$), customer focus ($r = 0.714$, $p < 0.01$); top management commitment/leadership ($r = 0.698$, $p < 0.01$); and supply management ($r = 0.458$, $p < 0.0.1$). The findings of this result indicate that all the eight QM elements have significant influence on construction project quality performance. The output also implies that the higher a construction firm Northern region Ghana interested in maximizing its QM's the higher the opportunity to achieve high levels of project quality performance. This finding is consistent with similar studies on relationship between QM practices and project quality performance (Zu, 2009; Kaynak & Harley, 2005; Jung & Wang, 2006; Jaafreh & Al- abedallat, 2012; saeed & Hasan, 2012; Gonzalez et al., 2013; Prajogo & Sohal, 2003; Samoson & Terziovski, 2000; Choi & Eboch, 1998; Kheni & Ackon, 2015).

After running a regression analysis (Table 4.10), the study found that the total quality management (QM) practices at project sites of the respondents' construction firms had significant effects on the project quality performance. Thus, 77.8percent of changes in the project quality performance of the respondents' construction firms is explained by the QM practices identified (employee relations, teamwork, client focus, top management/leadership, process management, supplier management effect and construction project design, and planning) together.

The results further indicated that teamwork, employee relation, top management commitment/leadership, client focus, and construction project design were the QM elements that contributed significantly to this relationship (a greater effect on the dependent variable), Impliedly, these five QM elements have high influence on construction project quality performance.

Teamwork made the strongest significant contribution (Beta = 0.358, $p < 0.05$) to explaining variations in project quality performance, when the variance explained by all other variables in the model is controlled for. This implies that teamwork had significant impact on the project quality performance of the respondents' construction firms. This implies that if employees demonstrate cooperative behaviour and positive attitude towards working in a team will greatly enhance the quality of project execution on site. Thus, the use of specific quality committees, and work teams, peer review teams, and effective coordination between various departments, as well as encouragement of frequent contracts between parties involved in project delivery greatly improve construction project quality performance. This finding is also consistent with the reported studies by Jha and Kumar (2010); Arditi Gunaydin (1997) and Imbeah (2012).

Employee Relations made the second significant contribution (Beta = 0.265, $p < 0.05$) to explaining variables in project quality performance, when the variance explained by all other variable in the model is controlled for. Impliedly, Employee relations had significant impact on the project quality performance of respondents' construction companies. The implication of this finding is that Employee relation (training, involvement, empowerment and commitment) have been found to impact significantly on project quality performance. This implies that allocating company resources of both time and money to training on quality pays off as employees know the use of tools, concepts of quality, and basic

characteristics of the project. Effective training on quality also increases employees' skills to work effectively and efficiently; thus, reducing clients' complaints. Furthermore, treating employees as a valuable resources increase their loyalty to the company, motivate them and makes proud of their jobs, improves their work related performances, and reduces employee turnover. Empowerment and involvement enhance the individual's self –esteem and improve his/her ability to solve problems and to make low –risk decisions. Employee training, involvement, empowerment, and commitment therefore, increase quality, and timely delivery of construction project. This finding corroborate with studies reported by Metri (2004); Jung and Wang (2006); Saeed and Hasan (2012); Gherbal et al. (2012); Fining et al. (2008) and Jaafreh and Al –abedallat (2012); Kheni & Ackon, (2015).

Top management commitment/leadership made the third acceptable contribution (Beta = 0.254, $p > 0.05$) to explaining variations in construction project quality performance, when the variance explained by all other variable in the model is controlled for. This implies that top management commitment/leadership had influence on construction project quality performance. The managerial implications of this finding is that if the top management of the construction firm provides policies for promoting customer satisfaction, and actively communicate quality policies and plans to employees; actively lead and direct quality management programs, assuming responsibility for evaluating and improving quality management system at pre-defined intervals; and motivate their employees; would greatly improve their quality performance. This finding is consistent with (Prajogo & Brown, 2004; Arumugam et al., 2008; Imbeah, 2012) assertions.

Client focus made the fourth acceptable contribution (Beta = 0.336, $p < 0.05$**)** to explaining variations in project quality performance, when the variance explained by all other variables in the model is controlled for. This implies that client focus had significant but weak impact on the project quality performance of the selected respondents' construction firms. This finding has implications for customer or client satisfaction. Construction companies ought to use clients' requirement as the basis for quality or should undertake preventive and corrective actions in line with clients' concerns as well as respond effectively to clients' queries and complaints. This result is also consistent with studies reported by Metri (20054); Jung and Wang (2006); Imbeah (2012); Gherbal et al. (2012); Fening et al. (2008); Zu 2009; Jaafreh & Al-abedallat (2012) and Gonzalez et al. (2013).

Construction project design made the fifth acceptable contribution (Beta = 0.336, $p < 0.05$**)** to explaining variations in project quality performance, when the variance explained by all other variables in the model is controlled for. This means that construction project design had significant impact on the project quality performance of the selected respondents' construction firms. The managerial implication of this finding is that if a construction firm effectively implements corrective and preventive actions; uses internal and external audits to ensure delivery of quality products and services; reviews drawings and specifications prior to authorization for construction works, and documents procedure for reviewing non–conforming products; the firm can produce high quality, reliable and timely delivered constructed facilities that satisfy or exceed clients' expectations. This result is also consistent with reported studies by (Prajogo, 2005; Sit et al., 2009; Imbeah, 2012).

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary of findings of the study in relation to the specific objectives outlined in chapter one. Additionally, the chapter presents the conclusion drawn from the study as well as key recommendations based on the findings of the study.

6.2 Summary of Findings of the Study

The subsections that follow present the findings of the study in relation to the specific objectives of the study.

6.2.1Quality Management Practices of Contraction in the Northern Region (Objective 1)

The findings of the study revealed that the important quality management practices adopted by the firms studied are presented in the paragraphs that follow.

The study revealed that quality practices are not implemented except for those expressly stipulated in terms of contract. The often implemented practices/techniques included; inspections with a focus on quality of works, carrying out quality audits, designs of experiments for testing concrete, and use of statistical sampling techniques on project sites. Many of these practices are specified in standard conditions of contract for most construction projects, thus explaining the respondents' implementation of the practices. Also, the findings of the study suggest construction firms in the Northern region of Ghana attach implement elements of quality management such as; construction project design,

supplier management, process management, planning, and client focus. This finding should be interpreted with caution given that there can be tendency to exaggerate firms' practices by employees. However, quality management efforts such as; teamwork, top management commitment, and employee relations are not implemented. The study also found that the potential constraints affecting quality management practices of construction firms in the Northern region of Ghana are:

- Lack of resources
- Lack of resources low bid mind set
- Lack of skilled workers
- Lack of top management commitment and
- Lack of training of employees

The result of this study has also revealed that team work, employee relations, top management commitment, client focus, and construction project design have significant impact on construction project quality performance.

Data analysis for this study also revealed that company size has significant effect on QM practices of construction firms in Northern region of Ghana. Large firms have larger levels of QM application than medium and small size firms. However, there was no significant difference with respect to constraints experienced.

6.3 Conclusion

In conclusion, managers of construction firms in Northern region Ghana should be more concern about terms of contract in relation quality, team work, employee relations, top management commitment, client focus, and construction project design to improve upon their project quality performance. Construction firms in the Northern region face constraints to the implementation of quality management practices on construction

projects. These constructions need to be overcome through commitment of all units within the organization and most importantly a strong commitment from the top management. Also, small and medium size firms should form partnering groups in order foster innovations in quality management and have competitive advantage in the bidding/award processes.

6.3.1 Recommendations

Based on the findings of the study, the following recommitments are made towards improving the implementation of QM practices in construction projects in the Northern region of Ghana. These recommendations could form the basis for interventions designed to improve construction project quality performance in the Northern region of Ghana.

- Construction firms in Northern region of Ghana should proactively manage quality of construction projects and demonstrate commitment to team work, employee relations, top management commitment, client focus and construction project design to enhance quality performance of projects.
- Management of construction firms must participate in quality management activities as they must be seen as exemplary pace setters in the quality management.
- Top management of construction firms should allocate a percentage of their profits earned for training and education of employees in the area of quality.
- Training course should be organized for top management in QM and staff recruitment should consider quality management expertise of prospective employees interviewed.
- Clients should not base their selection of contractors strongly on lowest bid but rather on their quality performance and possible given priority over contractors' estimated cost (tender sum).

6.4 Futures Research

The current study assessed the quality management practices and the constraints affecting quality management practices of construction firms in the Northern region of Ghana. Further research could also be looked into the quality management practices of other regions in Ghana.

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APPENDIX

APPENDIX A: COVER LETTER

UNIVERSITY OF EDUCATION, WINNEBA
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March 05, 2020

TO WHOM IT MAY CONCERN.

Dear Sir/Madam,

INTRODUCTORY LETTER

I write to introduce Mr. Adam Issah, an MPhil Construction Management student in the Department of Construction Technology Education of the College of Technology Education of University of Education, Winneba.

Mr. Adam Issah is currently carrying out a research on quality management in construction projects by construction companies in the Northern Region of Ghana with a view to developing quality indicators for conducting quality audits on construction project sites in the Northern Region. The specific objectives of the study are as follows:

- to assess the quality management practices of contractors in the Northern Region of Ghana;
- to determine key constraints to the adoption of proven quality management practices by contractors in the Northern Region of Ghana;
- to evaluates the effects (if any) of quality management practices of contractors on construction project variables (client satisfaction, commercial relations, contractor's profile, health, safety and environmental performance) in the Northern Region; and,

- to develop a set of critical-robust indicators of quality performance of construction projects in the Northern Region of Ghana.

He is currently at the data collection stage and would need the assistance of your good office to enable him administer questionnaires to construction professionals employed by your company. Therefore, the University would appreciate your support in this regard.

Thank you.

Yours faithfully,

Dr. Nongiba A. Kheni

Acting Head, Construction and Wood Technology Education

APPENDIX B: QUESTIONNAIRE FOR CONSTRUCTION PROFESSIONALS

The purpose of this questionnaire is to investigate Quality Management practices (QMPs) on Constriction Sites.

SECTION A: PERSONAL INFORMATION

Q1. Please, indicate your gender. (Please tick [√]) (a) Male [ ] (b) Female [ ]

Q2. What is the age category you belong? (Please tick [√])

Under 30 years [ ] ; 30 – 39 years [ ] ; 40 – 49 years [ ] ;

Above 50 years [ ]

Q3. What is the highest academic qualification? (Please tick [√] the appropriate boxes)

(a) Construction Technician Certificate [ ] (b) Higher National Diploma [ ]

(c) Bachelor's Degree [ ] (d) Master's Degree [ ]

Other [ ],

Please state …….

Q4. What type of construction works does your company undertake? (Please write in the box)

(a) Civil Engineering Construction [ ] (b) Building Construction [ ]

(c) Other [ ].

Please state …….....

Q5. What contractor classification does your company belong to? (Please write in the box)

Q6. What is the number of years you have been working in the construction industry?

(Please tick [√])

(a) 3- 5 years [ ] (b) 5 – 10 years [ ] (c) 11 – 15 years [ ] (d) Above 20 years

Q7. Please, state your current position with your company. (Please write in the box)

SECTION B: Quality Management Practices

This section seeks your expert opinion on quality management practices of your firm. Kindly supply answers to the questions on the quality management practices by your firm on construction project sites.

Q8. To what extent do implement the following quality management techniques or practices on construction projects sites. Please rate the level of implementation using a scale of 1 to 5 where 1represents the techniques is never implemented on project sites, 2 represents not certain, 3 represents the technique is somewhat implemented on project sites, 4 represents the technique is implemented on project sites, and 5 represents the technique is always implemented on project sites.

QM Technique or Practice	Rating				
	1	2	3	4	5
Cost of quality included in pricing of Bills of Quantities					
Training of site personnel on quality issues					
Carrying out quality audits					
Designs of experiments for testing concrete					
Carrying out quality audits					
Inspections with a focus on quality of works					
Using statistical sampling techniques on project site					
Monitoring quality of works using control charts					
Using pareto analysis					
Using trend analysis to monitor quality of works					
Using flow charts to in relation to quality management procedures					

Q9 To what extent do you agree on your company's implementation of the following elements of quality management in construction projects. Please rate using a scale of 1 to 5 where; 1= Strongly Disagree, 2= Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Elements of Quality Management	Rating				
Leadership					
My company provides policies for promoting customer					
My managers actively communicate quality policies and plans to employees.					
My managers and supervisors actively lead and direct quality management Programs, assuming responsibility for evaluating and					

My managers and supervisors motivate their employees and help them Perform at a higher level in their task.					
Employee relation					
My management organizes training for employees in problem Identification and solving skills, quality improvement skills,					
There is effective two – way communication links with employees and suppliers.					
Employees in my company are often encouraged by their supervisors to participate in decision making processes.					
Management and supervisors assume active roles as facilitators of continuous improvement, coaches of new methods and leaders of					
Customer focus					
My company uses customers' requirements at the basis for quality.					
My company responds effectively to clients' enquires and complaints.					
My company encourages employees to satisfy clients.					
My company undertakes preventive actions to delight clients.					
Process management					
My company uses flow chart, inspection and supervision and test plan for activities that directly affect quality.					
The processes used in this company include quality measures such as testing, reviewing, inspection and checklist of incoming products					
Clarity of work or process instruction is given to employees, artisans and site staff (these include both employees of subcontractors &					
My company conducts inspection and test plans, including checklist on completion of the construction project or pre-determined stage of					
Supplier management					
My company offers closer and long team working relationship to Suppliers.					
My Management encourages the usage of few suppliers, emphasizing quality rather than price or schedule and also providing					
My company Places requirements upon suppliers in order to find quality specifications.					
My company' purchasing department assumes responsibility for the quality of incoming products.					

Construction project design					
My company documents procedure for implementing corrective and Preventive actions.					
My company users internal and external audits to ensure delivery of quality products and services					
My company reviews drawings and specifications prior to authorization for construction works.					
My company documents procedure for reviewing non-conforming Products.					
Team work					
My company users specific quality committers and work teams to support quality improvements on sites.					
My company establishes peer review teams on sites.					
My company ensures effective coordination between various departments at the projects sites.					
My company encourages frequent contact between parties involved in Projects delivery and other functions.					
Planning					
Comprehensiveness of quality improvement plan within the					
Development and implementation of strategies and plans based on data concerning customers' requirements and the firm's capabilities.					
Management setting quality objectives for both managers and					
Management communication its strategy and objectives to the					
Well defined responsibilities of personnel who manages performs and verifies work that affects quality					

Section C: Expert opinion on Construction Project Quality Performance

Q10. To what extent do you agree on the following statements on construction quality performance of the most recent project carried out by you company. Please rate using a scale of 1 to 5 where; 1= Strongly Disagree, 2= Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Statement	Rating				
	1	2	3	4	5
My company has achieved reduction in quality cost					
My company has achieved reduction in wastage					
My company does not experience rework					
My company delivers projects on time					
My company has achieved reduction in defects					
My company has achieved reduction in non-conformance					
My company gets repeat contracts from existing clients					

Section D. Expert Opinion Potential Barriers to Effective QM Implementation on Project Site

Q11. The following statements are problems that construction companies face in relation to effective implementation of quality management practices. Please tick [√] the appropriate box, the extent to which you agree on each statement. Please rate using a scale of 1 to 5 where; 1= Strongly Disagree, 2= Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

Potential Barriers to Improvement of Quality on sites	Rating				
	1	2	3	4	5
Low bid mindset					
Lack of Skilled personal					
Resistance to change at various level in the firm					
Lack of Top Management commitment and understanding					
Lack of Training					
Lack of Resources					
Tight project schedule					
Lack of effective communication					
Lack of understanding of QM Processes					