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# Impact of Total Quality Management Practices (TQMPs) on Construction Project Quality Performance in Developing Countries: Study of Construction Businesses in Ghana

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**Abstract**
Globally, maintenance of quality is an important consideration in modern construction. This is evident by clients' increasing use of companies' reputations for good quality work as a basis for choosing prospective contractors. The aim of this research is to empirically examine the extent to which TQM practices are associated with Construction project quality performance (CPQP). Based on TQM framework developed from comprehensive literature review of TQM, a survey instrument was developed and used to collect data to test the impact of TQM practices on CPQP. The results of the study suggest that TQM elements are positively associated with CPQP and that, soft aspect of TQM elements has higher impact on CPQP than hard aspect of TQM elements.

## 1. Introduction

The construction industry constitutes a large part of the economy of many nations with a significant contribution to Gross Domestic Product (GDP), and determining economic growth of countries (Anaman & Osei-Amponsah 2007; Ofori, 2012; Willar, 2012). The sector currently accounts for more than 11% of global GDP (Betts et al., 2011). Ghana's construction industry contributes significantly to national development. According to Ghana Statistical Service (GSS) (2014), the sector contributed an average of 9.08% of the Gross Domestic Product since 2008, and recorded a relatively high growth of 11.2% in 2012. Given that the industry is essential for the construction of infrastructure, its quality management shortcomings will not only affect the economy of Ghana in terms of housing, infrastructure development and job creation, but will also make it impossible to achieve the Millennium Development Goals' that the nation is striving to attain by 2015.

Effective management of quality of construction processes and products 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 selecting prospective

contractors. Given the threat of global competition and the demand for building and civil engineering products, it is vital that the construction industry developing economies such as Ghana implement implements effective quality management practices to address the perennial concerns of the industry regarding poor performance, poor quality of works, and lack of innovation and professionalism (Ahadzie, 2009). It is estimated that lack of quality control costs contractors between15% and 20% of their annual income (Bezelga & Brandon, 1991, as cited in Baiden & Tuuli, 2004). Past studies have shown that the direct costs associated with rework, repair and replacement in construction projects accounts for an average of 12.4% of the total project cost and require as much as 11% of the total project working hours (Burati et al., 1992; Love et al., 1999; Barber et al., 2000).

Total Quality management when well utilized provides substantial benefits by achieving customer satisfaction, improving employee quality awareness and consciousness, reducing quality costs, decreasing wastage, avoiding delays, improving organizational performance and closer relationships with sub-contractors and suppliers and offers firms' competitive advantage (Bubshait & Al-Atiq, 1999; Love, et al. 2004). While these achievements have been recorded in developed countries it is contentious whether such benefits could also be derived from the implementation of TQM in developing countries such as Ghana given that the construction industry in such countries is faced with a myriad of issues.

Notably, construction companies in developing countries 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, poor coordination and scheduling and controlling techniques (Fugar & Agyarkwa-Baah, 2010; Amoah, Ahadzie & Dansoh, 2011; Ofori, 2012). Additionally, in spite of efforts of governments to stem corruption, the practice remains endemic in developing countries of which Ghana is not an exception (CDD-Ghana 2000; Kenny 2007).

## 2. Statement of the Problem, Objectives and Significance of the Study

While there has been extensive research on TQM and its impact on project performance, elsewhere (Zu, 2009; Kaynak, 2003; Kaynak & Hartley, 2005; Jung & Wang, 2006; Jaafreh & Al-abedallat, 2012; Saeed & Hasan, 2012; Gonzalez et al., 2013; Prajogo & Sohal, 2003; Choi & Eboch, 1998), there is paucity of similar research in Ghana, aimed at examining the effect of total quality management practices on construction project quality performance. The study therefore sought to examine the relationship between the identified total quality management practices (TQMPs) and construction project quality performance in Ghana.

The findings of the study contribute to both theoretical and managerial perspectives of TQM application in the construction industry. From the theoretical standpoint, the results obtained from the study are consistent with the theory of TQM practices and previous literature which support such studies by providing empirical evidence that provide insights about the body of knowledge on TQM theory. From the managerial perspective, the results of this study showed that employee relations, teamwork and customer focus (Soft aspect) have greater effects on construction project quality performance in Ghana. Thus, Managers' of construction firms should be more concerned about these TQM dimensions on project sites to enhance their quality performance.

## 3. Theoretical Review

### 3.1. Concepts of Quality and TQM

According to researchers one of the problems with Total Quality Management (TQM) implementation is the lack of a universally accepted definition of quality (Eng & Yusof, 2003 cited in Jaafreh & Al-abedallat, 2012).The term 'quality' has many conceptual and operational definitions. Many of the pioneers of the quality movement and gurus, such as Deming, Juran, Crosby, Feigenbaum, Oakland, Juran and others, had their own individual definitions of quality. For instance, Edward W. Deming defines quality as a product or a service "that meets the customer's expectations to ensure customer satisfaction" (Deming, 1986:54 as cited in Jaafreh & Al-abedallat, 2012). Philip B. Crosby's definition of quality is "conformance to requirements" (Crosby, 1979:7 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 Juran describes it with the phrase "fitness for use by the customer" as a definition of quality (Juran & Gryna, 1993). In Oakland's (2003) view, 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".

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 workmanship. Chung (1999) cited in Rumane (2011) defines quality of construction projects 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.

Total Quality Management (TQM), has been defined as "harnessing everyone's effort to achieve zero defects at

lowest cost and 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 following the end of the Second World War. In recent years, the level of awareness towards TQM has increased considerably due to intense global competition, increasing consumer consciousness of quality, rapid technology transfer, and trends 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 (Harris et al. 2006).

## 3.2. Application of TQM in Construction

In recent years, many of the management practices used to support construction organizations 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), and Lean (or Just-in-Time) Production, are being adopted and integrated into the construction industry. Total Quality Management is increasingly been adopted by construction companies as an initiative to solve quality problems and to meet the needs of the final customer (Kanji & Wong, 1998 as cited in Hoonakker, 2010).Harris and McCaffer (2001) explain that total quality management provides 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.

According to Hoonakker (2010) most of the research concludes that it is necessary to transpose and translate the principles, practices and techniques used for TQM in manufacturing to construction. In line with this suggestion, TQM elements that past researchers have identified as 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., 2012; Imbeah, 2012).

### (i) Top Management Commitment and Leadership

Tannenbaum et al. (1961) cited in Gherbal et al. (2012) defined leadership as: "the interpersonal influence, exercised in a situation, and directed, through the communication process, toward the attainment of a specified goal or goals". In the construction industry, top management commitment/leadership is very crucial to the success of total quality management program of a construction organization (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 the TQM agenda (Juran & Gryna, 1993). Management must also actively lead and direct quality management programs and assume responsibility for evaluating and improving quality system at pre-defined intervals (Imbeah, 2012).

### (ii) Human Resources 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 of total 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 programs attempt to teach employees 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).With TQM, quality becomes everyone's responsibility and the training must be targeted for every level of the company (Arditi & Gunaydin, 1997).

Construction organizations should organize customized training plans or programs 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 a form of in-service, external experts on quality, seminars on quality improvement programs or TQM philosophy. 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 TQM concepts become widely accepted throughout the construction industry, workers switching from one company to another should require less TQM training since all workers would have received basic quality awareness in their previous employment. 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).

### (iii) 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's need, so the customer should be closely involved in the product design and development with valuable input to every stage (Saylor 1996 as cited in Gherbalet al., 2012). The customer allows an organization to exist, for every organization, profit or non profitable, partnerships, departments, functions, groups, or teams, therefore customer focus is very critical in TQM. Impliedly, in construction industry, quality should be customer driven. Employers 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 Jurancited in Arditi & Gunaydin(1997) the parties in a process (Supplier, Processor, and customer) have a "triple role". This triple role concept is applicable to construction industry. Arditi & Gunaydin argued that in construction, the designer is the customer of the client because the designer has to receive the project requirements from the client in order to provide a feasible design. The designer supplies plans and specifications to the constructor; in this case the constructor is the designer's customer because the constructor uses the designer's plans 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 phase is affected by the quality in the preceding phases. Therefore customer service in each is essential for the overall quality performance of the process (Arditi & Gunaydin, 1997).

### (iv) Strategic Planning

The strategic planning involves how the company sets strategic directions, how it determines key action plans, and translates them into an effective 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 term goals through participative planning (Teh et al., 2009). 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).

### (v) Process Management

Process management refers to combinations of machines, methods, materials, tools, and people employed in production (Jaafreh & Al-abedallat, 2012). TQM works on the belief that the overall quality of products can be enhanced by improving the quality of the processes directly or indirectly related to their creation (Ahire et al., 1996). The objective of process management is to reduce process variation by building quality into the production process (Flynn et al., 1995; Anderson et al., 1994). This thus increases the quality of outputs as well as decreasing the costs such as rework costs and waste costs (Anderson et al., 1994; Flippini & Forza, 1998).

The maintenance of process capability to meet production requirements is an important matter in process control and improvement (Feigenbaum, 1991; Juran & Gryna, 1993). According to Metri (2004) process management focuses on managing the construction process so that it operates as expected, without breakdowns, shortage/missing materials, tools, etc. It is needed to reduce rework and waste due to wrong specification of processing parameters. 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 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 are a part of process management.

### (vi) 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 inter dependence 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. Materials are often a major source of quality problems and affect buyer satisfaction. According to Metri (2004) instead of relying on tools such as acceptance sampling to establish the quality of incoming materials and component parts, it is preferable for constructors to purchase from a more limited number of qualified or certified suppliers.

### (vii) 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 (Sadikoglu & 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 on the construction safety, work plans and workplace environment with a view for improvement, encourage project quality improvement discussions at subcontractor site meetings, practicing continual review of process completion time with a view of improvement, bench marking process in order to improve activities in the firm with subsequent improvement to delight customers (Black & Porter, 1996; Imbeah, 2012).

### (viii) 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 the TQM process. Team work is necessary to encourage competitive activities internally among employees and externally with respect to suppliers and customers.

According to Arditi and Gunayadin (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. Many authors acknowledge that team work is a critical element of TQM (Jha & Kumar, 2010; Gherbal et al., 2012; Imbeah, 2012).Employees must demonstrate cooperative behavior and positive attitude towards working in a team.

### (ix) Information Analysis and Evaluation

According to Jha and Kumar (2010) information analysis and evaluation is the critical enabler of TQM. 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 costs, 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.

### (x)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 TQM 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. 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 organization to achieve a successful implementation of TQM to encourage the employees to participate in all these activities.

The work culture must be very conducive. There should be an active 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.

## 4. Conceptual Framework and Hypotheses Development

### 4.1. Conceptual Framework

Extant literature review indicated that the generally accepted elements of TQM practices that affect construction project quality performance on project sitesare: Top Management Commitment and Leadership, Employee Relations, Customer focus, Teamwork, Suppler Management, Process Management and Information Analysis and Evaluation (Arditi & Gunaydin, 1997; Jaafari, 1996; Saeed & Hasan, 2012; Olatunji et al., 2012).

The interrelationships of the aspects of TQM are represented in the conceptual framework represented by Figure 1. The framework consists of three parts; TQM elements, project quality performance and barriers to the implementation of TQM and project quality performance. The TQM comprises seven elements namely; top management commitment and leadership, employee relations, customer focus management, supplier quality management, process management, teamwork and information analysis and evaluation adapted from Imbeah, (2012), Conca et al., (2004), and Black and Porter (1996),representing the independent variables of the study. These quality management elements have been identified by other authors like Arditi and Gunaydin (1997); Saeed and Hasan, (2012); Love et al. (2004); Gherbal et al. (2012); Jha & Iyer (2006); Metri (2004);Fening et al., (2008); Ahire et al., (1996); Flynn et al., (1994); Sila & Ebrahimpour (2005); Kaynak (2003) as well as major National Quality Awards models like Malcolm Baldrige National Quality Awards

(MBNQA), European Foundation for Quality Management (EFQM), Australian Quality Award (AQA), and the Deming Prize (Fening et al. 2008).

The hypothesized relationship is that the implementation of the TQM elements should promote project quality performance which will be indicative of client satisfaction, cost of quality, construction efficiency (minimal defects, rework and wastage), conformance to specification and project delivery time. The interaction of the TQM elements implemented for a given project (independent variables) and project quality performance (dependent variable) is moderated by the extent of the effect of barriers to TQM implementation and project quality performance. Anecdotal evidence suggest that common barriers currently being faced by construction companies in Ghana are the same as that experienced elsewhere in the world. These barriers are: low bid mindset, lack of expertise (Skilled workers), 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 and firm's emphasis on short term objectives (Imbeah, 2012).

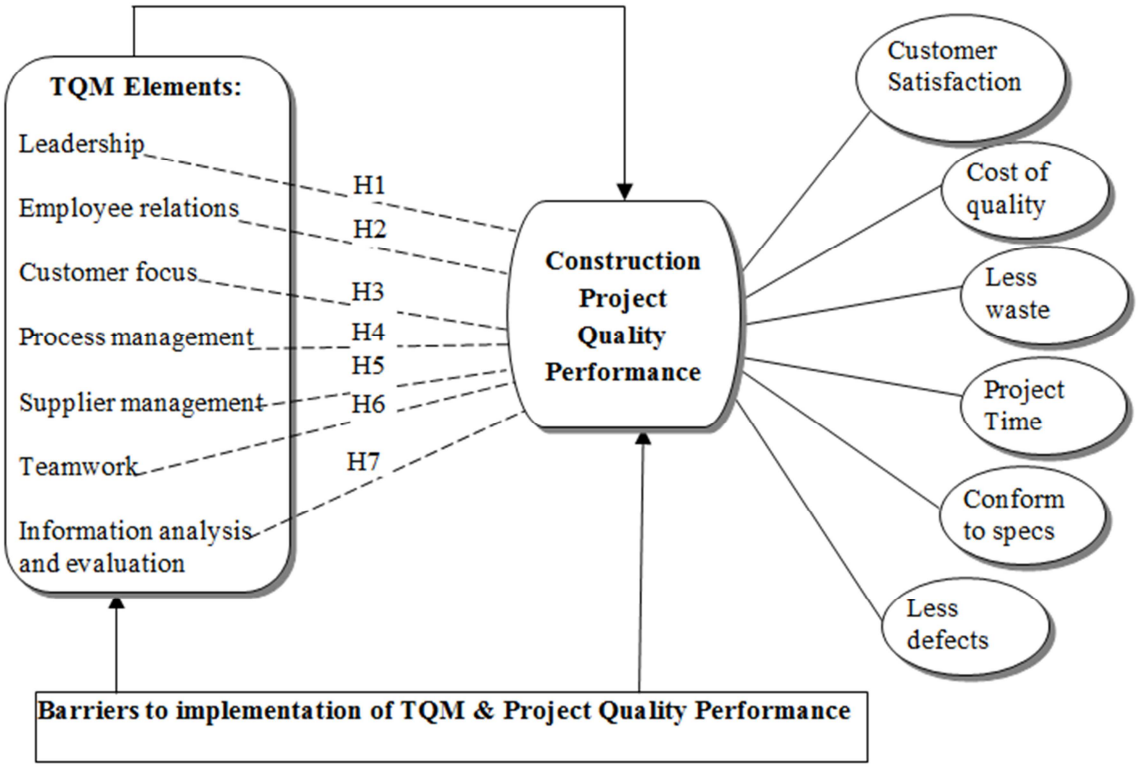


***Figure 1.*** *Conceptual framework.*

Note: Employee Relations, Teamwork, Customer focus and Leadership effort are classified as soft TQM elements while Process management, supplier management, and information analysis and evaluation are classified as hard TQM elements (Bullock & Rahman, 2005).

### 4.2. Hypotheses

The hypothesized relationships of interest are represented by H1 to H7 in Figure 1 and summarized below:

- H1: Top-management commitment and Leadership for TQM practices is positively correlated with quality performance of construction project.
- H2: Employee Relations for TQM practices is positively correlated withquality performance of construction project
- H3: Customer focus for TQM practices is significant, positively correlated with quality performance of construction project
- H4: Supplier management in relation to TQM practices is positively correlated with quality performance of construction project
- H5: Process management in relation to TQM practices is positively correlated with quality performance of construction project
- H6: Teamwork in relation to TQM practices is positively correlated with quality performance of construction project.
- H7: Information Analysis and Evaluation in relation to TQM practices is positively correlated with project quality performance.

## 5. Methods

This study employed Quantitative Survey approach. Quantitative research focuses on relationship between dependent variables and independent variables (Babbie,

2010). A survey research involves collecting data in order to test hypothesis or answer research questions concerning the correct status of the subject of study (Gay, 1992). Fraenkel and Wallen (2000) also indicated that a survey research involves the collection of data through the use of questionnaires, interview or ability test.

Survey, has the advantage of producing a good amount of responses from a wide range of people. According to Saunders et al. (2007), survey enables a lot of information to be collected from a sizeable population in a highly economical way. Besides, it enables researchers to use smaller groups of people to make inferences about larger groups which are prohibitively expensive to study (Holten & Burnett, 1997). The quantitative survey design was chosen because the study sought to examine the impact of total quality management practices on construction project quality performance.

## 5.1. Population

The population for the study comprised construction companies registered with metropolitan assemblies in four cities namely; Kumasi, Accra, Sekondi-Takoradi and Cape Coast in Ghana. These four Metropolises were selected because they are the major Metropolises in Ghana where most contractors and construction activities are highly concentrated (Akomah, Boakye & Fugar, 2010). The study drew its sampling frame from the registered list of contractors kept by the four Metropolitan Assemblies of the selected Metropolises (Kumasi, Accra, Cape Coast and Sekondi-Takoradi). The sampling frame for the study was 580 construction firms of various classifications.

## 5.2. Sampling Technique

The study employed systematic random sampling to select construction firms registered with metropolitan assemblies in the four cities. To determine the sample size of contractors for each Metropolis, the equation below which gives a scientific procedure for determining sample size was used (Kish, 1965). 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 of 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 formula, the sample size for the study was calculated as follows:

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

$$\text{sample size (n)} = \left[\frac{100}{1+\frac{100}{580}}\right] = 85 \text{ companies}$$

A non response rate of 50% was assumed to overcome a low response that could threaten the generalization and validity of the study's findings (Lahndt, 1999, Enshassi et al., 2010). The adjusted sample size taken into consideration non response was:

$$\frac{150}{100} \times 85 = 1.5 \times 85 = 128$$

The sample sizes for the four Metropolises were calculated as follows:

n for Kumasi = $\frac{150}{580} \times 128 = 33$ construction companies;

n for Accra = $\frac{250}{580} \times 128 = 55$ construction companies;

n for Sekondi-Takoradi = $\frac{115}{580} \times 128 = 26$ construction companies; and,

n for Cape Coast = $\frac{65}{580} \times 128 = 14$ construction companies.

## 5.3. Questionnaire Development and Administration

The final questionnaire was based on a draft questionnaire developed and tested. Opinion of quality management experts was sought on the validity of question items. Also, pilot –testing of the questionnaires was conducted in two phases. The first phase involved completing the pilot questionnaire, and the second phase involved the conduct of a 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 (Willar, 2012).

The final questionnaire was divided into three sections; A, B and C (see Appendix A). The first part sought the demographic background of respondents. The second part consisted of questionnaire items as indicators of the seven elements of TQM (constructs) adapted from Black and Porter (1996); Conca et al. (2004) and Imbeah (2012). The indicators were to be rated using a five-point Likert scale in which 1 represents strongly disagree, 2 disagree, 3 uncertain, 4 agree and 5 strongly agree. The third part assessed the respondents' perception on how the implementation of quality management contributed to project quality performance. The project quality performance was measured using 6 indicators rated by respondents using a five-point Likert scale similar to the one in the second part of the questionnaire. The questionnaires were personally delivered to the selected construction companies who were in turn requested to deliver them to the most experienced or qualified site manager for completion (Wilmot, 2005 as cited

in Danso, 2010).

### 5.4. Reliability of Measurement Scales

Cronbach alpha values in this study are shown in Table 1. The overall value of Cronbach's alpha for independent variables is 0.976. The alpha value of the dependent variable 'Performance' is 0.91. This means that all the cronbach's alpha values of the measurement used exceeded the cut-off threshold of 0.7 (Hair et al., 1998). Impliedly, all the measurement scales used had high internal consistency.

***Table 1.*** *Reliability Analysis*

| Variable | Cronbach's Alpha | No. of items |
|---|---|---|
| Employee Relations | 0.88 | 4 |
| Leadership | 0.89 | 4 |
| Customer Focus | 0.78 | 4 |
| Teamwork | 0.90 | 4 |
| Process Management | 0.75 | 4 |
| Supplier Management | 0.80 | 4 |
| Information Analysis & Evaluation | 0.83 | 4 |
| Project Quality Performance | 0.91 | 6 |

### 5.5. Data Analysis

Completed questionnaires from the field was edited and coded appropriately. 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 using Statistical Package for Social Science (SPSS) version 16. In addition to descriptive statistics such as tables, percentages, simple means and standard deviation, inferential statistical tools were employed; Pearson's Product Moment Correlation Coefficient (PMCC), and Multiple Regression Analysis were employed. Before applying the inferential tools, 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. The validity and reliability of the research questionnaire were examined using 'face' validity and Cronbach's alpha of 0.7 cut-off threshold. The upper level of statistical significance for hypothesis testing was set at 5%. All statistical tests were computed at 1-tailed level of significance.

## 6. Results

A total of 130 questionnaires were administered out of which 72 were completed and returned. The response rate was 56 percent which is good for a construction research survey (Lahndt, 1999b as cited in Hoonakker, 2010). However, out of the 72 respondents companies, fifty (50) representing 69.44 percent did not have TQM as their Quality Improvement Program; therefore, their questionnaires were discarded and not included in the number of questionnaires analyzed. Twenty two (22) representing 30.56 percent of the respondents companies had Total Quality Management as their Quality improvement Program and hence, only their questionnaires were usable for the analysis.

### 6.1. Demographic Characteristics of the Respondents

The demographic characteristics of the respondents provided descriptive information on Gender, Age, Qualification, Experience, Position, Type of Construction Company and the Classifications of the respondents companies. This information was necessary to ascertain the validity of the results obtained and to develop an understanding of the background respondents with respect to their qualifications and experiences.

Twenty (20) representing 91 percent of the total respondents (22) were males while two (2) representing 9 percent were females. Majority (19 representing 86%) were 40years and above. Impliedly, the respondents were matured. When asked about their educational qualifications, seventeen (17) representing 77 percent had Bachelors and Masters degree while the rest (five representing 23%) had obtained either Construction Technician Course or Higher National Diploma certificates. Impliedly, management of the respondents' firms can be said to employ highly qualified personnel. Responses on work experience suggested that majority of the survey respondents (twenty one (21) representing 96 percent) had more than 5years working experience. The responses of the respondents can be said to reflect their firms' characteristics and work culture in view of the greater working experience they possessed. Seven (7) of the respondents representing32 percent were project managers and ten (10) representing 45 percent were site engineers while five (5) representing 23 percent were supervisors (technical). These responses suggest that majority (seventeen (17) accounting for 77percent)of the respondents occupy senior positions in their respective companies.

Five (5) representing 23 per cent of the respondents' firms undertake civil engineering works while majority of them (seventeen (17) representing 77 percent) undertake Building works. Responses on classification of respondents' firms showed that fourteen (14) of the firms representing 64 percent belong to class D1K1 classification, six (6) of the respondents representing 27percent belong to D2K2 classification and two (2) representing 9percent belong to class D3.

### 6.2. Quality Management Practices of the Respondents' Companies

The first part of the QMS questionnaire related to how the respondents' perceived TQM practices within their construction organizations. Table 2 shows that the mean of the elements of TQM ranged from 4.53 to 4.67. This suggests that respondents' companies in general, had fully implemented TQM. The results indicate that supplier management has the highest mean (4.67) while employee relations had the lowest mean of 4.53. The results indicated

that the means of all the variables in the study were above the scale mid-point (3) which suggest that respondents' firms attach importance to all the TQM aspects assessed. However, high level of priority (importance) is accorded to supplier management (Mean = 4.67, SD = 0.50) and information analysis & evaluation (Mean = 4.61, SD= 0.50) as these ranked first and second respectively. These were followed by teamwork (mean = 4.59, SD = 0.50), customer focus (mean = 4.59, SD = 0.57), process management (mean =4.58, SD = 0.57) and leadership (mean = 4.57, SD = 0.61) in that order. Employee relations (Mean = 4.53, SD = 0.61) was accorded relatively low level of priority. The standard deviations (SD) lie between (0.50 - 0.61), this indicates homogeneous data and less spread out or dispersed.

***Table 2.*** *Prioritization of Total Quality Management practices of respondents*

| TQM Aspect | Mean (M) | Std dvt. (SD) | Rank | Category |
|---|---|---|---|---|
| Supplier Management | 4.67 | 0.50 | 1 | High |
| Information Analysis & Evaluation | 4.61 | 0.50 | 2 | High |
| Teamwork | 4.59 | 0.50 | 3 | Medium |
| Customer Focus | 4.59 | 0.57 | 4 | Medium |
| Process Management | 4.58 | 0.57 | 5 | Medium |
| Leadership | 4.57 | 0.61 | 6 | Medium |
| Employee relations | 4.53 | 0.61 | 7 | Low |

## 6.3. Impact of Total Quality Management on Project Quality Performance

### 6.3.1. Correlation Test for Association Between TQM Elements and Project Quality Performance

The results of correlation test between the TQM variables and Project quality performance is presented in Table 3. The results indicated that Total Quality Management variables are strongly, positively correlated with the Construction Project Quality performance (CPQP).There was a significant, positive relationship between employee relations and project quality performance ($r = 0.896$, $p < 0.01$). This supports the hypothesis that there is a significant, positive relationship between employee relations and project quality performance. Similarly, a significant, positive correlation is shown to exist between process management and project quality performance ($r = 0.786$, $p < 0.01$), supporting the hypothesis that there is a significant, positive relationship between process management and project quality performance. Similarly there was also a significant, positive relationship between supplier management and project quality performance ($r = 0.627$, $p< 0.01$). Hence, the hypothesis that there is a significant, positive relationship between supplier management and project quality performance is supported.

A significant, positive correlation also exist between information analysis and evaluation and project quality performance ($r = 0.748$, $p < 0.01$), supporting the hypothesis that information analysis and evaluation are significantly, positively correlated to project quality performance. The results show that the relationship between teamwork and project quality performance is significant and positive ($r = 0.871$, $p < 0.01$) and the hypothesis that teamwork is significantly, positively correlated with project quality performance is therefore supported. Correlation analysis of customer focus and project quality performance indicated a significant positive relationship ($r = 0.898$, $p < 0.01$) supporting the hypothesis that customer focus is significantly, positively correlated to project quality performance. A significant positive relationship also exists between leadership and project quality performance ($r = 0.806$, $p < 0.01$); thus, supporting the hypothesis that leadership is significantly, positively correlated to project quality performance.

A strong criterion-related validity exists between the variables since the bivariate correlations of the TQM practices with performance measures were statistically significant. The highest correlation coefficients value is 0.898 which is below the cut off threshold of 0.90 for the collinearity problem (Jaafreh & Al-abedallat, 2012). The output suggests that results of the regression model will be close to true value.

***Table 3.*** *Associationbetween TQM variables and CPQP variable.*

| | EMPL | PM | SM | IAE | TWK | CF | LD |
|---|---|---|---|---|---|---|---|
| PQP Pearson Correlation | 0.896** | 0.786** | 0.627** | 0.748** | 0.871** | 0.898** | 0.806** |
| Sig (1 – tailed) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Correlation is significant at the 0.01 level (1 – tailed).PQP: Project Quality Performance; EMPL: Employee Relations; PM: Process Management; SM: Supplier Management; IAE: Information Analysis and Evaluation; TWK: Teamwork; CF: Customer Focus and LD: Leadership.

### 6.3.2. StepwiseMultiple Regression Analysis

The results of the correlations suggest the existence of a relationship between the TQM variables and the project quality performance variable but do not identify the most crucial contributory variables for this relationship. To achieve this objective, Stepwise Multiple Regression technique was used to determine the importance of each independent variable and its contribution to the mathematical equation. The multiple regressions was conducted between TQM variables namely (Employee Relations, Process Management, Customer focus, Information Analysis and Evaluation, Supplier Management, Teamwork and

Leadership) as they were the independent variables, and the Project Quality Performance variable (dependent variable).The summary of the result of the multiple regression analysis is shown in Table 4.

Table 4 revealed that the $R^2$ adjusted value was 0.895. This indicates that three out of the seven factors proposed in our framework (employee relations, teamwork and customer focus) together can explain 89.5 percent of the variation in project quality performance as a dependent variable. The F-ratio of 60.741 ($p < 0.01$) indicates the regression of project quality performance on the constructs assessed, expressed through the adjusted R- squaredis statistically significant. The independent variables that were found to contribute significantly to this relationship (a greater effect on the dependent variable) were Employee relations and Teamwork while Customer focus seemed to play a synergistic role. The beta coefficient, which is the standardized regression coefficient, is used as a direct comparison between coefficients as to their relative explanatory power of the dependent variable (Hair et al. 1998).

The variable employee relation element of TQM practices made the greatest impact towards achieving the project quality performance (dependent variable) with a beta coefficient of 0.39 ($p < 0.05$). The variable teamwork made the second largest influence of the dependent variable with a beta coefficient of 0.353 ($p < 0.05$).The variable customer focus made the third acceptable contribution to the dependent variable with a beta coefficient of 0.282 ($p > 0.05$). However, customer focus contribution was not significant. Nevertheless, customer focus effort played synergistic role to enhance the overall contribution. The results further showed that Information Analysis & Evaluation, Supplier Management, Process Management and Leadership were out of the regression model because their contributions were not much and also insignificant.

The values of VIF and Tolerance showed no multicollinearity between the variables as their values less than 10 for VIF and more than 0.10 for tolerance level as suggested by Hair et al. (1998). Another way to check it is by using the coefficient of correlation; the highest in this research is 0.898, which is below the cut- off threshold of 0.90 for the collinearity problem. Therefore, multicollinearity problem does not occur in this research (Hair et al., 1998).

The variables account for 89.5 percent of the variance in project quality performance. This implies that other unexplored variables could account for the 10.5 percent of other variance in project quality performance. The integrity of the residual plot (see Appendix B) indicated less spread out or dispersed. This implies that the model is credible and can be used to measure construction project quality performance within the data range.

***Table 4.*** *Model: Summary of Multiple Regression Analysis between TQM variables and CPQP variable.*

| **Dependent Variable** | **R** | **R-Square** | | **Adjusted R Square** | **Standard Error** |
|---|---|---|---|---|---|
| Project Quality Performance | 0.954 | 0.910 | | 0.895 | 0.950 |
| Analysis of Variance | | | | | |
| | Sum of squares | Df | Mean square | F | Significance |
| Regression | 164.521 | 3 | 54.840 | 60.741 | 0.000 |
| Residual | 16.252 | 18 | 0.903 | | |
| Total | 180.773 | 21 | | | |
| Standard Coefficients | | | | | |
| | Beta | T | Significance | Collinearity Statistics Tolerance | VIF |
| Employee Relations | 0.390 | 2.790 | 0.012 | 0.256 | 3.910 |
| Teamwork | 0.353 | 2.936 | 0.009 | 0.345 | 2.902 |
| Customer Focus | 0.282 | 1.823 | 0.085 | 0.209 | 4.782 |

# 7. Discussion of Results

## 7.1. Prioritization of Total Quality Management Practices of the Respondents

The results of the study indicated that Supplier Management (4.67) and Information Analysis & Evaluation (4.61) are given high level of priority; Teamwork (4.59), Customer Focus (4.59), Process Management (4.58), Leadership (4.57) are given medium level of priority while Employee Relations (4.53) is given low level of priority. In the case of supplier management, the mean response exceeds the assumed mean (3). The results therefore suggest that the respondents' companies encourage the usage of few suppliers who have the capability and commitment to product and service quality. There is also a closer and long-term cooperative relationship with suppliers. It is also plausible that the respondents' companies provide clear specifications to their suppliers.

The results also indicated that Information Analysis and Evaluation element of TQM rank second in terms of priority in the Ghanaian construction industry. The mean response was (4.61) exceeding the assumed mean (3) of the study. This implies that the respondents' companies 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.

The results revealed that Teamwork and Customer focus elements of TQM were third level of importance in the Ghanaian construction industry with mean response of (4.59)

each. Impliedly, the respondents' companies attach importance to specific quality committees, work teams; peer review teams and also ensures effective coordination between the various departments at projects sites. They also encourage frequent contact between parties involved in projects delivery and other functions. This study further suggests that the respondents' companies use clients' requirement as the basis for quality; encourage employees to satisfy clients, undertakes preventive and corrective actions to delight clients and also respond effectively to clients enquires and complaints.

The results further indicated that process management rank fifth in level of importance in the Ghanaian construction industry among the TQM elements examined; with a mean score of (4.58) which is more than the assumed mean (3).This implies that the respondents' companies effectively use process flowchart, inspection and test plans including checklist for activities that directly affect quality; Process instructions are also given to employees, artisans and site staff. The results indicate that leadership was accorded the next (sixth) level of importance in the Ghanaian construction industry among the TQM elements examined; with a mean score of (4.57) which is more than the mid-point (3). This means that the leadership of the respondents' companies provides policies for promoting customer satisfaction; establish clear mission, vision and plan statements that define quality values. Their leaders effectively communicate quality policies to the employees. The results also suggest that the leadership of the respondents' companies actively lead and direct the quality management programs.

The results further revealed that Employee Relations is given the less priority among the TQM elements examined; with a mean score of (4.53) which also exceeds the assumed mean of (3). Impliedly, the respondents' companies train employees on site on quality principles, tools and techniques demanded by the project; builds quality awareness among employees; empower and involve their employees in decision making and also provides technical and managerial training to sub-contractors to enhance their project quality performance.

The aforementioned results suggest that TQM implementers in Ghana attach importance to all the identified TQM elements. This finding is consistent with the literature on TQM implementation (Arditi and Gunaydin 1999; Metri 2004; Imbeah 2012; Gherbal, et al. 2012). However, they discriminate between hard and soft aspects of TQM, with a tendency to accord higher priority to hard aspect of TQM elements than the soft aspect of TQM elements. These findings further suggest that the respondents' companies have understood the importance of the TQM elements that are used as criteria for other TQM models such as the Malcolm Baldrige Quality Award, European Quality Awards and Deming Prize.

## 7.2. Relationship Between TQM Practices and Project Quality Performance

The results of the correlation test indicated that all seven TQM variables are strongly, positively correlated with project quality performance. Additionally, the result of the study showed that TQM overall is strongly significant and positively correlated with project quality performance ($r = 0.925$, $p < 0.01$). The study found that there was strong significant, positive correlation between project quality performance, and employee relations($r = 0.896$, $p < 0.01$),leadership ($r = 0.806$, $p < 0.01$), process management($r = 0.786$, $p < 0.01$), customer focus ($r = 0.898$, $p < 0.01$), teamwork ($r = 0.871$,$p < 0.01$), information analysis & evaluation ($r = 0.748$, $p < 0.01$), and supplier management ($r = 0.627$, $p < 0.01$). The result of the correlation analysis, therefore, supported all the hypothesized relationships; $H_1$-$H_7$. Interestingly, all seven TQM elements have significant influence on construction project quality performance and this implies that Ghanaian construction companies more interested in maximizing total quality improvements factors (TQIF) will likely achieve higher levels of project quality performance. This finding is consistent with similar studies on relationship between TQM practices and project quality performance (Zu, 2009; Kaynak, 2003; Ahire, Kaynak & Hartley, 2005;Jung & Wang, 2006; Jaafreh & Al-abedallat, 2012; Saeed & Hasan, 2012; Gonzalez et al., 2013; Prajogo & Sohal, 2003; Choi & Eboch, 1998).

The regression analysis suggests that the total quality management (TQM) practices at project sites of the respondents' construction companies had significant effects on the project quality performance. In terms of explanatory power, 89.5 percent of changes in the project quality performance of the respondents' construction companies is explained by the TQM practices identified (employee relations, teamwork, customer focus, leadership, process management, supplier management effort and information analysis and evaluation).The results further indicated that employee relations and teamwork were the TQM elements that contributed significantly to this relationship (a greater effect on the dependent variable), while customer focus played a synergistic role to enhance the overall contribution. Impliedly, these three TQM elements have a high explanatory power on construction project quality performance.

Employee Relations made the strongest unique contribution (Beta = 0.39, $p< 0.05$**)** to explaining variations in project quality performance, when the variance explained by all other variables in the model is controlled for. Impliedly, Employee relations had significant impact on the project quality performance of respondents' construction companies. Subsequently, $H_2$ is supported. Teamwork made the second significant contribution (Beta = 0.353, $p< 0.05$) 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 companies. Therefore, $H_6$ is supported.

Customer focus made the third acceptable contribution (Beta = 0.282, $p> 0.05$) to explaining variations in construction project quality performance, when the variance

explained by all other variables in the model is controlled for. However, customer focus contribution had no significant impact on the project quality performance of the respondents' construction companies. Nevertheless, customer focus effort played synergistic role to enhance the overall contribution of the project quality performance of the respondents firms. Customer focus is therefore, positively related to construction project quality performance but the relationship is not significant. Subsequently, $H_3$ is partly supported.

These three factors, employee relations, teamwork and customer focus are characterized as 'soft aspect' of TQM elements by Bullock and Rahman (2005). Information analysis and evaluation, supplier management and process management, in the framework are characterized as 'hard aspect' of TQM elements by Bullock and Rahman (2005);were out of the regression model because their contributions towards achieving the project quality performance were barely appreciable and insignificant. This finding is consistent with Samson and Terziovski (1999)'s study where they found no significant relationship between 'hard aspect' TQM elements and firm's performance. Clearly, soft aspect of TQM elements had greater effects on construction project quality performance than the hard aspect of TQM elements in the present study.

Employee relations (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 them 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); Fening et al. (2008) and Jaafreh and Al-abedallat (2012).

Teamwork has also been found to impact significantly on construction project quality performance. This implies that if employees demonstrate cooperative behavior 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 contacts between parties involved in projects delivery greatly improve construction project quality performance. This finding is also consistent with the reported studies by Jha and Kumar (2010); Arditi and Gunaydin (1997) and Imbeah (2012).

Customer focus has been found to deliver synergistic enhancement of quality to project quality performance. Impliedly, if a company knows the needs and expectations of the clients accurately and also use clients' requirement as the basis for quality; encourage employees to satisfy clients, undertakes preventive and corrective actions to delight clients and also respond effectively to clients enquires and complaints, the company can produce high quality, reliability and timely delivered constructed facilities that satisfy or exceed clients' expectations. Thus, a firm's neglect of its customers may greatly affect quality performance of a project. This result is also consistent with studies reported by Metri (2004); 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).

## 8. Conclusion

Data analysis for this study showed that construction companies in Ghana attach high level of priority to supplier management, and information analysis and evaluation of TQM elements; medium level of priority to teamwork, customer focus, process management and leadership commitment of TQM elements and less level of priority to employee relations of TQM elements. This therefore suggests that the TQM implementers in Ghana accord higher priority to hard aspect of TQM elements than the soft aspect of TQM elements. The study found that the identified TQM practices had positive effects on construction project quality performance of the respondents. Thus, TQM practices can enhance the quality performance of construction project by reducing the cost of poor quality, delivery time, waste, defects, rework, non-conformities and increasing the quality of project implementation. This result will assist contractors to identify the positive effects for implementing TQM practices on construction project sites in developing economies like Ghana. data analysis further suggests that soft aspect of TQM elements has higher impact on construction project quality performance than the hard aspect of TQM elements.Construction firms therefore need to develop strategies to enhance employee relations, teamwork and customer focus (soft aspect) to bring about improvements in project quality performance. Further studies could look into the effect of the barriers to TQM practices and CPQP in order to exhaust the proposed framework.

# Appendices

## Appendix A: Questionnaire

The purpose of this questionnaire is to investigate impact of Total Quality Management practices (TQMPs) on Construction Project Quality Performance (CPQP) on project sites in Ghana.

### 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 type (s) of academic or professional qualification (s) do you have? (Please tick [√] or write in the space provided)

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

(c) Bachelors Degree [] (d) Masters Degree []

Other [] Please state .....

Q4.What type of construction works does your company undertake?(Please tick [√]

(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)Below 30 years [](b) 30 - 39 years [](c) 40– 49 years [](d) Above 50 years

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

| |
|---|
| |

Q8. Does your firm have a quality improvement program? [ ] Yes,[ ] No

If Yes, please go to question 9

Q9. What type of quality improvement program do you have?

[] ISO [] Total Quality Management

[] Quality Assurance [] Quality Control

### Section B: Elements of Total Quality Management Practices

The following statement relate to the way in which you perceive Total Quality Management practices within your company. Kindly rate each of the statement on how you perceive TQM practices within your company on the following scale:

1= Strongly Disagree 2= Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

| Elements ofQuality Management | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Leadership | | | | | |
| My company provides policies for promoting customer satisfaction | 1 | 2 | 3 | 4 | 5 |
| My managers actively communicate quality policies and plans to employees | 1 | 2 | 3 | 4 | 5 |
| My managers and supervisors actively lead and direct quality management programs, assuming responsibility for evaluating and improving quality management system at pre-defined intervals | 1 | 2 | 3 | 4 | 5 |
| My managers and supervisors motivate their employees and help them perform at a higher level in their task. | 1 | 2 | 3 | 4 | 5 |
| Employee Relations | | | | | |
| My management organizes training for employees in problem identification and solving skills, quality improvement skills, teamwork and other technical skills | 1 | 2 | 3 | 4 | 5 |
| There is effective two-way communication links with employees and suppliers | 1 | 2 | 3 | 4 | 5 |
| Employees in my company are often encouraged by their supervisors to participate in decision making processes. | 1 | 2 | 3 | 4 | 5 |
| Managers and supervisors assume active roles as facilitators of continuous improvement, coaches of new methods and leaders of empowering employees. | 1 | 2 | 3 | 4 | 5 |
| Customer Focus | | | | | |
| My company uses customers' requirements as the basis for quality. | 1 | 2 | 3 | 4 | 5 |
| My company responds effectively to clients' enquiries and complaints. | 1 | 2 | 3 | 4 | 5 |
| My company encourages employees to satisfy clients. | 1 | 2 | 3 | 4 | 5 |
| My company undertakes preventive and corrective actions to delight clients. | 1 | 2 | 3 | 4 | 5 |

| Elements ofQuality Management | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Process Management | | | | | |
| My company uses flow chart, inspection and supervision and test plan for activities that directly affect quality. | 1 | 2 | 3 | 4 | 5 |
| The processes used in this company include quality measures such as testing, reviewing, inspection and checklist of incoming products or work for specification compliance | 1 | 2 | 3 | 4 | 5 |
| Clarity of work or process instruction is given to employees, artisans and site staff (these includes both employees of subcontractors & project staff) | 1 | 2 | 3 | 4 | 5 |
| My company conducts inspection and test plans, including checklist on completion of the construction project or pre-determined stage of the work. | 1 | 2 | 3 | 4 | 5 |
| Supplier Management | | | | | |
| My company offers closer and long term working relationship to suppliers. | 1 | 2 | 3 | 4 | 5 |
| My Management encourages the usage of few suppliers, emphasizing quality rather than price or schedule and also providing clear specifications to suppliers. | 1 | 2 | 3 | 4 | 5 |
| My company Places requirements upon suppliers in order to find quality specifications. | 1 | 2 | 3 | 4 | 5 |
| My company' purchasing department assumes responsibility for the quality of incoming products. | 1 | 2 | 3 | 4 | 5 |
| Information Analysis and Evaluation | | | | | |
| My company documents procedure for implementing corrective and preventive actions. | 1 | 2 | 3 | 4 | 5 |
| My company uses internal and external audits to ensure delivery of quality products and services. | 1 | 2 | 3 | 4 | 5 |
| My company reviews drawings and specifications prior to authorization for construction works. | 1 | 2 | 3 | 4 | 5 |
| My company documents procedure for reviewing non-conforming products | 1 | 2 | 3 | 4 | 5 |
| Teamwork | | | | | |
| My company uses specific quality committees and work teams to support quality improvements on sites. | 1 | 2 | 3 | 4 | 5 |
| My company establishes peer review teams on sites. | 1 | 2 | 3 | 4 | 5 |
| My company ensures effective coordination between various departments at the projects sites. | 1 | 2 | 3 | 4 | 5 |
| My company encourages frequent contact between parties involved in projects delivery and other functions. | 1 | 2 | 3 | 4 | 5 |

## Section C: Total Quality Management Results (Project Quality Performance)

Please, answer the following questions using a rating from 1 to 5, how your quality program has influenced your firm's performance.

1 = Strongly disagree, 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly agree

| Statement | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| My company has achieved reduction in quality cost | 1 | 2 | 3 | 4 | 5 |
| My company has achieved reduction in wastage | 1 | 2 | 3 | 4 | 5 |
| Mycompanydoes not experience rework | 1 | 2 | 3 | 4 | 5 |
| Mycompanydelivers projects on time | 1 | 2 | 3 | 4 | 5 |
| Mycompany has achieved reduction in defects | 1 | 2 | 3 | 4 | 5 |
| My company has achieved reduction in non-conformance. | 1 | 2 | 3 | 4 | 5 |
| Mycompany gets repeat contracts from existing clients | 1 | 2 | 3 | 4 | 5 |

## Appendix B: Residual Plot

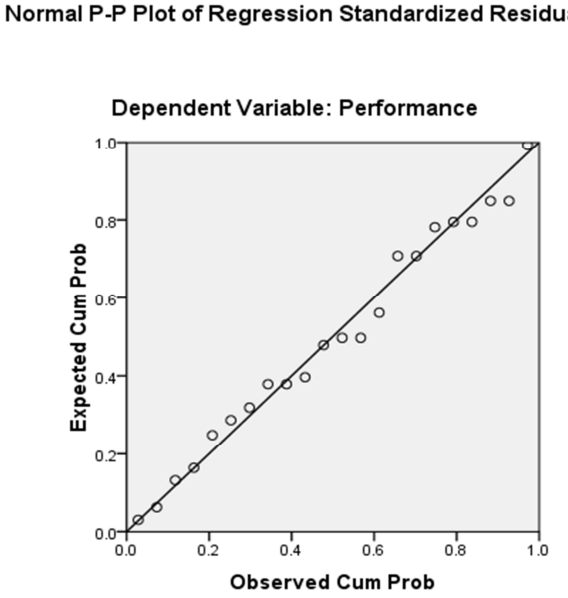


***Figure 2.*** *Integrity of residual plots*

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