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COLLEGE OF ART AND BUILT ENVIRONMENT

DEPARTMENT OF BUILDING TECHNOLOGY

**DEVELOPING A QUALITY ASSURANCE FRAMEWORK FOR PUBLIC WORKS
PROCUREMENT**

BY

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DEGREE OF MASTER OF PHILOSOPHY IN PROCUREMENT MANAGEMENT**

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DECLARATION/CERTIFICATION

I hereby declare that this work is the result of my own original research and this thesis has neither in whole nor in part been prescribed by another degree elsewhere. References to other people's work have been duly cited.

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ABSTRACT

Quality of construction is a problem worldwide. The problem is serious and evident in both developed and developing countries. This study aimed to develop Quality Assurance (QA) framework for public works procurement. The specific objectives were to identify practices and problems in works procurement; identify Critical Success Factors (CSF) for works procurement processes; and to develop a framework for enhancing quality assurance through public procurement. The study adopted both qualitative and quantitative data collection techniques. Data were obtained through questionnaire survey (N=120 distributed, n=88 received) from Works Officers, Quantity Surveyors, Architects, Quality Officers and Procurement Officers. Data analysis techniques include: descriptive statistics, factor analysis and correlation matrix. The Works Quality Assurance Framework (WQAF) was developed based on findings from literature review and questionnaire survey. The WQAF validation method includes validation questionnaire (N=5) with Quantity Surveyors, Architects and Procurement Managers. Key findings which came out from the study include: three main problems (award of contract primarily on price; single contractor buys all tender documents; and consultant acting on behalf of contractor) and three key CSFs (i.e. procurement system factors, quality related factors and contractor selection and training factors) were the determinants to enhancing quality delivery of works procurement. The developed WQAF enables the determination of the activities, problems, areas/parties for improvement and QA improvement measures for design, bid and build projects. The study recommended that quality assurance strategies should be adopted at the early stage of public works procurement. The content of the study will be of interest to major stakeholders of public procurement, educational institutions, construction professionals and contractors.

Keywords: Public Procurement, Quality Assurance, Works, Ghana

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DEDICATION

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LIST OF ABBREVIATIONS

| | |
|--------------|--|
| ABCECG..... | Association of Building and Civil Engineering Contractors of Ghana |
| ARCH..... | Architect |
| BCA..... | Building and Construction Authority |
| BEDC..... | Building Economic Development Council |
| BRE..... | Building Research Establishment |
| CE..... | Concurrent Engineering |
| CoE | Colleges of Education |
| CSF..... | Critical Success Factors |
| DTI..... | Department of Trade and Industry |
| EC..... | European Communities |
| EU..... | European Union |
| GETFund..... | Ghana Education Trust Fund |
| GSA..... | Ghana Standards Authority |
| IGF..... | Internally Generated Fund |
| MoE..... | Ministry of Education |
| NEDO..... | National Economic and Development Office |
| NSWG..... | New South Wales Government |
| PDCA..... | Plan-Do-Check-Act |
| PE..... | Procurement Entity |
| PO..... | Procurement Officer |
| PPA..... | Public Procurement Authority |
| PWGS..... | Public Works and Government Services |
| QA..... | Quality Assurance |
| QFD..... | Quality Function Deployment |

| | |
|-----------|-------------------------------------|
| QS..... | Quantity Surveyor |
| TRIZ..... | Theory of Inventive Problem Solving |
| WO..... | Works Officer |
| WP..... | Works Procurement |
| WPP..... | Works Procurement Process |
| WQAF..... | Works Quality Assurance Framework |

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Quality assurance is receiving increasing attention worldwide in recent times (Ahmed et al., 2005). It has advanced from a manufacture-centred discipline to one with broad management implications across all industries and professions (Chung, 2002). Clients and stakeholders in the global marketplace now look forward to organizations that meet or exceed customers' expectations. This demand led to concepts like Quality Function Deployment (QFD) (Martins and Aspinwall, 2001), the Theory of Inventive Problem Solving (TRIZ) (Mann, 2001) and Concurrent Engineering (CE) (Yassine and Braha, 2003) as a means of translating Voice of Customers into product features.

Walker (2002) distinctively characterized the construction industry as unique in terms of natural (diverse weather each time), task (e.g. diverse project each time), organizational (e.g. diverse team for each project) and contractual (e.g. diverse arrangement for each project). For these reasons the strategies in the manufacturing industry could not be replicated in the construction industry. The quest for improvement led to the Transformation, Flow and Value Generation Theory (TFV) (Koskela, 2000), Lean Project Delivery System Model (LPDSM) (Ballard and Howard, 2003) and Customer Requirements Processing Model (CRPM) (Kamara et al., 2000) which all sought to add value to the construction process, thus enhancing customer satisfaction in the industry.

FIDIC (2005) confirmed that construction quality is an issue worldwide. The problem is severe and apparent in both developed and developing countries. Lack of construction quality is made manifest in poor or non-sustainable workmanship and unsafe structures. The problems emanating from diverse countries led to the development of Building and Construction Authority (BCA) of Singapore under the BCA Act with functions to promote standardization and enhancement of construction techniques and materials; promote the adoption of internationally recognized quality management systems. In addition, Construction Industry Development Board of Malaysia under an Act in 1994 functions to maintain quality assurance in the built environment industry; promote standardization and enhancement of techniques and materials of construction and to accredit and certify skilled workers and construction site supervisors among other functions (Ofori, 2012).

In Ghana, irrespective of one's financial class, contractors are faced with challenges such as poor workmanship, insufficient engineering capacity, inadequate management and inability to secure adequate working capital (Ofori, 2012). Ghanaian consultants encounter problems as poor quality of work, low productivity, inadequate flow of jobs, low level of fees, etc. As a result, the performance of industry, in respect of cost, time, quality, safety and health of workers, durability of products and the satisfaction of stakeholders, is woefully inadequate (Ibid). For instance, in the UK, the Department of Trade and Industry (2003) reported that construction customers were not entirely satisfied with the products of the sector. Olugbenga et al., (2013) linked customer satisfaction to procurement system. It was mentioned that no procurement systems could be called 'the best' but one can be better than the other in terms of specific performance. The renowned

system of procurement is the traditional system where lowest price has been the core determining factor. Bottommost bidder acceptance is the elementary reason for inherent negative issues in completion of projects since low price quoted by bidders means low quality of structures (Huang, 2011). Section 59(3)(a) of the Public Procurement Act, 2003 (Act 663) postulate that, winning tenderer will be the bidder with the lowermost evaluated bid price. This does not differ from countries like Nigeria (Idrus et al., 2011), China (Huang, 2011), and Netherland (Favie et al., 2007).

Government as a key stakeholder in the construction industry has been making various efforts to improve public works performance (Dewi, 2011). However, the efforts have not shown significant impact to the project performance improvement (Ibid). Chung (2002) admitted that the construction industry has been sluggish to clinch to the ISO 9000 concepts of quality assurance in its practice. However, there is a drive especially in the public sector towards engaging only quality certified contractors for new projects (Chung, 2002). Additionally, without appropriate and correct method for selecting the most suitable contractor, the performance of the project will be affected (Cheng and Heng, 2004), thereby denying the client value for money.

To address this problem, practitioners, researchers and governments have attempted to improve quality by developing models, frameworks and methodologies (Delgado-Hernandez, 2006). However, focus has been on one or two issues of quality only, For instance, partakers' responsibility or communication, (Kagioglou et al., 2000) or on particular types of project e.g. real estate, etc. or on particular participant e.g. contractor, consultant, etc (Dewi, 2011).

This study therefore, sought to review quality assurance practices thus identifying problems with public works procurement; to identify critical success factors that greatly influence quality assurance and develop a framework through public procurement to enhance quality assurance.

1.2 PROBLEM STATEMENT

The assurance of quality in projects is indicated by the dynamic requirements of users. Product quality is not introduced by the builders rather it is adapted to suit consumer's prospect (Tam et al., 2000). Nowadays, clients are adequately aware of the data from the building trade, as a result, it is gradually demanding in terms of quality in the direction of their likely buying as customers demand value for money. This has a shift of concentration from costs to quality in construction process. In order to provide and assure customers with the product being purchased, the building constructed must meet or conform to lowest fulfillment level of construction quality (Ofori and Gu, 2001).

It is against this backdrop that the study seeks to review quality assurance practices and identify problems of public works procurement; identify critical success factors influencing quality assurance and develop quality assurance framework for public works procurement.

1.3 RESEARCH QUESTIONS

1. What are the current quality assurance practices and problems associated with public works procurement?
2. What are the critical success factors that have impact on quality assurance in public works procurement?
3. What framework can be developed to improve quality assurance in public works procurement?

1.4 AIM

The study aims to develop a framework for safeguarding quality assurance for public works procurement.

1.5 OBJECTIVES

The study wanted to achieve the following objectives:

1. To evaluate the current quality assurance practices and to identify problems related to public works procurement;
2. To identify critical success factors for quality assurance in public works procurement; and
3. To develop a quality assurance framework for public works procurement.

1.6 SIGNIFICANCE OF THE STUDY

Most institutions in Ghana are faced with the challenge of quality delivery in construction projects. This study developed a framework for improving and managing quality delivery in public works procurement. The findings in this study will be important for various

reasons. Firstly, they will provide data for future institutional and policy framework analysis, procurement audit and development regarding quality of public works procurement. Secondly, Management of institutions, stakeholders and procurement practitioners in the public sector would be enlightened on the need to be accelerators/facilitators of quality compliance thus, achieving value for money. Thirdly, it will constitute an important addition to the professional knowledge base to facilitate and give direction to future research in public procurement management.

1.7 SCOPE OF THE STUDY

This study was focused on the public sector educational institutions with particular focus on Colleges of Education to review current quality assurance practices and problems associated with execution of public works procurement and develop a quality assurance framework for its improvement.

The research covered Colleges of Education in Central and Western (CenWest), Eastern and Greater Accra (EGA) and Ashanti and Brong Ahafo (Ashba) regions of Ghana. The reasons for the selection of these clusters were that the researcher was conversant with the areas and they represented clusters with the largest number of colleges. The study involved key stakeholders like Ministry of Education (MoE), Ghana Education Trust Fund (GETFund), Ghana Standards Authority (GSA) and Public Procurement Authority (PPA). At the Colleges of Education level, Procurement Officers and Works Officers were the target group. Also, relevant personnel of construction companies (Quality Officers) and consulting firms (Quantity Surveyors and Architects) were questioned for

their input into the study. These target groups served as the key source of information on the issue under consideration.

1.8 RESEARCH METHODOLOGY

A methodology is referred to as a guide to conduct a study within the perspective of a particular paradigm. It entails the underlying sets of ideas that guide a researcher to choose one set of research methods over another (Sarantakos, 2005). The research questions required an overview of the current practices and problems of quality assurance in works procurement. As such primary and secondary data were collected. The secondary data source was collected via critical evaluation from relevant literature, internet sources, books, etc to examine the theoretical base of the practices and problems of quality assurance in general and in relation to works procurement.

The primary data adopted qualitative and quantitative approaches. The initial stage of the study adopted quantitative approach using questionnaires to solicit for information from study sample. One hundred and twenty (120) respondents (typically Procurement Officers, Works Officers, Quantity Surveyors, Architects and Engineers) received questionnaires on behalf of Colleges of Education, consulting firms and construction companies. The research strategy used were stratified, purposive and census sampling. The next stage adopted qualitative approach which involved the use of semi-structured interviews to identify problems that affect quality; success factors and improvement measures that can be adopted to improve quality practices in CoEs in Ghana. The major stakeholders included Public Procurement Authority, Ministry of Education, Ghana Standards Authority, and consulting firms which were purposively selected for the

interview. The responses were transcribed and analysed. Out of the 120 distributed to respondents, 88 were retrieved representing 73%. Statistical Package for the Social Science (SPSS) was adopted in analyzing facts using descriptive statistics and factor analysis.

1.9 ORGANISATION OF THE STUDY

The study consisted of five chapters: these are introduction, review of relevant literature, research methodology, empirical research (data presentation and analysis) and conclusions and recommendations.

Chapter one gave account of the background to the study. It included problem statement, research questions, aim and objects of the study, scope and significance of the study. The chapter concluded with a brief report on the research method to be adopted and organization of the study.

Chapter two presented detailed information about the concept of quality, quality assurance and construction quality assurance. It defined quality assurance in different perspectives, identified practices and problems associated with quality. Critical success factors for quality assurance implementation were identified through literature and pinpointed with the stage of the procurement process for its applicability and implications in respect of quality assurance. Finally, analysis was made on the various initiatives to improve quality and quality assurance and conclusions drawn for adoption into the formulation of the new framework.

Chapter three entailed a description of the research methods used in this study. The section focused on the methods that were used in conducting the empirical research,

namely quantitative, qualitative, and mixed approaches. Chapter four dealt with the empirical data collected from the field and answers various questions raised by the objectives. Chapter five concluded on the findings of the research and the fulfillment of the objectives. It gave a general outlook of the developed system.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The literature review first considered the overview of works procurement highlighting its definition. Public procurement, works procurement, procurement systems including tendering procedures are also discussed. The level of clients' confidence for project success is looked at by identifying critical success criteria from literature. Quality, quality assurance and construction quality assurance are then discussed in more detail, finally best practices of quality improvement initiatives appropriate and relevant to the study are reviewed and discussed leading to the development of the QA framework.

2.2 OVERVIEW OF WORKS PROCUREMENT

Procurement has always been one of the vital functions of governments all over the world. It is pivotal to government delivery service scheme, and enhances objectives which are, debatably, subordinate to the main object of procurement. For instance, procurement to encourage social, industrial or environmental policies (Cane, 2005). It exists to identify supply market openings and to instrument resourcing policies that carry the finest supply result to the organization, its investors and clienteles.

Procurement has gone through rigorous elaborations for its definition. There has not been such long standing one definition for procurement. Attempted definitions by authors and researchers have been posited. The Arizona Procurement Code (2004) defined procurement as:

- *Means of buying, purchasing, renting, leasing or otherwise acquiring any materials, services, construction or construction services.*
- *Includes all functions that pertain to obtaining any material, services, construction or construction services, including description of requirements, selection and solicitation of sources, preparation and award of contract, and all phases of contract administration.*

Whiles Ribeiro (2009), Transparency International (2006), Palaneeswaran et al., (2003) and Kerzner (2006) expressed procurement as the process through which a project team or contract partners comes to conclude one or several contracts through needs assessment, preparation, award, implementation/administration and close-out of contracts for goods, works and other services.

2.2.1 Definition of Works Procurement (WP)

Works are defined as the output of building or civil engineering, taken as a whole that is adequate of itself to fulfill a fiscal and technical function (EU Guidance, 2009). Works means work associated with the building, rebuilding, renovation and flattening of a structure or surface and includes site preparation, excavation, erection, assembly, installation of plant, fixing of equipment and laying out of materials, decoration and finishing, and any incidental activity under a procurement contract (Public Procurement Law, 2003; Act 663). It can be deduced from the above that works and construction can be used interchangeably. In this study, the two means the same.

Rwelamila (2010) identified the definition of construction procurement as an organizational arrangement labels the responsibilities of sponsors, the dealings between

them, their individual responsibilities, the order of activities and control of procedures vital for the provision of a facility. This requires the entire procurement procedure to be well understood by the players: administration, the procuring individuals and the business community/suppliers and other stakeholders, including professional associations, academic entities and the general public (Odhiambo and Kamau, 2003).

Construction procurement system has developed into something common with industry players and academia. The definition by Rwelamila also indicates the importance of the stakeholder role and relationship in construction procurement. In principle, it comes out with the overall structure of tasks and authorities for members within the building route, and is a vital feature aiding job accomplishment and hence sponsor fulfillment. The deliberation on the definition continues unabated, but these definitions of procurement depend on the perspective of the individual researcher on how purposively that reconciles with his or her interest.

Procurement may include actions and procedures before and after the signing of a contract. In another view, PWGS Canada (2014) highlights procurement phases as pre-contract, contracting, contract management and postcontract phases.

In Ghana, the PPA, 2003 (Act 663) provides the legal framework for public works procurement. It is supplemented by standard bidding documents and by a procurement manual developed for training purposes and also as a guide to practitioners. There are, therefore, numerous legislative frameworks that govern the auditing of the public accounts and procurement in Ghana as embedded in Article 187 to 189 of the Constitution, Audit Services Act, 2000 (Act 584), The Financial Administration Act,

2003 (Act 654) and The Internal Audit Agency Act, 2003 (Act 658). The public procurement law of Ghana to some extent ensures that public procurement is carried out in accordance with the principles of economy, efficiency, and transparency.

2.3 Stakeholders Involvement

Malpractices in public procurement could be restricted via the engagement of civil society organizations to be members of the procurement procedure. Furthermore, early involvement of stakeholders enables projects to make use of the knowledge base of the stakeholders (Mitropoulos and Howell, 2002). It has been emphasized that early stakeholder involvement during the project definition phase is one of the cornerstones of value creation (Wikström et al., 2010). Involvement of stakeholder will encourage civil society to be more conscious about decisions they make. It does provide civil society the chance to hold their leaders responsible thus upgrading the capability of government institutions, reduce fraud and waste of public finances, reinforce the organization of natural resources and ensure better delivery of service.

Moreover, the safety of every construction structure and the satisfaction of the stakeholders depend on the construction quality. Stakeholder engagement has been reiterated to be an important factor that influence quality (Joaquin, et al, 2010; Leonard, 2008; Chan and Tam, 2000; Marosszeky et al., 2002; Gransberg and Molenaar, 2004; and Yang, 2010). Stakeholders need to adopt measures in order for workers' to be committed to quality improvement initiatives. Effective relationships among key stakeholders (Wang and Huang, 2006) are needful in improving quality of construction projects.

2.3.1 Colleges of Education (CoE), Ghana

By the enactment of the Colleges of Education Act, 2008 (Act 778) which was given a Presidential assent in 2008, the thirty-eight public Teacher Training Colleges in the country were upgraded to the tertiary status and named Colleges of Education. As tertiary institutions, they now operate under the National Council for Tertiary Education (NCTE) instead of the then Teacher Education Division (TED) of the Ghana Education Service. The Colleges of Education moved from certificate awarding institutions to diploma awarding institutions. The Affiliation University of All Colleges of Education in Ghana is University of Cape Coast (NAB, 2009). Colleges of Education setup is aimed to further build up the country's human resources and advance academic standards of education institutions. In 2012, the Colleges of Education were given legal recognition as tertiary institutions by an Act of Parliament (Act 847). With the elevation of the Colleges of Education in Ghana to tertiary institution status, better education management with emphasis on assuring quality assumes centre stage. The colleges will enjoy institutional autonomy but will also be held accountable for performance. The continuing existence of a College of Education will be contingent on the quality of its operations, infrastructure and also ensuring that minimum acceptable standards are in place in the institution. The Colleges of Education are grouped into clusters of 5 as shown in the table below:

Table 2.1: Cluster of CoEs, Ghana

| Zones | Number of Colleges |
|--------------|---------------------------|
| EGA | 8 |
| VOLTA | 7 |
| CENWEST | 6 |
| ASHBA | 10 |
| NORTHERN | 7 |
| Total | 38 |

Source: Colleges of Education Act, 2008 (Act 778)

2.4 PARTICIPANTS IN WORKS PROCUREMENT (WP)

Delgado-Hernandez (2006) identified five participants to be involved in the construction industry as owner/user, client, contractor, supplier and professional. The Public Procurement Act, 2003 (Act 663) identified participants in the procurement process to include Procurement Entity (PE), Contractor/Supplier and Consultants/Professional.

It is important to note that the PE may be the client, owner and/or user of the finished facility. Act 663 defines PE as any entity conducting public procurement to accomplish the objectives of the Act. Clients are described as the originators or initiators of the construction process (Kamara et al., 2000) and stakeholders who might provide the funds for the project. PE might either be the funding agent or not. Works undertaken by PE's are mostly funded by the Ghana Education Trust Fund (GETFund) or Internally Generated Funds (IGF). Their main interests include: the clear communication of their current and future needs to the professionals and the receipt of the product on time, of

good quality and that satisfies their wishes. Their main constraints are: the willingness of the client to listen to their needs, and the skills of designers and the contractor to translate their needs into a product that satisfies their requirements. Users need to avoid complaining at the end of the building procedure because the final product does not satisfy their wishes.

Consultants may include a team of architects, quantity surveyors, civil, mechanical and electrical engineers with the responsibility for the developmental work. Indeed, appropriate and capable project consultants are fundamental to the success of a project (Chinyio and Olomolaiye, 2010). Among their interests are: to design a quality facility on time and within budget and to exceed clients' expectations. They also have two main constraints: the contract with the client and relevant regulations and codes. These "players" want to avoid: the postponement of a project because of high bids or unqualified contractors, the construction of a poor quality product, and errors and omissions in their designs.

The contractor is responsible for building the facility in question. The Ministry of Water Resource, Works and Housing group contractors into eight categories (A, B, C, S, D, K, E and G) according to the type of works they undertake. Their main motivations for taking part in a project are: to make a profit, to finish the job without delays and under budget, and to produce a quality product which will encourage repeat business with the client. The contractor wants to prevent under bidding, doing re-work without being compensated and delays, which cause extra operating costs. Suppliers are in charge of providing the materials and components to carry out the construction work. Suppliers are hired by contractors to provide the needed materials for the construction work. Among

their interests are: to supply quality products on time and to repeat business with contractors. Their main constraint is the contract with the contractor. These “players” want to avoid supplying poor quality products that are the causes of problems later in the construction process.

2.5 WORKS PROCUREMENT PROCESS (WPP)

Building and civil engineering are the two categories of works procured in the construction industry (DTI, 2003). Building construction deals with the construction, improvement and maintenance of buildings whilst civil engineering refers to the construction of structural facilities such as dams, bridges and roads (Delgado-Hernandez, 2006). There are six activities connected to works procurement process according to the British Standards Institution (2010), namely: establish what is to be procured; decide on procurement strategies; solicit tender offers; evaluate tender offers; award contract; and administer contracts and confirm compliance with requirements. NSW (2005) identified six steps to construction procurement namely needs analysis, funding approval, project procurement plan, service provider selection, contract management and procurement evaluation. Simply put, Austen and Neale (1984) reported five sequential stages as briefing, designing, tendering, construction and commissioning.

2.5.1 Procurement System

A procurement system maps the key means by which the project objectives are to be attained (NSW, 2005). Cheung (2001) suggested that procurement system includes the organizational arrangement of project participants and project stages to achieve the project objectives, and is critical for determining the overall structure of responsibilities and influence for participants within the building process.

Masterman (2002) attempted in categorizing procurement systems into four broader types: Separated systems; Integrated systems; Management oriented systems; and Collaborative systems. Separated system is often referred to as the traditional procurement system. The distinctive characteristic of the separated system is the rigid division of the design and construction process as different elements (Cox and Clamp, 2003; Walker and Rowlinson, 2008). In general, the competitive bidding process emphasises cost at the expense of value and the result is a problem with delivering project quality (Walker and Hampson 2003; Hampson 2005).

The non-traditional procurement systems are diversified strategies that not only consider design and construction, but also financing, operating and facility management (Masterman, 2002). Three types identified include integrated, management-oriented and collaborative/discretionary procurement strategies (ibid). Lam et al., (2008) believe that the non-traditional procurement strategy is proving to be successful in overcoming the hurdles inherent with the traditional strategies. The distinct feature of such recognition of non-traditional methods is early contractor involvement during the design (and development) process (Gamage, 2011).

Table 2.2 illustrates this classification with most common arrangements belong to each category.

Table 2.2: Category of Procurement System

| Category | Variants |
|--------------------------------|---|
| Separated systems | Lump sum, Measure and pay, Prime cost |
| Integrated systems | Design and build, Package deal, Turnkey, Develop and construct, Novated design and build, Concession contracts, All-in contracts |
| Management oriented Systems | Construction management, Management contracting, Design and manage |
| Collaborative systems | Partnering, Joint ventures, Alliancing, Voluntary arrangements |

Source: Shiyamini et al. (2005)

2.6 CONTRACTOR SELECTION FRAMEWORK

It is complex to select a suitable contractor. A study of UK construction industry indicated that some of the current practices are characterized by major weaknesses. Some frameworks have been developed to assess contractors' bids and select the most appropriate one. Among these frameworks are the Cost Consideration Framework (Lo et al., 2009); Prequalification Method (Palaneeswaran and Kumaraswamy, 2001); Multi Criteria Evaluation Models (Liu et al., 2010; Zavadskas et al., 2008; Alarcon and Mourgues, 2002); Value Procurement (Kashiwagi, 2010); and Most Economically

Advantageous Tender (MEAT) (EC, 2002; EU, 2004; Lambropoulos, 2007; RWS, 2006). In Ghana, the commonest framework used is the cost consideration framework.

2.6.1 The Cost Consideration Framework

Cost consideration has long been the main evaluation factor for the selection of a contractor (Huang, 2011). The winning bid will be the bid with the lowest evaluated tender price irrespective of the method of procurement adopted. Lo et al. (2009) indicate that the lowest price procurement is typically awarded the contract, and in this scheme the contractor's ability to control the project schedule and quality is generally not taken into account. In the lowest price procurement, to be successful in bidding, many contractors may tend to reduce their quote by reducing the quality of work (Lo et al. (2009). The contractor later makes financial claims after initiating construction which could negatively impact the quality of projects result. The weakness of a low-bid system is that it depends too heavily on price to evaluate contractors' competitiveness (Qin et al., 2010).

Even though the lowest bidder system protects the public from inappropriate practices, it has disadvantages. These include irrational low bids either accidentally or deliberately or unqualified contractor which cause extensive delay, cost overrun, quality problems and increased number of disputes (Huang, 2011). Over the years some amendment to the lowest bidder system were made, such as reasonable bidder, public interest and prequalification list which open the door to other evaluation methods to be adopted instead of the single criterion system lowest bidder system.

2.6.2 Most Economically Advantageous Tender (MEAT)

MEAT tenders enable value based procurement at tenders, introduced to European legislation in 1993 (EC, 2002). However, it has only been applied frequently in recent years. Today's EU legislation on public work tenders, directive 2004/18/EC, allows the award of a contract to be based on two award criteria only: 'lowest price' or 'most economically advantageous tender' (EU, 2004). These enable selection of contractors, based on their financial and technical capability to complete the project, which makes it possible to exclude parties at an early stage before bids are being prepared (Lambropoulos, 2007). In addition to price, MEAT tenders take in account performance and quality criteria (RWS, 2006):

1. *Price criteria have a direct relation with price, e.g. the tender price.*
2. *Performance criteria are expressed performance units, which can be directly translated into a monetary value. E.g. shortening the project duration with 5 weeks à € 20,000 per week, results in a MEAT value of € 100,000.*
3. *Quality criteria are valued by scores or mutual comparison among the bids. The final score of a bid can be expressed in a monetary value, score or value-price ratio.*

The monetary value is most common in the Dutch construction sector (Dreschler, 2008). For this, scores on value criteria (performance and quality criteria) are expressed in monetary scores, resulting in fictive discounts for good performances on value criteria and penalties for poor performances. Monetary scores are used to calculate the virtual tender price by deducting the tender price with discounts and penalties (RWS, 2006). The bid with the lowest virtual tender price gets the contract awarded.

2.7 CONTRACTOR SELECTION CRITERIA

One of the major difficulties associated with procurement selection is that no mutually exclusive sets of criteria uniquely and completely determine the appropriate procurement method for a specific project (Skitmore and Marsden, 1988; Love et al., 1998) and this generates the need to follow a systemic way for the selection of the criteria for the particular project. Selection criteria and processes are directly connected to project success and attainment of project objectives (Meland, 2000). The success criteria focus on objectives such as expertise, key personnel, availability of required technology, technical background, and communication skills (Fortune and White, 2006; Park, 2009; Zwikaël and Globerson, 2006).

Practices of project management, however, emphasize qualitative aspects in the selection of contractors such as key personnel, past project performance, company standing (reputation), and technical expertise (Watt et al., 2010). Despite numerous efforts to establish a universal set of selection criteria, the issue continues to plague both theory and practice (Holt, 2010; Watt et al., 2009). Bid price has been a major criterion for selecting contractors (Sarkis et al., 2012; Soenmez et al., 2001; Manideepk et al., 2009).

Waara and Brochner (2006) have stated that when awarding contracts owners should apply non-price criteria, such as quality provisions, technical solutions, and environmental policy and service, as a supplement of the price criteria. Luu et al. (2008) have added that the critical factors affecting a contractor's competitiveness in China, besides bidding price, are project management, organization structure, resources, competitive strategy, relationship, marketing, and technology. Bid evaluation procedures involve different types of criterion to evaluate the overall suitability of contractors such

as: general, technical, managerial, and financial criteria (Hunt et al., 1966); financial stability, managerial capability and organizational strength, technical expertise and experience of comparable construction (Merna and Smith, 1990); relevance of experience, size of firm, and safety record (Moselhi and Martinelli, 1990). Dennis (1993) suggests the financial strength to sustain the cash flows likely to arise during the project; experience of the similar nature of projects, competency and plant capacity to complete the project within the constraints of the likely contract; technical capability (including human resources) sufficient to satisfy the requirements of the contract; a complete understanding of similar project scopes and ability to absorb subsequent changes; the facilities (testing, quality control, etc.) necessary to endorse assurance of quality; and comply in all respects with health and safety regulations. Overall financial standing, technical ability, management capability were the main criteria identified based on studies such as (Plebankiewicz, 2009, Soenmez et al., 2001, Huang, 2011, Manideepk et al., 2009).

In Ghana, the procurement entity sets up an evaluation committee to evaluate and compare the tenders that have been accepted in order to ascertain the successful tender in accordance with the procedures and criteria set out in the invitation documents. At the opening of tenders, the tender opening form should be completed noting name of the tenderer and the total bid of the tender, and other relevant forms such as business registration certificate, contractor classification (i.e. D1K1), SSNIT certificate, VAT clearance certificate, labour certificate, etc.

Evaluation of bids are subdivided into two stages; *preliminary evaluation*, which means examination for substantial responsiveness of bids including their commercial

responsiveness, their technical responsiveness and their overall responsiveness and *detailed evaluation* and comparison of bids. The purpose of the preliminary examination of bids is to identify and reject bids that are not substantially responsive to both commercial and technical requirement of the bidding documents. Bids that pass preliminary examination are subject to detailed examination, thereafter, compared and award given to the lowest evaluated tender.

2.8 QUALITY PRACTICES

Quality management became a major concern in construction in the 1990s because companies that could not ensure a quality product could no longer participate efficiently in the marketplace (Harris and McCaffer, 1995). Quality was quickly becoming as major a selective factor as price had been traditionally. Quality management in construction implies to keep the quality of construction works at the required minimum standard in order to obtain customers' satisfaction that promotes long term competitiveness and survival of businesses (Tan and Abdul-Rahman, 2005). The progression of the quality movement has been alienated into four stages: inspection (I), quality control (QC), quality assurance (QA) and Total Quality Management (TQM). The study looked at quality assurance in the perspective of public works procurement.

2.8.1 Definition of Quality Assurance in Construction

Quality assurance is defined as a set of measures designed to ensure that quality standards and processes are adhered to, that the final product meets or exceeds the required technical and performance requirements. ISO (9001) defined quality assurance as that part of quality management focused on providing confidence that quality requirement is fulfilled. Quality Assurance (QA) is a management method that is defined as “*all those*

planned and systematic actions needed to provide adequate confidence that a product, service or result will satisfy given requirements for quality and be fit for use". Quality Assurance programme is defined as *"the sum total of the activities aimed at achieving that required standard"* (ISO, 1994). Quality assurance is an organization's guarantee that the product or service it offers meets the accepted quality standards (Eurostat, 2010). It is that component of quality management *'focused on providing confidence that quality requirements will be fulfilled'* (ISO, 9000). In short, quality assurance is oriented towards *prevention* of quality deficiencies. It aims at minimizing the risk of making mistakes in the first place, thereby avoiding the necessity for rework, repair or reject. In the spirit of quality assurance, inspection and testing is carried out mainly by the contractor. Because of this, customer satisfaction survey could also be a tool for quality assurance. It also enhances productivity because it stresses the integration of quality into the initial stage rather than at the final control stage (Dale, 2003).

Quality assurance by way of a well-structured quality system avoids problems and improves efficiency, resulting in high productivity and client satisfaction. Nevertheless, the architect/engineer can exercise control through the hold points and witness points of the inspection and test plans (ITPs). He may also retain the authority of approval at the hold points where appropriate. A witness point is when the presence of an authorized person, such as someone from the architect's/engineer's office, is essential during the inspection or test. A hold point is when the approval of the authorized person is required before the work can proceed. The final inspection/test of a certain stage of work is always a hold point: the completed part of work is not allowed to be built upon or covered up until the authorized person is satisfied with its quality and releases the hold. The

architect/engineer, acting as the client's representative, can make use of witness points and hold points to monitor the verification activities of the contractor. It is here that the quality control efforts of both parties are integrated. The architect/engineer or somebody authorized by him (Clerk of Works) will either witness the inspection or test (witness point), or in addition give permission for the work to proceed (hold point) if he is satisfied with the quality of the work so far.

If consistent quality assurance is to be achieved, all staff in the organization must:

- *know what their authorities are*: have suitable organization structure, clear lines of responsibility and communication;
- *know what their duties are*: have clear definition and description of duties;
- *know what to do*: have correct specifications and drawings;
- *know how to do it*: have proper training, appropriate procedures, ready access to necessary instructions;
- *want to do it*: have proper motivation;
- *be able to do it*: have the right resources, plant and materials;
- *know that it is done*: have appropriate checking, measurement or testing of products;
- *record that it has been done*: keep proper records, specified certificates (CIRIA, 1989).

To assure quality, quality implementation must start at the beginning (input stage), during (inprocess) and at the end (finished goods) of the production process (Ab. Wahid, 2006). In summary, quality assurance is oriented towards *avoidance* of quality deficiencies. It aims at minimizing the risk of making mistakes in the first place, thereby avoiding the necessity for rework, repair or reject.

2.9 PROBLEMS IN CONSTRUCTION QUALITY

The perspective of the construction industry in terms of quality is poor compared to the manufacturing sector, etc. (Kubal, 1994; Kanji and Wong, 1998; Wong and Fung, 1999). Criticisms had been pointed to the construction environment due to the workmanship performance, construction processes, the organizations involved, the materials (Wan Mahmood et al., 2006). Moreover as supported by many scholars (Jha and Iyer, 2006; Leonard, 2008 and Yung and Yip, 2010), impediments which most often end up in repetitive quality defects in construction building projects is the lack of project participant interest in quality planning and practices. Griffith and Sidwell (1997) stressed that the planning phase has the highest ability to influence the project quality. Generation of requirements of projects for quality begins at the project planning phase as substantiated by Arditi and Gunayin (1997). Leszaka (2002) added that attaining higher quality in the early phases of a project results in fewer defects and repair in the later parts of the process.

Darwish (2005) identified factors that influence quality at the design stage as inadequate design brief, repetitive design reviews by the owner, lack of understanding of client's requirements, unstable client's requirements, insufficient overall design time, last minute changes by client and consultants copy from previous work to minimize cost and time as

challenge at the design stage of the process. Oyedele et al. (2012) also identified poor client briefing, design changes, poor specification, lack of constructability, inadequate technical knowledge and lack of design code and standards on quality to affect design. Serpell et al. (2002) reported that owners had a short term mentality, limited knowledge of quality, poor definition of needs, unwillingness to assume the costs of their requests and they asked for too many requirements. Pheng and Peh (1996) identified poor workmanship, unclear drawings and specifications, cost and schedule constraints, lack of coordination, lack of buildability, lack of contractor's involvement in design and planning activities, unrealistic completion periods and lack of codes and standards as leading to rework and delays. It is recorded in instances that single contractor buys and price all the bidding documents, and the contractor/supplier, process the documents under different contracting proposals Crown Agents (1998) and Westring (1997).

These mistakes may be linked back to the buying of incorrigible or incompatible materials and the refusal to retrieve the out of date drawings (Kettlewell, 1990). Wai-Kiong and Sui-Pheng (2006) also identified poor quality workmanship as a defect occurring during the construction phase. In the United Kingdom, Egan (1998) also highlighted: a low and unreliable rate of profitability, little investment in Research and Development activities, a crisis in training and a lack of quality because too many clients still equated price with cost. BBC (2013), Boley (2009) and Purohit (2013) reported poor quality construction material to be the cause of collapse of Bangladesh factory, Diera building and Mumbai Mazgaon building respectively. Construction materials at times do not meet particular standards and this also leads to inferior quality on projects (Pheng and Wei, 1996). According to Pheng and Wei (1996) lack of knowledge of quality issues by

contractors is a major factor affecting quality negatively. Contractors do not have adequate skills to interpret the design drawings so they are not able to give the end products on site in accordance with the design and specifications and it is also argued that due to the lack of knowledge to establish a quality system, contractors cannot control the work properly (Pheng and Wei, 1996; Jha and Iyer, 2006).

Various studies undertaken by Alman (1989), Smallwood and Rwelamila (1998) and Smallwood (2000) identified barriers dominant to the achievement of quality as: (1) design related factors: inadequate details and inadequate specifications, and poor design coordination; (2) procurement related factors: including emphasis on time and budget, shortened project periods, lack of pre-qualification, competitive tendering and awarding of contracts primarily on price; and (3) construction related factors: including skills shortages and insufficient workforce training, lack of management commitment, and lack of strict quality control. However, corruption is being pinpointed as one of the major barriers to achieving construction quality in South Africa.

Table 2.3: Problems of Quality in Works Procurement

| Source of Reference | Problems of Quality |
|-----------------------|--|
| Darwish (2005) | Inadequate design brief, repetitive design review by the owner, lack of understanding of client's requirements, unstable client's requirements, last minute changes by client and insufficient overall design time |
| Oyedele et al. (2012) | Poor client briefing, poor specification, lack of design |

| | |
|--|---|
| | code and standards and inadequate technical knowledge |
| Serpell et al. (2002) | Limited knowledge of quality and poor definition of needs |
| Pheng and Peh (1996) | Poor workmanship, unclear drawings and specifications, cost and schedule constraints, lack of coordination, lack of contractor's involvement in design and planning activities, unrealistic completion periods and lack of buildability |
| Crown Agents (1998) and Westring (1997) | Single contractor buying and pricing all bidding documents |
| Malkin (2013), Boley (2009), Purohit (2013), Pheng and Wei (1996) | Poor quality construction material |
| Pheng and Kiong (2005), Pheng and Wei (1996) and Jha and Iyer (2006) | Poor quality workmanship |
| Alman (1989), Smallwood and Rwelamila (1998) and Smallwood (2000) | Award of contract primarily on price, competitive tendering, lack of pre-qualification, skills shortage, insufficient workforce training |

Source: Author's Construct

2.10 CRITICAL SUCCESS FACTORS INFLUENCING CONSTRUCTION QUALITY ASSURANCE

Research on the critical success factors (CSFs) are considered to be a means to improve the effectiveness of projects and to achieve project objectives. Researchers and organisations have decided on the three project performance criteria of cost, time and quality (Dainty et al., 2003; Chan and Chan, 2004; Swan and Khalfan, 2007).

Building EDC (1987) highlighted in particular motivation, commitment, clear specifications, management structures and responsible personnel as the key factors contributing to construction quality. Abdel Razek (1998), in his study stated that the findings of a study in the UK by BRE (1982) for poor construction quality are quite similar to those concluded by Building EDC (1987). Both of the papers highlighted the following issues: insufficient information, poor communications, poor concern in workmanship and lack of site supervision. Barriers identified by Serpell et al. (2002) included lack of clarity in responsibilities, rotating personnel, lack of training and a high dependency on national micro economy. Many other barriers have been identified in various other studies: unfair or illegal competition, high interest rates, project bureaucracy, unclear government planning, high foreign competitiveness, remote site, site security, company stability, market change, relationship between parties, lack of motivation, complexity of works, lack of quality culture, cooperation and management behaviour (Low and Goh, 1992; Sommerville, 1994; Zantanidis and Tsiotras, 1998). The attitudes of contractors and consultants to some extent influence the quality of construction work (Low and Peh, 1996). Hence, the quality of the products is greatly influenced if the parties to the contract do not carry out their duties correctly. Idoro

(2010) indicate that the quality of the project in the construction environment are influenced by standard of workmanship, assessment by the client on the quality of construction materials, level of defective works and maintenance costs of the project.

Quality culture, as stated by Leonard (2008), is a pertinent factor in successful implementation of quality and if employees of a construction project recognize the value of their performance in an appropriate manner and with the appropriate amount of care, then motivation will be a necessary driver of their quality culture (Pheng and Wee, 2001). According to Said et al. (2009), factors affecting construction quality may include; lack of management commitment, inconclusive interpretation of standard requirements and training policies. Quality factors in Malaysian construction environment is related by those actually doing the work, offsite and on site activities, project management, construction process, training and education, teamwork, supplier partnership, policies and recognitions (Sodangi et al., 2010; Wan Mahmood et al., 2006). The main factors involved with quality issues are the application of quality standards, management commitment, communication, activities during design and planning and relationship between construction players (Kandeil et al., 2010). Lack of efficient training skills and insufficient status acknowledgement of construction technology pointed out as factors hindering the Malaysian construction industry (Abdul Razak et al., 2010). Janipha and Ismail (2013) identified supervision, information, specification and documentation, communication, competitive bidding, management commitment, material quality by supplier and quality culture and attitude as factors militating against quality in construction procurement.

Table 2.4: CSFs for Works Quality Assurance

| Source of Reference | CSFs |
|---|---|
| Janipha and Ismail (2013) | Supervision, information, specification and documentation, communication, competitive bidding, management commitment, material quality by supplier and quality culture and attitude |
| Sodangi et al. (2010); Wan Mahmood et al. (2006) | Training and education, teamwork, supplier partnership, policies and recognition |
| Kandeil et al. (2010) | Application of quality standard, management commitment, communication |
| Building EDC (1987) | Motivation, commitment, clear specifications, management structure, responsible personnel |
| BRE (1982); Building EDC (1987) | Insufficient information, poor communications, poor workmanship and lack of site supervision |
| Serpell et al. (2002) | Lack of clear responsibilities, rotating personnel, lack of training and high dependency on national micro economy |
| Low and Goh (1992); Sommerville (1994), Pheng and Tan (1996); Zantanidis and Tsiotras (1998); Leonard (2008); Pheng | Lack of quality culture, cooperation and management behavior, lack of motivation, project bureaucracy, unclear government |

| | |
|-------------------------------|--|
| and Wee, (2001); Chung (1999) | planning and policies |
| Said et al. (2009) | Lack of management commitment, inconclusive interpretation of standard requirement, training policies |
| Abdul Razak et al. (2010) | Lack of efficient training skills, insufficient status acknowledgement |
| Low and Peh (1996) | Attitude of contractors and consultants |
| Idoro (2010) | Standard of workmanship, assessment by the client on the quality of construction materials and level of defective work |

Source: Author's Construct

2.11 DEVELOPING THE FRAMEWORK

The idea for developing a framework is that it provides the guideline for initiating quality assurance initiatives in a sequential manner and offers step-by-step guidance on how to proceed if a set of goals is to be achieved.

2.11.1 Works Quality Assurance Framework (WQAF) Design and Development

The continual process improvement methodology is an approach that can be used to understand and explore means of improving the issues relating to a situation. Plan-Do-Check-Act (PDCA) is a continual process improvement methodology used to analyze and measure sources of variations that cause products to deviate from project requirements. PDCA is the most popular and effective tool to monitor the assurance of quality. It analyses existing practices and methods used to provide the product or service to

customers. The method seeks to enforce that in every component of the process there is excellence. The time and conditions used to provide the product or service must be appropriate if the PDCA cycle is repeated throughout the lifetime. It helps improve internal company efficiency. The Deming Cycle provides a constructive, regulated problem solving process (Deming, 1986). PDCA methodology has been successfully applied in many sectors including construction.

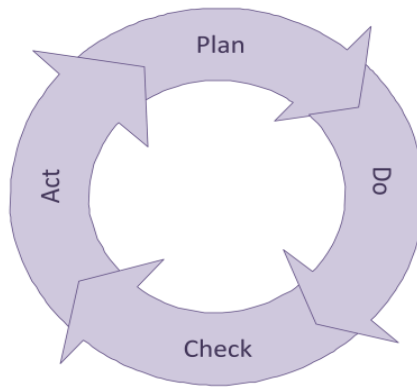


Figure 2.1: PDCA Cycle of Quality (Arveson, 1998)

The concept of the PDCA Cycle is to be methodical in an approach to problem solving and implementing solutions. The steps are explained below:

PLAN: Design or revise process components to improve results

DO: Implement the plan and measure its performance

CHECK: Assess the measurements and report the results to decision makers

ACT: Decide on changes needed to improve the process

The application of continual process improvement methodology to the results of this study (literature review, questionnaire survey, and interviews findings) helps to arrange the findings in a logical sequence. The findings of this research covered mainly two key

aspects: to carefully examine existing practices and identify problems; and to analyse problems and act to improve practices. The two key principles of the continual improvement process methodology provide a sound base to propose a framework for WQA in Traditional design bid and build projects.

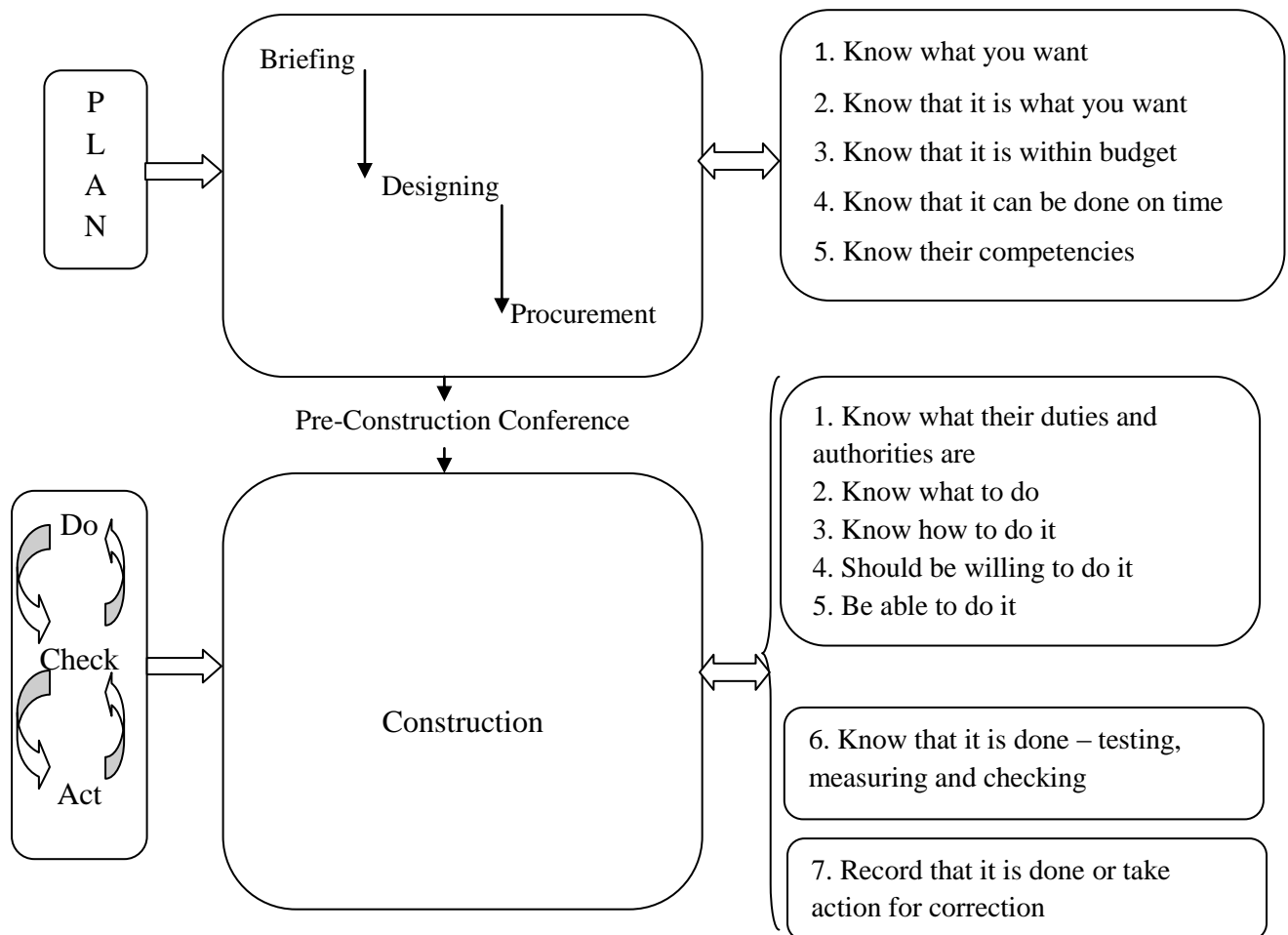


Figure 2.2: PDCA adopted into work processes

2.11.2 Aim of the Works Quality Assurance Framework (WQAF)

The proposed Works Quality Assurance Framework for traditional design, bid and build projects carefully examines practices, identify problems and attempt to propose quality

assurance improvement measures. Specifically, the proposed WQAF is applicable at strategic work procurement process level for small to medium scale traditional design bid and build projects that are undertaken by educational institutions especially Colleges of Education in Ghana. Therefore, the contents of the proposed WQAF mainly forwarded to consultant, client in-house representative and procurement officers. It is expected that the proposed WQAF provides assistance for the professionals to identify potential problems and respective CSFs for quality assurance throughout the project stages. The WQAF takes into cognisance the procurement process and the impact of PDCA cycle on every stage. Moreover, the WQAF contents may be in the interest of public educational institutions, public clients, quantity surveyors, and quality assurance managers.

2.11.3 Structure of the WQAF

The structure of the proposed WQAF comprise four main aspects. The stages of the traditional procurement system have the following abbreviations, Design (D/E), Bid (B) and Build (Bu). Generic activities was connoted (1), generic problems (2) and areas/parties for improvement (3).

2.11.3.1 Generic Activities: This typically identified the main activities that took place within the procurement process providing a sound base for practices that Colleges adopted. It took a critical look at the activities carried out by the colleges in thier quest to procure works with a mind of enhancing quality performance and delivery. Literature review and questionnaire provided information on this aspect of the framework.

2.11.3.2 Generic Problems: The literature review examined and identified several problems of quality. The problems emanated from the activities, this was depicted in

Figure 2.2. The identified problems were related to the stages of works procurement process. The analysis showed that procurement related factors including “consultant acting on behalf of the contractor”, “award of contract primarily on price”, and “single contractor buys all tender documents” were the problematic factors that led to failure in the process.

2.11.3.3 Critical Success Factors (CSFs): The study identified from literature success factors that enhance quality delivery of work processes. The CSFs had links with the activities as well as the problems. CSFs created the platform for quality delivery in projects. In their absence quality failure was imminent.

2.11.3.4 Improvement Measures: This looked at the pragmatic measures that address the issues outlined in Section 2.9. It first looked at the areas/parties for improvement and then the measures to take to assure quality in public works procurement.

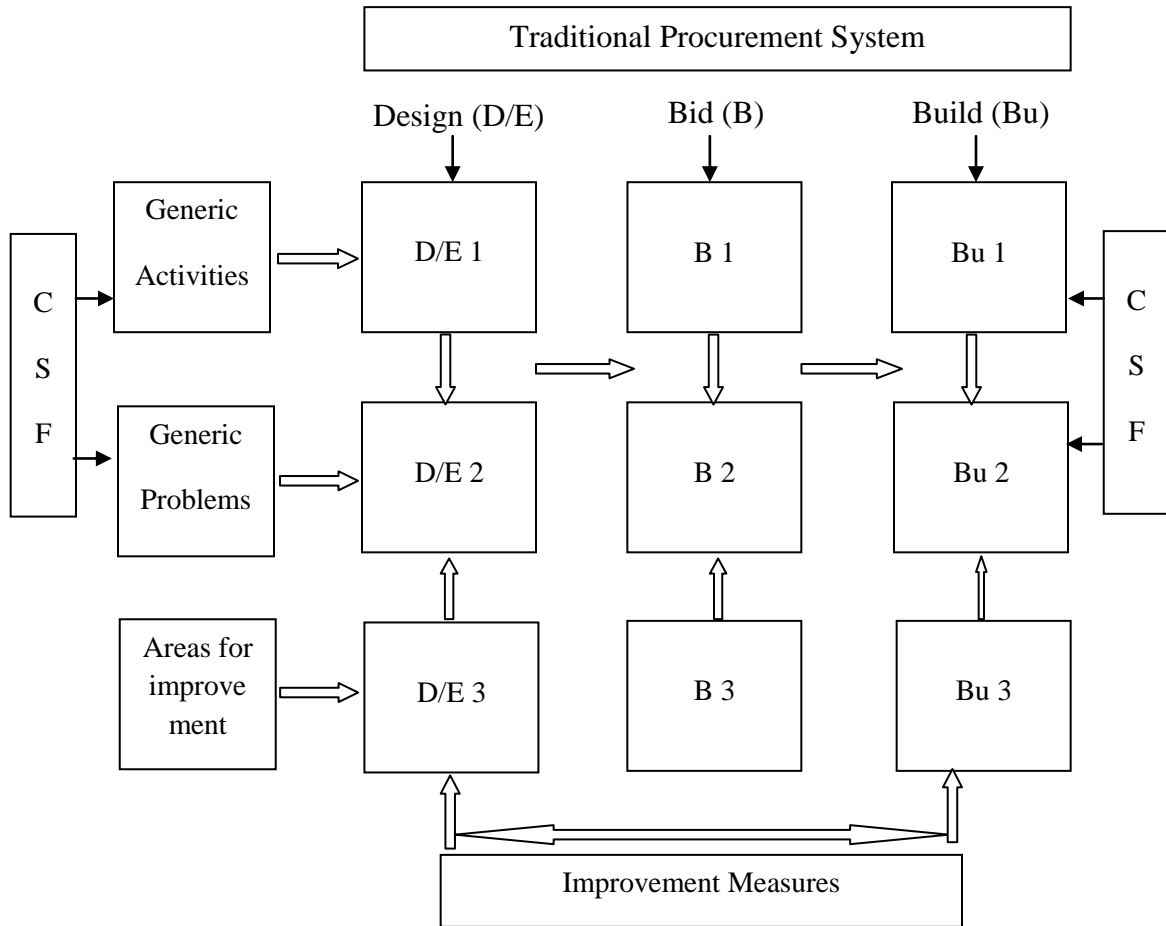


Figure 2.3: First Draft of the WQA Framework

2.8 SUMMARY

This chapter presented the literature review. It looked at practices of quality assurance and its issues on public works procurement. Finally, best practices of quality improvement initiatives appropriate and relevant to the study were reviewed and discussed leading to the development of the WQA framework. The next chapter discusses research methodology with the view of finding the best approach to achieve the research aims and objectives.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter discusses methods of finding the best approach to achieve the research aim and objectives. The chapter describes the research design and methodology including the philosophical position of the research. The methods and techniques which were used in the data collection and analyses are also presented.

3.2 PHILOSOPHICAL POSITION OF THE RESEARCH

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. It therefore, shapes the choice of research instruments (Christou et al., 2008). The research philosophy adopted by a researcher contained important assumptions about the way in which the researcher viewed the world. In part, the philosophy adopted by the researcher was influenced by practical considerations. However, the main influence was likely to be the researcher's particular view of the relationship between knowledge and the process by which it was developed.

Blaikie (1993) described ontology as the science or study of being and developed this description for the social sciences to encompass claims about what exists, what it looked like, what units made it up and how these units interacted with each other. The position adopted for this research at the ontological level was objectivism. This is because the practices and problems of quality assurance existed as external facts that were beyond the reach of influence of the researcher. The practices and problems are objective realities and not constructions of the researcher. Thus the objectivism ontological position was

followed in answering the research question what are the current quality assurance practices and problems associated with public works procurement?

Eriksson and Kovalainen (2008) described an objective epistemology as presuming that a world existed that was external and theory neutral, whereas within a subjective epistemological view no access to the external world beyond our own observations and interpretations was possible. Saunders et al., (2007) highlighted that data collected from objects that existed separate to the researcher (an external reality) were less open to bias and therefore more objective. Epistemologically, this research followed the positivists approach to knowledge. For the positivists, scientific knowledge is established through the accumulation of verified facts (Bryman, 2001). The researcher was of the view that the identification and analysis of the critical success factors for assuring quality in public works procurement was carried out in an objective way (free of researcher effects) which can be replicated. In summary, the researcher adopted objective ontology for research question one and objective epistemology for research question two.

3.3 RESEARCH STRATEGY

The research strategy dealt with how the research objectives were questioned. It connected the researcher to specific approaches and methods for collecting and analyzing data (Denzin and Lincoln, 2000). The three main strategies are quantitative, qualitative, and mixed method (Rice, 2008). The decision to follow any particular strategy depended on the purpose of the study, the type and availability of information for the research (Naoum, 2002). Quantitative approaches tend to be inclined towards positivism and seek to gather factual data, to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously

(Fellows and Liu, 2008). Creswell (1994) also noted that quantitative research generally involved the collection and analysis of data using statistical procedures. Qualitative approaches sought to gain insights and to understand people's perception of the world (Fellows and Liu, 2008). Combining qualitative and quantitative methods also known as mixed method provided an opportunity to collect data that were suited to the research question rather than being restricted to methods associated with one strategy. Also, combining two strategies enabled researchers to benefit from the advantages associated with each strategy with the possibility of avoiding the weakness of each (Morgan, 2006). The study adopted the mixed method approach as both qualitative and quantitative data were collected and analysed.

3.4 DESIGN OF THE RESEARCH INSTRUMENT

Research design describes the ways in which the data will be collected and analysed in order to answer the research questions posed and so provide a framework for undertaking the research (Bryman and Bell, 2003). As part of the exploratory phase of the research, survey research design was selected to capture a broad view on the research issues. As discussed earlier, a survey is a systematic method of collecting primary data based on a wider population using economical data collection methods such as questionnaires and semi-structured interviews which was used for the study. Yin (2003) noted that research designs can be used for exploratory, descriptive and explanatory research. The strategy of inquiry for this research is to involve both quantitative and qualitative strategies as it helps to neutralize biases inherent in any single method. A diversity of data collection methods is available such as questionnaires, interviews, observation techniques, the

analysis of past documents and simulation. Data collection methods can be known according to the type of data (i.e. qualitative data or quantitative data) produced.

3.4.1 Population and Sample Size

Table 2.1 depicts the cluster of Colleges of Education (CoE) in Ghana. There are 38 public CoEs in Ghana constituting the population for the study. The respondents included the colleges (Works Officers and Procurement Officers), consultant (Quantity Surveyors and Architects) and contractors (Engineers). These 5 professions who worked with the 38 colleges constituted the population size of 190. The sampling technique adopted was stratified sampling. The strata were identified in Table 2.1. The researcher purposively sampled three clusters (CENWEST, EGA and ASHBA) for the study. The three strata were all involved in the study i.e. census sampling.

Burns and Bush (2001) approach for calculating the size (n) of sample provided the sound base for this study. The approach is based on both previous experience from other research work and on the available budget to carry out the research. It takes cognizance that sample drawn from a population should have the tendency to generalize its results. Burns and Bush (2001) approach uses the formula $n = z^2 s^2 / e^2$, a value of $z = 1.96$ was chosen as the Standard Normal Value for a conventional 95% confidence level, the standard deviation, s , was calculated to be 0.85 (based on their method) and a precision, e , of $\pm 20\%$ was used (based on both the author's judgment and on budget restrictions).

$$n = (1.96^2 \times 0.85^2) / 0.2^2 = 69$$

The resultant value based on the formula is 69 (i.e. 69 responses should be adequate for analytical purposes). Sheenan, (2001) remarked that the expected response rate for surveys of this nature is thought to be around 70%, so (70% of 69 = 117.3). i.e. by

approximation, 120 questionnaires were distributed out of which 88 were retrieved for analysis purposes.

3.4.2 Sampling Frame

To this extent, sampling Procurement Officers and Works Officers, Colleges of Education were selected by stratified, purposive and census sampling to include Ashanti and Brong Ahafo (ASHBA), Eastern and Greater Accra (EGA) and Central and Western (CENWEST). The consultants (Architects and Quantity Surveyors) and contractors (Engineers) colleges engage in works procurement were also selected for the past five years.

Table 3.1: Sample size by profession

| By Profession | EGA | CENWEST | ASHBA | TOTAL |
|----------------------|------------|----------------|--------------|--------------|
| Procurement Officers | 8 | 6 | 10 | 24 |
| Works Officers | 8 | 6 | 10 | 24 |
| Quantity Surveyors | 8 | 6 | 10 | 24 |
| Engineers | 8 | 6 | 10 | 24 |
| Architects | 8 | 6 | 10 | 24 |
| TOTAL | 40 | 30 | 50 | 120 |

3.5 DATA COLLECTION

3.5.1 Questionnaire

Questionnaires collect data by questioning people to respond to exactly the same set of questions - may be self-administered or it may be administered over the phone, in person or web-based (Bernard, 2000). The type of questionnaire is determined by way of administering: mailed questionnaires (post or emails) (Fellows and Liu, 2008), collective administration and administration in public places (Saunders et al., 2007). The Colleges were contacted with an introductory letter from the Building Technology Department. The respondents were briefed about the exercise and they expressed their interest to participate. Procurement Officers provided names, contacts and locations of contractors and consultants they have engaged for a period of five years. Contacts received especially for contractors were to Directors of companies who did not have much technical information on projects. Through Directors, contacts of officers' in-charge of projects were received and made a call to brief and seek for permission to participate in the study. Upon acceptance, questionnaires were sent either by bus or personally to respondents.

The questionnaire was divided into four sections; Section A describes the background (5 questions); Section B explored current quality assurance practices (2 questions) on a 5-point Likert scale rating where 1 – Very Low, 2 – Low, 3 – Moderate, 4 – High, 5 – Very High; Section C looked out for problems of quality assurance practices on a scale where 1 – least likely and 5 – most likely and Section D, success factors for quality assurance in public works procurement, ranked 1-least and 5-highest. Despite literature arguments on the appropriateness of scale length, the selection of 5-point scale was mainly based on respondents' ability to express neutrality (Gamage, 2011).

3.5.2 Interview

The interview method allows the researcher to gather data interacting person to person between two or more individuals with a definite purpose in mind (Sekaran, 2002). Interviews can be classified into three forms: structured interviews, semi-structured interviews and unstructured interviews (Fellows and Liu, 2008). Semi-structured interviews are more formal than an unstructured interview in that there are a number of specific topics around which to build the interview (Naoum, 1999). Interviewer can formulate question while carrying out the interview; and enable the use of a theoretically informed interview pro-forma to build structure into the data collection process (Fellows and Liu, 2008). The interview format contained four sections: background information (4 questions); current practices and problems associated with quality assurance (4 questions); critical factors for works quality assurance (1 question); and improvement measures (1question).

The data collection method for this phase of the research adopted telephone conversation and face-to-face, semi-structured interviews with the selected respondents. The organizations were purposively selected for their rich knowledge in the issue at hand. The interviewees were selected from different organizations/institutions. Typically, respondents were from Ministry of Education (MoE), Ghana Standards Authority (GSA), Ghana Education Trust Fund (GETFund), Public Procurement Authority (PPA), Quality Assurance Manager (QAM) and Consultancy Firms (Private and Public - CF).

3.6 DATA ANALYSIS

This section presents the data analysis process and techniques used in the study. It describes the methods used to analyse quantitative and qualitative data that were collected through the questionnaire survey, semi-structured interviews and framework validation questionnaires.

The data collected through questionnaire survey and the Works Quality Assurance Framework validation questionnaire were analyzed using quantitative techniques. Data were entered by the researcher into a computer for analyses using the SPSS version 16.0 software. The data were coded and analyzed to answer the research questions. One of the main advantages of computer aided software is its ability to rapidly handle large volumes of data. The SPSS (Statistical Package for Social Science) is one of the most widely used software packages for statistical data analysis. One sample T-test was employed to conduct test for the mean value of the distribution of factors identified for problems of construction quality. It adopted both parametric statistics (means, standard deviations, etc.) and non-parametric procedures (correlation matrix and factor analysis) to analyze data collected for critical success factors for quality assurance in public works procurement.

Data collected through semi-structured interviews were analyzed using qualitative techniques. Owing to the open-ended nature of interview questions, the data gathered were not well-structured which consisted of long paragraphs, similar concepts identified in different locations of the text and with uncomely data to the study. Thus, each transcript was read repeatedly to clean up and re-organise the contents of the

transcription, to obtain a clearer meaning of the information which were arranged in themes and sub-themes. Finally, the identified themes and sub-themes were discussed and presented in chapter 4.

3.7 ETHICAL CONSIDERATIONS

All appropriate ethical standards and statutory requirements were applied in the collection of data from the members of the study population and in the execution of the research. The confidentiality of the study respondents was assured. The lives and professional career of the study respondents were not endangered by their participation in this research. Also, to ensure reciprocity, the findings and conclusions of the study were shared with the respondents.

3.8 SUMMARY

This chapter has discussed research methodology and given reasons for the options selected to achieve the research aims and objectives. The chapter also described the research design including the philosophical positions of the research. The methods and techniques which were used in the data collection and analyses were also presented. The analytical technique adopted for the study has also been explained. The chapter that follows presents the results of the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the analysis and discussion of the results on data collected. The first section presents the findings from key stakeholders through exploratory interviews. It presents data on the practices of quality assurance and procurement and the problems associated and critical success factors that influence quality assurance. The results come in a form of narratives and quotations (qualitative). The second section presents results from questionnaire survey administered through procurement officers, works officers, quantity surveyors, architects and quality assurance managers. The results come in a form of descriptive statistics summaries (quantitative) of the problems and critical success factors having influence on quality delivery of works procurement.

4.2 QUALITATIVE SURVEY RESULTS

This section presents results from the exploratory interview. It covers the qualitative survey of stakeholders' opinions on practices and problems of quality assurance and critical success factors that influence quality on works procurement. The survey was conducted on seven (7) major stakeholders who were selected purposively based on their business focus on procurement. This stage looked at the following from interviewees:

- Experience in public works procurement;
- QA Practices and problems in public works procurement;
- Critical success factors for works quality procurement; and
- Improvement measures.

4.2.1 Experiences of Stakeholders in Public Works Procurement

With the exception of the Procurement and Quality Assurance Managers, all other professionals had professional qualification from either a local association or an international association or both. All interviewees except 2, had less than 20 years' experience in their various professions. All the 7 interviewees had experience in works procurement.

4.2.2 QA Practices and Problems in Public Works Procurement

This section presents responses from interviewees on QA practices and problems. Practices looked at the various stages of procurement and the key areas where quality can be built into the process and makes the presentation below.

Literature revealed that the cost consideration framework is mostly adopted e.g. in Ghana (Awal, 2010), in China (Huang, 2011), in Nigeria (Idrus et al., 2011) and in Netherland (Favie et al., 2007). Lo et al. (2009) and Huang (2011) purported that lowest price means lowest quality. On this, the researcher asked interviewees their opinion on the cost consideration framework and its influence on quality. In response, several respondents said *“When selecting consultant, the law provides alternative methods like the least cost, quality and cost based, etc, this must be same for contractor selection: least cost means least consulting services leading to least supervision and least quality delivery of work, similarly lowest price means lowest quality”* (Informant's view). In view of this, interviewees suggested that the public procurement law must be amended to pave way for other innovative contractor selection frameworks to enhance quality delivery.

From the cost consideration framework, another question worth mentioning was the traditional procurement system and its relation to quality assurance. Respondents replied

that *“for the traditional procurement system where design is completed before tendering and construction, project deliverables are certain right from the onset, thus this system on paper must deliver best quality, but seems to give off the worst in terms of quality delivery”* (Informant’s view). Another said *“you know what you want so should get what you wanted”* (Informant’s view). *The reason for the lack of quality in the traditional system was the use of the cost consideration framework and competitive bidding* (Informants’ view). This was a confirmation to Walker and Hampson, (2003) and Hampson (2005) that competitive bidding process looked at cost at the expense of value leading to poor project quality delivery.

Hardy (1978) expressed that the criterion for selection the successful tenderer is then that bid which maximizes the return on the client’s investment. This meant that project success is dependent on the criteria used in selecting the contractor. Hunt et al. (1966), Merna and Smith (1990), Moselhi and Martinelli (1990), Watt et al. (2010) mentioned technical, managerial, general and financial among other criteria for selecting a successful contractor. When put to fore about any other criteria for contractor selection, an interviewee responded as *“ based on the study objective, one obvious criteria is quality. To mention sub-criteria for quality it is pertinent to look at quality culture of contractor, i.e. contractors quality assurance plan and in-house structures, another sub-criteria is ABCECG certification; where the association builds capacity of members in terms of equipment and plant, personnel and through regular continuous development plans (CDP)”* (Informant’s view).

In this section the last question was on the problems professional face in achieving quality objective. Several respondents revealed that *“... would be more appropriate to categorize*

the problems into stages – design, procurement or tendering and construction. At the design stage some problems faced are continuous design changes by clients and too much workload on one consultant which can run through all stages. At the procurement stage, problems included award based on price only, single contractor buys all tender documents, consultant acting on behalf of contractor, and competitive bidding. The construction stage faced problems like poor workmanship, poor materials and lack of supervision” (Informants’ view). The categorization of problems by stages asserted to Alman (1989), Smallwood and Rwelamila (1998) and Smallwood (2000). Problems mentioned by respondents including “consultant acting on behalf of contractor” and “too much workload on one consultant” were not consistent with literature, hence, an impression that these problems were peculiar to the Ghanaian works procurement.

4.2.3 Critical Success Factors for Works Quality Assurance

Critical success factor is an element that is necessary for a project to achieve its mission. In achieving quality objective of a project certain critical success factors will be necessary. These factors have roles to play in ensuring continued quality throughout the procurement process. On this respondents were asked to list critical success factors that will enhance quality assurance in public works procurement. *“Procurement system adopted, contractor selection framework, government policies and regulations, competency of consultant, competency of contractor, client construction know-how, and documentation quality were the factors enlisted”* (Informants’ view). One interviewee mentioned that the factors are interrelated in that elimination of one factor will lead to quality failure. *“To achieve quality assurance all factors are keen, they complement one another”* (Informant’s view). Very few of the factors mentioned by interviewees were consistent with literature such as

“government policies and regulations”, “documentation quality” and “training policy and education”. “Elimination of external forces”, “contractor selection framework”, “competency of consultant”, “competency of contractor”, and “client technical know-how” were not consistent with literature implying that these factors were peculiar to only the Ghanaian works procurement.

4.2.4 Improvement Measures

Upon discussions with interviewees on the problems and success factors, measures for improving quality of public works procurement were sought for. Below were measures suggested to improve quality:

- *Continuous Professional Development of Procurement Entities by PPA through seminars and workshops on non-traditional procurement systems;*
- *Incorporating quality criteria into contractor selection;*
- *The Association of Building and Civil Engineering Contractors of Ghana (ABCECG) should incorporate training and education into its programmes to build capacity of its members in terms of quality initiatives to enhance project delivery; and*
- *Early involvement of stakeholders like the procurement authority and funding agent in the process.*

4.3 QUANTITATIVE SURVEY RESULTS

This section presents results from the questionnaire survey. It covers the quantitative survey of quantity surveyors, architects, works officers and procurement officers' opinions on practices and problems of quality assurance and critical success factors that propels quality assurance of public works procurement. The survey was conducted on 120 officers who were selected from colleges of education and consulting firms based on their experience in public works procurement. This stage looked at the following from interviewees:

- Background information;
- QA Practices and problems in public works procurement; and
- Critical success factors for works quality procurement.

4.3.1 Background information

Table 4.1: Percentage Distribution of Area of Expertise

| Area of Expertise | Frequencies | Percentage (%) |
|--------------------------|--------------------|-----------------------|
| Quantity Surveyor | 35 | 40 |
| Architect | 21 | 24 |
| Quality Officers | 0 | 0 |
| Works Officer | 13 | 15 |
| Procurement Officer | 19 | 21 |
| Total | 88 | 100 |

(Source: Field Survey, 2014)

Bansa (2007) stated that, you may be able to target the best institution for your research, but as to whether the right individuals in that institution are contacted is more important since the people that matter most are the once that are able to provide us with all the needed responses. Rodriguez (2008) indicated that the position held by any person form a great part in every response that comes from that person. Table 4.1 demonstrates that a number of the respondents representing 40 percent are Quantity Surveyors, followed by 24 percent which were Architects. It was followed by Procurement Officers and Works Officers which scored 21 percent and 15 percent respectively. Whiles 0 percent of the remaining respondents were Quality Officers which happened to be the least number of respondent belonging to that area of expertise. It is always best when researchers target a certain sector of an institution in preparation of getting information. As shown in the above Table the persons that were targeted are people that have in-depth knowledge on public works procurement.

Table 4.2: Percentage Distribution of Professionals Experience

| Responses | Frequencies | Percentage (%) |
|------------------|--------------------|-----------------------|
| 1-5years | 13 | 15 |
| 6-10 years | 7 | 8 |
| 11-15 years | 30 | 34 |
| 16-20 years | 27 | 31 |
| > 20 years | 11 | 12 |
| Total | 88 | 100 |

(Source: Field Survey, 2014)

It is often argued that the number of years one stay in a particular work add up to his experience. Drawing from this, there was a need to know how long the respondents have been on professional work to determine their level of experience over the years. From Table 4.2 above, 15 percent of the respondents involved in the survey have been in the Profession for Up to 5 years while 8 percent of the respondents have been in the profession from 6 to 10 years. Meanwhile 34 percent have been in the profession from 11 to 15 years it was followed by 31 percent of the respondents who were in the profession for 16 to 20 years. But 12 percent of the respondent had stayed in their respective profession for a period of more than 20 years. The conclusions drawn on these findings are that, the results give indications that the respondents have reasonable experience in professional practice. This is evidenced by 85% of respondents having worked over 5years (between 6 and above 20years).

Table 4.3: Percentage Distribution of Respondents level of Education

| Level of Education | Frequencies | Percentage (%) |
|---------------------------|--------------------|-----------------------|
| Professional Diploma | 30 | 34 |
| Bachelor Degree | 35 | 40 |
| Master/PGD Degree | 10 | 11 |
| Doctorate | 0 | 0 |
| Higher National Diploma | 13 | 15 |
| Total | 88 | 100 |

(Source: Field Survey, 2014)

It can be noted that the level of training will show the level of knowledge of a professional. Training is gained by the level of education acquired from a particular field

of study. It is also a general knowledge that the training of a learned person contribute greatly to problem solving. Essentially, as presented in Table 4.3 above, out of a total of 88 respondents, 40 percent have Bachelors Degree, while 34 percent of the total number had Professional Diploma in various professions such as Architect, Quantity Surveyors, etc. 15 percent had obtained Higher National Diploma (HND) with 11 percent qualified with Masters Degree. Nobody had a Doctorate degree. This emphasized the perceived influence that the respondent would have on the survey since when the right people are contacted they provide responds that are very meaningful.

Table 4.4: Percentage Distribution on Professional Bodies Respondents belong to

| Professional Affiliation | Frequencies | Percentage (%) |
|--|--------------------|-----------------------|
| Ghana Institution of Construction (GIOC) | 0 | 0 |
| Ghana Institution of Surveyors (GhIS) | 24 | 27 |
| Ghana Institution of Engineers (GhIE) | 0 | 0 |
| Ghana Institution of Architects (GIA) | 18 | 21 |
| No Affiliation | 46 | 52 |
| Total | 88 | 100 |

(Source: Field Survey, 2014)

To find out which professional bodies respondents belonged to, Table 4.4 gives a presentation of the results. 24 respondents representing 27 percent belonged to Ghana Institution of Surveyors (GhIS), 18 respondents representing 21 percent belonged to Ghana Institution of Architects (GIA), and 46 respondents representing 52 percent had no professional affiliation. The respondents attended to had no affiliation to Ghana Institution of Engineers (GhIE) and Ghana Institution of Construction (GIOC). When

workers belong to professional bodies, they create enabling platform that allows them to share information related to their area of work and improves their capacity.

Table 4.5: Percentage Distribution on Contractor category Respondents normally work with

| Contractor Category | Frequencies | Percentage (%) |
|----------------------------|--------------------|-----------------------|
| Class D1 K1 | 39 | 44 |
| Class D2 K2 | 15 | 17 |
| Class D3 K3 | 14 | 16 |
| Class D4 K4 | 20 | 23 |
| Total | 88 | 100 |

(Source: Field Survey, 2014)

Table 4.5 above explores respondents' responses on the classification of contractors they normally work with. Out of the total 88 respondents, 44 percent worked with class D1K1 contractors while 17 percent of the respondents worked with class D2K2 contractors. 23 percent of the respondents engaged class D4K4 contractors with the remaining respondents representing 16 percent work with class D3K3 contractors.

Majority of respondents agreed to have engaged the services of class D1K1 which implied that the expectation of clients from contractors were high in terms of quality delivery.

4.4 RESEARCH OBJECTIVE ONE

To review Current Quality Assurance Practices and identify Problems related to Public Works Procurement

4.4.1 QA Practices in Public Works Procurement

This part of the report presents results on QA practices and its associated problems encountered by professions in executing their functions. The report first looked at the standards or documents that provide guideline for compliance in public works procurement, then followed by contractor selection criteria and the problems of quality assurance in public works procurement.

Table 4.6 Percentage Distribution on Standards for Public Works Procurement

| Standards or Documents | Frequencies | Percentage (%) |
|----------------------------------|--------------------|-----------------------|
| Public Procurement Act (Act 663) | 50 | 57 |
| Contract Drawings | 9 | 10 |
| Bills of Quantities | 6 | 7 |
| Conditions of Contract | 13 | 15 |
| Specification | 10 | 11 |
| Total | 88 | 100.0 |

(Source: Field Survey, 2014)

Table 4.6 displays the standards or documents that provide guidelines for compliance in public works procurement. 57 percent of the respondents agreed, using PPA 2003 (Act 663) as the document that provides guidelines for compliance in the public works procurement, 10 percent of the respondent agreed that, the document that provide

guidelines for compliance in the public works procurement is Contract drawing 7 percent of the respondents mentioned the document that provide guideline for compliance for public works procurement was Bills of Quantities. 15 percent of the respondents identified conditions of contract and finally, 11 percent of the remaining respondents chose Specifications as a guideline for compliance in the public work procurement. The PPA, 2003 (Act 663) had been given the majority consent as the main document providing guidelines to public works procurement.

Table 4.7 Financial Criteria (FC) for Contractor Selection

| Response | Mean | Standard Deviation |
|--|-------------|-------------------------------|
| Tender price | 3.94 | 1.28 |
| Audited financial statement for the last 3 years | 3.70 | 1.46 |
| Annual turnover | 2.61 | 1.31 |
| Lines of credit | 2.70 | 1.41 |

(Source: Field Survey, 2014)

Table 4.7 above, depict respondent's responses on the importance of the financial criteria (FC) for determining the successful contractor in Ghana. The sub-criteria have two upper values and two lower values. Tender price (3.94) and audited financial statement for the last 3 years (3.70) had high mean values whilst annual turnover (2.61) and lines of credit (2.70) had low mean values. This indicated that tender price and audited financial statement for the last 3 years are keen in determining the successful contractor in Ghana. Tender price ranked highest asserted to literature (Sarkis et al., 2012; Soenmez et al., 2001 and Manideepk et al., 2009).

TABLE 4.8 Technical Criteria (TC) for Contractor Selection

| Response | Mean | Standard Deviation |
|---|-------------|-------------------------------|
| Proof of experience of similar nature of works | 3.97 | 1.18 |
| Proof of experience of key staff relevant for works | 3.75 | 1.26 |
| Number of current projects | 3.32 | 1.52 |
| Plant and equipment holding | 3.68 | 1.30 |
| Contract period | 2.88 | 1.55 |
| Completed projects on time | 3.73 | 1.28 |
| Completed projects within budget | 3.64 | 1.36 |

(Source: Field Survey, 2014)

Table 4.8 above, portray respondents' responses on the importance of the technical criteria (TC) for determining the successful contractor in Ghana. Literature revealed the importance of these sub-criteria in determining a successful contractor based on technical criteria. A contractor who has experience in similar works is less likely to commit most errors in carrying out the project than one who has little experience in the proposed works. In reference, proof of experience of similar nature of works ranked highest (3.97). This was followed by proof of experience of key staff relevant for the works. The experiences of the personnel at the site do have influence on the outcome of the works. Well experienced personnel are likely to produce good work than inexperienced personnel.

Sub-criteria such as completed project on time, equipment and plant holding and completed projects within budget followed with mean values of 3.73, 3.68 and 3.64 respectively. Respondents considered number of current projects (3.32) and contract period (2.88) as less likely sub-criteria in determining a successful contractor.

Table 4.9: Management Criteria (MC) for Contractor Selection

| Response | Mean | Standard Deviation |
|--------------------------------|-------------|-------------------------------|
| Relationship with past clients | 3.65 | 1.17 |
| Organizational structure | 3.53 | 1.16 |
| Material suppliers | 3.81 | 1.29 |
| Health and safety records | 3.24 | 1.36 |

(Source: Field Survey, 2014)

Table 4.9 above, depict respondents' responses on the importance of the management criteria (MC) for determining the successful contractor in Ghana. The mean values for all sub-criteria under management criteria for contractor selection were very close indicating that all sub-criteria were important in determining a winning contractor. From the table 4.9 above, material suppliers was ranked the highest with a mean value of 3.81 followed by relationship with past clients (3.65). In achieving good quality of materials for the project, a tenderer would be required to provide source of supplier. This supplier must provide listings certified by the Ghana Standards Authority. Organizational structure had a mean value of 3.53 whilst health and safety records scored 3.24.

4.4.2: QA Problems in Public Works Procurement

Descriptive analysis such as mean scores, standard deviations and standard means error of each of the variables conducted were used to ascertain the outcome of the survey and presented in Table 4.10. Respondents were required to rank on a scale of 1 (Least) to 5 (Most) the effects of the variables (obtained from literature and semi-structured interview) on quality assurance in public works procurement. One-sample t-test was run for the variables obtained and a test value of 3.5 was used. A significance level was set at 95% in accordance with predictable risk levels (Cohen, 1992). Field (2005) explained standard error as the standard deviation of sample means and a measure of how representative a sample is likely to be of the population. The larger the standard error the more variations from the means of different samples and the smaller the standard error the less variation depicting an precise image of the populace.

Table 4.10 presents means, standard deviations and standard error mean of the problems. The problems were labeled variables which were extracted from Table 2.3. Out of the 13 variables, 10 scored mean values above the test mean of 3.5. Variables like poor definition of needs (2.45), inadequate design details (3.45) and bid rotation (3.23) scored mean values less than the test mean of 3.5. The 10 variables constituted problems of quality assurance in public works procurement. The standard error connected to all the mean scores were closer to zero indicating that the sample chosen is an accurate reflection of the population (Field, 2005). Table 4.10 again depicts that most standard deviations have values slightly more than 1.0, revealing that, there is marginal variability in the data collected.

Table 4.10: Descriptive Statistics

| Problems associated with quality in public works | N | Mean | Std. Deviation | Std. Error Mean |
|---|----------|-------------|-----------------------|------------------------|
| Unstable client requirement | 88 | 3.53 | 1.381 | .147 |
| Poor definition of needs | 88 | 2.45 | 1.493 | .159 |
| Lack of buildability in design | 88 | 3.67 | 1.201 | .128 |
| Inadequate design details | 88 | 3.45 | 1.364 | .145 |
| Poor design coordination | 88 | 3.60 | 1.427 | .152 |
| Lack of codes and standards | 88 | 4.00 | 1.028 | .110 |
| Consultant acting on behalf of contractor | 88 | 4.17 | 1.085 | .116 |
| Bid rotation | 88 | 3.23 | .854 | .091 |
| Award of contract primarily on price | 88 | 4.17 | 1.053 | .112 |
| Single contractor buys all tender documents | 88 | 4.05 | 1.113 | .119 |
| Poor supervision | 88 | 3.86 | 1.315 | .140 |
| Poor construction materials | 88 | 3.74 | 1.434 | .153 |
| Poor workmanship | 88 | 4.03 | 1.179 | .126 |

Source: Author's Construct

The significance (i.e. p-value) of each variable is presented in Table 4.11. The t-test shows the mean values of the population mean, t , which is the one sample t-test, Df , the degree of freedom and the significance (i.e. p-value). The p-value provides a basis for a statistical decision to be made as to whether or not the population mean and sample mean are equal. From the Table 4.11, the p-value is for two-tailed test and since the interest of the study is on one-tailed test, the p-values are divided by two and the results presented in Table 4.12.

Table 4.11: Results of One-Sample Test showing test significance

| Problem | Test Value = 3.5 | | | | | |
|---|------------------|----|-----------------|-----------------|---|-------|
| | t | Df | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | | | Lower | Upper |
| Unstable client requirement | .232 | 87 | .817 | .034 | -.26 | .33 |
| Poor definition of needs | -6.571 | 87 | .000 | -1.045 | -1.36 | -.73 |
| Lack of buildability in design | 1.332 | 87 | .186 | .170 | -.08 | .42 |
| Inadequate design details | -.313 | 87 | .755 | -.045 | -.33 | .24 |
| Poor design coordination | .672 | 87 | .503 | .102 | -.20 | .40 |
| Lack of codes and standards | 4.561 | 87 | .000 | .500 | .28 | .72 |
| Consultant acting on behalf of contractor | 5.796 | 87 | .000 | .670 | .44 | .90 |
| Bid rotation | -2.996 | 87 | .004 | -.273 | -.45 | -.09 |
| Award of contract primarily on price | 5.974 | 87 | .000 | .670 | .45 | .89 |
| Single contractor buys all tender documents | 4.596 | 87 | .000 | .545 | .31 | .78 |
| Poor supervision | 2.595 | 87 | .011 | .364 | .09 | .64 |
| Poor construction materials | 1.561 | 87 | .122 | .239 | -.07 | .54 |
| Poor workmanship | 4.250 | 87 | .000 | .534 | .28 | .78 |

Source: Author's Construct

Table 4.12: Results of T-Test showing ranking and results of 1-tailed test

| Problems | Mean | Std. Deviation | Ranking | Sig. (1-tailed) |
|---|-------------|-----------------------|-----------------------|------------------------|
| Unstable client requirement | 3.53 | 1.381 | 10th | 0.409 |
| Poor definition of needs | 2.45 | 1.493 | 13th | 0.000 |
| Lack of buildability in design | 3.67 | 1.201 | 8th | 0.093 |
| Inadequate design details | 3.45 | 1.364 | 11th | 0.378 |
| Poor design coordination | 3.6 | 1.427 | 9th | 0.256 |
| Lack of codes and standards | 4 | 1.028 | 5th | 0.000 |
| Consultant acting on behalf of contractor | 4.17 | 1.085 | 2nd | 0.000 |
| Bid rotation | 3.23 | 0.854 | 12th | 0.002 |
| Award of contract primarily on price | 4.17 | 1.053 | 1st | 0.000 |
| Single contractor buys all tender documents | 4.05 | 1.113 | 3rd | 0.000 |
| Poor supervision | 3.86 | 1.315 | 6th | 0.006 |
| Poor construction materials | 3.74 | 1.434 | 7th | 0.061 |
| Poor workmanship | 4.03 | 1.179 | 4th | 0.000 |

Source: Author's Construct

From Table 4.12, award of contract primarily on price was highly ranked as the main problem of quality in public works procurement. Lo et al. (2009) brought to fore that many builders may lessen their sums by dropping the quality of work. The justification is that if award is solely on price, then product quality is likely not to be met. The reason behind this could be attributed to the public procurement law of Ghana which advised procurement entities to select contractors on price. Section 59(3)(a) of the Public

Procurement Act, 2003 (Act 663) specify that the successful tenderer shall be the tender with the lowest evaluated tender price. This practice does not differ from countries like China (Huang, 2011), Netherland (Favie et al., 2010) and Nigeria (Idrus et al., 2011) to mention but a few. Sarkis et al. (2012); Soenmez et al. (2001) and Manideepk et al. (2009) mentioned bid price as a major criterion for contractor selection. Based on this, interviewees suggested a review of the Public Procurement Act (Act 663) to incorporate innovative contractor selection framework than price. EU (2004) allows award of contract to be based on two award criteria, i.e. 'lowest price' or 'most economically advantageous tender'.

Other problems ranked high were 'consultant acting on behalf of contractor' and 'single contractor buys all tender documents'. These problems related to the bidding stage of the process. The problem of single contractor buys all tender documents asserted to Crown Agents (1998) and Westring (1997) which was ranked third (3rd). A single contractor buys all bidding documents meant denial of competition which will in turn deny quality. Mostly for a single contractor to buy all tender documents there has to be an agreement between either the contractor and the consultant or the client or all parties. This has the tendency to influence quality delivery on projects. A revealing problem was consultant acting on behalf of the contractor, ranked second (2nd). It was disclosed that this started from the problem of a single contractor buying all bidding documents. The consultant processes the bidding documents under different contracting proposals and submits on behalf of the different contractors. This problem has a link to the single contractor buys all documents. *It implied consensus working agreement mostly between the contractor and the consultant to the detriment of the client* (an informant's view). The consultant

working on behalf of the contractor can be deduced that the contractor can influence the consultant. At the site, the consultant can compromise on quality.

Other problems worth mentioning included poor workmanship (4th), lack of codes and standards (5th), poor supervision (6th), poor construction materials (7th), lack of buildability in design (8th), poor design coordination (9th) and unstable client requirement (10th) which obtained a mean value greater than the hypothetical mean (3.5). An implication that all these problems need to be addressed if quality is to be assured in public works procurement.

4.5 RESEARCH OBJECTIVE TWO

To identify Critical Quality Assurance Success Factors for Public Works Procurement

4.5.1: Critical Quality Assurance Success Factors for Public Works Procurement

Factors influencing quality assurance in public works procurement. The variables are coded for easy interpretation.

| CODE | VARIABLE |
|-------------|--|
| V1 | Project supervision |
| V2 | Competitive bidding |
| V3 | Management commitment |
| V4 | Communication |
| V5 | Training policy and education |
| V6 | Material quality |
| V7 | Motivation and quality recognition |
| V8 | Quality culture and attitude of contractor |
| V9 | Contractor selection framework |
| V10 | Relationship between construction players |
| V11 | Information, specification and documentation |
| V12 | Contract review |
| V13 | Procurement system |
| V14 | Application of quality standards |
| V15 | Government policies and regulations |

Extracted from Table 2.4, page 38

Table 4.13: Descriptive Statistics of Factors

| Variables | Mean | Std. Deviation |
|-----------------|-------------|----------------|
| V ₁ | 1.49 | 0.61 |
| V ₂ | 1.39 | 0.68 |
| V ₃ | 1.13 | 0.61 |
| V ₄ | 3.65 | 1.27 |
| V ₅ | 3.73 | 1.34 |
| V ₆ | 1.12 | 0.39 |
| V ₇ | 2.35 | 0.93 |
| V ₈ | 4.89 | 1.66 |
| V ₉ | 4.94 | 1.98 |
| V ₁₀ | 1.91 | 0.89 |
| V ₁₁ | 1.22 | 0.64 |
| V ₁₂ | 1.11 | 0.69 |
| V ₁₃ | 4.95 | 0.34 |
| V ₁₄ | 3.31 | 1.41 |
| V ₁₅ | 1.13 | 0.66 |

(Source: Field Survey, 2014)

Table 4.13 above, shows that the factor V₁₃ (“procurement system”) recorded the highest mean value of 4.95 with a corresponding standard deviation of 0.34 being the least number of standard deviation. It is observed that variables like management commitment, V₃ (1.13), material quality, V₆ (1.12), contract review, V₁₂ (1.11) and government policies and regulations, V₁₅ (1.13) all recorded least mean values. This means that

respondents rated it mostly under 1 and 2, implying that it is the least important when it comes to factors that influence quality assurance in public works.

On the other hand, factors such as; procurement system (4.95), contractor selection framework (4.94), quality culture and attitude of contractor (4.89), training policy and education (3.73) and communication (3.65) had large numbers of mean. This suggests that they have been rated high by the majority of the respondents under 4 and 5.

Table 4.14: Correlation Matrix

| | V ₁ | V ₂ | V ₃ | V ₄ | V ₅ | V ₆ | V ₇ | V ₈ | V ₉ | V ₁₀ | V ₁₁ | V ₁₂ | V ₁₃ | V ₁₄ | V ₁₅ |
|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| V ₁ | 1.00 | | | | | | | | | | | | | | |
| V ₂ | 0.09 | 1.00 | | | | | | | | | | | | | |
| V ₃ | -0.23 | 0.09 | 1.00 | | | | | | | | | | | | |
| V ₄ | 0.32 | 0.13 | 0.13 | 1.00 | | | | | | | | | | | |
| V ₅ | 0.15 | 0.28 | 0.03 | 0.27 | 1.00 | | | | | | | | | | |
| V ₆ | 0.42 | 0.17 | -0.03 | 0.32 | 0.57 | 1.00 | | | | | | | | | |
| V ₇ | 0.27 | 0.00 | -0.01 | 0.28 | 0.38 | 0.55 | 1.00 | | | | | | | | |
| V ₈ | 0.39 | -0.10 | -0.16 | 0.35 | 0.15 | 0.39 | 0.23 | 1.00 | | | | | | | |
| V ₉ | 0.29 | 0.02 | -0.26 | 0.10 | 0.23 | 0.27 | 0.19 | 0.41 | 1.00 | | | | | | |
| V ₁₀ | -0.07 | -0.06 | 0.19 | 0.09 | 0.07 | -0.08 | -0.01 | -0.10 | -0.08 | 1.00 | | | | | |
| V ₁₁ | -0.29 | 0.27 | 0.14 | 0.15 | 0.39 | 0.65 | 0.18 | 0.04 | 0.21 | -0.05 | 1.00 | | | | |
| V ₁₂ | 0.07 | 0.55 | 0.04 | 0.17 | 0.23 | 0.04 | -0.07 | -0.07 | -0.25 | 0.12 | 0.10 | 1.00 | | | |
| V ₁₃ | 0.17 | 0.20 | -0.09 | 0.07 | 0.22 | 0.22 | -0.07 | 0.38 | 0.31 | -0.22 | 0.25 | 0.05 | 1.00 | | |
| V ₁₄ | -0.17 | 0.41 | 0.12 | 0.23 | 0.44 | 0.28 | -0.08 | -0.06 | -0.69 | 0.21 | 0.21 | 0.62 | 0.09 | 1.00 | |
| V ₁₅ | -0.20 | -0.08 | -0.09 | -0.03 | 0.19 | -0.06 | 0.04 | 0.14 | 0.05 | 0.02 | 0.15 | -0.05 | 0.11 | -0.01 | 1.00 |

(Source: Field Survey, 2014)

The Table 4.14 above, represents the correlation matrix of the data. The correlation matrix helps in determining the relationship between the various factors. The highest correlation is between V_{14} (Application of quality standard) and V_9 (Contractor selection framework) with the value of 0.69.

The second highest correlation is between V_{11} (Information, specification and documentation) and V_6 (Material quality) with the value of 0.65. Other correlations like V_7 (Motivation and quality recognition) and V_6 (Material quality), V_{12} (Contract review) and V_2 (Competitive bidding) have moderate high correlation, 0.55.

Again, another correlation of 0.39 was observed between V_6 (Material quality) and V_8 (Quality culture and attitude of contractor), V_8 (Quality culture and attitude of contractor) and V_1 (Project supervision), and V_{11} (Information, specification and documentation) and V_5 (training policy and education).

The correlation between V_{15} (government policies and regulations) and V_{10} (relationship between construction players) recorded the least value of correlation with a value of 0.01.

Also, negative correlation exist between V_3 (management commitment) and V_8 (quality culture and attitude of contractor) with a value of -0.16. There is also a negative correlation of -0.10 between V_{10} (relationship between construction players) and V_8 (quality culture and attitude of contractor). Between V_{13} (procurement system) and V_3 (management commitment), there exist a negative correlation of -0.09.

Table 4.15: KMO and Bartlett's Test

| Measure | value |
|--|--------------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | 0.71 |
| Bartlett's Test Critical Value | 274.45 |
| Bartlett's test degree of freedom | 104 |
| Bartlett's significant value | 0.00 |

(Source: Field Survey, 2014)

The Kaiser-Meyer-Olkin (KMO) indicator was first considered to assess sample size adequacy (Brah et al., 2002). With the KMO value of 0.7, as indicated in Table 4.15 above, there is indication that the text is meritoriously adequate for factoring. This suggests that factor analysis is appropriate and correlation matrix is appropriate for factoring. The Bartlett's test of sphericity is also significant (a p - value of 0.00 at a large chi-square value of 274.45, this though relative, is large enough to warrant factor analysis.

The correlation analysis, the KMO and the Bartlett's tests above suggest that, there are correlations among the indicator variables and hence, can subject the original 15 indicators to a factor analysis procedure. The value of KMO statistic mingle between 0 and 1, the sum of partial correlations is large relative to the sum of correlations only if the value is 0, indicating diffusion of pattern of the correlations and hence factor analysis is likely to be inappropriate but if it's not zero then it means factor analysis is appropriate (Brah et al., 2002).

Table 4.16: Total Variation Explained

| Component | Eigenvalue | % of | Cumulative |
|-----------|------------|----------|------------|
| | | Variance | % |
| 1 | 4.85 | 28.56 | 28.56 |
| 2 | 2.98 | 18.55 | 46.11 |
| 3 | 1.98 | 12.62 | 57.73 |
| 4 | 1.39 | 9.20 | 65.83 |
| 5 | 1.29 | 7.57 | 73.50 |

(Source: Field Survey, 2014)

Eigenvalues are the variances of the components. The % of variance contains the percentage of total variance accounted for by each component. The cumulative percentage contains variance accounted for by the current and all preceding components. Using the Eigenvalue greater than one rule, the first factor explains about 28.56% of the data. The second factor also explains about 18.55% of the data which was not explained by the first factor. The third factor explains about 12.62% of the data which was not indicated by the first and second factors. The fourth factor explains about 9.20% of the data which was not explained by the first three factors having about 65.83 cumulative percentages which is highly significant to explain the total variations in the data.

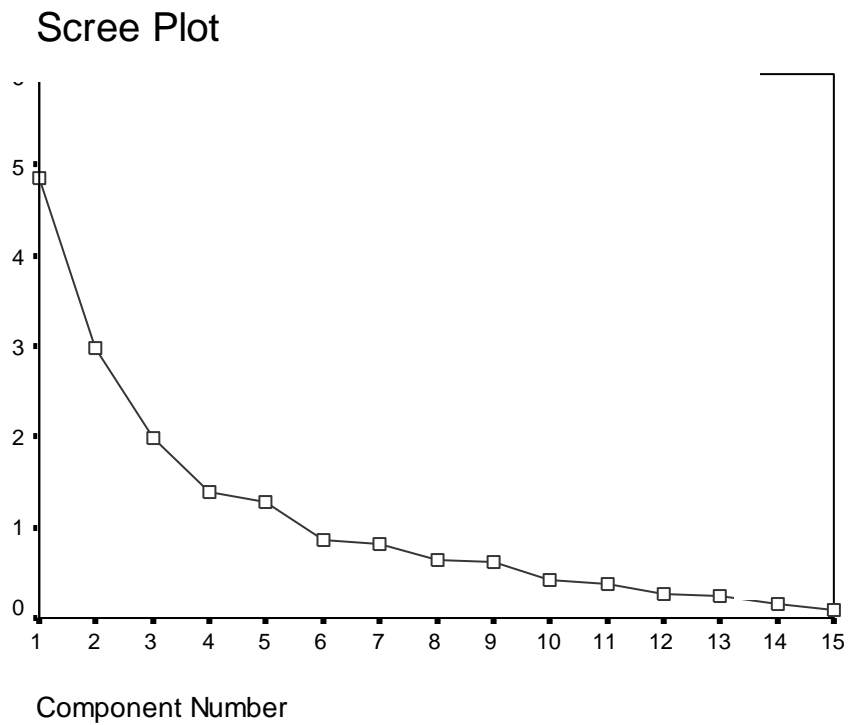


Figure 4.1: Scree Plot

The Scree plot graphs the eigenvalue against the component number. From Figure 4.1, it can be seen that the 'elbow' of the diagram happens at the fourth component. This intends depicts that, the number of factors that must be considered for extraction is four (4) but must not exceed five.

Table 4.17: Rotated Factor Matrix

| Variable | Component | | | |
|-----------------|-------------|--------------|-------------|--------------|
| | 1 | 2 | 3 | 4 |
| V ₁ | 0.02 | 0.39 | 0.37 | -0.80 |
| V ₂ | 0.92 | 0.02 | 0.52 | 0.03 |
| V ₃ | 0.06 | -0.04 | -0.14 | 0.16 |
| V ₄ | 0.24 | 0.21 | -0.20 | 0.03 |
| V ₅ | 0.36 | 0.09 | 1.07 | 0.24 |
| V ₆ | 0.13 | 1.22 | 0.18 | -0.07 |
| V ₇ | -0.18 | 0.48 | 0.08 | 1.03 |
| V ₈ | -0.09 | 0.17 | 0.13 | -0.09 |
| V ₉ | -0.25 | 0.28 | 0.60 | 0.04 |
| V ₁₀ | 0.04 | 0.04 | -0.42 | 0.05 |
| V ₁₁ | 0.27 | 0.27 | 0.42 | 1.13 |
| V ₁₂ | 0.91 | 0.02 | -0.18 | -0.10 |
| V ₁₃ | 0.14 | 0.13 | 0.33 | 0.05 |
| V ₁₄ | 1.04 | -0.67 | -0.11 | 0.25 |
| V ₁₅ | -0.03 | 0.03 | 0.00 | 0.09 |

(Source: Field Survey, 2014)

According to (Sharma, 1996), the rotation of the factors offers an opportunity to have a simpler factor structure that can be meaningfully interpreted. Table 4.18 above presents the results of the rotated component matrix it was observed that, factor one loads highly on V₂ (Competitive bidding), V₁₂ (Contract review) and V₁₄ (Application of quality

standards). Thus the factor was termed procurement system factors. The factor two loaded highly on V_{14} (Application of quality standards) and V_6 (Material quality). Thus the factor was named quality related factors.

The third factor loaded highly on V_2 (Competitive bidding), V_9 (Contractor selection framework) and V_5 (Training policy and education), thus the factor is named contractor selection factors.

Factor four loads highly on V_1 (Project Supervision) V_7 (Motivation and quality recognition) and V_{11} (Information, specification and documentation), thus the factor was named project related factors.

Principal Component 1: Procurement System Factors

Three factors loaded on Principal Component 1 were Competitive bidding (0.92), Contract review (0.91) and Application of quality standards (1.04). These factors loaded on this component related more to procurement, thus, the theme procurement system factors. From Table 4.14, it became evident that contract review and competitive bidding had high correlation of 0.55. The mean values of 1.39 (Competitive bidding) and 1.11 (Contract review) showed how least they were ranked as factors for assuring quality (Table 4.13). The core objective of any procurement system is to achieve fair competition. The problems identified above highlighted single contractor buying all documents. Its implication is that competition is denied. Literature revealed that a bane to achieving excellence in quality linked to the system of procurement adopted (Janipha and Ismail, 2013). The survey revealed that all procurement entities in the colleges adopted the traditional system of procurement. Semi structured interview brought to bare the

necessity to explore other non traditional systems of procurement to identify its potential benefits in terms of quality.

Principal Component 2: Quality Related Factors

Two factors loaded on Principal Component 2 were Application of quality standards (0.67) and material quality (1.22). This principal component was named quality related factors. The various factors loaded on this principal component were affirmations from literature like application of quality standards (Kandeil et al., 2010) and material quality (Idoro, 2010 and Janipha and Ismail, 2013). Standard of quality for the project is set out at the onset. The onus laid on the supervisor (consultant) to guide parties especially the contractor to work in line with the laid down standards. Quality standard looks at material and workmanship. From literature material quality has been a cause of collapse of several buildings (Purohit, 2013; BBC 2013 and Boley, 2009). Poor quality workmanship has also led to defects and eventual collapse of some buildings (Pheng and Wei, 1996 and Jha and Iyer, 2006). It can be deduced from the above that misapplication of quality standards is likely to lead to quality failure. This implies that to assure quality, quality related factors will be paramount.

Principal Component 3: Contractor Selection and Training Factors

On this principal component, three factors were loaded namely Competitive bidding (0.52), Contractor selection framework (0.60) and Training policy and education (1.07). The problems to achieving quality in public works procurement listed in Table 4.12 ranked award of contract primarily on price as one of the principal factors. Literature and semi structured interview confirmed that lowest price meant least quality (Awal, 2010,

Huang, 2011, Idrus et al., 2011). To overcome this problem, the framework for contractor selection needs to change from only price to include non-price factors. Sodangi et al. (2010), Wan Mahmood et al. (2006) and Said et al. (2009) identified the impact training policy and education will have on quality. The global marketplace keep changing which implies that policies and personnel need to continually change through amendments and education to keep abreast with current demands. An informant said “*hardly do Ghanaian contractors invest in their personnel, ... ABCECG activities does not have any bearing to winning a contract ... why do I waste my resources*”.

Principal Component 4: Project Related Factors

Principal component 4 loaded on these factors; project supervision (0.80), motivation and quality recognition (1.03) and information, specification and documentation (1.13). Literature confirmed the effects of these factors on quality assurance in public works procurement (Building EDC, 1987; BRE, 1982; Sodangi et al., 2010; Wan Mahmood et al., 2006 and Janipha and Ismail, 2013). Project supervision was keen as an informant mentioned “*the contractor is as good as the consultant who supervises him*”. Lack of supervision will lead to contractor misapplying contract conditions and specification to his advantage. Quality recognition and motivation through award ceremonies organized by ABCECG in collaboration with other stakeholders to honour contractors of high quality performance will augur well for the industry.

4.6 FINDINGS

From the results and discussions, it became evident that of all the stages in the traditional procurement system, the procurement stage (bidding/tendering) contributed to most of the problems and their activities were critical to achieving quality assurance. This implied that improving systems and mechanisms at that stage will in turn enhance implementing quality assurance strategies, thus achieving quality in public works procurement. From the above, four principal components were identified including procurement system factors, quality factors, contractor selection and training factors and project related factors. Considering the procurement stage, three principal components (procurement system factors, quality factors and contractor selection and training factors) will be factored into the framework design. Below is a diagrammatical representation of the reviewed framework based on survey.

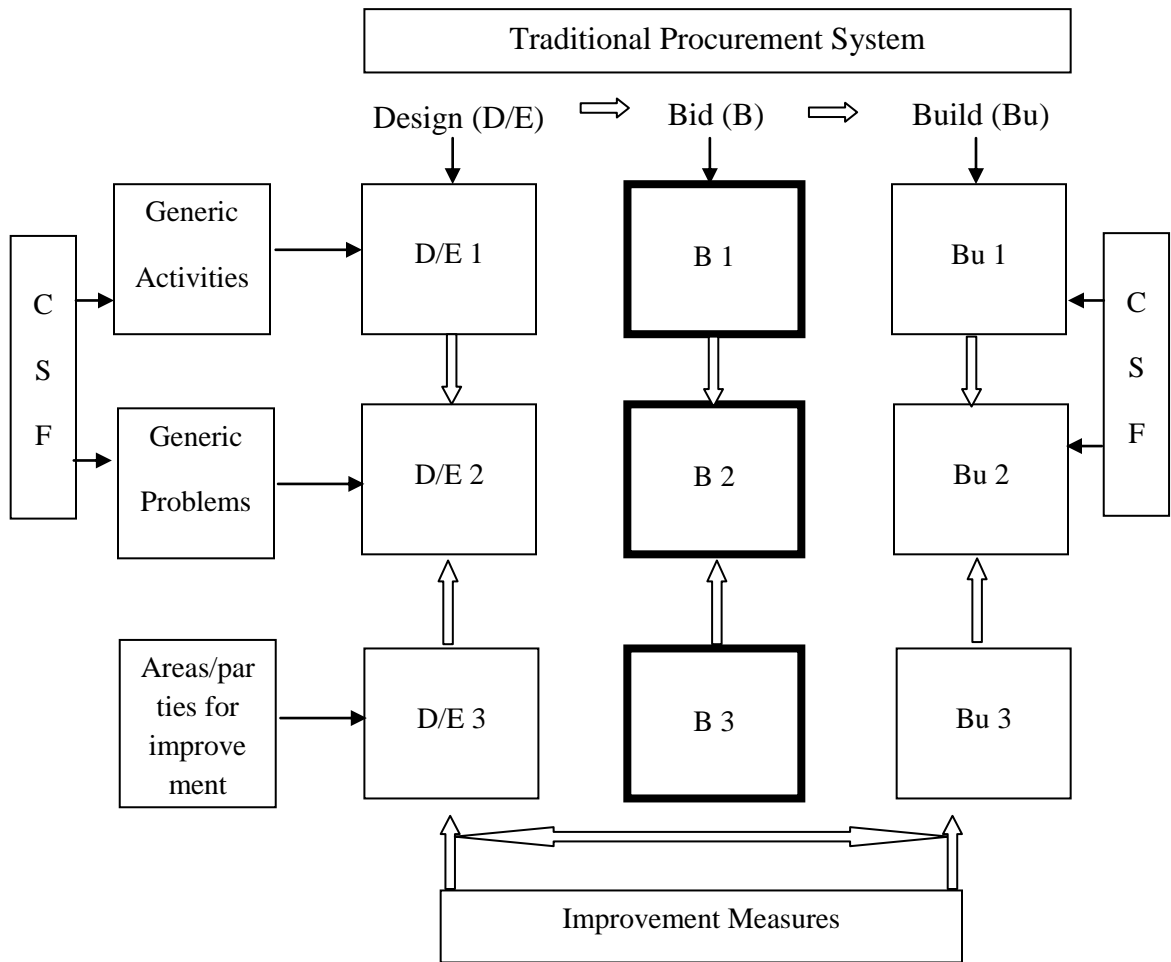


Figure 4.2: Review of Framework after Survey

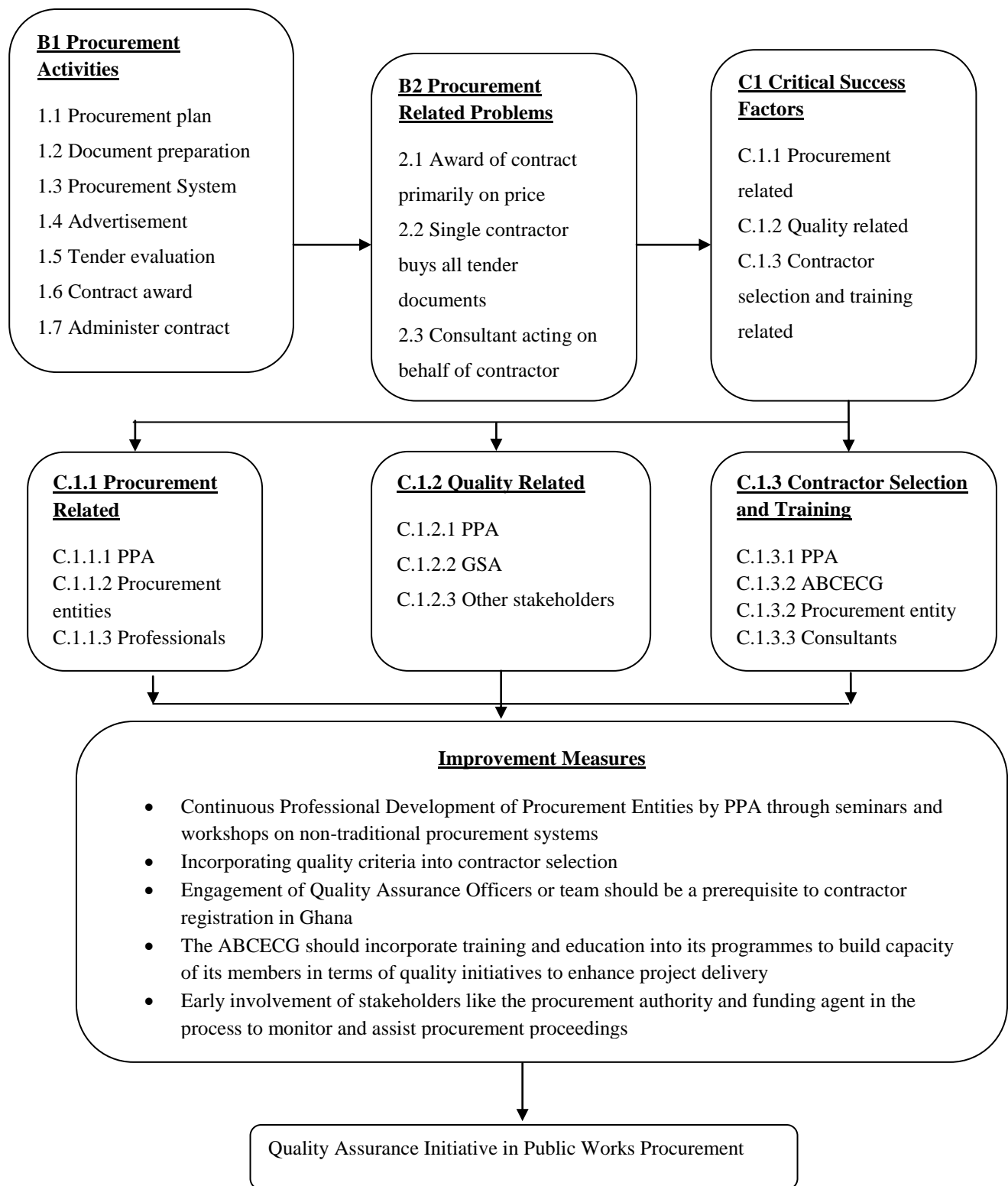


Figure 4.3: WQAF for public works procurement

4.7 FRAMEWORK VALIDATION

Validation is confirming about the credibility by strengthening confidence of research findings (Patton, 2003). Validation process also can involve getting reviews from respondents those who responded at first place for the research (Lincoln and Guba, 1985; Patton, 1990). Furthermore, if respondents are provided an opportunity to examine and comment on the findings, it allows researchers to learn a great deal about the accuracy, completeness, fairness about the final research outcome presented (Patton, 2003). The aim of the framework validation is to refine and examine the appropriateness of the proposed WQAF for public works procured using traditional D B and B system. In achieving this aim, specific objectives of the evaluation were set out:

- Determine the clarity and simplicity of the proposed WQAF;
- Determine the systematic nature and comprehensiveness of the proposed WQAF;
- Examine the applicability and practicalities of the proposed improvement measures; and
- Identify potential implementation strategies for the proposed framework.

4.7.1 Background Information of Respondents

A total number of five (5) respondents were chosen for the framework validation. 4 of the respondents took part at the initial interview survey whilst 1 only took part in the validation questionnaire. The questionnaire comprised both closed and opened questions (Appendix 3). Respondents belonged to one professional body or another and have been

in practice for an appreciable number of years in various professions as Quantity Surveyors, Architects and Procurement Managers.

4.7.2 Framework Validation Survey Results

Table 4.18: Rating for the Evaluation of the Framework

| Requirements | P1 | P2 | P3 | P4 | P5 | Mean Score |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-------------------|
| Simple | 4 | 4 | 4 | 4 | 4 | 4 |
| Easy to understand | 4 | 3 | 3 | 4 | 4 | 3.6 |
| Systematic | 4 | 4 | 4 | 4 | 4 | 4 |
| Well structure | 4 | 4 | 4 | 4 | 3 | 3.8 |
| Comprehensive | 3 | 4 | 4 | 3 | 4 | 3.6 |
| Practical approach | 4 | 3 | 4 | 4 | 4 | 3.8 |
| Applicable to your work | 4 | 5 | 4 | 4 | 3 | 4 |

Source: Author's Construct

Table 4.20 presents a summary of the ratings given by participants. Looking at extreme values, it can be seen that “easy to understand” and “comprehensive” scored the least mean value of 3.6. On the other hand, only one participant (P2) chose “strongly agreed” with the item “applicability of the framework”. Apart from these, participants agreed, in general, that the framework provided a “simple”, and “systematic” way to build quality into work processes (these requirements obtained 4). They also tended to agree that it was well structured and practical, since the mean scores for these aspects were 3.8.

4.7.3 Suggested Implementation Strategy for the Framework through Validation

This section presents suggested implementation strategies by participants. The following are the suggestions made:

- *Collaborative working amongst stakeholders to build quality into the early stages of the procurement process through education and stakeholder responsibility.*
- *Development of contractors' capacity through effective registration process and a link to Association of Building Civil Engineering Contractors of Ghana (ABCECG) for continuous training and education.*
- *Engagement of Quality Assurance Officers or Team should be a prerequisite to contractor registration in Ghana.*
- *Independent bodies (Procurement auditors) must be in place to eliminate single contractor buying all documents.*

4.8 SUMMARY

This chapter offered the analysis and discussions of outcomes obtained from questionnaire survey and semi-structured interview. It first made a presentation on the qualitative survey from stakeholders on the practices and problems of QA in public works procurement and identified success factors. The next stage presented results from the quantitative survey. Descriptive statistics and factor analysis were tools used in the analysis. Finally, the chapter concluded with the framework development and validation. The next chapter brought to fore the conclusions and recommendations of the research.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

Against the background that quality is a problem in developing countries (such as Ghana) there is the prerequisite to employ public procurement for advancing effective works procurement practices, this research has developed a framework for enhancing quality assurance of works procurement in Ghana. Later, the appropriate critical success factors for enhanced performance of quality assurance in Ghana have been acknowledged.

5.2 REVIEW OF RESEARCH OBJECTIVES

The purpose of this thesis was to develop a WQAF. In pursuing this aim, two other objectives were established. The fulfillment of each of the objectives is forwarded in the following sections.

5.2.1 Fulfillment of First Objective

Objective one was to review current quality assurance practices and identify problems associated with works procurement. In this regard, the literature reviewed practices and identified problems associated with public works procurement. Consequently, the survey findings revealed that the traditional design, bid and build procurement system continues to be the most preferred system for all Colleges of Education under study. All problems identified in literature survey were the same problems faced in the industry except “Consultant acting on behalf of the contractor” which was mentioned by some stakeholders and reiterated the effect it will have on the project in relation to quality.

5.2.2 Fulfillment of Second Objective

Objective two was to identify critical success factors for quality assurance in public works procurement. This objective was carried out by conducting thorough literature review, questionnaire survey and semi-structured interviews to pinpoint factors for quality assurance in works procurement. The key success factors identified included “procurement related factor”, “quality related factor” and “contractor selection and training factor”.

5.2.3 Fulfillment of Third Objective

Objective three was to develop a WQAF based on generic activities, generic problems, CSFs and improvement measures for QA. The WQAF development process was based on the concept of continuous process improvement methodology and the key findings emerging from the study. The proposed framework has three levels: activities and problems, areas/parties for improvement and improvement measures. The WQAF contents guide the user by knowing what to do at each stage, identifying the likely problems, identifying key areas for improvement and devising measures to improve the situation.

5.3 RESEARCH CONTRIBUTIONS

This research has explored the practices, problems and critical success factors that impact on quality assurance for public works procurement, thereby developing a WQAF for traditional design bid and build projects undertaken by public procurement entities especially Colleges of Education in Ghana. The specific contributions of this study are as follows:

The findings of the study contribute to literature on public procurement and quality assurance to enhance improvement in works procurement practices.

The study reported how other procurement systems other than the traditional design bid and build could be adopted by Colleges of Education in Ghana to enhance quality delivery.

The study came out with a framework for projects acquired using traditional design, bid and build procurement system. The WQAF provides the basis for QA within D B and B projects guiding through not only to determine potential problems but also suggesting potential measures for QA.

5.4 RESEARCH LIMITATIONS

There were problems encountered in the course of conducting the study at the fieldwork phase, which posed serious constraints to the execution of the study. Firstly, limitations originating from the nature of the questions/topic being investigated are acknowledged. There is a possibility that respondents were reluctant to disclose current practices concerning their institutions. Although respondents were assured that their responses would be treated confidentially and there would not be any adverse impacts on their institution, it is difficult to assess the extent to which this was a success in gaining exact responses. Similarly, the researcher noticed that several participants were reluctant to declare a complete opinion on certain issues raised (e.g. when they were asked company specific quality assurance plans and policies). Furthermore, in this regard, the research would have been even more successful, if all the participants were aware and had greater experience in aspects of both procurement and quality assurance.

Secondly, the research respondents sample was drawn from Colleges of Education in ASHBA, CENWEST and EGA. Although, the current study attempted to draw an appropriate and best possible sample for the study, it would have been slightly different if it was a larger sample size and a different sample frame. This was a key reason for limiting the study sample considering the availability of time and resources involved in reaching the respondents.

5.5 RECOMMENDATIONS

Considering the findings and conclusions of this research, a number of key recommendations can be made to public procurement entities and policy regulators in order to improve current practices.

5.5.1 Public Procurement Entities

Public Procurement Authority should organize regular training and education for procurement entities on non-traditional procurement systems and their impact on quality delivery of projects.

5.5.2 Policy Regulators

Government policies and legislations relating to public procurement need to be further reviewed in order to incorporate quality assurance strategies at the initial phase of the project. Furthermore, the research reported that QA could be achieved through the collective effort of all stakeholders. As such, a positive commitment from all project stakeholders is essential to act on their specific QA responsibilities. This study recommends the establishment of a cyclical *modus operandi* for stakeholders in public

procurement with the use of web interface to enhance performance for each project stakeholder to drive collective and holistic QA agenda.

5.6 Further Research

This study reports its findings based on the subjective opinions of respondents. The developed WQAF is only limited to projects that are acquired using the old-style design and tender and construct procurement approach. Therefore, future research could be extended to study other procurement approaches in depth. Also, the findings may have differed if other project stakeholders'/participants' opinions were gained. Therefore, it is recommended that future studies should consider different project characteristics (e.g. project size, project duration). Furthermore, based on the evidence provided in this study, further study can be focused on formulating implementation strategies and devising mechanisms for continuous improvement for WQAF within traditional design, bid and build projects.

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APPENDIX 1: INTERVIEW GUIDE

Preamble

My name is Nana Osei-Bonsu an MPhil. student from Department of Building Technology at Kwame Nkrumah University of Science and Technology, Kumasi.

This research questionnaire has been designed to solicit views from Professionals, based on their experience and high profile work undertaken in their capacity as construction professionals as practiced in Ghana. It is aimed at:

1. Understanding current quality assurance practices and identifying challenges in public works procurement;
2. Identifying critical factors influencing quality assurance in public works procurement; and
3. Developing a quality assurance framework for works procurement improvement.

The implication of the findings is for the future development of the public works procurement in Ghana and any information provided will be treated with the highest confidentiality.

I would like to convey my appreciation for your cooperation in completing these questions. If you have any questions and contributions about this research, please mail at bonann85@yahoo.com or call on 0243422694.

Thank you in advance for your participation and assistance with this study.

Interview Guide

SECTION A: *Background Information*

1. Please indicate which of the following that best describes your area of expertise.

| | |
|---------------------------------|-----|
| Quantity Surveyor | [] |
| Architect | [] |
| Quality Officers | [] |
| Works Officer | [] |
| Procurement Officer | [] |
| Other (s), please specify | |

2. For how long have you been in professional practice?

| | |
|---------------|-----|
| Up to 5years | [] |
| 6-10 years | [] |
| 11-15years | [] |
| 16-20 years | [] |
| Over 20 years | [] |

3. Please indicate your level of education.

| | |
|----------------------|-----|
| Professional Diploma | [] |
| Bachelor Degree | [] |
| Master/PGD Degree | [] |
| Doctorate | [] |

4. Which of the following professional bodies do you belong to?

| | |
|--|-----|
| Ghana Institute of Surveyors (GhIS) | [] |
| Ghana Institution of Engineers (GhIE) | [] |
| Ghana Institution of Architects (GIA) | [] |
| Ghana Institution of Construction (GIOC) | [] |
| Other(s), please specify | |

SECTION B: *Current Quality Assurance Practices and Problems in Public Works Procurement*

5. By PPA law, the cost consideration framework is the underlying factor for selecting a contractor, how does this influence quality?

.....
.....
.....

6. Survey revealed that traditional procurement system is dominant, what is its influence on quality?

.....
.....
.....

7. Apart from the technical, financial and management criteria, what other criteria can be used to assess contractors to enhance quality delivery?

.....
.....
.....

8. What problems do you normally encounter in your quest to ensure quality delivery of project?

.....
.....
.....

SECTION C: *Critical success factors for works quality assurance*

9. From your experience with public procurement, what factors can enhance quality delivery of works procurement?

.....
.....
.....

SECTION D: *Improvement Measures*

10. What measures do you propose to improve quality delivery in public works procurement?

.....
.....
.....

APPENDIX 2: QUESTIONNAIRE FOR THE STUDY

Preamble

My name is Nana Osei-Bonsu an MPhil. student from Department of Building Technology at Kwame Nkrumah University of Science and Technology, Kumasi.

This research questionnaire has been designed to solicit views from Professionals, based on their experience and high profile work undertaken in their capacity as construction professionals as practiced in Ghana. It is aimed at:

1. Understanding current quality assurance practices and identifying challenges in public works procurement;
2. Identifying critical factors influencing quality assurance in public works procurement; and
3. Developing a quality assurance framework for works procurement improvement.

The implication of the findings is for the future development of the public works procurement in Ghana and any information provided will be treated with the highest confidentiality.

I would like to convey my appreciation for your cooperation in completing these questions. If you have any questions and contributions about this research, please mail at bonann85@yahoo.com or call on 0243422694.

Thank you in advance for your participation and assistance with this study.

Questionnaires

SECTION A: *Background Information*

1. Please indicate which of the following that best describes your area of expertise.

| | |
|---------------------------------|-----|
| Quantity Surveyor | [] |
| Architect | [] |
| Quality Officer | [] |
| Works Officer | [] |
| Procurement Officer | [] |
| Other (s), please specify | |

2. For how long have you been in professional practice?

| | |
|---------------|-----|
| Up to 5years | [] |
| 6-10 years | [] |
| 11-15years | [] |
| 16-20 years | [] |
| Over 20 years | [] |

3. Please indicate your level of education.

| | |
|----------------------|-----|
| Professional Diploma | [] |
| Bachelor Degree | [] |
| Master/PGD Degree | [] |
| Doctorate | [] |

4. Which of the following professional bodies do you belong to?

| | |
|---|-----|
| Ghana Institute of Surveyors (GhIS) | [] |
| Ghana Institution of Engineers (GhIE) | [] |
| Ghana Institution of Architects (GIA) | [] |
| Ghana Institution of Construction (GIOCI) | [] |
| No affiliation | [] |
| Other(s), please specify | |

5. Which contractor category do you normally work with?

| | |
|-----------------|-----|
| Class D1 and K1 | [] |
| Class D2 and K2 | [] |
| Class D3 and K3 | [] |
| Class D4 and K4 | [] |

SECTION B: *Current Quality Assurance Practices in Public Works Procurement*

6. Which standards or documents provide guideline for compliance in public works procurement?

Public Procurement Act, 2003 (Act 663) []

Contract drawings []

Bills of Quantities []

Specifications []

Conditions of Contract []

Others, please state

7. How would you rate the importance of the following critical success criteria (CSC) for determining the successful contractor in Ghana? Please tick (√) the appropriate number. 1=Very Low, 2=Low, 3=Moderate, 4=High and 5=Very High

| Criteria for contractor selection | Levels | | | | |
|--|--------|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Financial Criteria | | | | | |
| 1. Tender price | | | | | |
| 2. Audited financial statement for the last 3 years | | | | | |
| 3. Annual turnover | | | | | |
| 4. Lines of credit | | | | | |
| Technical Criteria | | | | | |
| 5. Proof of experience of similar nature of works | | | | | |
| 6. Proof of experience of key staff relevant for works | | | | | |
| 7. Number of current projects | | | | | |

| | | | | | |
|---|--|--|--|--|--|
| 8. Plant and equipment holding | | | | | |
| 9. Contract period | | | | | |
| 10. Completed projects on time | | | | | |
| 11. Completed projects within budget | | | | | |
| Management Criteria | | | | | |
| 12. Relationship with past clients | | | | | |
| 13. Organizational structure | | | | | |
| 14. Material suppliers | | | | | |
| 15. Organisational safety and health plan | | | | | |
| <i>Others please indicate</i> | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

SECTION C: *Problems of quality assurance practices*

8. In your experience, which of the following factors have the likelihood to affect the quality of public works procurement? Please rank their level of influence by indicating 1 to 5; where 1=Least likely and 5=Most likely

| Factors | Rank |
|---|------|
| 1. Unstable client requirements | |
| 2. Poor definition of needs | |
| 3. Lack of buildability in design | |
| 4. Inadequate design details and specifications | |
| 5. Poor design coordination | |

| | |
|---|--|
| 6. Lack of codes and standards | |
| 7. Consultant acting on behalf of contractor | |
| 8. Bid rotation | |
| 9. Award of contract primarily of price | |
| 10. Single contractor buys all tender documents | |
| 11. Poor supervision | |
| 12. Poor construction materials | |
| 13. Poor workmanship | |
| | |
| | |

SECTION D: *Success factors influencing quality assurance in public works procurement*

9. Which of the following would you consider as critical factors affecting quality assurance in public works procurement? Please rank 1 to 5; 1 = Least and 5 = Highest

| Factors | Rank |
|---|------|
| 1. Project supervision | |
| 2. Competitive bidding | |
| 3. Management commitment | |
| 4. Communication | |
| 5. Training policy and education | |
| 6. Material quality | |
| 7. Motivation and quality recognition | |
| 8. Quality culture and attitude of contractor | |

| | |
|--|--|
| 9. Contractor selection framework | |
| 10. Relationship between construction players | |
| 11. Information, specification and documentation | |
| 12. Contract review | |
| 13. Elimination of external forces | |
| 14. Application of quality standard | |
| 15. Government policies and regulations | |
| | |
| | |

APPENDIX 3: VALIDATION FRAMEWORK QUESTIONNAIRE

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BUILDING TECHNOLOGY

FRAMEWORK VALIDATION QUESTIONNAIRE

The aim of this validation questionnaire is to refine and validate works quality assurance framework in terms of clarity, simplicity, systematic nature, comprehensiveness, applicability and practicality of components.

The questionnaire would take maximum 15 minutes to complete and the information ascertained will be adopted to refine the proposed framework. All responses remain confidential.

Thank you in advance for your help in assisting this research.

Nana Osei-Bonsu, MPhil Student,

Department of Building Technology,

KNUST-Kumasi

Email: bonann85@yahoo.com

Mobile: 0243422694 / 0203071574

Section A: Background Information

1. Area of Expertise

2. Number of years in practice

Section B: Clarity and Systematic nature of the framework

| Requirements | Strongly disagree (1) | Disagree (2) | Neutral (3) | Agree (4) | Strongly disagree (5) |
|----------------------------|-----------------------|--------------|-------------|-----------|-----------------------|
| Simple | | | | | |
| Easy to understand | | | | | |
| Systematic | | | | | |
| Well structured | | | | | |
| Comprehensive | | | | | |
| Practical approach | | | | | |
| Applicability to your work | | | | | |

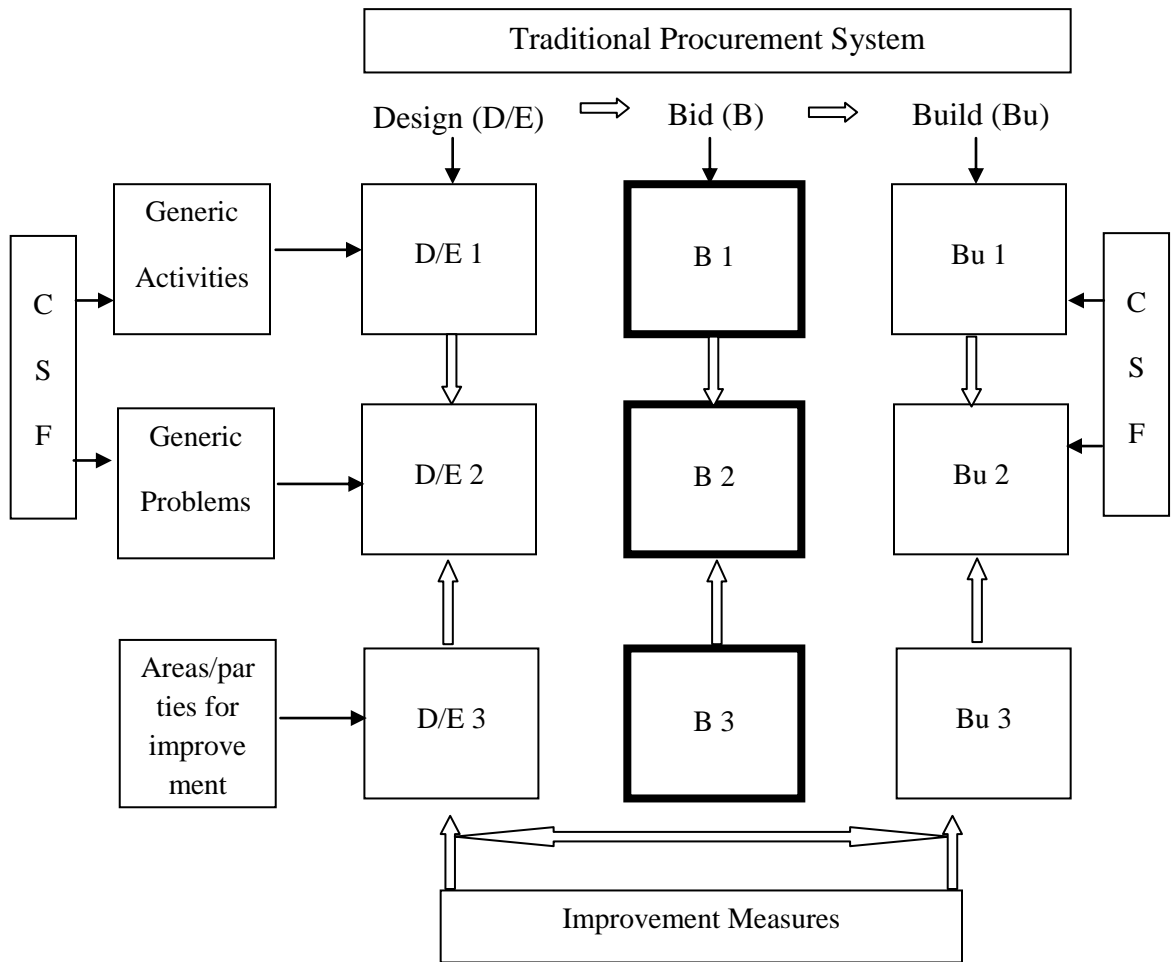
Section C: Implementation Strategy

4. What strategies do you suggest to implement the proposed framework?

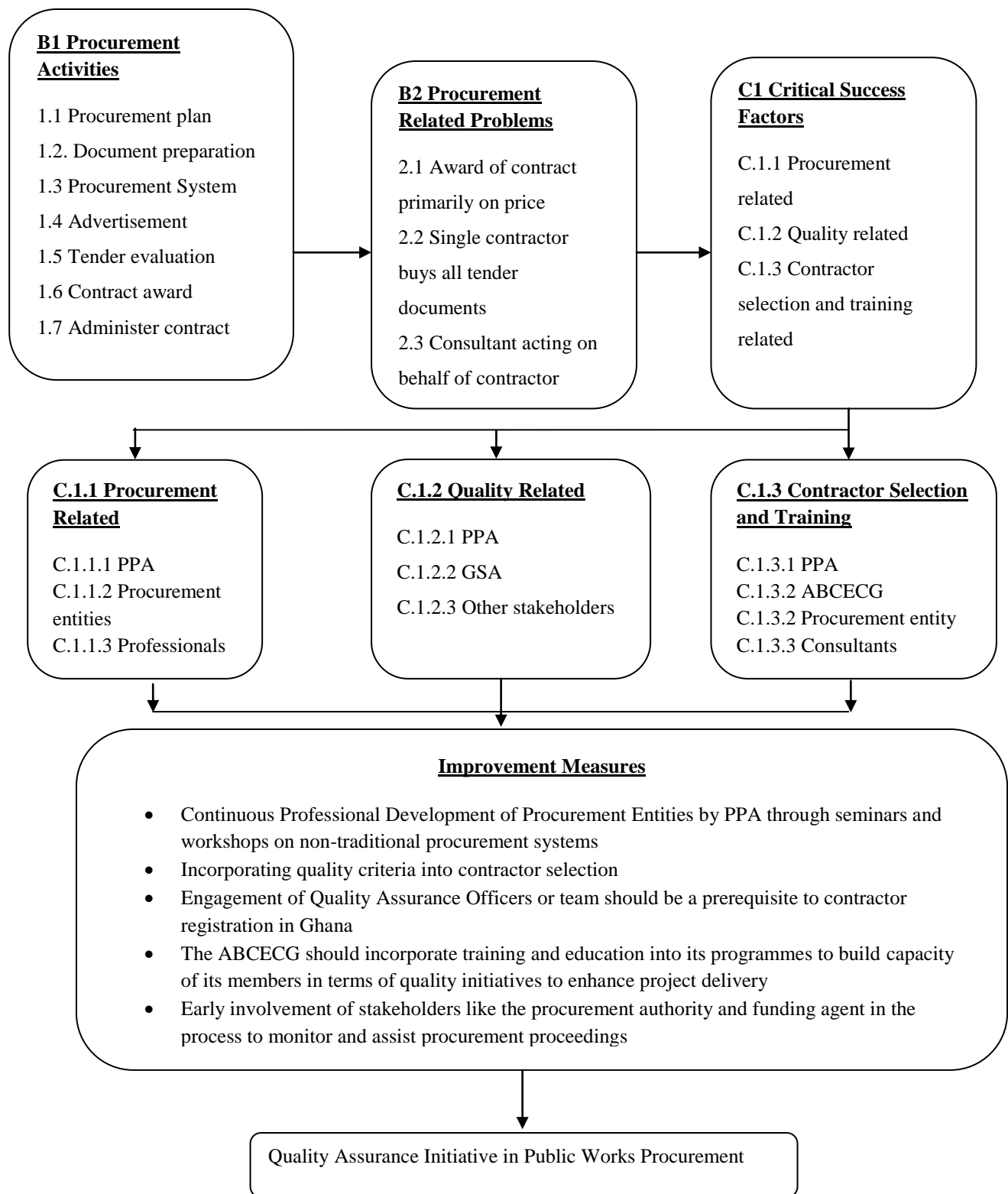
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Review of framework after survey (A)



Proposed Works Quality Assurance Framework for Public Procurement (B)

APPENDIX 4: BRIEF BACKGROUND OF INTERVIEWEES' ORGANISATIONS

GHANA EDUCATION TRUST FUND (GETFund)

Demands for expansion of educational facilities to cope with increased student population became a challenge to the Education Ministry and so in 2000, by an act of Parliament, the Ghana Education Trust Fund (GETFund) Act (Act 581) of 2000 was established. The GETFund is resourced with 2½% of Value Added Tax (VAT) accruing to the country with an objective of being a sustained source of funds to provide and maintain infrastructure for the educational sector. A GETFund Secretariat, headed by an Administrator was set up to administer and manage the fund. The funds are disbursed to beneficiary tertiary institutions through the National Council for Tertiary Education (NCTE). The function of the fund includes but not limited to monitoring GETFund sponsored projects to ensure their conformity with technical specifications and for the promotion of quality assurance.

GHANA STANDARDS AUTHORITY (GSA)

The Ghana Standards Authority (GSA) which is the national standards body was established by the Standards Decree, 1967 (NLCD 199) which has been superseded by the Standards Decree, 1973 (NRCD 173). The Authority is also the custodian of the Weights and Measures Decree (NRCD 326, 1975). Its mandate is to promote standardization for the improvement of the quality of goods, services and sound management practices in industries and public institutions in Ghana. Ghana through the Ghana Standards Authority takes part in international and regional standardization activities and is currently a participating member in seventeen ISO Technical Committees and sub-committees. It has membership with the following organizations; International

Standards Organization (ISO), ASTM International, African Organization for Standardization (ARSO) among other bodies.

MINISTRY OF EDUCATION (MoE)

The Ministry of Education was established under the Civil Service Law 327 and under the PNDC Law 1993 with the mandate to provide relevant education to all Ghanaians. The Ministry is committed to put in place an education system focused on promoting creativity and problem-solving through the development of academics, technical and vocational programmes that will improve the acquisition of skills and assure job-market readiness. The FPMU is a multi-donor projects implementation Unit which was created in 1999 to overcome the multiplicity and duplication of functions of Project Implementation Units hitherto to being operated by the Ministry of Education. The Funds and Procurement Management Unit (FPMU) is responsible for the coordination and management, disbursement and procurement of Donor/bilateral/ multilateral funded projects as well as projects funded through GOG related funds lodged at the GETFund.

PUBLIC PROCUREMENT AUTHORITY (PPA)

Public Procurement Authority was established in 2003 under Act 663 to harmonise the process of procurement in the public service to secure a judicious, economic, and efficient use of public funds to ensure that public procurement is carried out in a fair, transparent and non-discriminatory manner while promoting a competitive Local Industry. A world-class, efficient, transparent, accountable and professionally managed public sector procurement system in Ghana, which enjoys high level of business

confidence, and ensures consistent attainment of best value for money in the procurement of goods, works and services, in support of national development and fiscal policies. It provides standard documents, regulations and manual which serves as guide to procurement entities.

ASSOCIATION OF BUILDING AND CIVIL ENGINEERING CONTRACTORS OF GHANA (ABCECG)

The Association of Building and Civil Engineering Contractors of Ghana (ABCECG) was formed about thirty-five (35) years ago, " to offer a common and united front for persons in building and civil engineering construction to dialogue effectively with the Government of Ghana through our sector Ministry (Ministry of Water Resources, Works and Housing) for the development and growth of the industry and for the economic benefit of the nation with a membership strength of approximately 1282 companies, including 12 foreign contractors the Associating keeps growing. It has its mission to develop a code of ethics and adherence to quality workmanship on projects as well as contract specifications. Also, to link up with building materials manufacturers and suppliers (importers) to ensure that quality products are put on the market. One of its objectives is to monitor operations and liaise with members for quality execution of building projects in all the regions.