KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

ASSESSING THE EFFECT OF PROCUREMENT SYSTEMS ON THE DESIGN TEAM'S PERFORMANCE

BY

HARRIET ESHUN

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DEDICATION

I dedicate this work firstly to Almighty God for the gift of life and also for making all this possible. Secondly to my wonderful family for their immeasurable support, especially to my wonderful husband Mr. Kwame Baah Eshun and to my awesome children Papa Kojo Eshun, Jemimah E. N. Eshun and Keziah E.A. Eshun who have supported me all through.

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ABSTRACT

The study investigated into performance of design team under traditional and design and build systems of procurement using selected public procurement entities in Kumasi Metropolis. The study employed purposive sampling technique to identify and select the institutions and they were Kwame Nkrumah University of Science and Technology (KNUST) (development office) and Kumasi Metropolitan Assembly (KMA), Architects, Engineering Services Limited (AESL) and Building and Road Research Institute (BRRI). The study further identified and selected four members of the design team in all the institutions and these were architects, quantity surveyors, engineers and surveyors who are permanently engaged in procurement activities with specific roles. The study discovered that design team performed their roles better under the design and build system than the traditional system and design and build system reduces time cost and financial cost due to project variable and increases clients expectation. Moreover, design and build systems offered collaboration and coordination among design team and between design team and clients. However, the study found that despite the merit of design and build over traditional system, the traditional system is commonly adopted in Ghana. It was recommended that the building industry should have recruitment or succession and retention plan, increase awareness of design and build method and there should be more collaboration and co-operation among the design team and between design team and clients.

DECLARATION

I hereby declare that this submission is my own work towards the award of MSc in Procurement Management and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for award of any degree of the University, except where due acknowledgement has been made in the text.

HARRIET ESHUN …………………… ………………
Signature Date

Certified by:

Dr. Emmanuel Adinyira …………………… ………………
(Supervisor) Signature Date

Certified by:

Prof. J. Ayarkwa …………………… ………………
Head of Department Signature Date

CHAPTER ONE

INTRODUCTION

1.1 Background

In the modern world, construction usually involves the translation of designs into reality. A formal design team may be assembled to plan the all proceedings, and to integrate those proceedings with all stakeholders. The design consists of drawings and specifications, usually prepared by a design team including surveyors, civil engineers, cost engineers (or quantity surveyors), mechanical engineers, electrical engineers, structural engineers, fire protection engineers, planning consultants, architectural consultants, and archaeological consultants. The design team is most commonly employed by (i.e. in contract with) the property owner. However, the performance of the design team is influenced by the kind of procurement system employed (Koskela, 2000).

Project procurement has been described as an organized method or process and procedure for clients to obtain or acquire construction products (Weele, 2010). Apart from the traditional approach, there are now other "fast-tracking" or innovative procurement systems such as management contracting and design and build used by the construction industry worldwide. The different procurement systems differ from each other in terms of allocation of responsibilities, activities sequencing, process and procedure and organizational approach in project delivery. These differences in procurement methods according to Chan (1996) influence the time performance of construction projects. Time would be affected by the flow of project that is driven by different type of procurement methods. Similarly, Naoum (1991) stated that the major factor affecting cost and project duration were the procurement method adopted. Bowen *et al.* (1999) supported the view that one of the reasons contributing to the poor performance of the construction industry principally is the inappropriateness of selection of procurement systems. These indicate the effect of using different types of procurement methods in project delivery. For instance, the design-and-build approach integrates the design and construction processes whereas in the traditional system the two processes are separate. These differences invariably affect the performance of all project teams i.e. design team and construction team and this has great impact on overall project performance.

Project performance has been defined as “completion of a project within acceptable time, cost and quality and achieving client's satisfaction” (Pheng and Chuan, 2006). All economic agents expect that projects meet performance expectations since a good design enhances the value of building and may produce significant savings, especially when it comes to operating, staffing and/or tenanting the building and project cost (Raia, 2012). All economic units; households, firms, and the government try to either minimize cost or maximize profit. The budget of these economic units is getting increasingly expensive every day and each unit of resource is becoming scarce. Despite the scarcity of resources, population is increasing at a fast rate. Ghana’s population for example increased from 18.9 million in 2000 to 24.3 million in 2010 (GSS, 2012). Structures are to be put in place to accommodate the increasing populace in the form of schools, offices, theatres, etc. The government over the years has tried to reduce cost and maximize revenue through means like procurement laws.

However, the construction industry has attracted criticism for inefficiencies in outcomes such as time and cost overruns, low productivity, poor quality and inadequate customer satisfaction (Latham, 1994, Egan, 1998, Ericsson, 2002, Chan *et al.*, 2003). Practitioners, researchers and society at large have, therefore, called for a change in attitudes, behaviour and procedures in order to increase the chances for construction projects to be successful and result in improved end products (Love *et al.*, 2000, Dubois and Gadde, 2002).

Increased complexity, uncertainty, and time pressure in construction projects have increased the need for cooperation among different project actors (Anvuur and Kumaraswamy, 2007). Traditionally, relationships are, however, very competitive and adversarial in the construction industry (Cheung *et al.*, 2003), which to a large extent is due to the customary procurement procedures potentially causing many problems in all stages of the buying process (Eriksson and Laan, 2007). Therefore, in order to take advantage of collaboration, procurement procedures is one key improvement area and can contribute substantially to project success (Cheung *et al.*, 2003, Eriksson, 2007). A change of procurement procedures is, however, impeded by clients' habitual behaviour (Laedre *et al.*, 2006). Although procurement procedures need to be tailored to enhance the fulfilment of different project objectives (Cox and Thompson, 1997, Love *et al.*, 1998, Wardani *et al.*, 2006), clients tend to choose those procurement procedures they have a habit of using, regardless of any differences between projects (Laedre *et al.*, 2006).

In order to enhance change, an increased understanding of how different procurement procedures affect project design team performance is vital.

1.2 Problem Statement

Innovative or "fast-tracking" project procurement systems is the attempt by the construction industry to provide better deal to its clients or customers, who are increasingly insisting on "better value for money" from their projects in terms of cost, time and quality. The different project procurement systems present different processes and procedures of design and construction of projects for the client. These different systems also prescribe the variation of the organizational structure of the project teams in term of role, responsibility and authority. So how do the different procurement systems affect the performance of the project team specifically the design team given that the method, process, procedure and organization vary according to the systems? This study looks at the different procurement systems and their attributes and how each of them affects the performance of the design team.

1.3 Objectives of the Study

The objective of this study is to determine effect of the different procurement systems on the performance of the construction project design team.

Specifically, the study seeks;

1. To determine the roles of the design team under the various procurement systems.
2. To determine the critical challenges of the design team under the various procurement systems.
3. To determine the impact of procurement system on the design team performance

1.4 Research Questions

The research is designed to answer the following question;

1. What are the roles of the design team under the various procurement systems?
2. What are the critical challenges of the design team under the various procurement systems?
3. What is the impact of various procurement systems on the design team performance?

1.5 Scope of the Study

There are many different project procurement systems, however it is appropriate for the purpose of this study to limit to the common ones i.e. traditional system and design and build. Moreover, this study does not cover all the project team. It is limited to design team (surveyors, quantity surveyors, engineers and architects) in the public sector. The performance indicators considered are in this study were time performance, cost performance and quality performance.

1.6 Justification

Currently, there is a lack of specific operational solutions and recommendations that public procurement agents can adopt to enhance performance of design team through procurement system for the benefit of all economic agents (Governments, firms and individuals). This is particularly important, as the topic is of relevance for policy makers and stakeholders in procurement since the research aims to provide up-to-date and evidence-based recommendations to them on effective strategies that can be employed to ensure that design teams work efficiently and effectively to the expectation of all economic agents. The work provides an overview of the roles, authority under each procurement system, challenges and potential solutions to the problem of which procurement system is the ideal for ensuring high performance of design team all in public sector agencies of Ghana.

Moreover, development of appropriate strategies first requires an understanding of roles, authority and powers and challenges of design team under each procurement system. This work therefore serves as a reference for upcoming generations. This study is important because it contributes to knowledge and development of literature in the subject area under investigation; and serve also as a basis for further research for all those interested in the topic.

1.7 Organization of the Study

The study is divided into five chapters. Chapter One deals with the introduction, the statement of the problem, and justification of the study, objectives, methodology and organization of the study. Chapter Two provides an overview of existing literature. This chapter provides a review of already existing literature on this topic. Chapter Three gives the profile of the district chosen. It also describes the data that form the basis for the research that are reported in this paper and provides an overview of methodology that was used in the study. Again, it deals with the theoretical framework and the empirical model that underpinned the analysis of the data. Chapter Four reports the results of the empirical analysis. It deals with the presentation, analysis and discussion of the data collected from the field. Chapter Five which is the last chapter looks at the conclusion, recommendation and policy implications of the research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter review literature based on the objectives of the study. It covered the following issues;

1. Procurement systems: traditional, design and build and management contracting
2. Reasons for choice of design and build over others
3. Forms of design team and their roles
4. Performance measurement in construction industry and
5. Factors affecting performance of Design Team

2.2 Procurement System

Many authors have tried to define procurement and some of the definitions are summarized in this section. Procurement has been defined as, "the purchase of merchandise or services at the optimum possible total cost in the correct amount and quality or simply as the procedure in which goods or commodities are bought when prices are low" (Cole, 2007). Moreover, according to Ghana Integrity Initiative (2007), procurement is the acquisition of goods and services at the best possible total cost of ownership, in the right quantity and quality, at the right time, in the right place for the direct benefit or use of governments, corporations, or individuals, generally via a contract. The Business Dictionary (2011) defines it as "the overarching function that describes the activities and processes to acquire goods and services. Importantly, and distinct from "purchasing", procurement involves the activities involved in establishing fundamental requirements, sourcing activities such as market research and vendor evaluation and negotiation of contracts".

From the above definition, procurement is the acquisition of works, goods and/or services. The procurement process not only involves the purchasing of commodities but also adopting quality and quantity checks. Usually, suppliers are listed and pre-determined by the procuring company. Cole (2007) states that, this makes the process smoother, promoting a good business relationship between the buyer and the supplier.

In the building industry, procurement describes the activities undertaken by the client to obtain a building. There are many different methods of construction procurement; however, the three most common types of construction procurement are:

1. Traditional (Design-bid-build)
2. Design and build
3. Management contracting

There is also a growing number of new forms of procurement that involve relationship contracting where the emphasis is on a co-operative relationship between the principal and contractor and other stakeholders within a construction project. New forms include partnering such as Public-Private Partnering (PPPs) or Private Finance Initiatives (PFIs) and alliances such as "pure" or "project" alliances and "impure" or "strategic" alliances.

2.2.1 Traditional / Design–bid–build

The Traditional method is also known as Design–bid–build (or design/bid/build, and abbreviated D–B–B or D/B/B accordingly) or Design–tender (or "design/tender") or hardbid, which is a project delivery method in which the agency or owner contracts with separate entities for each of the design and construction of a project. There are three main sequential phases to the design–bid–build delivery method:

1. The design phase
2. The bidding (or tender) phase and
3. The construction phase

In the Design Phase, the owner retains an architect (or engineer for infrastructure works) to design and produce tender documents on which various general contractors will in turn bid, and ultimately be used to construct the project. For building projects, the architect will work with the owner to identify the owner's needs, develop a written program documenting those needs and then produce a conceptual or schematic design. This early design is then developed, and the architect will usually bring in other professionals including mechanical, electrical, and plumbing engineers (MEP engineers), a fire engineer, structural engineer, sometimes a civil engineer and often a landscape architect to complete documents (drawings and specifications). These documents are then coordinated by the project manager and put out for tender to various general contractors.

In the bidding phase, bids can be "open", in which any qualified bidder may participate, or "select", in which a limited number of pre-selected contractors are invited to bid. The various general contractors bidding on the project obtain copies of the tender documents, and then put them out to multiple subcontractors for bids on sub-components of the project. Sub-components include items such as the concrete work, structural steel frame, electrical systems, and landscaping.

Once bids are received, the architect typically reviews the bids, seeks any clarifications required of the bidders, ensures all documentation is in order (including bonding if required), and advises the owner as to the ranking of the bids. If the bids fall in a range acceptable to the owner, the owner and architect discuss the suitability of various bidders and their proposals. The owner is not obligated to accept the lowest bid, and it is customary for other factors including past performance and quality of other works to influence the selection process. The project is usually awarded to the lowest bid by a qualified general contractor.

After the project has been awarded, the construction documents may be updated to incorporate addenda or changes and they are issued for construction. The necessary approvals (such as the building permit) must be achieved from all jurisdictional authorities for the construction process to begin. In most instances, almost every component of a project is supplied and installed by sub-contractors. The general contractor often provides work with its own forces, but it is not uncommon for a general contractor to limit its role to management of the construction process and daily activity on a construction site (see also construction management). The architect acts as the owner's agent to review the progress of the work and to issue site instructions, change orders or other documentations necessary to the construction process.

2.2.1.1 Merits

This method has a number of benefits and this include:

1. The design team is impartial and looks out for the interests of the owner.
2. The design team prepares documents on which all general contractors place bids. With this in mind, the "cheaper is better" argument is rendered invalid since the bids are based on complete documents. Incomplete, incorrect or missed items are usually discovered and addressed during the bid process.
3. Ensures fairness to potential bidders and improves decision making by the owner by providing a range of potential options. It also identifies new potential contractors.
4. Assists the owner in establishing reasonable prices for the project.
5. Uses competition to improve the efficiency and quality for owners (Love *et al*, 1998).

2.2.1.2 Demerits

However, the traditional procurement is be deviled with a number of problems including;

1. Failure of the design team to be current with construction costs, and any potential cost increases during the design phase could cause project delays if the construction documents must be redone to reduce costs.
2. Redesign expense can be disputed should the architect's contract not specifically address the issue of revisions required to reduce costs.
3. Development of a "cheaper is better" mentality amongst the general contractors bidding the project so there is the tendency to seek out the lowest cost sub-contractors in a given market. In strong markets, general contractors will be able to be selective about which

projects to bid, but in lean times, the desire for work usually forces the low bidder of each trade to be selected. This usually results in increased risk (for the general contractor) but can also compromise the quality of construction. In the extreme, it can lead to serious disputes involving quality of the final product, or bankruptcy of a sub-contractor who was on the brink of insolvency desperate for work.

4. As the general contractor is brought to the team post design, there is little opportunity for input on effective alternates being presented.
5. Pressures may be exerted on the design and construction teams, which may lead to disputes between the architect and the general contractor (Love *et al.*, 1998).

2.2.2 Design and Build

Design–build (or design/build, and abbreviated D–B or D/B accordingly) is a project delivery system used in the construction industry. It is a method to deliver a project in which the design and construction services are contracted by a single entity known as the design–builder or design–build contractor. The owner produces a list of requirements for a project, giving an overall view of the project's goals. Several D&B contractors present different ideas about how to accomplish these goals. The owner selects the ideas he or she likes best and hires the appropriate contractor. Often, it is not just one contractor, but a consortium of several contractors working together. Once a contractor (or consortium/consortia) has been hired, they begin building the first phase of the project. As they build phase 1, they design phase 2.

2.2.2.1 Merits

The review of the literature indicated that several studies such as Konchar and Sanvido 1998), Songer and Molenaar (1996) have examined the performance of the design-build delivery method. These studies point out that this delivery approach outperforms other delivery methods with regards to several measures of project performance. Design-build delivery method creates the possibility for the owner to contract with a single entity. The design-build team is responsible for providing the owner with all aspects required to deliver the facility, starting from design services to construction, and including equipment selection and procurement (Beard *et al*., 2001). In this method, the risks associated with design management and control are transferred to the design-build entity. Moreover, the owner relies on the design-build team for coordination, quality and cost control, in addition to schedule monitoring. Design-build, as a project delivery system, emerged to satisfy the owners' recent requirements to complete projects faster and at lower costs (Tulacz, 2003).

Moreover, Design–build saves time and money for the owner, while providing the opportunity to achieve innovation in the delivered facility. The cost and schedule reduction and decreased litigation associated with design–build project delivery have been demonstrated repeatedly. Researches on *Selecting Project Delivery Systems* by Victor Sanvido and Mark Konchar (1998), found that design–build projects are delivered 33.5% faster than projects that are designed and built under separate contracts (design-bid-build). Sanvido and Konchar (1998) also showed that design–build projects are constructed 12% faster and have a unit cost that is 6.1% lower than design-bid-build projects. Similar cost and time savings were found in a comparison study of design–build, and design-bid-build for the water/wastewater construction industry, a peer-reviewed paper authored by Smith Culp Consulting in 2011. A benchmarking and claims study by Victor O. Schinnerer, one of the world's largest firms underwriting professional liability and specialty insurance programs, found that, from 1995–2004, only 1.3% of claims against A/E firms were made by design–build contractors. They also note that design–build allows owners to avoid being placed directly between the architect/engineer and the contractor. Design–build places the responsibility for design errors and omissions on the design–builder, relieving the owner of major legal and managerial responsibilities. The burden for these costs and associated risks are transferred to the design–build team.

2.2.2.2 Demerits

This method has however been criticized. The critics of the design–build approach claim that design–build limit the clients' involvements in the design and allege that contractors often make design decisions outside their area of expertise. They also suggest that a designer—rather than a construction professional—is a better advocate for the client or project owner and/or that by representing different perspectives and remaining in their separate spheres, designers and builders ultimately create better buildings.

Moreover, during the design–build procedure, the contractor is deciding on design issues as well as issues related to cost, profits and time exigencies. Whilst the traditional method of construction procurement dissociates the designers from the contractors' interests, design–build does not. On these grounds it is considered that the design–build procedure is poorly adapted to projects that require a complex and elaborated design for aesthetical or technical purposes.

A notable design–build project that received significant criticism, not only for excessive cost but for environmental issues, was the Belmont Learning Center. The scandal involved alleged contaminated soil that caused significant delays and massive cost overruns. In Los Angeles, District Attorney Steve Cooley, who investigated the Los Angeles Unified School District's Belmont project, produced a final investigative report, released March, 2003. This report concluded that the design–build process caused a number of issues relating to the Belmont scandal:

1. Design–build does not make use of competitive bidding where prospective builders bid on the same design.
2. Criteria to select contractor is subjective and difficult to evaluate and to justify later.
3. The design and price selected arouses public suspicion, true or not.
4. This can lead to loss of public confidence.

2.2.3 The reasons for choice of Design- Build method over others- Empirical Evidence

Several studies have researched the continuously growing trend towards the use of the design-build delivery method and the shift from other traditional delivery methods. The reasons and factors promoting this trend have been outlined.

Sanvido and Konchar (1998) conducted an empirical study whose goal was to compare the different delivery systems that are widely used in the United States. Construction management at risk, design-build, and design bid- build were the three main delivery approaches compared. The study consisted of identifying the performance metrics for comparison purposes, data collection through a survey, and data analysis. Seven performance metrics were defined to provide the criteria for evaluating the projects and the systems used to deliver them. These seven metrics were defined in cost, schedule and quality categories. The data collection phase was achieved using a survey that gathered data for 351 projects. The survey consisted of questions regarding the project delivery methods, the performance metrics, contract types, project team characteristics, and other project specific information. Finally, the project data was analyzed using several statistical methods, including univariate and multivariate regression analysis.

The median scores reported through the results of the research concluded that projects delivered using the design-build approach performed better than those delivered through the construction management at risk or the design-bid-build delivery systems regarding several performance metrics. Specifically, the univariate analysis revealed that design-build projects experienced less cost and schedule growth.

Also, the univariate analysis conducted for the quality metrics indicated that the design-build approach resulted in better start-up quality, fewer call backs, in addition to improved operation and maintenance quality. Moreover, design-build projects performed better than the design-bid-build projects with regards to the envelope, roof, structure and foundation metric. Interior space and layout, together with process equipment and layout metrics had higher mean scores in the case of design-build projects. In conclusion, the study revealed that the design-build delivery system often resulted in time and cost savings. With regard to quality performance and owner satisfaction, the design-build delivery led to a higher or equal quality product than construction management at risk and design-bid-build systems.

In another study that emphasized the importance of the design-build delivery system, Songer and Molenaar (1996) pointed out the rapid growth of this delivery approach and the need to examine the owners' attitudes towards it. The research also aimed at determining a number of selection criteria that lead owners to select the design-build delivery method. These criteria were related to the project duration; budget; number of claims; project size and complexity; and project constructability and innovation. Data was collected through a survey questionnaire that targeted 209 owners with experience in design-build projects. Owners were asked to determine how they rank each of the selection criteria.

Based on means and medians calculations, each selection criterion was assigned an overall ranking. The scores indicated that the primary reason that owners select the design-build delivery method is the possibility of reducing the project duration. The factors that received the least ranking were the large project size and the high level of complexity. Frequency histograms confirmed the owners' attitudes regarding the highest and lowest ranking factors. The research also concluded that the other lower-score criteria could serve as a basis for selecting the design-build delivery method, depending on specific project requirements (Songer and Molenaar 1996).

The Songer and Molenaar (1996) study results were also verified by Tookey *et al.* (2001) study, which indicated that the owner's requirements with regard to cost, time and quality often impact the delivery system selection decision. For design-build projects, time and budget were the main drivers for the selection of the design-build delivery method. Also, the owners' requirements were mostly directed towards benefiting from contracting with a single entity. These findings were established through studying several projects and interviewing owners to help formulate a general conclusion.

Another goal of Songer and Molenaar's (1996) research was to compare private and public owners' attitudes toward the design-build approach. The study showed that private and public owners' rankings for the different factors did not significantly differ. Only the criterion of reducing claims ranked significantly differently for both owner types. Public owners were more concerned with reducing the number of claims and thus were more inclined to choose the design build delivery method to mitigate the effects of claims. The study attributed this to the likelihood that claims occur more frequently on public projects and handling them could significantly hinder the project performance.

A research study performed for The National Institute of Standards and Technology (NIST), aimed at assessing and documenting the economic impacts of adopting the design-build delivery method (Thomas *et al*, 2002). The study methodology relied on comparing the performance of projects, submitted by either owners or contractors, present in the Construction Industry Institute (CII) Benchmarking and Metrics database. The research focused only on design-build and design-bid-build projects that were evaluated based on two categories: performance metrics and practice use metrics. The performance category consisted of cost, schedule, safety, changes, and rework metrics. The practice use category consisted of the pre-project planning, constructability, team building, zero accident techniques, project change management, design/information technology, materials management, planning for startup, and quality management metrics. The results of the performance and practice use comparisons revealed that the design-build delivery approach performed better regarding cost in the case of ownersubmitted projects (Thomas *et al.*, 2002). Regarding contractor-submitted projects, although no significant differences were detected between design-build and design-bid-build delivery systems, design-build projects showed better performance in rework and practice use. Statistical tests also concluded that design-build projects were performing significantly better with respect to the changes in project scope measure.

2.3 Composition of the Design Team

This aspect of the review considered the various design team and their specific roles in the building industry.

2.3.1 Architect

An **architect** is a person trained to plan and design buildings, and oversees their construction. To *practice architecture* means to provide services in connection with the design and construction of buildings and the space within the site surrounding the buildings that have as their principal purpose human occupancy or use. Etymologically, *architect* derives from the Latin *architectus*, which derives from the Greek *arkhitekton* (*arkhi-*, chief + *tekton*, builder), that is, **chief builder**.

Professionally, an architect's decisions affect public safety, and thus an architect must undergo specialized training consisting of advanced education and a *practicum* (or *internship*) for practical experience to earn a license to practice architecture.

The architect is responsible for creating a design concept that meets the requirements and provides a facility suitable to the required use. In that, the architect must meet with and question the client to ascertain all the requirements and nuances of the planned project. This information, known as a program or brief, is essential to producing a project that meets all the needs and desires of the owner—it is a guide for the architect in creating the design concept. The Architects responsibility is to interpret and develop the clients brief during the various stages of the project.

The Architect will define the client's requirements, identifying constraints, advise in terms of feasibility studies and option appraisals, arrange site investigations, establish the preferred solution, advise on sustainability, manage health and safety issues, develop the design, prepare room data sheets, obtain client sign off of the design at appropriate stages, advise on materials selection, provide space planning services, advise on furniture/equipment selection, prepare construction drawings and specifications, etc. and with due respect to the client's brief , prepare a design which meets all the clients requirements, including budget and timescale (APUC, 2011).

Architects deal with local and federal jurisdictions about regulations and building codes. The architect might need to comply with local planning and zoning laws, such as required setbacks, height limitations, parking requirements, transparency requirements (windows) and land use.
The Architect acts as the leader of the rest of the Design Team and co-ordinates their specialist input with their own. The Architect will prepare and lodge the Planning Application and Building Warrants in co-ordination with the rest of the Team. During the works on site, the Architect will assist the Clerk of Works in monitoring quality on site. At handover the Architect will assist in ensuring that the works are complete and that the client needs have been met, and will continue their involvement through the Defects Liability period, and the final resolution of defects. After novation (in the case of a Design & Build Contract), the Architect will work for the contractor and will no longer be in the direct employment or control of the client (APUC, 2011).

Architects typically put projects to tender on behalf of their clients, advise on the award of the project to a general contractor, and review the progress of the work during construction. They typically review contractor shop drawings and other submittals, prepare and issue site instructions, and provide construction contract administration and Certificates for Payment to the contractor. In many jurisdictions, mandatory certification or assurance of the work is required.

2.3.2 The Quantity Surveyor

A quantity surveyor (QS) is a professional working within the construction industry concerned with building costs. The Quantity Surveyors (QS) roles are primarily in connection with providing cost advice to the Client throughout all stages of the project. During the pre-contract stage, the QS will assist the Project Manager in providing advice on procurement routes for the main contractor, preparing the tender documentation, receiving and analysing tenders and preparing the tender report for the Client and recommendations for approval. The QS will prepare the contract documentation on behalf of the Client. Where the client has procurement department it is essential the QS liaise with procurement throughout the procurement process (APUC, 2011).

During the contract period the QS monitors the project spend, providing regular reports to the Client, and will receive monthly valuations from the Main Contractor and will check these, before authorising the Architect to approve payment in the form of an Architect's Certificate. The QS will also assist with negotiations with the Contractor if any variations (changes) occur during the project, which have a financial impact. Following completion of the Construction Works, the QS will liaise with the Contractor in agreeing the Final Account. It is normal for this to take up to 12 months after completion, but this could take longer if the project is complex and there were many variations during the project (APUC, 2011).

Other responsibilities are: life cycle cost analysis, preparing the elemental cost plan, preparing bills of quantities if required, assisting with selection of and interviewing of tendering contractors, and dealing with contractors queries (APUC, 2011).

2.3.3 Construction Engineer

A construction engineer is the individual who directs a construction project. He/she will handle everything from the design of the construction project to being on hand during the daily construction activities to make sure that everything is going as planned. Depending on the particular project, the role of the construction engineer will vary. However, many construction engineers share the same tasks in various projects. A construction engineer may design the plans for roads, bridges, pipelines, sewage systems, railroads and more.

In general, a construction engineer is responsible for the planning of the construction project. This includes conducting surveys, engaging in research, analyzing results, planning the construction and overseeing it along the way. The construction engineer will also provide information to the parties involved in project and general public to keep them informed and in the case that any issues arise before, during and after the construction. A construction engineer is the one who plans the project and advises the workers.

A construction engineer will have to fulfill a variety of specific duties on a daily basis. Prior to even thinking about starting a construction project, the construction engineer will have to survey the area. In conjunction with this they will need to produce reports and environmental statements detailing how the project will be done and what areas it will affect. During the pre-construction phase, the construction engineer will prepare diagrams, charts and surveys showing specific information about the area and the desired project. Once the reports, charts and data have been compiled, the construction engineer will then need to discuss such items with related parties such as builders, environmental agencies and local, state and federal entities. These items may also have to be made available to the general public for their objections to be heard.

The construction engineer must also inspect the site to ensure that the building which will be taken place can be accommodated by that area. Tests will be performed relating to the ground and water level. The construction engineer may also have to determine the grade and elevation levels of the area. Some construction engineers must determine the costs of their construction projects. This is done by proposing bids and determining the costs of labor and materials to ensure that the project can be carried through in keeping with the budget that has been set aside. This will be an estimation on the part of the construction engineer but it must be as close to the true number as possible. The construction engineer must also provide technical advice to all parties involved with the project. This may relate to any number of topics including the construction of the site to abide by certain laws, codes and regulations. A construction engineer is something of a jack of all trades in many respects and therefore will be consulted on a number of issues.

2.3.4 Service Engineer

Building services engineering comprises mechanical engineering, electrical engineering and plumbing or public health (MEP) engineering. Building services engineers work closely with other construction professionals such as architects, structural engineers and quantity surveyors. They influence the architecture of a building and play a significant role on the sustainability and energy demand of a building. Within building services engineering, new roles are emerging, for example in the areas of renewable energy, sustainability, low carbon technologies and energy management. With buildings accounting for around 50% of all carbon emissions, building services engineers play a significant role in combating climate change. The building services engineer has the following specific roles;

1. Design: designing layouts and requirements for building services for residential or commercial developments.
2. Construction: supervising the construction of the building services, commissioning systems and ongoing maintenance and operation of services.
3. Environmental: developing new energy saving methods for construction, designing new and improved energy conservation systems for buildings.
4. Heating, ventilation and air conditioning (HVAC): specialising in the design, development, construction and operation of HVAC systems.
5. Electrical technology: specialising in the design and development of electrical systems required for safe and energy sustaining operation of buildings (Wikipedia, 2007).

2.3.5 Other Consultants

Dependant on the scope and scale of the project, the Client may wish to appoint other consultant such as; Interior Designer, Space Planner, Legal Advisers, Ecologist, Landscape Designer, Sustainability Adviser, Fire Engineer Façade Engineer and Service Providers (APUC, 2011).

2.4 Measuring Performance in Construction Industry

Traditionally, researchers and organisations have focused on the three project performance criteria of cost, time and quality (Dainty *et al.*, 2003, Chan and Chan, 2004, Swan and Khalfan, 2007). Recently, many studies have, however, included other performance aspects, such as health and safety (Chan and Chan, 2004), environmental performance (Chan and Chan, 2004, Swan and Khalfan, 2007), customer satisfaction (Chan and Chan, 2004, Collins and Baccarini, 2004), and innovation (Harty, 2008). This section therefore reviews criteria for evaluating performance of construction projects.

2.4.1 Economic performance

This has traditionally been seen as one of the most important areas – if the economy of the project is off, the project can seldom be seen as a success. *Overall project cost,* i.e. the overall cost that a project incurs from inception to completion, is of major interest as it shows the resource usage in economical terms. Another important aspect regards cost predictability, that is, whether the final overall cost is in line with the initial cost estimate (Swan and Khalfan, 2007). *Cost overruns* can be a source of problems for an otherwise successful project as contractors are frequently criticized for the common occurrence of cost overruns (sometimes labelled cost growth) in construction projects (Chan and Chan, 2004).

2.4.2 Time performance

The increasing importance of time in our globalised society has affected the construction industry in the form of shortened project schedules. *Project duration* is simply the number of days/weeks/months from start to completion of the project. Since time can be a critical issue for many clients, project duration is often of prime interest. However, *schedule overruns* may be an even more important issue.

Completing projects in a predictable manner on time (within schedule) is an important indicator of project success and the construction industry is frequently criticised for project delays (Chan and Kumaraswamy, 1997, Odeh and Battaineh, 2002, Faridi and El-Sayegh, 2006, Swan and Khalfan, 2007). Schedule overruns (sometimes labeled time growth) are often very negative since they hinder the client to start using the end product as planned.

2.4.3 Quality

Satisfactory time and cost performance is of little value if the project delivers inferior quality. The concept of quality is closely related to customer satisfaction, which has gradually been elevated as importance in the construction industry (Latham, 1994, Egan, 1998, Forsythe, 2007). Customer satisfaction is commonly described as a comparison between the customer's pre-purchase expectations and their post-purchase perceptions. Hence, it involves the customer's final feelings about whether the outcome provided a satisfying or dissatisfying experience (Forsythe, 2007). Since construction industry products are highly customised and co-created during the construction process, the concept of quality regards both the final product and the process during which it is created. Therefore, we see two main aspects of quality. First, *quality of end product* has to do with the users' satisfaction with the finished construction and it is a critical success factor (Collins and Baccarini, 2004, Forsythe, 2007). It is also related to how the final product and its function meets the specification (Chan and Chan, 2004, Collins and Baccarini, 2004). The second aspect of quality is the service quality during the construction process, which reflects the client's perception of the process during which project participants interact to create the end product (Maloney, 2002, Forsythe, 2007).

2.4.4 Environmental performance

Environmental management in construction has become a critical issue in recent decades since the actors start to acknowledge that the construction industry is one of the major contributors to environmental problems (Crawley and Aho, 1999, Tam *et al.*, 2006a, Tam *et al.*, 2006b). Environmental impact is affected by both the activities performed during the construction process and the material and technical solutions incorporated in the end product (Crawley and Aho, 1999). Furthermore, the environmental performance depends not only on choices made but also how these choices are executed. Hence, two main aspects can be identified within this area. First of all, it is in what degree the construction actors make *environmentally friendly choices of material and processes*, i.e. in the planning and procurement choose those material and those methods that will leave the least environmental "footprint" over the construction's life span (not only the construction period). Secondly, it is about how the material and processes are used during construction, i.e. *environmentally friendly use of material and processes*. With little concern over environmental impacts, excess loss of material and improper waste treatment are always common in the construction industry (Tam *et al.*, 2006b).

2.4.5 Work environment

Having a safe and healthy work environment for those involved in the construction process is another important indicator for a successful project performance. Construction has a poor record in this area and is still today generally a dangerous work place (Ai Lin Teo *et al.*, 2005).

However, this does not mean that a project can allow the work environment to continue to cause project participants to become ill or even die. Rather, it is the opposite. A construction project must not harm those involved, if it can be helped. A failure to succeed with this may cause long-term problems as it reduces the legitimacy of those responsible. A risk-free work environment is today seen as necessary for achieving other goals linked to cost, time and quality (Koehn and Datta, 2003). The most important sub-facets of work environment are health and safety. *Health* is concerning the physical and mental wellbeing of those who are involved in a construction project. Physical health issues (such as back injuries are more likely to concern those working at the construction site, while mental health issues (such as stress) are more likely to be common among offsite workers. *Safety* is about avoiding accidents of any kind that can cause injuries or even fatalities for those involved in the construction process. A safe project has few accidents in relation to the total man-hours worked on the specific project (Chan and Chan, 2004).

2.4.6 Innovation

Traditionally, the construction sector has been seen as a low technology industry, with little innovation compared to other industries (Reichstein *et al.*, 2005, Harty, 2008). Actually, many of the problems outlined in the introduction of this thesis can be seen as symptoms of a lack of new thinking and innovative action. During recent years, innovation in construction has received increasing interest in an explicit manner, both among practitioners and academics. Innovation thus seems to be a success criterion to be reckoned with. There are two aspects of innovation. First is *product innovation* implies innovation in the final construction, for instance in terms of innovative architecture or innovative features in other aspects of the building. Second is *process* *innovation* which is about novel ways to work with the actual construction phase. It can comprise new ways to organize the work and new construction methods.

2.5 Factors affecting performance of design team

This section is devoted to review of factors affecting the performance of design team. The review is based on Eriksson (2008) and Eriksson and Nilsson (2008) frame. In this study, collaboration and cooperation under procurement systems is reviewed.

2.5.1 Collaboration/ Cooperation as key factor

The design stage is a very important phase of project performance. In design-bid-build contracts the client performs detailed design work together with consultants before contractors are procured, in order to develop a solid base for competitive bidding. In design-build contracts, contractors are procured very early based on the project brief or sketchy drawings, after which the contractor performs detailed design. This facilitates solutions with high constructability, due to contractor focused design (Tam, 2000). The drawback is diminished client influence in the design work. Between these extremes, where design relies heavily either on the client or the contractor, there are alternatives in which the client and the contractors, together with consultants, cooperate in developing the detailed design. As for design-build, the contractors need to be involved early in the design process. This approach is often called "joint specification" (Eriksson and Nilsson, 2008) or "concurrent engineering", since it make parallel and integrated design and construction possible (Brown *et al.*, 2001). A high degree of specification prior to contractor procurement results in a divorce between design and construction, since construction planning cannot affect design (Pietroforte, 1997, Dubois and

Gadde, 2002, Eriksson and Laan, 2007). This separation results in long project durations (Pietroforte, 1997, Love *et al.*, 1998) and decreased innovation due to lack of joint problem-solving (Korczynski, 1996).

The literature shows some positive results for both design-build and for design-bid-build. Looking at design-build contracts, these have shown to provide better value for money and reduced project duration, compared to design-bid-build contracts (Tam, 2000). Other studies show that design-bid-build contacts have ensured quality better than design-build contracts (Cheung *et al.*, 2001). A complete design before construction also improves budget performance (Chua *et al.*, 1997). In order to decrease the risk for defective design, increased coordination between designer and contractors is suitable (Andi and Minato, 2003). Early involvement of contractors in concurrent engineering facilitates cost saving and shortened project duration due to increased buildability (Bresnen and Marshall, 2000c, Bresnen and Marshall, 2000a, Brown *et al.*, 2001, Andi and Minato, 2003, Rahman and Kumaraswamy, 2004) and reduced rework (Love *et al.*, 2004), increased client satisfaction since the client maintains the possibilities to influence and control the design work (Pietroforte, 1997, Eriksson, 2008b) and improved environmental performance (Cole, 2000), work environment (Cameron and Duff, 2007), and innovation (Ling, 2003).

From the above, collaboration and coordination is a major factor in design team performance and the higher the level of collaboration and coordination between client and contractors in the design stage, the better the performance of design team.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter highlights the research design and methods employed by examining the techniques and procedures used in carrying out the study. The chapter covers the research design, data collection and processing, and data presentation and analysis.

3.2 Research Design

The study adopted case study method which seeks to examine the effects of procurement systems on performance of design team benefits management practices of public procurement entities in the procurement of infrastructural projects in Ghana, using Kumasi Metropolis as a case study a the case study design is useful in investing into contemporary phenomenon (Frankfort- Nachmias and Nachmias, 1996). Also according to Yin (2009), case study design offers an opportunity to gather data from various sources and the study selected KMA, KNUST, BRRI and AESL from which data were sourced.

3.2.1 Population of the Study

The sample population of this study is public procurement agencies in Kumasi Metropolis of Ashanti region. The public procurement agencies of focus of this study are Kumasi Metropolitan assembly (KMA), Kwame Nkrumah University of Science and Technology (KNUST) development office, Building and Road Research Institute (BRRI) and Achitectural and engineering Services Limited (AESL).

3.2.2 Sampling and Sample Size

The difficulty of collecting data from the whole population due to financial and time constraints make sampling an inevitable element in research work. According to Agyedu (1999) the process of sampling makes it possible to limit a study to a relatively small portion of the population. A sample is thus a representative selection of a population that is investigated into in acquiring statistical information of the whole.

In this study, purposive sampling technique was employed in the identification and selection of the institutions and they were Kwame Nkrumah University of Science and Technology (KNUST) (development office) and Kumasi Metropolitan Assembly (KMA), Architects, Engineering Services Limited (AESL) and Building and Road Research Institute (BRRI). These institutions were selected because they have permanent design team for easy accessibility. The study further identified and selected four members of the design team in all the institutions and these were architects, quantity surveyors, engineers and surveyors who are permanently engaged in procurement activities with specific roles. Purposive sampling is what is needed in some cases – study such as community, or some other clearly defined and relatively limited group and helps to identify most suitable respondents (Patton, 1990; Kuzel, 1999). Purposive sampling can be applied to research in a number of ways such as, sampling informants with a specific type of knowledge or skill (Li *et al*. 2006, Prance, 2004).

In selecting the sample size for the respondents, the study made reference to work done by Leedy and Ormrod, (2001). Leedy and Ormrod asserted that rather than sampling a large number of respondents with the view of making generalizations, qualitative research tends to select few respondents who can best shed light on the phenomenon or study under consideration. In view of this the study sampled 48 members of the design team since the number was few. The breakdown for each group is given in Table 3.1.

Table 3.1: Sample Size of Each Design Team Member

Design	**Development office, KNUST**	**KMA**	**AESL**	**BRRI**	**Sample size**
Architect	3	3	3	3	12
Quantity surveyor	3	3	3	3	12
Surveyors	3	3	3	3	12
Engineers	3	3	3	3	12
Total	**12**	**12**	**12**	**12**	**48**

Source: Field Data, 2013

3.3 Collection and Processing of Data

This looks at the data collection instrument employed and how the data collected was processed. The data required for the research included the procurement systems used by the institutions, roles, authority and power of design team under each procurement system and performance of design team under each procurement system.

The study used both secondary and primary sources of data. The secondary sources included both published and unpublished reports on the subject under investigation. Annual reports of the department on the subject matter were made use of.

The primary data was gathered through direct interviews using structured questionnaires.

3.3.1 Data Collection Instruments and Method

The selection of data collection tools and methods is very significant in research both scientific and social. This is due to the fact that the choice of an appropriate tool offers adequate flexibility in addressing respondents differently while investigating into the phenomenon under study. The data collection instruments employed for the research was questionnaire. In the questionnaire, a number of close and open ended questions were posed and administered, targeting only design team selected institutions. The questionnaire was made up of the following parts;

1. Procurement systems
2. Roles, authority and powers of design team under each procurement system
3. Challenges facing design team under each procurement system.

3.3.2 Processing of Data

The data collected was processed. Data was screened to identify all the missing and unclear data and was then coded and entered into Statistical Package for Social Sciences (SPSS).

3.4 Data Presentation and Analysis

The considered the how the data collected was presented and then discussed.

3.4.1 Presentation of Data

The data were presented in tables. This method of presenting data allows for easy and quick interpretation of the data.

3.4.2 Analysis of Data

The analyses of data were done descriptively using Statistical Package for Social Sciences (SPSS). Each research question was analyzed and discussed.

3.5 Profile of Study Area

This considered the profile of the Kumasi Metropolitan Assembly and the detailed profiles of the selected institutions.

3.5.1 Kumasi Metropolitan Assembly

The Kumasi Metropolitan Assembly, which is the second largest city in Ghana, constitutes the highest political authority in the Kumasi metropolis. It was established by Legislative Instrument 1614 of 1995 under the Local Government Law 1988, PNDC Law 207, which is now replaced by the Local Government Act 462, 1993. The LI 1604, which was amended as LI 1805, 2005, guides, directs and supervises all other administrative authority in the metropolis. It also divides the Kumasi Metropolitan Assembly into ten sub Metropolitan District Councils namely Asokwa, Subin, Nhyieaso, Bantama, Manhyia, Kwadaso, Oforikrom, Tafo, Suame and Asawase. As part of its sub-structures, the Assembly has 24 Town Councils and 419 Unit Committees.

VISION

To develop Kumasi into a safe and vibrant city by improving city management through good governance, local economic development, tourism promotion, improved sanitation, proper environmental and social services as well as spatial and infrastructural development.

MISSION

The Kumasi Metropolitan Assembly is committed to improving the quality of life of the people in the metropolis through the provision of essential service and creation of an enabling environment to ensure the total and sustainable development of the city by a well motivated staff.

FUNCTIONS

The functions of the Assembly, as given by the Local Government Act 462, 1993, Legislative Instrument 1614 of amended (LI 1805), are as follows:

1. To facilitate the effective and efficient functioning of Local Government administration in the metropolis,
2. To ensure efficiency and effectiveness in the use of resources of the Assembly and decentralized departments,
3. To monitor, co-ordinate and harmonize the implementation of development plans and programmes in the metropolis,
4. To facilitate the provision of basic social services and economic Infrastructure such as schools, markets and health facilities in the metropolis,
5. To facilitate community based and private sector developments,
6. To ensuring existence of peace and tranquility to enable people go about their social and economic activities,
7. To establish, install, build, maintain and control public latrines, lavatories urinal and wash places,
8. To improve environmental and sanitation condition through sound waste management practices,

9. To control haphazard land development and the provision of basic social physical Infrastructure (ie. Educational & health facilities)
10. To enhance the planning, budgeting and project execution role of the Assembly,
11. To ensure efficient service delivery, staff orientation, co-ordination of departmental activities as well as client feedback information on the Assembly's performance,
12. To provide for building lines and the layout of buildings, to prepare and undertake and otherwise control schemes for improved housing layout and settlement,
13. To regulate and control markets including the fixing and collection of stall rates and tolls,
14. To promote civic participation and transparency in local governance and information through the operation of the Sub structures of the Assembly, and
15. To ensure effective and efficient revenue mobilization and management.

The KMA is responsible for:

1. The issuance of Building Permit
2. The issuance of birth and death certificates and burial permits
3. The issuance of marriage certificates
4. The approval of Planning Schemes(Layouts)
5. The control of developments - orderly physical development of settlement
6. Waste Management and waste collection.
7. Revenue Mobilization
8. Fixing of Fees and Rates
9. The preparation of development budgets

10. The provision of basic socio-economic infrastructure etc. schools, health centers, markets, lorry parks.
11. The maintenance of peace and security and
12. The development of sports and culture.

The KMA has the following departments:

1. Works department: The Kumasi Metropolitan Works Department is one of the departments established under Act 462 (first schedule) for the five (5) Metropolitan Assemblies in Ghana. In order to carry out these functions, the Metropolitan Works Department is structured into units namely: Structures, Administration, Maintenance, Electrical, Development Control, Architectural and Surveying, Out Door Advertising, Projects and Research with the Metropolitan Works Engineer as the Head. The Department performs its functions by relating with the Ten (10) Sub-Metropolitan District Councils and other departments under the umbrella of the Kumasi Metropolitan Assembly, especially Waste Management, Roads Department, Town and Country Planning, Education, Finance, Planning and Budget and Legal Departments.

   The Department is responsible for the development and maintenance of first cycle schools, markets, sanitary structures, management of the Assembly's landed properties in collaboration with the Estate and Town and Country Planning Department, design and management of all building and development projects of the Assembly, as well as collaborate with the Department of Urban Roads in the development of road infrastructure and all lorry terminals (lorry parks). The Department also renders services such as building permits, outdoor advertisement permits, certification of true copy of approved building plans and identification and ownership of buildings. The Metropolitan Works Department also demolishes unauthorized developments as well as dangerous and unsightly buildings/structures. The Department has the requisite human resources to deliver all the services listed above.

2. Planning Department: It serves as the secretariat of the Metropolitan Planning and Coordinating Unit (MPCU). The MPCU is the hub for coordinating all programmes, projects and activities of all the departments and units of the Assembly including the Decentralised departments. Minutes of the monthly meetings of the MPCU are prepared by the unit. The unit is responsible for building the data base of the Assembly. This includes the collection of baseline data, the updating of existing data, the analysis and synthesis of data for planning and other decisions. The unit is also responsible for the preparation of Medium Term Development plans like the MTEF strategic plan, 5-year Medium Term Development Plans based on guidelines issued from the NDPC, MLGRDE, annual action plans of the Assembly, investment proposals and annual budget and supplementary estimates of the Assembly including revenue projections. The unit takes the lead in the monitoring and evaluation of development projects of the Assembly including Donor funded programmes and projects. In this regard the unit issues on-the-spot, monthly, quarterly and annual monitoring/progress monitoring/progress reports on all programmes and projects of the Assembly. Also, the endorsement of payment certificates for work executed is a major responsibility of the unit.
3. Finance Department: The Metro Finance Office of Kumasi Metropolitan Assembly is responsible for the financial and accounting duties of the Kumasi Metropolitan

Assembly. It is responsible for the keeping of the Local Accounts as the Assembly and reporting on them periodically (monthly and annually) as well as servicing the decentralized departments of the Kumasi Metropolitan Assembly by paying their quarterly grants (F. E. s) from the central government to them and reporting on them to the Controller and Accountant General. The finance office is headed by the Metropolitan Finance Officer.

4. The Budget Department: The Budget Unit of Kumasi Metropolitan Assembly is responsible for budgeting and financial management functions to ensure prudent and judicious use of the Assembly's resources.
5. Internal Audit Department: The Internal Audit Unit exit to carry out audits and professional evaluations of the activities of the Kumasi Metropolitan Assembly and to ensure that the system of Internal Controls applicable to financial, programme and project areas provide reasonable assurance to management.
6. Environmental Health Department: The purpose of the Environmental Health Department is to ensure the prevention of any hazard or negative impact the environment may have on man. The department is therefore to assess, correct, control and prevent those factors in the environment which can adversely affect the health of both present and future generations.

3.5.2 The Building and Road Research Institute (BRRI)

BRRI is a research Institute under the Council for Scientific and Industrial Research of Ghana. It is based in Kumasi in the Ashanti Region of Ghana. The institute was established in 1952 and was known as the West African Building Research Institute in Accra. It was made up of building engineers from Ghana and Nigeria. The institute had a name change in 1960 when the institute's members from Nigeria left to form the Nigerian Building and Road Research Institute. This was because Nigeria had gained independence from Britain. It became known as the Building Research Institute of the Ghana Academy of Arts and Sciences. The institute relocated to the campus of the Kwame Nkrumah University of Science and Technology in Kumasi in 1963. This was to allow the institute's members to lecture at the university due to university under-staffing. In 1995, the institute moved from the KNUST campus to it present site at Fumesua .The new site which is about 20 kilometres from the institute's former location is called the Kumasi Science City. It houses research institutions in Kumasi. The other institutions include the Forestry Research Institute of Ghana (FORIG) and the Crops Research Institute (CRI)

In 1964 the government of Ghana expanded the functions of the institution to include road research. The name of the institution was changed to include the new function to the Building and Road Research Institute. The institute is made up of various professional groupings. They include architects, engineers, planners, quantity surveyors.

Aim of the institute

The institute was established as a research and development organisation in the construction industry with the purpose of offering research and development products and services to the building and road sectors for the development of Ghana.

The institute works on developing alternative building materials that last longer and cost cheaper for the Ghanaian building industry.

The institute in the 1990s begun researching into Pozzolana cement, an alternative cement to the Portland cement for building. Pozzolana cement cost less than Portland cement. In May, 2007, BRRI and PMC Global Incorporated of America signed a contract for the commercial production of Pozzolana . The agreement included PMC offering 150,000 dollars to BRRI for expansion of the pilot plant for the production of the pozzolana at the institute and land acquisition for the building of a plant by PMC for the production process.

BRRI has research collaboration with other state and foreign agencies. In 2007, BRRI and the Transport and Road Research Laboratory (TRRL) of the United Kingdom worked together on a program of national studies in Ghana for two years. The purpose of the collaboration was to research into developing building materials that would benefit both bodies. In 2009, the institutes and its Nigerian counterpart (NBRRI) signed a memorandum of understanding to research into building and road construction materials.

3.5.3 Architectural and Engineering Services Limited

AESL was established by ARCHITECTURAL AND ENGINEERING SERVICES CORPORATION ACT: 1973 (NRCD 193) and it is an architectural firm aimed at offering multidisciplinary design service. AESL is into the following: Home & Garden / Planning / Architects, Building, Construction & Engin / Planning / Architects, Business Services / Finance / Management & Business Consultation Financial & Legal / Financial / Management & Business Consultation.

The objects of the Corporation are:

1. To provide consultancy services in respect of all works required by or on behalf of the Government in the fields of engineering, building and architecture, urban and regional planning and development;

2. To carry out technical studies in planning, designing as well as the supervision of such infrastructural works as will assist the economic and social development of the country;

3. To undertake the investigation, survey, design, administration and management both in Ghana and elsewhere of all kinds of architectural and engineering consultancy works, whether public or private including the design of houses, highways, airfields, bridges, harbour, water supplies and sewerage systems, soils and foundations investigation;

4. To undertake the testing of construction materials, surveying and mapping, valuation and appraisal of property, and design of irrigation works;

5. To carry on such other activities as appear to the Corporation to be conducive or incidental to the attainment of all or any of the foregoing objects.

6. The Corporation may charge fees in respect of any of its objects specified in subsection (1) of this section. No Ministry, or Department of State, Government agency or statutory corporation shall engage the services of any consultant for any work falling within the objects of the Corporation or within its competence without the prior approval in writing of the Commissioner.

7. The Commissioner may on the advice of the Corporation give directions in writing to any Ministry, Department of State, Government agency or statutory corporation with regard to the engagement of consultants in respect of all technical works, and such Ministry, Department of State, agency or corporation shall comply with such directions.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1. Introduction

In this chapter the results of the study are presented and discussed. Data was analyzed using the SPSS to perform largely descriptive statistics. The presentation and discussion of data was done in accordance with the arrangement of objectives of the study. However, characteristics of the respondents were first presented and discussed.

4.2 Personal Data (Characteristics of Respondents)

As shown in the questionnaire, personal data of the respondents who were all design team professionals of various institutions in the Kumasi Metropolis were composed of three items, including: gender, age and years of experience.

4.2.1 Gender

Out of the 48 respondents interviewed, only 15 of them constituting 31.2% were females. The remaining 33 respondents forming 68.8 % were all males. Males outnumbered the females since in Ghana males normally pursue building related professions since they are considered more masculine than feminine. This is consistent with survey by Building Careers Center (1996). According to this survey, building construction industry is male dominant and a change will not be easy with a survey by the Building Careers Centre showing the highly male makeup of the industry is a deterrent to women who fear isolation, discrimination and harassment should they pursue construction industry careers. Moreover, according to the Building Careeers Center

Survey, young women believe the industry is male-dominated and perceive sexism, discrimination and harassment to be widespread and that half of all young people still believe young women are not suited to all work in the construction industry and more than 30 per cent believe they should only work in administrative, para-professional and professional areas. Moreover, according to De Graft-Johnson *et al*., (2009), Campayne *et al*., (2007), women in construction initiatives have been slow to show progress in increasing the percentage of women in construction, especially on site. There are still few women in senior positions

With the number of women in trades dismally low, the implication is that individuals, the industry, and ultimately the community all suffer from only fully utilizing one sex. The responses from the study are summarized in Table 4.1.

Table 4.1: Gender Distribution of Respondents

Gender	Frequency	Percentage
Male	33	68.8
Female	15	31.2
Total	48	100.0

Source: Field Data, 2013

4.2.2Age

With regard to age distribution of respondents, 15 respondents forming 31.2%, 19 respondents forming 39.6% and 14 respondents forming 29.2% were within the age group of: 25-34 years, 35-44 years and 45-54 years respectively. The responses are summarized in Table 4.2.

The finding from the study is confirmed by (CIOB, 2010). The sector stands to lose valuable skills and experience with the retirement of the older generation in the next five to 10 years (CIOB, 2010). Moreover, the Strategic Promotion of Ageing Research Capacity (SPARC) research programme (Leaviss *et al.*, 2008) noted not only the void left behind from lost experience, but also how older workers reluctant to retire can still add value to the workforce. Older workers in the construction industry were found to be committed, valued and appreciated for their skills, but as they age they slow down and become less productive and this affect performance of role by the design team.

Table 4.2: Age Distribution of Respondents

Age Group	Frequency	Percentage
25-34	15	31.2
35-44	19	39.6
45-54	14	29.2
Total	48	100.0

Source: Field Data, 2013

4.2.3 Years of Experience

From Table 4.3, 56.2%, 16.7% and 27.1% of the respondents have had 1-5 years of working experience in the profession, 6-10 years of working experience in the profession and above 10 years of working experience in the profession respectively.

Table 4.3: Years of Experience of Respondents

	Frequency	Percentage
1-5 years	27	56.2
6-10 years	8	16.7
Above 10 years	13	27.1
Total	48	100.0

Source: Field Data, 2013

It was moreover evident from the study that years of experience in the industry are positively correlated with age of design team professionals with correlation coefficient of 0.828. The older-age design team professional have high or more years of experience than the younger-age design team professionals. The result is shown in correlation coefficient matrix in Table 4.4

Table 4.4: Correlation Coefficient Matrix

Variables	Age	Years of experience
Age	1.00	0.828
Years of experience	0.828	1.00

Source: Field Data, 2013

4.2.4 Characteristics of respondents and Design Team

From Table 4.5, out of 33 males' respondents, 24.2%, 33.3%, 24.2% and 18.2% of them were architects; quantity surveyors, surveyors and engineers respectively whiles out of 15 female respondents, 26.7%, 6.7%, 26.7% and 40.0% were architects, quantity surveyors, surveyors and engineers respectively. Within quantity survey as a profession, there were 11 (91.7%) males and only 1 (8.3%) female indicating highly males dominance in that profession. However, within engineering, the number of males and that of female were the same and this is a clear indication of gender balance in engineering profession. This therefore suggests that among the design team, quantity surveying is seen by women as a scary profession and uncondusive for them.

Also, from Table 4.5, out of 14 respondents who fell within the age group of 45-54 years, 57.1%, 28.6% and 14.3% were quantity surveyors, surveyors and architects respectively. This suggests that quantity surveying and surveying as professions have older professionals who are nearer to their retirement age than other professions.

According to Lynch (2007), many companies are finding it difficult to recruit and retain Quantity Surveyors. The RICS commissioned a nationwide survey in January 2007 in UK which identified 6,500 QS vacancies, 49% of which remained unfilled for more than 6 months, and 35% for more than 12 months (Lynch 2007). The study also predicted a projected shortfall of 9,000 trained Quantity Surveyors in ten years' time, and highlighted the fact that although QS student numbers are increasing, this will not meet the shortfall in time to tie in with the planned programme of construction in the future. This pattern of future shortage of QS and surveyors is consistent with findings of this study.

Moreover, the years of working experience has similar pattern with the ages of professionals in the building industry.

Table 4.5: Cross Tabulation of Characteristics of Respondents and Design Team

Variable	Architect	Quantity Surveyor	Surveyor	Engineer	Total
Gender:					
Male	8 (24.2%)	11 (33.3%)	8 (24.2%)	6 (18.2%)	33 (100.0%)
Female	4 (26.7%)	1 (6.7%)	4 (26.7%)	6 (40.0%)	15 (100.0%)
Age :					
25-34	5 (33.3%)	0 (0.0%)	1 (6.7%)	9 (60.0%)	15 (100.0%)
35-44	5 (26.3%)	4 (21.1%)	7 (36.8%)	3 (15.8%)	19 (100.0%)
45-54	2 (14.3%)	8 (57.1%)	4(28.6%)	0 (0.0%)	14 (100.0%)
Years of Experience:					
1-5 years	10 (37.0%)	3 (11.1%)	3 (11.1%)	11 (40.7%)	27 (100.0%)
6-10 years	0 (0.0%)	2 (25.0%)	6 (75.0%)	0 (0.0%)	8 (100.0%)
Above 10 years	2 (15.4%)	7 (53.8%)	3(23.1%)	1 (7.7%)	13 (100.0%)

Source: Field Data, 2013

4.3 Roles of Design Team

The section compares the roles of design team (architect, quantity surveyor, surveyor and engineer) under traditional and design and build methods of procurement.

4.3.1 Common procurement method in Built Industry

This study chose public procurement entities and the study considered common procurement method adopted in public procurement entities. From the study, it was realized that traditional method of procurement is mostly adopted in Ghana than design and build method. In KMA, about 85%-90% of the procurement is through traditional method and the remaining 10%-25% is done through design and build method. Moreover, in KNUST-Development office, about 60%-80% of the procurement is through traditional method and the remaining 20%-40% is through design and build method. In AERSL, about 50%-70% of the procurement is through traditional method and the remaining 30%-50% is through design and build method. Finally in BRRI about 55%-70% of procurement is through traditional method and the remaining 30%-45% is through design and build method. It is therefore evident that in Ghana, traditional method of procurement is commonly used than design and builds method. The result is shown in Table 4.6.

This result supports the findings of Rahmat (2008). Rahmat found that in UK traditional method was the most popular followed by design and build. The clients mostly decide the type of procurement method used and this implies that clients are more familiar with traditional method. Moreover design and build method according to the design team produces higher initial cost since all the risk of the projects would be fully absorbed by the contractor.

Table 4.6: Percentage Usage of Procurement Method (in range)

Institutions / Method	Traditional method	Design and build
KMA	85%-90%	10%-25%
KNUS-Development Office	60%-80%	20%-40%
AERSL	50%-70%	30%-50%
BRRI	55%-70%	30%-45%

Source: Field Data, 2013

4.3.2 Performance of Roles under Procurement Methods

This aspect of the study analysis the performance of roles of selected design team members (architects, quantity surveyors, surveyors and engineers) under traditional and design and buld methods of procurement.

4.3.2.1 Architects

The key roles performed by architect were identified as preparation of design, development and interpretation of brief, advice on material/ furniture and equipment selection, management health and safety issues and leader of design team. According to the design team, their identified roles are performed as: preparation of design (not often: 8.3%, often: 41.7% and all the time: 50.0%); development and interpretation of brief (not at all: 8.3%, not often: 8.3%, often: 33.3% and all the time: 60.0%); advice on material/ furniture and equipment selection (often: 100.0%); management of health and safety issues (not often: 8.3%, often:91.7%) and team leader (often:75.0% and all the time: 25.0%) under the traditional method. This suggests that though architects know what to do under the traditional method, they do not perform such roles at all times throughout construction works.

However, under the design and build method, the identified roles are performed as: preparation of design (all the time: 100.0%); development and interpretation of brief (often: 25.0% and all the time: 75.0%); advice on material/ furniture and equipment selection (all the time: 100.0%); management of health and safety issues (all the time 100.0%) and team leader (not at all: 58.3% and not often 41.7%). Therefore under the design and build method, architect perform their roles all the time with the exception of role of leadership of the design team. The findings are summarized in Table 4.7.

Table 4.7: Roles of Architect

Roles	Responses				
Traditional Method	Not at all	Not often	Often	All the time	Total
Preparation of design		1 (8.3%)	5 (41.7%)	6 (50.0%)	12 (100.0%
Development and interpretation of brief	1 (8.3%)	1 (8.3%)	4 (33.3%)	6 (50.0%)	12 (100.0%)
Advice on material/ furniture and equipment selection	0 (0.0%)	0 (0.0%)	12 (100.0%)	0 (0.0%)	12 (100.0%)
Manage health and safety issues	0 (0.0%)	1 (8.3%)	11 (91.7%)	0 (0.0%)	12 (100.0%)
Leader of design team	0 (0.0%)	0 (0.0%)	9 (75.0%)	3 (25.0%)	12 (100.0%)
Design and Build					
Preparation of design	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Development and interpretation of brief	0 (0.0%)	0 (0.0%)	3 (25.0%)	9 (75.0%)	12 (100.0%)
Advice on material/ furniture and equipment selection	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Manage health and safety issues	0 (0.0%)	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Leader of design team	7 (58.3%)	5 (41.7%)	0 (0.0%)	0 (0.0%)	12 (100.0%)

Source: Field Data, 2013

4.3.2.2 Quantity Surveyors

The key roles performed by quantity surveyors were identified as advice on preparation on tender document, monitoring construction expenses, advice on evaluation of variation in contract, checking evaluation report before payment and regular report on project to client. According to quantity surveyors, their identified roles are performed as: advice on preparation on tender document (not often: 33.3%, often: 50.0% and all the time: 16.7%); monitoring construction expenses (often: 33.3% and all the time: 66.6%);); advice on evaluation of variation in contract (not often: 25.0%, often:33.3%, all the time:41.7%); checking evaluation report before payment (not often: 25.0%, often: 16.7%, all the time: 58.3%) and regular report on project to client (often:75.0% and all the time: 25.0%) under the traditional method.

The study however identified that quantity surveyors under design and build method performed their roles all the time with the exception of advice on preparation on tender document. The findings are summarized in Table 4.8.

Table 4.8: Roles of Quantity Surveyor

Roles	**Response**			
Traditional Method	Not often	Often	All the time	Total
Advice on preparation on tender document	4 (33.3%)	6 (50.0%)	2 (16.7%)	12 (100..0%
Monitoring construction expenses	0.0 (0.0%)	4 (33.3%)	8 (66.7%)	12 (100.0%)
Advice on evaluation of	3 (25.0%)	4 (33.3%)	5 (41.7%)	12 (100.0%)

variation in contract				
Checking evaluation report before payment	3 (25.0%)	2 (16.7%)	7 (58.3%)	12 (100.0%)
Regular report on project to client	1 (8.3%)	6 (50.0%)	5 (41.7%)	12 (100.0%)
Design and Build				
Advice on preparation on tender document	12 (100.0%	0 (0.0%)	0 (0.0%)	12 (100.0%)
Monitoring construction expenses	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Advice on evaluation of variation in contract	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Checking evaluation report before payment	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Regular report on project to client	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)

Source: Field Data, 2013

4.3.2.3 Surveyors

From Table 4.9, surveyors were of the view that they perform their role not all the time under traditional method but under design and build method, they perform such roles all the time with exception of giving of technical advice on building laws, codes and regulations (often: 25.0%, all the time: 75.0%). The extent of the performance of their roles under the two methods is summarized in Table 4.9.

Table 4.9: Roles of Surveyor

Roles	Response			
Traditional Method	Not often	Often	All the time	Total
Drawings	2 (16.7%)	7 (58.3%)	3 (25.0%)	12 (100..0%
Conduct environmental impact analysis on project	9 (75.0%)	0 (0.0%)	3 (25.0%)	12 (100.0%)
Give technical advice on building laws, codes and regulations	0 (0.0%)	5 (41.7%0	7 (58.3%)	12 (100.0%)
Engage stakeholders on discussion of survey report	0 (0.0%)	2 (16.7%)	10 (83.3%)	12 (100.0%)
Advice to workers	2 (16.7%)	4 (33.3%)	6 (50.0%)	12 (100.0%)
Design and Build				
Drawings	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Conduct environmental impact analysis on project	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)
Give technical advice on building laws etc.	0 (0.0%)	3 (25.0%)	9 (75.0%)	12 (100.0%)
Engage stakeholders on discussion of survey report	0 (0.0%0	0 (0.0%)	12 (100.0%)	12 (100.0%)
Advice to workers	0 (0.0%)	0 (0.0%)	12 (100.0%)	12 (100.0%)

Source: Field Data, 2013

4.3.2.4 Engineers

From the study, it was realized that engineers perform all their roles at all times under both traditional method and design and build method with the exception of ensuring sanitary site. With regards to ensuring sanitary site, 75.0% was of the view that they perform this role at all times whiles 25.0% perform this roles often. However, all engineers were of the view that they ensure sanitary site all the time under design and build method. See Table 4.10 for details.

Table 4.10: Roles of Engineers

Roles	**Response**		
Traditional Method	Often	All the time	Total
Analyze maps, drawing and topographical information	0 (0.0%)	12 (100.0%)	12 (100.0%
Design hydraulic system and structure	0 (0.0%)	12 (100.0%)	12 (100.0%)
Calculation of load and grade requirement	0 (0.0%)	12 (100.0%)	12 (100.0%)
Ensure sanitary site	3 (25.0%)	9 (75.0%)	12 (100.0%)
Test soil and materials for use	0 (0.0%)	12 (100.0%)	12 (100.0%)
Design and Build			
Analyze maps, drawing and topographical information	0 (0.0%)	12 (100.0%)	12 (100.0%)
Design hydraulic system and structure	0 (0.0%)	12 (100.0%)	12 (100.0%)
Calculation of load and grade requirement	0 (0.0%)	12 (100.0%)	12 (100.0%)
Ensure sanitary site	0 (0.0%)	12 (100.0%)	12 (100.0%)
Test soil and materials for use	0 (0.0%)	12 (100.0%)	12 (100.0%)

Source: Field Data, 2013

From the findings, design and build method create the platform for design team to perform their roles all the time more than traditional method and the reasons given include the following:

1. The design-build team is responsible for success and failure of project and bear risk of failure but traditional method does not put sole responsibility on design team. Therefore according the design team member interviewed, they become more committed to the construction works and work to ensure successfulness of the project.
2. The design –build team start with design work and continue afterward till successful completion of project but most of the work of design team under traditional method is terminated with design work since contractor takes over from them.

4.3.3 Termination of Roles of Design Team

From Table 4.11, 60.4% of the design team had the opinion that their role end with design work and only 39.6% continue with their role till completion of projects under traditional method. Under design and build method, as many as 35.4% had the view that they continue with their role even after completion to ensure post construction evaluation and review of the project. This clearly shows that design team has long term involvement and interest in project under design and builds method than traditional method.

Table 4.11: Where Roles of Design Team End under Procurement Systems

Roles	Responses	
Traditional Method	Frequency	Percentage (%)
Ends with design works	29	60.4
Ends with completion of project	19	39.6
Goes beyond completion of project	0	0.0
Total	48	100.0
Design and Build		
Ends with design works	0	
Ends with completion of project	31	64.6
Goes beyond completion of project	17	35.4
Total	48	100.0

Source: Field Data, 2013

4.4 Problems Design Team Face under Each Procurement System

From Table 4.12, the number of design team who agreed design and build method offer coordination among design, coordination between design team and clients team, trust among design team, trust between design team and clients and commitment out number that of traditional method.

Table 4.12: Coordination, trust and commitment under procurement systems

Problems	Responses			
Traditional	NO	NOT SURE	YES	TOTAL
Coordination among design team	0 (0.0%)	17 (35.5%)	31 (64.6%)	48 (100.0%)
Coordination between design team and clients	28 (58.3%)	17 (35.5%)	3 (6.3%)	48 (100.0%)
Commitment to work	30 (62.5%)	18 (37.5%)	0 (0.0%)	48 (100.0%)
Trust among design team	20 (41.7%)	0 (0.0%)	28 (58.3%)	48 (100.0%)
Trust between design team and clients	22 (45.8%)	19 (39.6%)	7 (14.6%)	48 (100.0%)
Design and build				
Coordination between design team and clients	0 (0.0%)	7 (14.6%)	41 (85.4%)	48 (100.0%)
Coordination between design team and clients	0 (0.0%)	6 (12.5%)	42 (87.5%)	48 (100.0%)
Commitment	0 (0.0%)	3 (6.3%)	45 (93.8%)	48 (100.0%)
Trust among design team	0 (0.0%)	15 (31.3%)	33 (68.8%)	48 (100.0%)
Trust between design team and clients	0 (0.0%)	13 (27.1%)	35 (72.9%)	48 (100.0%)

Source: Field Data, 2013

4.5 Procurement Method and Performance of Design Team

The procurement system affect the performance of design team in relation to time, money and entire satisfaction of clients and this aspect of the study considered how traditional and design and build methods have these performance indicators from the perspective of the design team.

4.5.1 Time Cost/ Time Savings

From Table 4.13, 13 respondents forming 27.1%, 26 respondents forming 54.2% and 9 respondents forming 18.8% had the view that time scheduled to complete project are 'not at all met', 'not often met' and 'often met' respectively under traditional method of procurement. However, under design and build method, 35 respondents forming 72.9% were of the view that time scheduled to complete project is 'often met' and as many as 27.1% of the respondents believed time scheduled to complete project is 'all the time met'. This therefore suggests that project complete as scheduled more under design and builds than with traditional method.

This finding is consistent with studies by Victor Sanvido and Mark Konchar of Pennsylvania State University. According to the study by Victor Sanvido and Mark Konchar R on Selecting Project Delivery Systems' design–build projects are delivered 33.5% faster than projects that are designed and built under separate contracts (traditional method). Moreover, study by Songer and Molenaar (1996), confirmed design-build delivery method makes it possible to reduce project duration.

4.5.2 Monetary cost

From Table 4.13, 14.6% , 62.3% and 22.9% of design team professionals had the view that: project cost 'not often ' go beyond estimated cost, project cost 'often go beyond estimated cost and project cost ' all the time' go beyond estimated cost under traditional method of procurement. Under the design and build method of procurement, 41.7%, 39.6% and 18.7% of design team professionals had the view that: project cost 'not at all' go beyond estimated cost, project cost 'not often' go beyond estimated cost and project cost 'often' go beyond estimated cost respectively. From the findings the project cost mostly within the budgeted cost under the design and build method than the traditional method this is because, project variation is minimized under the design and build method and also the design team believe that any delay is to their disadvantage since cost normally rise in Ghana with time.

The finding from this study is consistent with empirical literature. Researches on Selecting Project Delivery Systems by Victor Sanvido and Mark Konchar (1998) of Pennsylvania State University found that design–build projects have a unit cost that is 6.1% lower than projects under traditional method. Similar cost savings was found in a comparison study of design–build, and design-bid-build for the water/wastewater construction industry (a peer-reviewed paper authored by Smith Culp Consulting and published in July 2011 by the American Society of Civil Engineers).

4.5.3 Meeting expectation of clients

From Table 4.13, 18.8%, 33.3%, 47.9% of the design team was of the view that: clients expectation is 'not at all met', clients' expectation are ' not often met' and clients' expectation is ‘often met’ respectively under traditional method of procurement. Under the design and build method, 18.8%, 52.0% and 29.2% of the design team had the view that clients expectation are ‘not often met’, clients expectations are ‘often met’ and clients expectations are ‘met at all times’ respectively. The finding therefore indicates that there is higher client satisfaction and fulfillment under design and build method than traditional method.

From the above performance criteria, design and build method of procurement produce higher performance in the area of time cost, monetary cost and client satisfaction than traditional method. The design and build method allows owners to avoid being placed directly between the architect/engineer and the contractor. Design–build places the responsibility for design errors and omissions on the design–builder, relieving the owner of major legal and managerial responsibilities. The burden for these costs and associated risks are transferred to the design–build team. The design-build team is responsible for providing the owner with all aspects required to deliver the facility, starting from design services to construction, and including equipment selection and procurement (Beard *et al.* 2001). In this method, the risks associated with design management and controls are transferred to the design-build entity. The design team under this method therefore works in a way to minimize any cost since they know any additional risk and cost may be borne by them. They are directly held responsible for their actions and outcome of project and therefore work efficiently and effectively to minimize any cost that would be borne by them.

Table 4.13: Design Team Performance under Procurement Systems

Performance Indicators	**Responses**				
Traditional Method	Not at all	Not often	Often	All the time	Total
Design team complete work as scheduled	13 (27.1%)	26 (54.2%)	9 (18.8%)	0 (0.0%)	48 (100.0%)
Project cost go beyond estimated cost	0 (0.0%)	7 (14.6%)	30 (62.5%)	11(22.9%)	48 (100.0%)
Expectations are met	9 (18.8%)	16 (33.3%)	23 (47.9%)	0 (0.0%)	48 (100.0%)
Design and Build					
Design team complete work as scheduled	0 (0.0%)	0 (0.0%)	35 (72.9%)	13 (27.1%)	48 (100.0%)
Project cost go beyond estimated cost	20(41.7%)	19 (39.6%)	9 (18.7%)	0 (0.0%)	48 (100.0%)
Expectations are met	0 (0.0%)	9 (18.8%)	25 (52.0%)	14(29.2%)	48 (100.0%)

Source: Field Data, 2013

CHAPTER FIVE

MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study's findings and provides evidenced based recommendation from the study. This chapter moreover, provides the conclusion for the study.

5.2 Major Findings

The major findings from the data analysis presented in chapter four of this study are summarized as follows:

1. There were more males design team professionals (68.8%) than females (31.2%) with majority of males as quantity surveyors (33.3%) and majority of females as engineers (40.0%).

2. More of design team professionals were within the age group of 35-44 years (39.6%) with only 29.2% of them within the age group of 45-54 years and within the age group of 45-54 years, quantity surveyors accounted for 57.1%.

3. It was evident from the study that , design and build method create the platform for design team to perform their roles all the time more than traditional method because under design-build method design team is responsible for success and failure of project and bear risk of failure and they are committed to duty throughout the project from beginning to completion.

4. It was found in the study that design-built method promotes coordination, commitment, and trust more than traditional method. Under –built method, commitment was highest

(93.8%), followed by coordination between design team and clients (87.5%), coordination between design team and clients (85.4%), trust between design team and clients (72.9%) and trust among design team (68.8%) whiles under traditional method, coordination among design team was rated highest (64.6%) followed by trust among design (48.3%).

5. Project under both traditional and design-build methods often go beyond estimated cost. However, under traditional method, 22.6% had the view that project cost all the time goes beyond estimated cost but this not the case of design –built method. Moreover, projects are completed more often under design-built method (72.9%) than traditional method (18.8%) with clients' expectorations met more under design –built method than traditional method.

5.3 Recommendations

The recommendations were based on the findings of the study and these included the following:

1. Recruitment/ succession and retention. The study found that there were old- age professionals who would soon go on retirement and relatively few women in the industry. To overcome this challenge, the industry should have recruitment or succession and retention plan. The stakeholders in the industry should find out where students of quantity surveying and surveying go after graduation and why they are not interested in the profession. The long serving professionals can provide counseling and advice to upcoming ones. Moreover, since there are relatively few women, they should target more women and encourage more women to have interest in the industry. The women professionals should take key interest in this to encourage their colleagues and develop capacity of women to enter into the profession.

2. Increase awareness of design and build method: the study found that design team perform their roles better under the design and build method than traditional method and design and build method has advantage of reducing project cost, time and increasing client satisfaction. However, traditional method is mostly adopted by clients and procurement entities due to low awareness of the design and builds method. The design team should take on board to educate clients on the merits of the design and build method and what the clients turn to gain from the method when used.

3. Improvement in collaboration and co-operation. The study identified that the major challenge of design team under the traditional method is lack of collaboration and co-operation among design team and between design team and clients but design and build method has this as its advantage causing higher performance under design and build method. Traditional method in Ghana is most preferred and for this method to achieve better result as the design and build method, there should be more collaboration and co-operation among the design team and between design team and clients. There should be a platform for the design team to work together and share ideas; however care must be taken to avoid conflict of roles. The design team should see the need to communicate with the clients as often as possible and constant communication would help to reduce project variation after the project has started to reduce cost and time delay.

5.4 Conclusion

In building industry, procurement describes the activities undertaken by the client to obtain a building. There are many different methods of construction procurement including traditional method (Design-bid-build), Design and build and Management contracting. Moreover, there is also a growing number of new forms of procurement that involve relationship contracting where the emphasis is on a co-operative relationship between the principal and contractor and other stakeholders within a construction project. New forms include partnering such as Public-Private Partnering (PPPs) or Private Finance Initiatives (PFIs) and alliances such as "pure" or "project" alliances and "impure" or "strategic" alliances. In this study however, only traditional method and design and build method were considered.

The study was conducted in Kumasi Metropolis to assess the performance of design team under each procurement system and to help conduct the study, KMA, KNUST-Development office, BRRI and AESL were sampled from which design team professionals were selected as respondents. The findings of the study are consistent with literature on performance of design team under procurement systems.

From the study, there were more males design team professionals than females and quite a number of design team professionals are closer to their retirement age and this calls for good replacement plan for such institution especially target women. Moreover, it was evident from the study that , design and build method create platform for design team to perform their roles all the time more than traditional method because under design-build method, design team is responsible for success and failure of project and bear risk of failure and they are committed to duty throughout the project from beginning to completion. It was also found in the study that design-built method promotes coordination, commitment, and trust more than traditional method and yield higher performance in the area of money cost, time cost and client satisfaction. However, despite the great performance of design team under design and build method, the method is less used an adopted in Ghana making traditional method as most common method of procurement in Ghana.

5.5 Further research

Realizing the objectives of this study, the researcher therefore recommends that a further study can be undertaken in the area of 'assessing challenges facing the design team in performance of their roles'.

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APPENDIX A

Design Team Questionnaire

Sir/ Madam

I am a research student from Department of Building Technology, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI and I am writing a thesis on the topic: The Impact of Procurement systems on the Design Team's Performance. Your opinions are highly essential as they will help to determine the impact of different procurement systems on design team's performance. Whatever you say will be treated confidential, so feel at ease to express your candid opinion. Be assured that your responses will not in any way be linked to your identity. You are kindly requested to answer the questions below by indicating a tick or writing the appropriate answer when needed.

THANK YOU

Personal Data

1. Gender: 1= Male [ ] 2= Female [ ]
2. Age: 1= 18-24 [ ] 2= 25-34 [ ] 3= 35-44 [ ] 4= 45-54 [ ] 5= 55+ [ ]
3. Please where do you work?

Institution	**Response**
Development office, KNUST	
KMA	
AESL	
BRRI	

4. How long have you worked with this institution?

1= below 1 year [ ] 2= 1-3 years [ ] 3= 3-5 years [ ] 4= 5 – 10 [ ]

5=10 years and above [ ]

5. How long have you engaged in design in construction industry?

1= below one year [ ] 2= 1- 5 years [ ] 3= 5 – 10 years [ ] 4= 10 -15 years [ ] 5= 15 years and above [ ]

Roles/ Authority/ powers of design team

1. Are the roles clearly defined? 1= Yes 2= No

Traditional method	
Design and build	

Rating systems for roles of design team in this questionnaire	Level of exercise of role
1	Not at all
2	Not often
3	Often
4	Very often

2. How often do you exercise the following roles under each procurement system as an architect throughout in a given project? (FOR ARCHITECT ONLY)

Roles	**Traditional method**	**Design and build**
Preparation of design		
Developing and interpreting client brief		
Advice on material/ furniture/ equipment selection		
Manage health and safety issues		
Leader of design team		

2. How often do you exercise the following roles under each procurement system as a quantity surveyor throughout in a given project? (FOR QS ONLY)

Roles	**Traditional method**	**Design and build**
Advice on preparation on tender document		
Monitoring construction expenses		
Advice on evaluation of variation in contract		
Checking evaluation report before payment		
Regular report on project to client		

2. How well do you exercise the following roles under each procurement system as a surveyor throughout in a given project? (FOR SURVEYORS ONLY)

Roles	**Traditional method**	**Design and build**
Preparation of charts, diagrams and survey to convey needed information on a project		
Conduct environmental impact analysis on project		
Give technical advice on building laws, codes and regulations		
Engage stakeholder of a project on discussion of survey report		
Advice to workers on a project		

3. How do you perceive the following under each procurement system? Please indicate with: 1= not at all 2= No 3= Yes

Indicators	**Traditional method**	**Design and build**
Coordination among design team		
Coordination between design team and clients/ stakeholders		
Commitment to work		
Trust among design team		

Trust between design team and client/ stakeholders		

4. Where does your role end?

   1= end with the design works [ ] 2= end with final completion of project [ ]

   3=after completion of project [ ]

5. Indicate frequency of problems under each procurement system?

Problems	Traditional	Design and build method
Project delay		
Conflict		
Higher additional project cost		
Lower quality of project		
Lower client involvement		

Performance

6. Please use these words to indicate the following

Performance indicators	Traditional method	Design and build method
Design team complete work as scheduled		
Project cost go beyond estimated cost		
Design team are satisfied with work		
Client are satisfied with work		