

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND  
TECHNOLOGY, KUMASI, GHANA**

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**Managing Contract Variations within the Legal Framework of Public  
Procurement in Ghana: A Case Study of Electricity Company of**

**Ghana  
Limited.**

**BY**

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A Thesis submitted to the Department of Building Technology, College of Art and Built  
Environment in partial fulfilment of the requirements for the degree of

**MSc. PROCUREMENT MANAGEMENT**

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## Declaration

I hereby declare that this thesis is my own work and that, to the best of my knowledge, the content neither contains material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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### **Dedication**

To Him who sits upon the throne and to God whom we adore and the lamb that was once slain be glorified evermore for how far He has brought me. I dedicate this to my family, spiritual fathers and all my well-wishers most especially Nana Esi Baidoo for their prayers, encouragement and support throughout the study.



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## **Abstract**

Construction in Ghana is a high risk prone industry because of the complex and dynamic project environment. Construction projects are complex because they involve many human and non-human factors and variables. Construction contracts usually last long and experience various uncertainties such as variations. Even well planned projects may eventually require variations. The management of contract variations can be enhanced by the identification and analysis of potential contract variations as early as possible. All issues regarding procurement in Ghana are governed by a legal framework. The study aimed to ascertain the adequacy of the legal framework of public procurement and the root causes, effects and controls of variations in ECG works procurement contracts. The study adopted a case study approach through which structured questionnaires were designed to solicit views from all staff of the Premises Division of ECG. The study revealed after analysing the data using a Relative Importance Index, Kendall's Rank Test and Gap Analysis that the five most prevalent root causes of variations in ECG contracts include; Change in plans by the client, Discrepancy in design details and BOQ, Differing site conditions, Client's financial constraints and Change in economic conditions. That of the effects of variations identified include; Increase in project cost, Completion schedule delay, Project progress is affected but without any delay, Rework and demolition and Dispute between parties to the contract. Control measures identified to manage contract variations effectively include; Clarity of variation order scope, Written approvals, Prompt approval procedures, Variation logic and justification and Review of contract documents. A Gap analysis was conducted to ascertain the level of knowledge and usage of variation provisions within the legal framework of public procurement. It was concluded that ECG contract variations are not properly managed using all the necessary variation principles in line with the legal framework of the Public Procurement. There is a very wide gap between

the level of knowledge and application of variation principles and that this gap has to be bridged. This should serve as a source of worry to ECG if it desires to effectively manage its construction contract variations.

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## ABBREVIATIONS AND ACRONYMS

|      |                                  |
|------|----------------------------------|
| ANAO | Australian National Audit Office |
| BOQ  | Bills of Quantities              |
| BRRI | Building Road Research Institute |

|                          |                                                   |
|--------------------------|---------------------------------------------------|
| CII                      | Construction Industry Index                       |
| CMAA                     | Construction Management Association of America    |
| CPM                      | Critical Path Method                              |
| ECG                      | Electricity Company of Ghana                      |
| FIDIC                    | Federation Internationale des Ingenieurs Conseils |
| GDP                      | Gross Domestic Product                            |
| NSW                      | New South Wales                                   |
| PERT                     | Program Evaluation Review Technique               |
| PPA                      | Public Procurement Authority                      |
| PPOG                     | Public Procurement Oversight Group                |
| PUFMARP                  | Public Financial Management Reform Programme      |
| RII                      | Relative Importance Index                         |
| SPSS                     | Statistical Package for Social Sciences STD       |
| Standard Tender Document |                                                   |

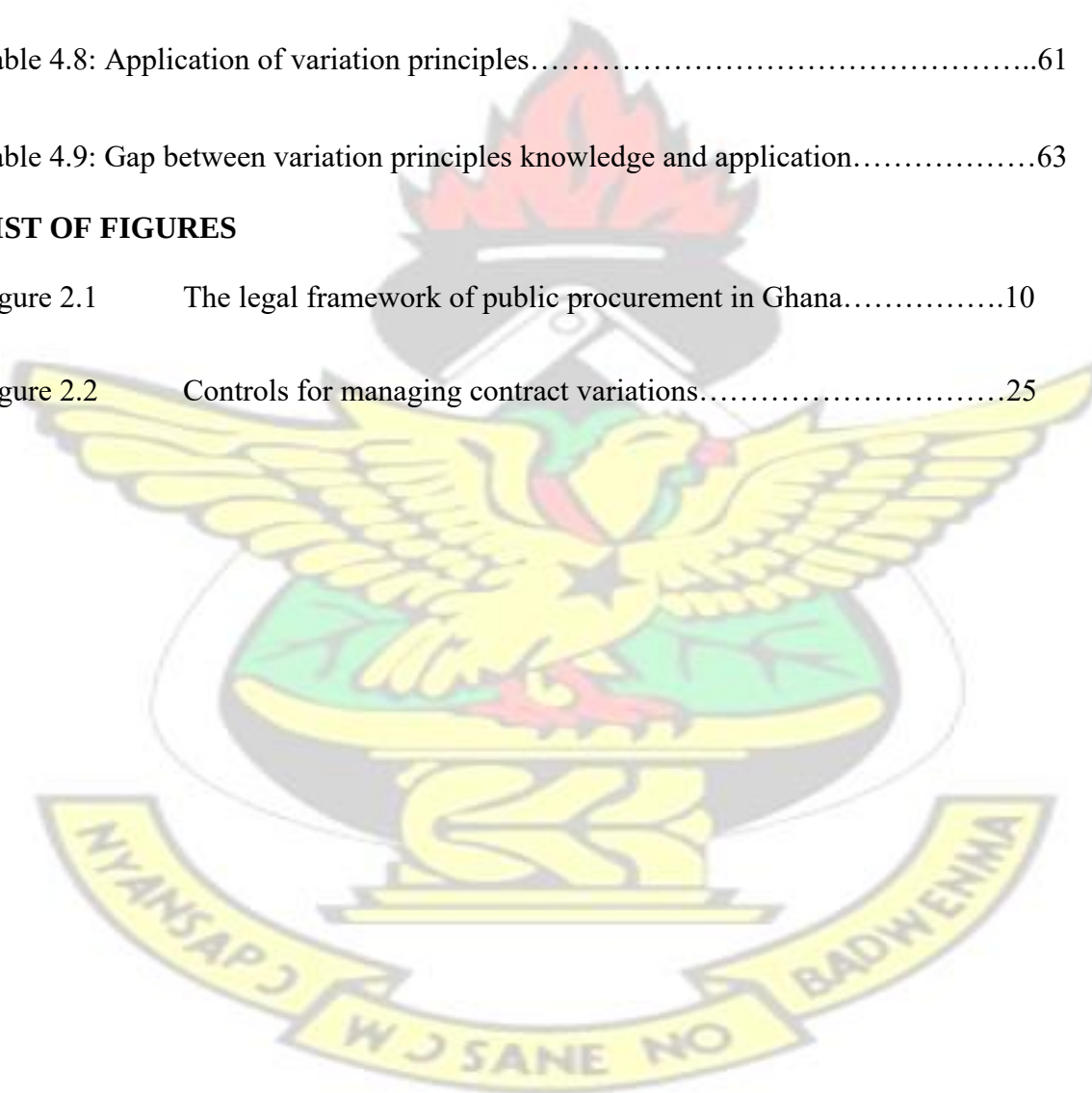
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## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 BACKGROUND OF STUDY**

Public Procurement involves the acquisition of goods, works and services by a state and other publicly-funded entities to implement public projects. Public procurement accounts for at least 15% of the world's Gross Domestic Product (GDP) and even more in African countries. A World Bank study revealed that procurement constitutes a greater portion of about 50% -70% of state resources. This suggests that tax payers' money forms the bulk of the state resources and that must be utilized well (World Bank, 2013).

Up until 1996, to improve the overall public financial management, the State operationalized a programme, Public Financial Management Reform Programme (PUFMARP), which was meant to examine public sector systems, identify weaknesses and to make recommendations to the government to address the situation. Key amongst the recommendations was the enactment of laws to improve Public Procurement in Ghana (Osafo-Marfo, 2003).

In 1999, the Minister for Finance was tasked by the government to establish a group, Public Procurement Oversight Group (PPOG), whose mandate was to help improve Public Procurement Reform Programme (Ameyaw et al., 2012). The Act was eventually passed on the last day of the year 2003 with the object of harmonising all public procurement processes.

All public procurement in Ghana is governed by a legal framework which ensures that procurement is conducted in a fair and open manner. The Legal Framework covering public procurement in Ghana comprises the;

- Act 663 of 2003
- Regulations

- Public Procurement Manual

-Standard Tender Documents

-Guidelines

The Electricity Company of Ghana Limited, a State Owned Enterprise involves heavily in infrastructural works procurement and that their procurement activities must be in accordance with the procurement laws of Ghana. The company is mandated with the responsibility of distributing electricity within its operational areas (Ashanti, Eastern, Volta, Central, Western and Greater Accra Regions). For the company to efficiently and effectively perform its responsibilities, it must ride on the five strategic pillars of the company; Improve network reliability, Reduce system losses, Improve customer service delivery, Improve operational efficiency and Improve organisational culture. These require the need for infrastructural works procurement such as the construction of Substation Control Buildings, Regional and District Offices, Customer Service Centres, Warehouses and Residential facilities (ECG Annual Report, 2014).

Effective management of construction contracts is very critical to the success of every procurement and must ensure that all contractual requirements are met efficiently by parties to the contract. The Premises Division of the Premises and Estates Directorate of ECG which is mandated to procure works for and on behalf of the company must ensure that constant monitoring of all on-going contracts is maintained so that control measures can be taken when problems arise or preventative measures taken when problems are foreseen (PPA, Manual 2007). Many are the post-contract administration issues prevalent to ECG construction contracts and that need to be dealt with, monitored and controlled before the contract reaches its conclusion. Notable among these is the issue of

Contract Variation.

A contract variation is an amendment to an original contract terms and conditions of a contract or any agreed change which adds to or subtract from the terms and conditions or

intent of an original contract. Construction contracts must have the flexibility of being amended. The authorisation of unavoidable variation in construction contracts must be done by the body making the acquisition. Parties to the contract must agree on varying contracts through documentation. Contract Administrators should not consent to unauthorized variations. Variations to be instructed should not contravene any provisions within the legal framework of public procurement (ANAO, 2012).

## **1.2 PROBLEM STATEMENT**

The government of Ghana has a goal of achieving value for money in all public procurements. In this regard, it has established a legal framework to regulate the procurement activities of all public entities. This framework expressly outlines procedures and steps in managing all procurement processes (Ayitey, 2012).

The management of contract variations has become very critical in ECG works procurement. Their occurrence can be foreseeable but mostly unavoidable. Standard forms within the legal framework generally make express provision for instructing variations.

Variations in ECG works procurement contracts are often sources of disputes, time and cost overruns (Premises Division, 2015).

In response to this problem, the study proposes to investigate the adequacy of the legal framework of public procurement in managing ECG works procurement contracts, identify the root causes and impact of variations on ECG contracts and the way forward to effective management of the occurrence of variations.

## **1.3 SIGNIFICANCE OF STUDY**

The Electricity Company of Ghana, a State Owned Enterprise uses public funds in the procurement of works with the Act as a guide. The legal framework governing public

acquisition outlines procedures to manage works contract variations and yet the management of the occurrence of variations coupled with their impact on the success of the procurement at ECG does not seem to be effective.

In view of the above, this study is seen as very vital to effective works procurement by ECG. Given the role of ECG in economic and general development of Ghana, the significance of this study can be seen beyond just ECG.

#### **1.4 AIM AND OBJECTIVES**

##### **Aim**

This study aims to ascertain how ECG can manage effectively works contract variations within the legal framework of public procurement in Ghana.

##### **Objectives**

In order to achieve the aim of this research, the under listed objectives must be achieved;

- i. To ascertain the adequacy of the Act 663 in managing contract variations in ECG works procurement.
- ii. To identify the root causes of variations and their effects on ECG works contracts.
- iii. To identify controls to manage the occurrence of variations in ECG works procurement.

#### **1.5 RESEARCH QUESTIONS**

This study seeks to find answers to the following research questions;

- i. How adequate is the Legal framework of Ghana in managing variations in ECG works procurement contracts.
- ii. What are the root causes of variations and their impact on ECG works procurement contracts.
- iii. What control measures must be put in place to manage effectively foreseen and unplanned variations in ECG works procurement contracts?

## **1.6 SCOPE OF RESEARCH**

The government of Ghana established the legal framework to steer the affairs of public procurement with the aim of achieving value for money. This research concentrated on the management of contract variations within the legal framework of public procurement in Ghana and the major causes and impact of these variations. Establishing control measures to mitigate the impacts of contract variations will help attain a procurement goal. The target population from which data was sourced was the Premises Division of ECG which handles all works procurement of the company.

## **1.7 RESEARCH METHODOLOGY**

In assessing an effective management of contract variations within the legal framework of public procurement at ECG, a case study approach and the administration of structured questionnaires was adopted. The information for the research was obtained from the questionnaire and literature. Opinion on the major causes, effects and controls of contract variations was solicited from the staff of Premises Division of ECG. The staff were assessed on predetermined variation principles for their knowledge and the application of these principles using Gap analysis.

Details on the methodology adopted in carrying out the study is presented in chapter 3 of this report.

## **1.8 OUTLINE OF RESEARCH REPORT**

The report is categorised into five (5) Chapters.

- Chapter 1 outlines Background, Statement of problem, Significance of study, Aim and Objectives, Research question, Scope, Research methodology and the research arrangement.

- Chapter 2 is committed to procurement reforms, contract variations with their types, root causes of variations to contracts and their impact, managing variations and seeking approval for variations under Act 663.
- Chapter 3 explains the Research Method including the research design, sampling procedure, method of data collection and analysis in the collection of data.
- Chapter 4 deals with Data Analysis, Findings and discussions.
- Chapter 5 summarizes the research discoveries coupled with inferences and proposal for further study.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

There has always been complications and uncertainties in construction contracts though each contract has its own unique circumstances and conditions. The complexity of the

industry suggests that it is inevitable for a project to be executed without the occurrence of variations within its lifecycle. Every project, though unique in diverse ways has the likelihood of the occurrence of variations; an attribute that generally differentiates almost all projects (Alsuliman et al. 2012).

In works procurement contract, there is always the need to strategize the effective management of contract variations should they occur. Arguably, variations may be deemed as a counter to the strategy of waste reduction. The more of its occurrence on a project, the greater likelihood of time and cost overruns. The occurrence of variations in works procurement contracts often involves time and cost overruns and sometimes disruption to work already executed. The success in managing contract variations leads to the mitigation of any adverse effects variations brings. However, this is not practically achievable hence the need for effective management of variations (Halwatura and Ranasinghe, 2013).

According to a World Bank study, public procurement in Ghana constitutes about 50% - 70% of state resources after personal emolument. This suggests that tax payers' money forms a greater proportion of the state resources and that must be put into a judicious and effective use to achieve value for money (Ameyaw et al. 2012).

## **2.2 THE LEGAL FRAMEWORK OF PUBLIC PROCUREMENT IN GHANA**

The Ghana government to achieve value for money in public procurement, established the legal framework comprising the; ○ Act 663 ○ Public Procurement Regulations ○ Public Procurement Manual ○ Standard Tender Documents ○ Guidelines

### **2.2.1 Act 663**

The Act is enacted to set up the regulatory body with the mandate of monitoring and manning all state procurement and specifying the procedural methods for public acquisition. The Act also gives tenderers the opportunity to present their petition in the

event of unsuccessfulness or when there are traces of foul play. It also specifies the procedures for disposing obsolete state assets. It also outlines the applicable punishment in the event of any breach of the law.

### **2.2.2 Public Procurement Regulations**

These regulations are established in accordance with Section 97 of the Act 663 with the function of detailing out all procedures and rules to aid in the fulfillment of the object of the Act 663 and also the implementation of the Act's provisions. These regulations are applicable to all public procurement activities.

### **2.2.3 Guidelines**

The function of the Guidelines established under the provisions of the Act 663 by the Board is to give additional explanation and information on specific areas of the various aspects of the public procurement.

### **2.2.4 Standard Tender Documents**

This is issued by PPA and listed in Schedule 4 to the Act 663. They have been prepared purposely for the acquisition of works, goods and services. The usage of STDs is compulsory for open and competitive systems of public procurement.

### **2.2.5 Manual**

This is issued by PPA to give a practical guidance and step-by-step procedures for undertaking public acquisitions.

All State Entities are to make acquisitions in accordance with this legal framework of which any breach is punishable by the Laws of the land.

Passed by Parliament.

|                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Public Procurement Act, 2003 (Act 663)</b> | <p><u>Establishes</u> the Public Procurement Board (PPB), as a regulatory body and specifies functions of Tender Committees and Tender Review Boards in procurement entities.</p> <p><u>Specifies</u> outline rules for procurement methods, procedures, appeals by tenderers and disposal of stores.</p> <p><u>Defines</u> offences under the Act and applicable penalties.</p> <p><u>Specifies</u> thresholds, which require regular updating, in Schedules to the Act.</p> <p><u>Authorises</u> the issue of Regulations, which are enforceable in the same way as the Act.</p> |
| <b>Public Procurement Regulations</b>         | <p><u>Issued</u> by the Minister for Finance in consultation with PPB.</p> <p><u>Contains</u> detailed rules and procedures for all aspects of the procurement system, including the operations of PPB and procurement entities and the conduct of procurement activities.</p>                                                                                                                                                                                                                                                                                                     |
| <b>Guidelines</b>                             | <p><u>Issued</u> by the Public Procurement Board under the Act.</p> <p><u>Provide</u> supplementary guidance on specific topics e.g. disposal, single source procurement or margins of preference.</p>                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Standard Tender Documents</b>              | <p><u>Issued</u> by the Public Procurement Board in accordance with a Schedule to the Act.</p> <p><u>Contains</u> standard invitation and contract documents for procurement of all values from tender documents to Requests for Quotations.</p> <p><u>Includes</u> separate documents for goods, works and services.</p>                                                                                                                                                                                                                                                          |
| <b>Public Procurement Manual</b>              | <p><u>Issued</u> by the Public Procurement Board.</p> <p><u>Provides</u> practical guidance and step-by-step procedures to assist procurement entities to undertake procurement in accordance with the Act.</p> <p><u>Contains</u> standard forms to assist with procurement record keeping.</p>                                                                                                                                                                                                                                                                                   |

Figure 2.1 The Legal framework of Public Procurement in Ghana

Source: PPA Procurement Module 1, Updated 13<sup>th</sup> October, 2006

## **2.3 CONTRACT VARIATION**

Many researchers have come out with different definitions for contract variation. A contract variation is any amendment that occurs to a contract to differentiate the initially agreed terms (Baxendale and Schofield, 1986). A common phenomenon in works procurement contracts which involves a change of the initial scope of works as expressly specified in the contract terms (Memon et al. 2014). Keane et al. 2010 also define a contract variation as a change in any contract from the agreed contract as at the time of signing the agreement. CMAA (1993) defined a contract variation as a documented agreement between parties to a contract, representing additions, omissions, amendment to contract documentations and also spelling out the time and cost impact on the project as well as detailing out the scope of the work to be executed. A contract variation is a change to the original work scope of a contract to make an addition, substitution and or deletion from the initial work scope.

From the foregoing definitions, it can be deduced that a contract variation comes with an alteration to the original contractual terms or any agreed change (design, quality, quantity and working conditions) which has the tendency to add to or subtract from the terms and conditions or intent of an original contract.

Contract variations must not be instructed to alter the basic features or characteristics of the works or delete works meant for a different contractor or are instructed within the maintenance period or instruct works to be executed by the principal contractor of which are originally to be executed under Prime Cost Sum (Designing Buildings Wiki).

### **2.3.1 Key characteristics of a contract variation**

According to ANAO (2012), the flexibility and regulation of contract amendment should be a common trait of every contract. Section 87 of the Act makes a provision for variation. The

authority to instruct a variation must not be implied and therefore should be expressly stipulated in the contract in order to give authorization to amend the contract. The non-existence of express terms which gives authorization to instruct a variation may lead to a contractor rejecting the instruction without any legal consequence. A typical example for express term for instructing variation is FIDIC Clause 51.1.

The authority to amend a contract should be the responsibility of the procuring entity and must occur only under extreme situations as expressly stated in section 87 (2) of the PPA, 2003 (Act 663). ANAO (2012) further identified that; provisions to authorize variations must be agreed by parties to the contract through proper documentation. In some instances, oral agreement may be accepted though it is expressly stated in the contract to adhere to procedural requirements.

Proposed variations must not in any way breach the requirements of the legal framework governing public procurement. Variations to be instructed must be in conformity with contract provisions or the acquiring entity's procedures.

There should be justification and proper documentation for variations. Variations may not be utilized as an element to disguise poor performance and its impact on the contract must be assessed.

### **2.3.2 Classification of Contract variations**

Variations are mostly classified under the following;

- Unavoidable variations.
- Client initiated variations.
- Contractor initiated variations.

### **2.3.2.1 Unavoidable variations**

These are initiated and instructed to mitigate the probable harsh impacts that may arise from unpredictable situations. Variations of this nature do not affect the work scope. Illustration of this type of variation is; Minimization of cost overruns or other effects of inherent circumstance such as unexpected site conditions (NSW Procurement Guide, 2008).

### **2.3.2.2 Client initiated variations**

Client initiated variations are basically instructed as a result of the client's original prescription. There can be instances when a contract can be executed to completion without the need to amend the initial demands. Such variations normally change the work scope which eventually increases the cost of the works.

Adequate funds must be available and committed to the project before such variations can be instructed. Client must undertake not to instruct a variation unless a full assessment of the cost and time implication has been conducted (NSW Procurement Guide, 2008).

### **2.3.2.3 Contractor initiated variations**

This type of variation is initiated by the contractor. The client is under no compulsion to adhere to such a variation though may be advantageous to the project. The request by the contractor to amend the contract must be backed with supporting details comprising the probable impacts of the said variation before approval can be made.

Instructing such variation could either be done by the consultant upon the client's authorization or the client can personally authorize (NSW Procurement Guide, 2008).

## **2.4 EVALUATING THE NEED FOR VARIATIONS IN WORKS CONTRACT/ CAUSES OF VARIATIONS**

Variations in works contracts crop up due to numerous causative factors which some can either be easily foreseeable and others unforeseeable. Many researchers in their quest to

ascertain the root causes of variations identified various causes. As a result of literature, Nineteen (19) causes were established.

#### **2.4.1 Change in contract duration/schedule**

A change in contract duration during the execution stage of a construction project is regarded a major cause of contract variation which may result in reallocation of resources. This implies that extra resources may be required or some resources kept unused. In the event of the project progress being accelerated to early completion, extra costs are required to be committed to the project (Fisk 1997; O'Brien 1998). Example of this type of variation is educational facilities where contractors are sometimes instructed to accelerate progress to complete projects before their originally stipulated time. This suggests that more hands will be employed to meet the revised schedule. This always attracts extra cost.

#### **2.4.2 Change of scope**

Change in work scope of a construction contract is a common causative factor of variation according to CII (1990b). Arain et al. (2004) affirmed that this cause is as a result of poor and insufficient planning at the signing phase and sometimes lack of involvement of the client and or the end user in the design stage.

#### **2.4.3 Client's financial constraints**

According to Clough and Sears (1994) and O'Brien (1998), progress of construction projects is greatly affected when the financial position of the client becomes unstable.

This situation mostly result to varying project schedule and specification because delays in payment to contractors may affect the project progress and may also tempt contractors to use inferior materials which are less costly hence subjecting the work quality to disrepute.

#### **2.4.4 Obstruction to expeditious decision making process**

Sanvido et al. (1992) and Gray and Hughes (2001) identified that how expeditious decisions pertaining to construction contracts are taken is key to the successful delivery of almost every project. The inability to take certain decisions promptly may affect project progress hence prolonging the project schedule which in effect will increase the project cost (Memon et al., 2014).

#### **2.4.5 Unyielding nature of the client**

Construction requires coordination from all team members involved at the various phases of the project life cycle (Wang 2000; Arain et al. 2004). In the event of the client being obstinate and unyielding, there is the likelihood of the occurrence of a major variation later on in the project phases.

#### **2.4.6 Varying specification by the client**

Variation to contract specification by the client is a rampant occurrence due to inefficient project goals (O'Brien, 1998). In the event of the execution of such changes, there is the possibility of the occurrence of variation during the construction phase of the project.

#### **2.4.7 Design change by the consultant**

According to Arain et al. (2004), amendment in design as an improvement by the consultant is very dominant in current professional practice. According to Fisk (1997), amendment to design is identified to be very predominant in projects where execution of the works commences before detailed designs are concluded. Such amendment

influences the project in diverse ways.

#### **2.4.8 Complexity of design**

The complex nature of designs demands exclusive proficiency, attention and technological advancement in construction (Arain et al. 2004). The flow of the construction sequence is affected by the complex nature of the designs while uncomplicated construction activities are comparatively manageable (Fisk, 1997).

#### **2.4.9 Sketchy working drawing details**

Geok (2002) asserts that drawings should be detailed enough to carry an integrated conceptualization of the project design. Arain et al. (2004) affirmed that scrappy detailing of construction working drawings can lead to misconstruction of the prerequisite hence causing variations in the project.

#### **2.4.10 Ambiguities in contract documentation**

Contentions in contract documentations mostly lead to confounding of the actual proviso of project (CII, 1986). Care must be taken in the preparation of contract documents to have a high level of precision and also devoid of any form of ambiguities. Insufficient details in the contract documentation mostly lead to delays in project and cause variations in cost (Memon et al. 2014).

#### **2.4.11 Varying specification by the consultant**

The occurrence of variation to specification is commonly detected in most construction projects (O'Brien, 1998). These amendments often result to variations in the form of delays and increased overall project cost.

#### **2.4.12 Unavailability of equipment**

O'Brien (1998) asserts that absence of equipment meant for a specific task in a project can affect the project completion schedule. In the construction of high rise or multistorey

structures which require the use of cranes and hoist, unavailability of such equipment will affect the completion of such projects.

#### **2.4.13 Shortage of skilled manpower**

Arain et al. (2004) identified that with the advancement of technology in present day construction, skilled manpower is highly required. There is the likelihood of the occurrence of variations and delay due to the shortage of skilled manpower.

#### **2.4.14 Contractors' cash flow constraints**

With construction regarded as a labour intensive industry, payment of wages to contractors' workers while work progresses is not contingent on the cash inflow of the contractor. Whether the client pays the contractor or not, labourers will demand their wages (Thomas and Napolitan, 1995). Whenever a contractor experiences cash inflow problems during the execution of a project, resources required for the works may not be readily available which may eventually result in the delay of the project schedule (Memon et al., 2014).

#### **2.4.15 Poor work delivery**

Deficient work output mostly leads to the redo of the defective work and sometimes demolition in construction projects (Fisk 1997; O'Brien 1998). This kind of happenings eventually results to project variations leading to delays in delivery and increment in project cost.

#### **2.4.16 Inadequacy of project design**

The inadequacy of construction design is frequently portrayed as a causative factor of construction contract variation (CII 1990a; Fisk 1997).

#### **2.4.17 Poor procurement process**

Procurement delays according to Fisk (1997) have numerous detrimental effects on the construction cycle proceedings. Other proceedings are however also affected by poor procurement processes hence the need for variations.

#### **2.4.18 Lack of strategic planning**

The existence of an applicable strategic plan is a vital tool for a fruitful delivery of a project (Clough and Sears, 1994). Absence of a proper plan eventually becomes a predominant causative factor of variations in construction projects in the event of work commencing before the completion of designs (O'Brien, 1998).

#### **2.4.19 Fluctuations in Contract**

With changes in work scope leading to a change in contract amount, price variance or fluctuations contributes to a change in contract figures.

Fluctuation is a mechanism to cater for inflation on projects with long duration. In projects with a short duration, contractors are expected to make provisions in their price build-up to cater for the persistent increment of prices of resources required for the works.

However, in a project requiring longer duration, prospective tenderers are advised to price at prevailing market prices. Provisions are therefore made in the contract to cater and reimburse the contractor in the event of price increment of resources over the duration. Fluctuations may be computed from published price indices (Designing Buildings Wiki) e.g. BRRI Indices, Ghana Statistical Service Indices and Bank of Ghana indices etc.

Table 2.1 summarizes the major causes of variations in construction contracts identified by various researchers.

**Table 2.1: Causes of contract variations**

| Causes | AUTHOR |
|--------|--------|
|--------|--------|

|                                              | CII<br>(1990a) | Arain<br>et al.<br>(2004) | Clough<br>and<br>Sears<br>(1994) | O'Brien<br>(1998) | Sanvido<br>et al.<br>(1992) | Gray<br>and<br>Hughes<br>(2001) | Wang<br>(2000) | Fisk<br>(1997) | Geok<br>(2002) | Thomas<br>and<br>Napolitan<br>(1995) |
|----------------------------------------------|----------------|---------------------------|----------------------------------|-------------------|-----------------------------|---------------------------------|----------------|----------------|----------------|--------------------------------------|
| Inadequate working drawing details           |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Design complexity                            |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Poor workmanship                             |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Lack of strategic planning                   |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Inadequate design                            |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Changes in design                            |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Change in specification by the owner         |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Obstinate nature of owner                    |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Impediment to prompt decision-making process |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Change in scope of the project               |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Poor procurement process                     |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Unavailability of equipment                  |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Change in schedule                           |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Contractor's financial details               |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Shortage of skilled manpower                 |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Owner's financial problems                   |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Change in specification by the consultant    |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |
| Conflict among contract documents            |                |                           |                                  |                   |                             |                                 |                |                |                |                                      |

Source: Adopted from Memon et al. 2014

## 2.5 POTENTIAL EFFECTS OF CONTRACT VARIATIONS

The occurrence of variations is coupled with effects or impacts on the construction contracts. Many research works have been conducted on the impacts of variations on construction contracts. Reichard and Norwood (2005) assert that contract variations that occur during the execution of project will certainly affect the project. Lewis (1991) as cited

in Nachartar et al. 2010, also identified that variations have its rippling impacts on construction contracts and that contractors must ensure economic allocation of resources. This implies that in the event of the occurrence of a variation, contractors must strategize by making adjustment to works under the original contract, reallocate time, materials and labour.

The review of studies conducted by the many researchers identified the following notable effects of variations on construction contracts.

### **2.5.1 Delay in completion**

Construction contract variations mostly serve as a hindrance to the achievement of project deliverables within stipulated time frame (CII 1995; Ibbs 1997). According to research, it is identified that variation may serve as an impediment to the successful delivery of a project by about 9% of the stipulated project schedule (Zeitoun and Oberlender, 1993). In a study conducted by Kumaraswamy et al. (1998), most projects often elapse their expected duration as a result of variations.

However, Arain and Low (2005) assert that the occurrence of a dominant variation in a construction project may influence the delivery schedule. Most contractors as a strategy will utilize the schedule free floats to contain the variation. Therefore, project progress is hindered but without any appreciable delay in the delivery time.

### **2.5.2 Increment in project cost**

During the execution phase of a construction project, the predominant variation impact identified is the increment in project amount (CII, 1990). This increment is mostly as a result of major additions or design alterations (Clough and Sears, 1994). Contingency amounts are usually provided in virtually all projects to accommodate for unforeseen cost likely to be incurred to keep overall project cost intact. Further, variations will have to be

documented before implementation (O'Brien, 1998). The procedural approach and application of contract variations would escalate the overhead costs for parties to the contract. The contingency amount is normally used to accommodate such cost (Memon et al. 2014).

### **2.5.3 Delays in payment**

According to CII (1990), this is a frequent occurrence in construction contracts due to variations. Variations may be regarded as an impediment to the progress of a project which affects the delivery period and eventually affecting the contractor's cash flow. Contractors mostly depend on prompt payments to also pay their workers and subcontractors. This leads to serious complication to contractors (CII, 1995).

### **2.5.4 Quality of project**

Fisk (1997) identified that the quality of work is adversely affected as a result of contract variations. CII (1995) earlier identified that the introduction of contract variations frequently affects contractors in the form of losses and that are tempted to produce an output which is sub-standard.

### **2.5.5 Productivity degradation**

According to Nachatar et al. (2010), disruption, impediments and alterations to work have an adverse effect on labour output as a result of variations. According to Hester et al. (1991) labour output is expected to be severely influenced in the event of labour required to work extra hours to cater for lost time.

It has also been established that delays caused as a result of the occurrence of variations in construction contracts is the root of the reduction in labour output or productivity.

Averagely, about 30% of labour efficiency is lost when amendments are being executed. Notable among the categories of interruptions were scarcity of resources and unavailability of information. These interruptions according to Thomas and Napolitan (1995) lead to a periodic efficiency loss ranging from a quarter to half of a percent.

It was established in a study that in the event where variations extend to 10% or up to 15% of the initially estimated labour hours, output of the outstanding works will diminish as a result of more hours being required to execute the amended works (Reichard and Norwood, 2001).

#### **2.5.6 Re-execution of work**

Contracts variations usually result in redo and or sometimes demolition of defective works in the event of the occurrence of the variation within the execution phase of project or at the completion stage (CII, 1994; Clough and Sears, 1994). The impact of this kind of variation is only experienced within the execution phase of the project and not at the design phase (Memon et al. 2014).

#### **2.5.7 Logistics delay**

Some forms of variations require that extra resources are employed to aid the successful delivery of the project. The period between the procurement of these resources and when they are actually acquired and incorporated into the works mostly lead to delays in receipt of logistics (Fisk, 1997). Delays in receipt of logistics are a predominant impact of variation in construction projects according to Hester et al. (1991).

#### **2.5.8 Hiring new professionals**

There is the likelihood of the occurrence of variations in complex technological contracts. Hiring of new professionals may be as a result of a detail ignored by the designer (CII,

1995). To get a multiplex project completely executed, experts must be involved (Fisk, 1997). Arain and Low (2005) in their study established that there are situations when a new expert or a collection of experts from diverse fields are required on a project. The time taken to bring these experts may take some time which will eventually influences the progress of the project (Nachatar et al. 2010).

Table 2.2 summarizes effects of variations in construction contracts identified by various researchers.



**Table 2.2: Effects of contract variations**

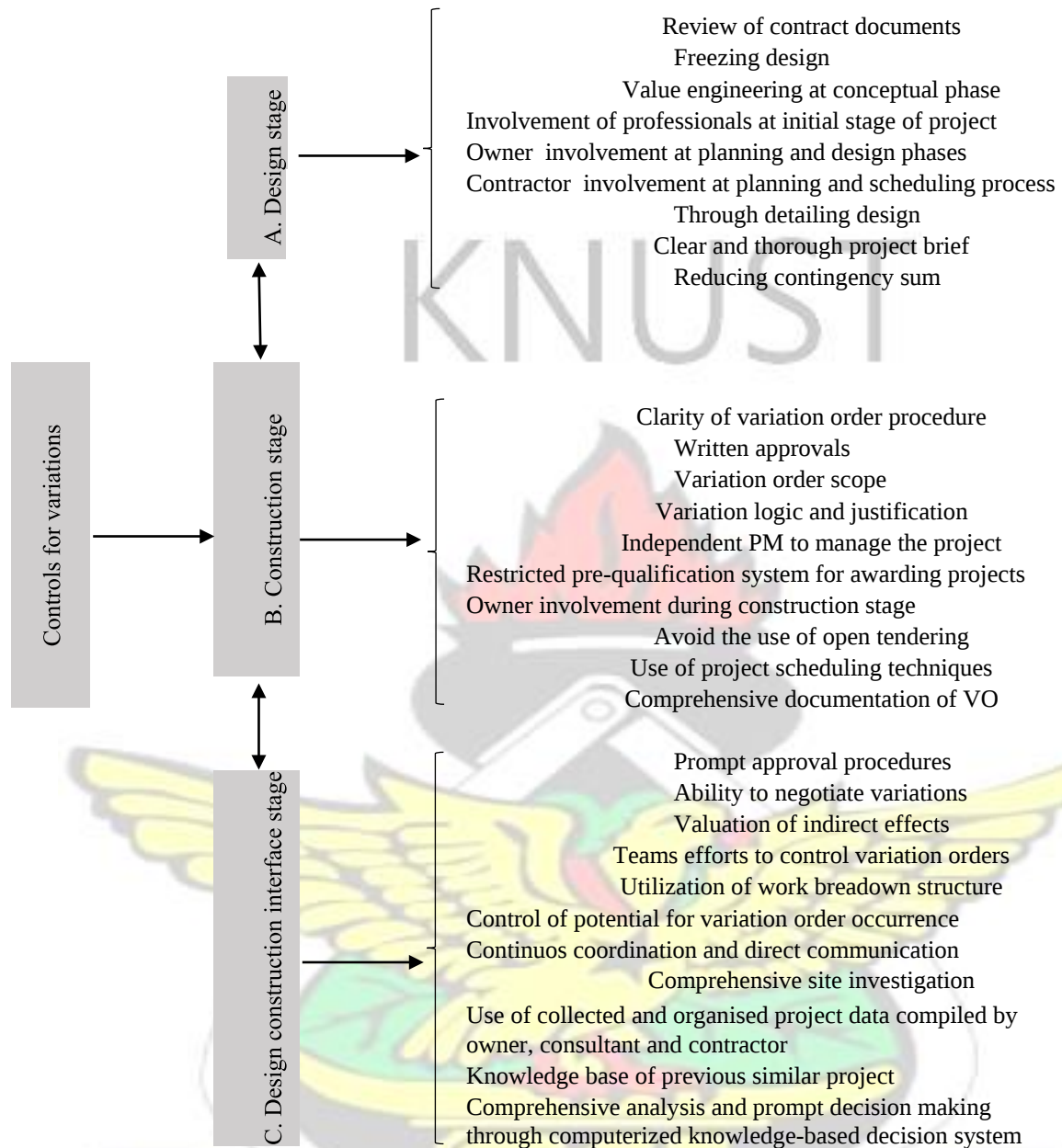
| Effects                                       | AUTHOR        |                           |                                  |                   |                             |                |                                      |                          |                         |
|-----------------------------------------------|---------------|---------------------------|----------------------------------|-------------------|-----------------------------|----------------|--------------------------------------|--------------------------|-------------------------|
|                                               |               |                           |                                  |                   |                             |                |                                      |                          |                         |
|                                               | CH<br>(1990a) | Arain et<br>al.<br>(2004) | Clough<br>and<br>Sears<br>(1994) | O'Brien<br>(1998) | Ibbs and<br>Allen<br>(1995) | Fisk<br>(1997) | Thomas<br>and<br>Napolitan<br>(1995) | Asaf et<br>al.<br>(1995) | Hester et<br>al. (1991) |
| <i>Delay in completion</i>                    |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Slower project<br/>progress</i>            |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Increase in project cost</i>               |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Quality degradation.</i>                   |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Rework and<br/>demolition.</i>             |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Productivity<br/>degradation</i>           |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Unnecessary<br/>procurement</i>            |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Logistics delay</i>                        |               |                           |                                  |                   |                             |                |                                      |                          |                         |
| <i>Causes non value<br/>adding activities</i> |               |                           |                                  |                   |                             |                |                                      |                          |                         |

Source: Adopted from Memon et al. 2014

## 2.6 POTENTIAL CONTROLS FOR CAUSES OF CONTRACT VARIATIONS

Many researchers through their study have established control measures for variations in works contract. Discussed below are potential control measures identified from literature review. These control measures were classified into Design, Construction and DesignConstruction interface stages. This categorization helped in establishing a compendious catalog of probable control measures for contract variations (Arain and Pheng, 2006).

Figure 2.2 depicts this classification.



**Figure 2.2 Controls for contract variations**

Source: Adopted from Arain and Pheng (2006)

## **2.6.1 Design stage control measures for contract variations**

### **2.6.1.1 Auditing of contract documentation**

The main hub of dossier for construction contracts is the contract document. A thorough and unprejudiced variation provisions helps in developing correlation and the quality of dissemination of information (CII, 1994a). The existence of contention in contract documentation mostly leads to misjudgment of contractual requisition.

### **2.6.1.2 Freezing designs**

CII (1990a) asserts that, amendment to design which is contingent on the time frame within which such variation occurs can greatly influence a project. Therefore, placing an embargo on the changes in design is a potent measure for controlling contract variations. After finalizing design drawings, clients must not give any room for amendment to the design requiring that the design of the construction project should be well detailed to prevent the project objectives from being adversely affected.

### **2.6.1.3 Value engineering at conceptual stage**

This is a cost minimization procedure at the design phase of a construction project. There will be no need for rework or demolition at the construction site when a change in design element at this stage occurs. Project goals are clearly defined when value engineering is exercised at the preliminary phase of a project to assist in minimizing disparities in project designs (Dell'Isola, 1982).

### **2.6.1.4 Engaging the services of experts at the design phase**

Engaging experts at the design phase of a project helps bring on board creativity and practicable ideologies (Arain et al. 2004). The engagement of these professionals would help come out with comprehensive designs devoid of any or minimal disparities (O'Brien, 1998). Practicable ideologies if not accommodated at the design phase of the project may

greatly influence the delivery of the project. Variations which occur during the execution cycle of a construction project are mostly expensive as they may trigger numerous changes to construction activities.

### **2.6.2 Client involvement at the planning and design phase**

According to Fisk (1997), the inclusion of the project owner at the design stage will help in defining the project goals and also aid in establishing conflicts with approved standards at this stage. This will go a long way to do away with unwanted variation as the severity of their impact is very alarming.

#### **2.6.2.1 Comprehensive design details**

An exhaustive design is very easy to understand and manageable to work with (O'Brien, 1998). This helps in establishing mistakes and deficiencies in the design at this stage of the project cycle. Exhaustive detailing of designs can also help do away with any vagueness.

#### **2.6.2.2 Clarity of project requirements**

According to O'Brien (1998), clarity of project briefs is a vital mechanism for controlling the occurrence of contract variations in construction. This aids the formulation of project goals clear to parties to the contractual agreement. The clarity of project requirements will eventually diminish mistakes in designs.

#### **2.6.2.3 Reduction of contingency amount**

The accommodation of huge contingency amount in contracts greatly affects the delivery of professionals on the project especially with designers. Most designers upon realizing the existence of huge contingency amount in a project may not produce exhaustive design with the intention of remedying the deficiencies as a variation during the execution phase.

In this regard, a reduction in the contingency amount will be beneficial in ensuring that the designers perform their roles with assiduousness (Arain and Pheng, 2006).

### **2.6.3 Construction stage control measures for contract variation**

#### **2.6.3.1 Comprehensibility of variation procedures**

The transparency and tangibility of the procedural approach to contract variation is an essential component of efficient variation management (Moktar et al. 2000). The procedural approach to effective management of contract variation should be established early at the preliminary stage of the project and must be comprehensible to parties to the contract. The legibility of the variation approach will help mitigate the long duration it takes to process the approval (Ibbs et al. 2001).

#### **2.6.3.2 Documentation of approvals**

Prior to instructing variations which has the tendency of amending the initial contract figure, there must be the proper documentation with the client's authorization comprising signatures of parties to the contract (CII 1990a; Hester et al. 1991; Cox 1997).

Signatories to the variation agreement must have the requisite authorization. In a hectic construction industry, documentation of proceedings serves as a legal backing in the event of disputes.

#### **2.6.3.3 Scope of variation order**

According to Ibbs et al. (2001), a comprehensive scope can help the project team identify and plan sufficiently to curtail the adverse effect of the contract variation. The initial work scope should be clearly established to differentiate the scope of amended works and amendment to design. CII (1994b) in a study affirmed that a predominant conflict between parties to a contract was ascertaining the work scope of an amendment. Spelling out clearly the variation order scope is very vital to the effective management of variations.

#### **2.6.3.4 Justification of variations**

Ibbs et al. (2001) established in a study that the justification of the need to vary a contract is a very vital approach in the management of contract variations. The knowledge and application of variation principles coupled with the justification of the prospective variation helps project managers in recommending advantageous variations and eradicating unfavorable variations.

#### **2.6.3.5 Client involvement during the construction phase**

The involvement of clients at this stage of the construction cycle will help to ascertain the dissension with the prerequisite and in recommending the variation speedily (Ibbs et al. 2001). The inclusion of the project owner may render him observant on an all current happenings on the project and also help in making expeditious decisions.

#### **2.6.3.6 Use of project scheduling/management techniques**

Hester et al. (1991) identified that the effective management of a contract variation is the ability to anticipate its effect on a project and to strategize to control the adverse impacts on project schedule and cost. The most common scheduling techniques according to Clough and Sears (1994) are PERT, Gantt chart and CPM. These techniques are deemed to be beneficial in ascertaining the adverse impact of any variation (Mokhtar et al. 2000). These techniques help in doing away with unfavourable variations.

#### **2.6.3.7 Completeness of variation order documentation**

Timeous dissemination and authorization of change orders will prompt parties to the contract to keep their contractual rights or have the prerogative to make a claim or counter a claim (Cox 1997; O'Brien 1998). According to Fisk (1997), an irritating situation that can occur is the lengthy period it takes to approve or disapprove a recommended contract

variation. It was established that effective documentation of variation orders aids in discovering the adverse impact of contract amendments (Cox, 1997).

#### **2.6.4 Controls mechanisms for managing variations at the Design-construction interface stage**

##### **2.6.4.1 Expeditious approval procedures**

With reference to Fisk (1997), the longer the period between proposing and approving variation for execution can be very disturbing. The lengthy time frame between these two periods will however render the amendment expensive. Consequently, expeditious processes for approving variations can facilitate the minimization of the harsh impacts of contract variations.

##### **2.6.4.2 Capacity in negotiating contract variations**

According to Clough and Sears (1994), ability to negotiate contract variation is a potent control measure for controlling variations. Cushman and Butler (1994) also confirmed that effective negotiation of contract variation can help the project manager in curtailing the unfavourable effects of variations. Knowledge of contractual terms, project details, technology, labour rates, equipment, methods and communication skills are effective skills for negotiating contract variations.

##### **2.6.4.3 Valuation of indirect effects**

Significant effects according to Ibbs et al. (2001) can occur later in the project cycle. In this regard, it is essential to recognise this likelihood and ascertain the mechanism for evaluating the effects. Complicated impacts of varying contract can be significant in the later stages of a multifarious project (Fisk, 1997). It is the responsibility of experts to assess the impact a variation may have on a later stage of a project cycle to effectively manage the occurrence of variation.

#### **2.6.4.4 Team effort by all stakeholders to manage variations**

Team work is very vital in a multi-player terrain as likened to construction industry (CII 1994a; Assaf et al. 1995). Inconvenient variations which influence contracts harshly can be managed at the initial stage with perseverance in team work.

#### **2.6.4.5 Uninterrupted coordination and direct communication**

Team work, effective correspondence and dissemination of information are necessary in a multi-player terrain as in construction (Assaf et al. 1995). Disadvantageous variations which influence contracts unfavourably can be controlled at the initial stage of the project with all parties to the contract getting involved and ensuring the presence of effective communion among them.

#### **2.6.4.6 Controlling the possibility of occurrence of variations through the use of contract clauses**

Choosing a suitable contract type with relevant and comprehensible variation clauses will be essential in the effective management of variations (Cox, 1997). Sharing of risk and enhanced channels of communication could be by virtue of comprehensively drafted variation clauses (CII, 1990a). Feasible procedural approach established in the contract and a fair risk allocation can assist in the resolution of conflicts through arbitration rather than litigation.

#### **2.6.4.7 Thorough investigation of site**

A thorough site investigation can assist in planning adequately activities of construction (Fisk, 1997). Digressive site condition is a prevalent causative factor of delays in major construction projects (Assaf et al. 1995). For that reason, a comprehensive site

investigation would assist in curtailing the probability of the occurrence of variations in projects.

## **2.7 MANAGEMENT OF CONTRACT VARIATIONS**

### **2.7.1 Authorisation by client agency**

In modern construction, the management of contracts is entrusted into a legitimate client's representative to oversee all administrative proceedings including finances but with limitations. Commonly, this person acting on behalf of the client is termed as a construction project manager. There must be a coexistent relationship between the client and his representation to ensure effective variation (NSW Procurement Guide, 2008). The following arrangements are suggested;

### **2.7.2 Unavoidable variations**

According to the NSW Procurement Guide (2008), authorizing unavoidable variations in contract must be done expeditiously to avoid any delays. Should there be the need for unavoidable variation, the representative may approve and instruct such variations based on the agreed financial limit upon the client's authorisation or the owner may device a procedural approach to enhance the speedy feedback of variation requests.

A feasible choice is for the client to give room to the representative to authorize unavoidable variation up to an agreed limit or the client agreeing to expedite variation response above the agreed limit. In the case of the authorization comprising financial committal, there must be a compliance with the Schedule 3 of the PPA, Act 663.

### **2.7.3 Client's initiated variations for convenience**

Variations may not be instructed at the convenience of the client unless a complete assessment of the time and cost effects has been conducted and approved with the evidence of enough funding to cover all impacts ascertained (NSW Procurement Guide, 2008).

### **2.7.4 Contractor's initiated variations for convenience**

The client's representative may approve the contractor's initiated variation upon the client's authorization or the client agreeing to expeditiously give a feedback to the contractor's requisition. Should such a request comprise extra funding, then the authorization will be contingent on the defined financial threshold (NSW Procurement Guide, 2008).

### **2.7.5 Instructing contract variations**

In the event of a client's representative authorizing a variation to the contract, such variation becomes mandatory to the parties to the contract. In the event of a contractor seeking for variation authorization, there must be the necessity to ascertain whether such a variation is unavoidable, for the comfort of the owner or for the comfort of the contractor.

Below are principles pertinent to contract variations. ○ Variation authorization should

be given by the client's legitimate representation. ○ All variation instructions must be documented.

- Prior to authorizing a contract amendment, except such authorization is needed exigently, to proceed, contractor must be made to point out the probable impact of such a variation on the contract.
- Where possible, variation should only be instructed after the full time and cost impact on the project has been assessed and agreed in writing with the contractor. ○ Under no circumstance should a contractor's submitted quotation be altered without the

contractor's consent and agreement. If there is an agreed vetted quotation, it is advisable to instruct the contractor to make a resubmission. Alternately, should an oral agreement be reached, confirmation of such agreement must be documented.

- Variation instructions must comprise a short and precise narrative of the varied works.
- Authorization of variation should be by a client's legitimate representative and adequate funding must be committed to such variation.
- Disagreement of the time and cost prior to the starting of an evitable variation must be resolved early.
- Variations should never be instructed after completion of a project unless it is meant to make good defective works (NSW Procurement Guide, 2008).

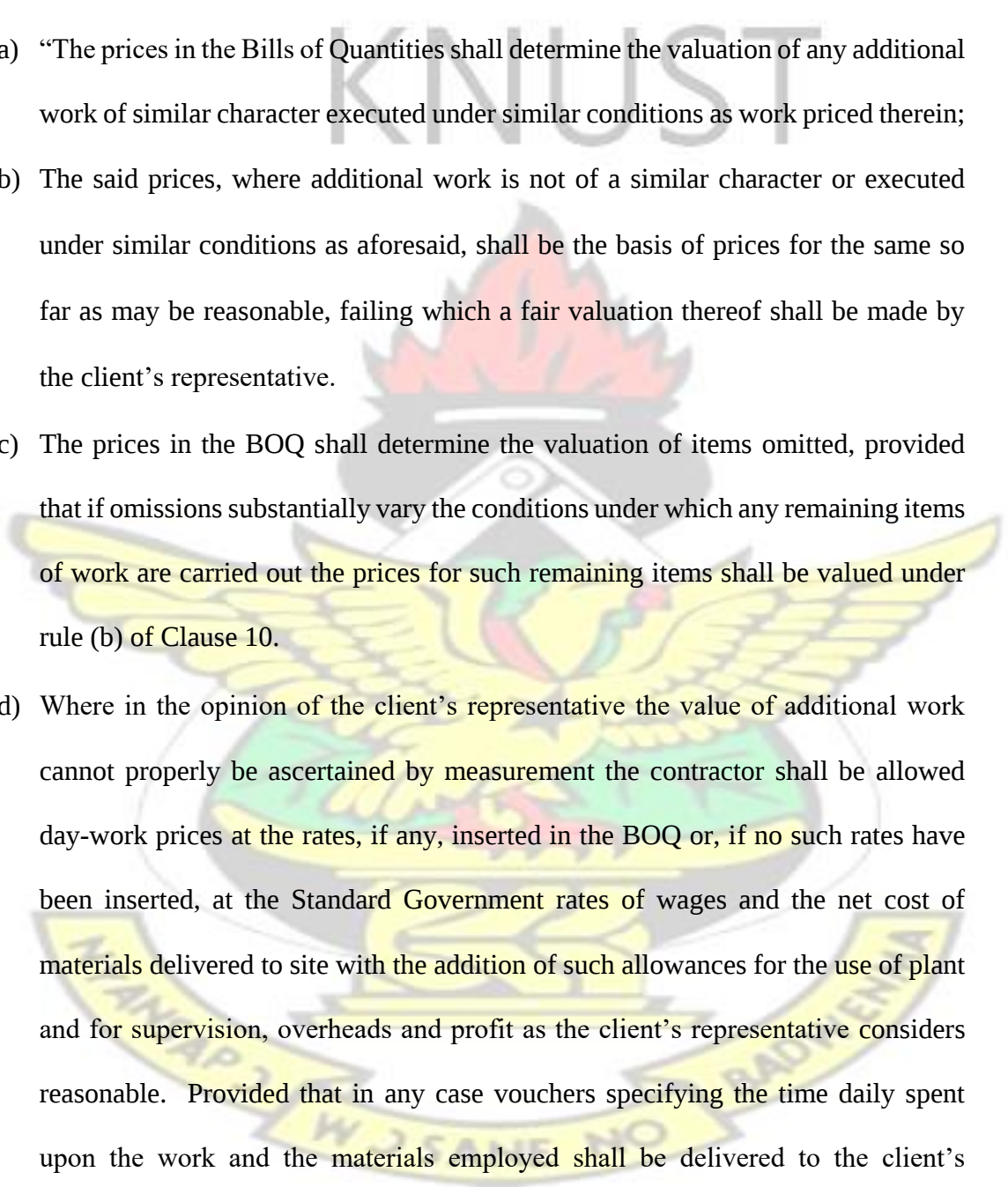
#### **2.7.6 Valuing variations**

Following Clause 52.1 of FIDIC contract conditions, "all variations referred and or any additions to the contract price which are required to be determined shall be valued at the rates and prices set out in the contract if, in the opinion of the client's representative, the same shall be applicable. If the contract does not contain any rates or prices applicable to the varied work, the rates and prices in the contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the client's representative with the Employer and the contractor, suitable rates or prices shall be agreed upon between the client's representative and the contractor.

In the event of disagreement, the client's representative shall fix such rates or prices as are, in his opinion, appropriate and shall notify the contractor accordingly, with a copy to the client. Until such time as rates or prices are agreed or fixed, the client's representative shall

determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60”.

The Ghana Government Conditions of Contract (Pink Form, 1988) also instructs how variations are to be valued in accordance with Clause 10 as follows;

- 
- a) “The prices in the Bills of Quantities shall determine the valuation of any additional work of similar character executed under similar conditions as work priced therein;
  - b) The said prices, where additional work is not of a similar character or executed under similar conditions as aforesaid, shall be the basis of prices for the same so far as may be reasonable, failing which a fair valuation thereof shall be made by the client’s representative.
  - c) The prices in the BOQ shall determine the valuation of items omitted, provided that if omissions substantially vary the conditions under which any remaining items of work are carried out the prices for such remaining items shall be valued under rule (b) of Clause 10.
  - d) Where in the opinion of the client’s representative the value of additional work cannot properly be ascertained by measurement the contractor shall be allowed day-work prices at the rates, if any, inserted in the BOQ or, if no such rates have been inserted, at the Standard Government rates of wages and the net cost of materials delivered to site with the addition of such allowances for the use of plant and for supervision, overheads and profit as the client’s representative considers reasonable. Provided that in any case vouchers specifying the time daily spent upon the work and the materials employed shall be delivered to the client’s representative or the supervising officer not later than the end of the week following that in which the work has been executed”.

An assessment of the total cost of a variation takes into account Direct, Indirect and

Consequential costs.

- Direct costs are the costs specifically attributed to included labour, plant and materials expenses.
- Indirect costs are not specifically attributed to any cost centre but might include profit and overheads and other head office expenses etc.
- Consequential costs may be suffered due to interruption of work progress, delay in work schedule or some critical activities within the work schedule and or unproductivity generated by executing activities beyond scheduled activities  
(NSW Procurement Guide, 2008).

#### **2.7.7 Seeking approvals for variations under Act 663**

Pursuant to Section 87 of the Act 663; “(1) Except in cases of extreme urgency, where there will be an aggregate increase in the original amount of the contract by more than 10 percent of the original price, a procurement entity shall inform the appropriate Tender Review Boards in the case of a contract subject to review by the Tender Review Board of any proposed extension, modification or variation order with reasons.

(2) In the case of contracts which are not originally subject to review by a Tender Review Board, any proposed modification of contract which will make the revised contract price exceed the procurement method threshold or the threshold of the procurement entity shall be cleared with the appropriate Tender Review Board”.

#### **2.7.8 Submission requirements for variations under Section 87 of Act 663**

- Submit prior to executing the contract variation or immediately after the execution for unavoidable variations.
- Outline reasons or justifications for the variations.
- Confirm issuance of instruction.

- Submit a valuation of the variation, consistent with contract conditions indicating time and cost impacts on the project.
- Provide information on progress status of the original contract.
- Provide evidence of approved funding.

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## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 INTRODUCTION**

This chapter gives an overview of the research methodology adopted in the study. It further looks at the strategy embraced to accomplish the research goals. In ascertaining the effective management of variations in ECG works contracts within the legal framework of public procurement, a case study approach was carried out as a research strategy as it is distinguished by its ability to investigate trends and specific situations.

Information for the study was obtained from questionnaires and literature. Through literature review, 19 causative factors of variation were ascertained, coupled with 8 adverse impacts and 22 control measures. These offered the foundation for devising a questionnaire specifically for the staff directly involved in procurement of works at the Premises Division of ECG.

#### **3.2 Research procedure**

This aspect of the research methods addresses the sampling method, data collection instruments, and procedures.

##### **3.2.1 Sources of Data**

In this research, the approach for gathering data involved both literature review (secondary data) and questionnaires to solicit for opinions (primary data). Literature was employed as the basis for the development of the questionnaires. The secondary data obtained from literature on the area of study includes; internet, journals, articles and published works of interest. The primary data deals with a collection of empirical data based on the literature reviewed using survey questionnaires.

### **3.2.2 Development of Questionnaire**

The structured questionnaire designed had close-ended and open-ended form. Prior to the administering of the questionnaires, a pre-test was conducted to ascertain the duration for completing the questionnaire, check for ambiguities and clarity and to allow for the elimination of questions that do not yield usable data.

The questionnaire comprises four parts thus Parts A, B, C and D. Part A questions centred on the respondent's data. Part B questions centred on the contraction industry characteristics. Part C questions centred on the potential causes and impacts and the controls for managing contract variations. Part D hinges on the knowledge of variation provisions and its application.

### **3.2.3 Scope of Questionnaire Survey, Target Respondent and Sampling technique**

The usability of the data collected is determined by the structure and the format of questions addressed. Questionnaires were self-administered. A census sampling method was embraced for the research owing to the limited population. Thus, questionnaires were administered to all eligible respondents of the Premises Division. The questionnaires targeted all key staff within the division; Quantity Surveyors, Structural Engineers, Architects, Services Engineer, Project Supervisors, CAD Technician/Draftsman. For easy understanding, the questionnaires were phrased to be self-explanatory in order to get the required information. All questionnaires were received for subsequent analysis and discussion.

### **3.2.4 Method of data analysis**

Close-ended data from questionnaire was coded into the Statistical Package for Social Sciences (SPSS) and processed using descriptive statistics and presented in tables. There was no responses to the open-ended questions.

Relative Importance Index (RII) system was employed to establish the relative significance of each of the causative factors, impacts and controls identified. A Rank Order Scale ranging from 1 (not important) to 5 (very important) was embraced and altered to relative importance indices (RII) for each as follows:

$$RII = \frac{\sum W}{A * N} (0 \leq RII \leq 1)$$

Where

RII = Relative Importance Index

W = weighting allotted each factor from responses between the range of 1 to 5

A = highest weighting

N = Total no. of respondents

The RII value varied from 0 to 1 exclusive of 0. The greater the index, the more relevance was the causative factor, impact or controls identified.

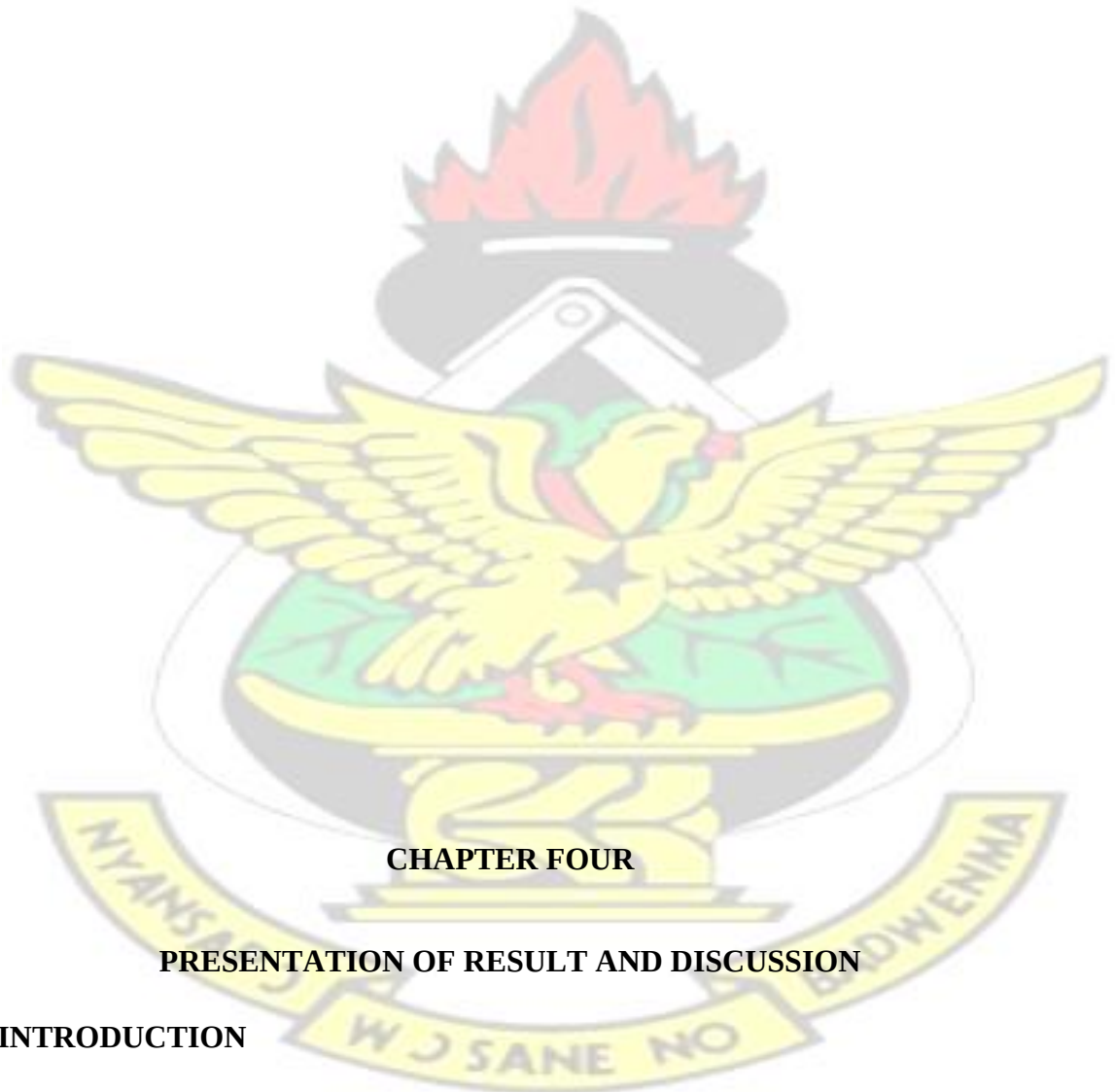
The RII derived for the causative factors of variations, effects and controls were ranked. The consequential rankings served as a platform for comparative assessment of relevance for the various factors.

Kendall rank correlation coefficient was also carried out to assess the level of knowledge and application of variation principles. Kendall's coefficient of concordance (W) is a measure of the agreement among several (p) respondents on different (n) principles. In this study, the respondents were the staff at the premises division of ECG assessing the level of knowledge and application of variation principles. The W statistic was obtained from the formula below:

$$W = \frac{12S}{n^2(n+1)}$$

$$p = \frac{n(n+1)}{2} T(\frac{1}{n})$$

Where (n) is the number of principles and (p) the number of respondents. 'T' is a correction factor for tied ranks. It was estimated with the aid of the non-parametric test of K-related sample which gave the various mean rank values attached to the identified principles. It also provided the Kendall's W, which is their knowledge level and the associated p-value. The significance of the P-value indicates the degree of concordance or agreement.



## CHAPTER FOUR

### PRESENTATION OF RESULT AND DISCUSSION

#### 4.1 INTRODUCTION

This chapter presents and discusses the result of the study in an effort to deal with the specific objects of the research. The major areas the chapter discusses include socio demographic qualities of respondents, the industrial characteristics of the surveyed company, the root causes of contract variations and their effects on ECG works contracts,

the controls to manage the occurrence of contract variations in the construction projects of ECG, and the adequacy of the legal framework of public procurement in Ghana in managing contract variations in ECG works procurement contracts.

## 4.2 SOCIO DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

The socio demographic qualities of respondents of the surveyed Electricity Company of Ghana Limited are examined in this section of the study. The major or main socio demographic information of the respondents discussed included age distribution, the highest level of education, years spent with the division, the position of the respondent, and years in their current position.

**Table 4.1: Socio demographic information of respondents**

| Socio demographics                   | Frequency | Percent |
|--------------------------------------|-----------|---------|
| <b>Age group</b>                     |           |         |
| 25-35 years                          | 8         | 29.7    |
| 36-45 years                          | 3         | 11.1    |
| 46-55 years                          | 13        | 48.1    |
| 56-60 years                          | 3         | 11.1    |
| <b>Highest level of education</b>    |           |         |
| CTE                                  | 2         | 7.4     |
| HND                                  | 8         | 29.7    |
| BSc                                  | 11        | 40.7    |
| MSc/MBA                              | 6         | 22.2    |
| <b>Years spent with the division</b> |           |         |
| 0-5 years                            | 5         | 18.5    |
| 6-10 years                           | 10        | 37.0    |
| 11-15 years                          | 4         | 14.8    |
| 16 years +                           | 8         | 29.7    |
| <b>Position of respondent</b>        |           |         |
| Director                             | 1         | 3.7     |
| General manager                      | 1         | 3.7     |
| Manager                              | 2         | 7.4     |
| Supervisor                           | 13        | 48.1    |
| Others                               | 10        | 37.0    |

**Years in current position**

|             |    |      |
|-------------|----|------|
| 0-5 years   | 4  | 14.8 |
| 6-10 years  | 14 | 51.9 |
| 11-15 years | 8  | 29.6 |
| 16 years +  | 1  | 3.7  |

Source: Field Survey, 2015

The result of table (4.1) shows that the prevalent (48.1%) of the surveyed respondents for the study were in the age range of 46 and 55 years, whereas 29.7% were in the age range of 25 and 35 years. However, 11.1% were equally in the age range of 36 and 45 years and 56 and 60 years respectively. This therefore denotes that the majority of respondents are in the active working age bracket of the Ghanaian population. The highest level of education of the majority (40.7%) of the surveyed respondents of the study was Bachelor of Science in various areas of academic study. However, 29.7% and 22.2% of the surveyed respondents of the study have the highest level of education of Highest National Diploma (HND) and MSc or MBA respectively. It is evident from the result of the study that 18.5% of the respondents have been with the division for 0 to 5 years, 37.0% have been with the division for 6 to 10 years, 14.8% have also been with their division for 11 to 15 years, whereas 29.7% have been with their current division for more 16 years.

The result of table 4.1 shows that the majority (48.1%) of the surveyed respondents were in supervisory positions, whereas 37.0% were in other positions such as Quantity Surveying, Structural Engineering and Services Engineering. However, 3.7%, 7.4% and 3.7% of the surveyed respondents of the study were in the positions of Director, Manager and General Manager respectively. The majority (51.9%) of the surveyed respondents have been in their current position for 6 to 10 years, whereas 29.6% have also been in their current position for 11 to 15 years. However, 14.8% and 3.7% of the surveyed respondents have been in their current position for 0 to 5 years and more than 16 years respectively.

### 4.3 INDUSTRY CHARACTERISTICS

The industrial profile of the company of the surveyed respondents is discussed in this section of the study. The major or main industrial characteristics of the surveyed company discussed included the type of contract form for building projects, the design of corporate buildings, the average amount of variation in building projects as a percentage of contract value, the delays in completion schedule due to variation as a percentage of original schedule, the source of variations in construction projects, the basis of the tender awarding system and the basis of the valuation of variations. The result of the industrial characteristics of the company is presented in Table 4.2.

**Table 4.2: Industry profile**

| <b>Industrial Profile</b>                                                                  | <b>Frequency</b> | <b>Percent</b> |
|--------------------------------------------------------------------------------------------|------------------|----------------|
| <b>Type of contract form for building projects</b>                                         |                  |                |
| Design build                                                                               | 4                | 14.8           |
| Traditional                                                                                | 6                | 22.2           |
| Construction management                                                                    | 17               | 63.0           |
| <b>Design of corporate building</b>                                                        |                  |                |
| In-house professionals                                                                     | 19               | 70.4           |
| External professionals                                                                     | 3                | 11.1           |
| Joint Venture                                                                              | 5                | 18.5           |
| <b>Average amount of variation in building projects as a percentage of contract value</b>  |                  |                |
| 0-5%                                                                                       | 3                | 11.1           |
| 6-10%                                                                                      | 17               | 63.0           |
| 11-15%                                                                                     | 5                | 18.5           |
| More than 15%                                                                              | 2                | 7.4            |
| <b>Delays in completion schedule due to variation as a percentage of original schedule</b> |                  |                |
| 0-10%                                                                                      | 2                | 7.4            |
| 11-20%                                                                                     | 3                | 11.1           |
| 21-30%                                                                                     | 20               | 74.1           |
| More than 30%                                                                              | 2                | 7.4            |
| <b>Originator of variations in construction projects</b>                                   |                  |                |
| Consultant                                                                                 | 18               | 66.7           |
| End-user                                                                                   | 3                | 11.1           |
| Contractor                                                                                 | 2                | 7.4            |

|                                                                                   |    |      |
|-----------------------------------------------------------------------------------|----|------|
| Equal contributions of all parties                                                | 4  | 14.8 |
| <b>The tender awarding system is based on</b>                                     |    |      |
| Lowest tenderer                                                                   | 19 | 70.4 |
| Negotiated offer                                                                  | 3  | 11.1 |
| Selective tendering                                                               | 5  | 18.5 |
| <b>Valuation of variations is based on</b>                                        |    |      |
| Unit price as stated in tender                                                    | 17 | 63.0 |
| Adjusted unit price                                                               | 3  | 11.1 |
| Actual cost plus a margin                                                         | 4  | 14.8 |
| Negotiated fixed price                                                            | 3  | 11.1 |
| <b>Type of variations implemented without formal written approval</b>             |    |      |
| Below a certain price limit                                                       | 18 | 66.7 |
| Urgent change                                                                     | 7  | 25.9 |
| None                                                                              | 2  | 7.4  |
| <b>Key personnel assigned to the project</b>                                      |    |      |
| Kept on the job until completion                                                  | 19 | 70.4 |
| Changed sometimes                                                                 | 3  | 11.1 |
| Changed frequently                                                                | 5  | 18.5 |
| <b>Areas that have more tendencies towards variation in construction projects</b> |    |      |
| Electrical & mechanical                                                           | 4  | 14.8 |
| Structural                                                                        | 18 | 66.7 |
| Finishes                                                                          | 5  | 18.5 |

Source: Field Survey, 2015

The result of table (4.2) shows that the majority (63.0%) of the surveyed respondents indicated that the appropriate type of contract form for the building projects of the Electricity Company of Ghana Limited (ECGL) was the construction management.

However, 14.8% and 22.2% of the surveyed respondents of the Electricity Company of Ghana Limited also indicated that the type of contract form for building projects were design build and traditional respectively. The majority (70.4%) of the surveyed respondents of the Electricity Company of Ghana Limited also indicated that the design of the corporate buildings of the company is mainly carried out through in-house professionals. However, 11.1% and 18.5% of the respondents of the Electricity Company

of Ghana Limited also indicated that the designs of corporate buildings of the company are done through external professionals and joint ventures respectively.

The corporate buildings of the Electricity Company of Ghana Limited are perceived by the majority (63.0%) of the surveyed respondents to have an average amount of 6% to 10% variation in their building projects as a percentage of the contract value. However, 11.1% and 18.5% of the surveyed respondents indicated that the average amounts of variation in the building projects as a percentage of the contract value are 0% to 5% and 11% to 15% respectively. The delays in the completion schedule of the building projects of the Electricity Company of Ghana Limited due to variation as a percentage of the original schedule is perceived by the majority (74.1%) of the respondents to be 21% to 30%. However, 7.4% and 11.1% of the respondents also indicated that the delays in completion schedule due to variation expressed in percentage with original schedule as basis are 0% to 10% and 11% to 20% respectively. The majority (66.7%) of the surveyed respondents indicated that the source or originators of the variations in Electricity Company of Ghana Limited contracts is the consultants. This discovery is coherent with the study of Arain et al. (2004) that suggest that design change by the consultant is very dominant in present day practice. However, 11.1% and 14.8% of the surveyed respondents also attributed the variations in the building projects of the company to the End-users and all the stakeholders respectively. The stakeholders least perceived to be originators of the variations in the construction projects of the Electricity Company of Ghana Limited are the contractors. Variations requested by contractors could have cost implications and contractors requesting for such variations should provide adequate information to assist appropriate assessment. Instructing such variations could either be done by the consultant upon the client's authorization or the client can authorize himself (NSW Procurement Guide, 2008).

The result of the table (4.2) shows that the majority (70.4%) of the respondents indicated that the tender awarding system of the Electricity Company of Ghana Limited is based on the lowest tenderer. However, 11.1% and 18.5% of the respondents indicated that the tender awarding system of the Electricity Company of Ghana Limited is based on negotiated offer and selective tendering respectively. The valuation of the variation in the building projects of the Electricity Company of Ghana Limited is indicated by the majority (63.0%) of the surveyed respondents of the study to be based on unit price as stated in tender. However, 11.1% and 14.8% of the surveyed respondents of the study indicated that the valuation of the variation in the building projects of the company is based on adjusted unit price and actual cost plus a margin respectively. The remaining 11.1% surveyed respondents also indicated that the valuation of the variations in the building projects of the company is based on negotiated fixed price.

The result of the table (4.2) further shows that the majority (66.7%) of the surveyed respondents of the study indicated that the type of the variations implemented by the Electricity Company of Ghana Limited without any formal written approval is below a certain price limit. The key personnel assigned to the project as indicated by the majority (70.4%) of the surveyed respondents of the study are kept on the job until completion, whereas 18.5% believe they are changed frequently. The areas of the Electricity Company of Ghana Limited that have more tendencies towards variation in the construction projects of the company is indicated by the majority (66.7%) of the respondents to be structural. However, 14.8% and 18.5% of the respondents indicated that the major areas of the surveyed company that have more tendencies towards variations in construction projects are electrical and mechanical and finishes respectively.

#### 4.4 Root causative factors of variations and their adverse impacts on ECG works contracts

The root causative factors of variations and their negative impacts on the construction projects of the Electricity Company of Ghana Limited are discussed in this section of the study. The objective of the section is achieved employing both the Kendall's Rank test and the Relative Importance Index (RII). The results of the section are presented in Tables 4.3 and 4.4.

##### 4.4.1 Causes of variations in ECG contracts

This section of the study identifies the potential causative factors of variations in the Electricity Company of Ghana Limited construction contracts. To achieve this objective, the respondents were presented with a list of 37 constraints usually reported in the literature as causing variations in the construction projects. The task of each respondent was to rank the causes using the scale 1 = Not often, 2 = often, 3 = Most often and 4 = Not at all. This ranking is in terms of their contribution to the variations in the construction projects of the Electricity Company of Ghana Limited. The Table 4.3 presents the mean ranks and by extension, the ranks of the causes as adjudged by the 27 respondents of the Electricity Company of Ghana Limited.

**Table 4.3: Causes of variations in construction project**

| Potential Causes of Variations                         | Mean rank | Rank |
|--------------------------------------------------------|-----------|------|
| Change of plans by the client.                         | 6.86      | 1    |
| Discrepancy in design details and Bills of Quantities. | 6.65      | 2    |
| Differing site conditions.                             | 5.78      | 3    |
| Client's financial constraints.                        | 5.38      | 4    |
| Change in economic conditions.                         | 5.34      | 5    |
| Lack of coordination between parties to the contract.  | 5.31      | 6    |
| Lack of communication.                                 | 5.12      | 7    |
| Errors and omissions in design.                        | 5.05      | 8    |
| Defective workmanship.                                 | 5.01      | 9    |
| Contractor's financial difficulties.                   | 4.98      | 10   |
| Change in design.                                      | 4.86      | 11   |

|                                                                      |      |    |
|----------------------------------------------------------------------|------|----|
| Change in specification.                                             | 4.79 | 12 |
| Non-compliance design with owner's requirement.                      | 4.73 | 13 |
| Inadequate drawing details.                                          | 4.45 | 14 |
| Conflicts in contract documents.                                     | 4.28 | 15 |
| Lack of strategic planning.                                          | 4.19 | 16 |
| Replacement of materials.                                            | 4.15 | 17 |
| Impediment in prompt decision making process.                        | 4.12 | 18 |
| Technology change.                                                   | 4.04 | 19 |
| Unavailability of skills.                                            | 4.01 | 20 |
| Weather conditions.                                                  | 3.94 | 21 |
| Change of schedule by the client.                                    | 3.93 | 22 |
| Ambiguous design details.                                            | 3.86 | 23 |
| Inadequate scope of works for contractor.                            | 3.73 | 24 |
| Contractor's lack of judgment and experience.                        | 3.69 | 25 |
| Unforeseen problems.                                                 | 3.57 | 26 |
| Design complexity.                                                   | 3.46 | 27 |
| Poor procurement process.                                            | 3.28 | 28 |
| Complex design and technology.                                       | 3.06 | 29 |
| Long lead procurement.                                               | 2.98 | 30 |
| Lack of consultant's knowledge of available materials and equipment. | 2.67 | 31 |
| Non-compliance design with government requirement.                   | 2.52 | 32 |
| Unavailability of equipment.                                         | 2.09 | 33 |
| Lack of contractor's involvement in design.                          | 1.79 | 34 |
| Change in government regulations.                                    | 1.67 | 35 |
| Inadequate project objectives.                                       | 1.38 | 36 |
| Contractor's desired profitability.                                  | 1.08 | 37 |

Source: Field Survey, 2015

The result of the table (4.3) was obtained following the non-parametric test for k-related samples in SPSS version 17. The level of agreement between the 27 surveyed respondents from the Electricity Company of Ghana Limited was tested using the Kendall's coefficient of concordance since there are three or more judges.

The result of the table (4.3) shows that the ten most pressing variations causes in Electricity Company of Ghana Limited contracts included: (1) change of plans by the client (Mean Rank = 6.86); (2) Discrepancy in design details and Bills of Quantities (Mean Rank =

6.65); (3) Differing site conditions (Mean Rank = 5.78); (4) Client's financial constraints (Mean Rank = 5.38); (5) Change in economic conditions (Mean Rank = 5.34); (6) Lack of coordination between parties to the contract (Mean Rank = 5.31); (7) Lack of communication (Mean Rank = 5.12); (8) Errors and omissions in design (Mean Rank = 5.05); (9) Defective workmanship (Mean Rank = 5.01); and (10) Contractor's financial difficulties (Mean Rank = 4.98).

The other variations causes ranked from 11<sup>th</sup> to 30<sup>th</sup> in terms of their frequency were change in design, change in specification, non-compliance design with owner's requirement, inadequate drawing details, conflicts in contract documents, lack of strategic planning, replacement of materials, impediment in prompt decision making process, technology change, unavailability of skills, weather conditions, schedule change by the client, ambiguous design details, insufficient work scope for contractor, lack of judgement and inexperience of contractor, unforeseen problems, design complexity, poor procurement process, complex design and technology, and the long lead procurement in that order of ranking.

However, the factors perceived to least cause variations in the construction projects of the Electricity Company of Ghana Limited were lack of consultant's knowledge of available materials and equipment, non-compliant design with government requirement, unavailability of equipment, lack of contractor's involvement in design, change in government regulations, inadequate project objectives and the contractor's desired profitability.

This finding is consistent with the NSW Procurement Guide (2008) that stipulates that

Client's initiated variations for convenience will change the work scope and virtually always escalate the cost of works. Factors revealed by literature as root cause of variation that are consistent with the findings of the current study include improper strategic planning (Clough and Sears, 1994), inadequacy of construction design (Fisk 1997), financial difficulties (Memon et al. 2014), shortage of skilled manpower (Arain et al. 2004) and many others.

**Table 4.4: Kendall's Coefficient of Concordance**

| Test Statistics         |        |
|-------------------------|--------|
| N                       | 27.00  |
| Kendall's W             | 0.58   |
| Chi-Square ( $\chi^2$ ) | 780.59 |
| Degree Of Freedom       | 36.00  |
| P-Value                 | 0.00   |

Source: Field Survey, 2015

Kendall's coefficient of concordance ( $W_a$ ), testing the null hypothesis that there is no agreement among the respondents with respect to how often the inventory of factors causes variations in the construction projects of the Electricity Company of Ghana Limited was rejected at a 1% significance level as shown in Table 4.4. The degree of unanimity as measured by the W-statistics is about 58% since the score is zero for random ranking and 1 for perfectly unanimous ranking. The respondent of the study can therefore, be said to unanimously agree that the commonest causative factor of variations in ECG contracts are more related first to Changes in the plans by the client, discrepancies in the design details and bills of quantities, and the differing site conditions.

#### 4.4.2 Effects of construction projects

The various effects of the variations in the construction projects of the Electricity Company of Ghana Limited are identified in this section of the study. To achieve this objective, the study employs the Relative Importance Index (RII) to examine how the surveyed respondents perceive the 12 listed items of Table 4.5 as potential effects of construction contract variations. Table 4.5 therefore presents the responses of the surveyed respondents, the weight, RII values and by extension their relative ranks.

**Table 4.5: Effects of variations on construction projects**

| Potential Effects of Variations             | Responses |    |   |    | RII    |       |      |
|---------------------------------------------|-----------|----|---|----|--------|-------|------|
|                                             | 1         | 2  | 3 | 4  | Weight | RII   | Rank |
| Increases in project cost.                  | 0         | 0  | 4 | 23 | 104    | 0.963 | 1    |
| Completion schedule delay.                  | 0         | 0  | 5 | 22 | 103    | 0.954 | 2    |
| Progress is affected but without any delay. | 0         | 1  | 6 | 20 | 100    | 0.923 | 3    |
| Rework and demolition.                      | 0         | 2  | 6 | 19 | 98     | 0.907 | 4    |
| Dispute between parties to the contract.    | 0         | 3  | 6 | 18 | 96     | 0.889 | 5    |
| Additional payment for contractor.          | 0         | 4  | 6 | 17 | 94     | 0.870 | 6    |
| Increase in overhead expenses.              | 0         | 5  | 7 | 15 | 91     | 0.843 | 7    |
| Delays in payment.                          | 0         | 6  | 7 | 14 | 89     | 0.824 | 8    |
| Productivity degradation                    | 1         | 7  | 7 | 12 | 84     | 0.778 | 9    |
| Quality degradation.                        | 2         | 8  | 7 | 10 | 79     | 0.731 | 10   |
| Procurement delay                           | 3         | 9  | 7 | 8  | 74     | 0.685 | 11   |
| Tarnish of consultant reputation.           | 4         | 10 | 5 | 8  | 71     | 0.657 | 12   |

Rank: [1-Not at all, 2-Not Often, 3-Often, 4-Most Often]

Source: Field Survey, 2015

The result of the Relative Importance Index (RII) in Table (4.5) indicates that the ten most perceived potential effects of ECG contract variations include: (1) Increases in project cost (RII = 0.963); (2) Completion schedule delay (RII = 0.954); (3) Work progress is affected but without any delay (RII = 0.923); (4) Rework and demolition (RII = 0.907);

(5) Dispute between parties to the contract (RII = 0.889); (6) Additional payment for contractor (RII = 0.870); (7) Increase in overhead expenses (RII = 0.843); (8) Delays in payment (RII = 0.824); (9) Productivity degradation (0.778); and (10) Quality degradation (RII = 0.731). The result of this study is consistent with the studies of Memon et al. (2014) that suggests that contract variations could breed increases in project cost, and the study of Arain and Low (2005) that asserts that only key variations during the execution phase of a project may influence the completion schedule of the project.

However, the result of the Relative Importance Index (RII) indicates that procurement delays and tarnish of consultant reputation are not perceived as probable effects of contract variations since their RII values fell short of the minimum importance threshold value of 0.700.

#### **4.5 CONTROLS TO MANAGE THE OCCURRENCE OF VARIATIONS IN ECG WORKS PROCUREMENT**

This section of the study discusses the control tools that can potentially be employed to manage the occurrence of the variations in the construction projects of the Electricity Company of Ghana Limited. The outcome of the section is descriptively represented in Table

4.6.

**Table 4.6: Controls to manage the variations of ECGs procurement works**

| <b>Controls of Variations</b>                                                         | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> | <b>Std. Dev.</b> |
|---------------------------------------------------------------------------------------|----------------|----------------|-------------|------------------|
| Clarity of variation order procedures.                                                | 1              | 3              | 2.89        | 0.27             |
| Written approvals.                                                                    | 1              | 3              | 2.62        | 0.17             |
| Variation order scope.                                                                | 3              | 3              | 3.00        | 0.36             |
| Prompt approval procedures.                                                           | 1              | 3              | 2.81        | 0.25             |
| Ability to negotiate variations.                                                      | 1              | 3              | 1.86        | 0.43             |
| Variation logic and justification.                                                    | 1              | 3              | 2.57        | 0.56             |
| Review of contract documents.                                                         | 2              | 3              | 2.93        | 0.17             |
| Freezing design (no changes after final design).                                      | 1              | 3              | 1.89        | 0.32             |
| Team effort by stakeholders (Client, Consultant & Contractors) to control variations. | 1              | 3              | 2.65        | 0.85             |
| Value engineering at conceptual phase.                                                | 1              | 3              | 2.85        | 0.16             |
| Professionals' involvement at initial stages of project.                              | 1              | 3              | 2.75        | 0.56             |
| Client involvement at planning and design phase.                                      | 1              | 3              | 2.73        | 0.21             |
| Client involvement during construction stage.                                         | 1              | 3              | 1.57        | 0.39             |
| Continuous coordination and direct communication between parties to the contract.     | 1              | 3              | 2.83        | 0.34             |
| Control of variation order potential to arise through contractual clauses.            | 1              | 3              | 2.64        | 0.25             |
| Thorough detailing of design.                                                         | 1              | 3              | 2.54        | 0.24             |
| Clear and thorough project brief.                                                     | 2              | 3              | 2.87        | 0.21             |
| Use of project scheduling techniques.                                                 | 1              | 3              | 1.67        | 0.59             |
| Comprehensive site investigation.                                                     | 1              | 3              | 2.74        | 0.37             |
| Comprehensive documentation of Variation orders.                                      | 2              | 3              | 2.92        | 0.74             |

Rank: [1-Ineffective, 2-Neutral, 3-Very effective]

Source: Field Survey, 2015

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The result of Table (4.6) depicts that many of the surveyed respondents perceive clarification of the variation order procedures as a very effective control tool to manage the variations in the construction building projects of the ECG as shown by the mean response value of 2.89. This is essential because at the early stages of the project cycle, the procedural approach should be established and clarified to all contract parties. Therefore, clarification of the procedural approach to variation order is fundamental to resourceful contract variation management (Moktar et al. 2000).

Written approvals are also perceived as very effective control tools in managing the variations in the construction projects of ECG as shown by the mean response value of 2.62. Literature asserts that contract variations that result in an increment contract amount must be subjected to approval prior to instructing (CII 1990a; Hester et al. 1991; Cox 1997). The variation order scope is further perceived by the majority of the surveyed respondents as a tool to manage very effectively the variations in the construction projects of the ECG as shown by the mean response value of 3.00. This result is also coherent with the study of Ibbs et al. (2001) that suggest that a comprehensively prepared scope can aid the professional team in identifying and planning sufficiently to curtail the probable adverse effects of contract variation.

The mean response value of 2.81 also implies that the surveyed respondents perceive prompt approval procedures as a very effective control tool to manage the variations in the construction projects of the ECG. Fisk (1997) indicates that the time lapses between the conception of a variation and its eventual approval or disapproval can be very irritating. The variation logic and justification is perceived to be a very effective control tool to manage the variations of construction projects of the ECG as shown by the mean response value of 2.57. The review of contract documents is perceived to be a very effective control

measure to manage the variations in the construction projects of ECG as shown by the mean response value of 2.93.

The result of Table (4.6) further shows that team effort by stakeholders (Client, Consultant & Contractors) is also perceived as a very effective control tool to manage the variations in the constructions of the ECG as shown by the mean response value of 2.65. This is consistent with the existing literature that suggests that coordination is very vital in a multi-player arena as likened to most construction projects (CII 1994a; Assaf et al. 1995). The value engineering at conceptual phase is perceived as a very effective control tool to manage the variations in the construction projects of ECG as shown by the mean response value of 2.85. It is asserted in existing literature that conducting value engineering at the conceptual stage of a project can aid in simplifying the objects of the project and decreasing the possibility of inconsistencies in the design (Dell'Isola, 1982).

Furthermore, other control measures perceived by the majority of the respondents to effectively manage contract variations include professionals inclusion at initial stages of project, client inclusion at planning and design phases, continuous coordination and direct communication between parties to the contract, control of the occurrence of variation order potential through contractual clauses, thorough detailing of design, clear and thorough project brief, comprehensive site investigation and the comprehensive documentation of variation orders.

However, the control tools perceived by the respondents to aid in the effective management of the variations in the construction projects of ECG include ability to negotiate variations, freezing design (no changes after final design), client involvement during construction

stage, and the usage of project scheduling techniques as these factors produced an approximate mean response values of 2.00.

#### **4.6 ADEQUACY OF THE PPA IN MANAGING CONTRACT VARIATIONS IN ECG WORKS PROCUREMENT**

This section of the study attempts to assess the adequacy of the Public Procurement Act in managing contract variations in ECG works contracts. This objective is achieved by assessing the respondent's knowledge in managing the level of variation in the construction projects of the company and the company's application of the provisions in the legal framework of public procurement.

##### **4.6.1 Knowledge of variation provisions in the legal framework of public procurement**

The respondent's level of knowledge in the variation provision in the legal framework of the Public Procurement Act is examined in this section of the study. The researcher employs descriptive tools in the presentation and the discussion of the result in an attempt to achieving this objective. The outcome of the section is represented in Table 4.7.

**Table 4.7: Knowledge of variation principles**

| <b>Variations principles</b>                                                                                                                                                    | <b>Min</b> | <b>Max</b> | <b>Mean</b> | <b>Std. Dev.</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|-------------|------------------|
| Following all procedures required by the contract. [FPR]                                                                                                                        | 1          | 4          | 4.18        | 0.58             |
| Assessing the reasons for the proposed variations and whether these variations will pose emerging or actual performance problems. [ARP]                                         | 1          | 4          | 2.13        | 1.03             |
| Assessing the impact of the proposed variation to the contract, particularly whether the variation is actually required and whether it was part of the original contract. [AIP] | 1          | 4          | 2.19        | 1.06             |
| Determining the effect the proposed variation will have on the contract price. [DEP]                                                                                            | 1          | 4          | 3.43        | 0.82             |
| Considering the authority for making the variation. [CAM]                                                                                                                       | 1          | 4          | 3.25        | 0.97             |
| Proper procedure for obtaining and documenting the required approvals. [PPO]                                                                                                    | 1          | 4          | 4.15        | 0.32             |
| Proper documentation of details of variations and its impact. [PDD]                                                                                                             | 1          | 4          | 4.09        | 0.25             |
| Meeting reporting requirements such as updating the entity's contract register. [MRR]                                                                                           | 1          | 4          | 2.17        | 1.26             |
| Variations are not to be instructed after completion unless it is meant for dealing with defects. [VNI]                                                                         | 2          | 4          | 4.31        | 0.45             |

Rank: [1-Not at all, 2- Limited, 3-Working knowledge, 4-very good knowledge]

Source: Field Survey, 2015

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The result of Table (4.7) shows that the majority of the surveyed respondents have very good knowledge about following all procedures required by contracts as shown by their mean response value of 4.18. The mean response value of 4.15 indicates that the majority of the surveyed respondents have very good knowledge about proper procedures for obtaining and documenting the required approvals. The mean response value of 4.09 also indicates that the majority of the surveyed respondents indicated that they have very good knowledge about proper documentation of details of variations and its impact on construction projects. The surveyed respondents also have very good knowledge about the fact that variations are not to be instructed after completion, unless it is meant for dealing with defects in the construction project as shown by their mean response value of 4.31.

The result of Table (4.7) however shows that the surveyed respondents have just working knowledge about determining the effects that proposed variations in the construction projects will have on the contract price as shown by the mean response of 3.43. The surveyed respondents also have just working knowledge on considering the authority for making the variation in the construction projects as shown by the mean response value of 3.25.

However, the surveyed respondents have limited knowledge about assessing the reasons for the proposed variations and whether the variations will pose emergent or definite performance problems, and in evaluating the effect of the anticipated contract variation, specifically whether the variation is really necessary and whether it was originally catered for.

#### **4.6.2 Application of the provisions in the legal framework of public procurement**

This section of the study examines the various variations principles adopted by Electricity Company of Ghana Limited to effectively manage the variations in the construction projects of the company. To achieve this objective, the Relative Importance Index (RII) is employed to examine the relative importance of each of the listed principles in Table 4.8 in terms of their usage by ECG in controlling the variations in their construction projects. The Table 4.8 therefore presents the responses of the respondents, the weight attached to each principle and the RII values and by extension the rank of each principle.



**Table 4.8: Application of variation principles**

| Variation principles                                                                                                                                                     | Responses |   |   |    | Mean | RII    |       |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|---|----|------|--------|-------|------|
|                                                                                                                                                                          | 1         | 2 | 3 | 4  |      | Weight | RII   | Rank |
| Assessing the reasons for the proposed variations and whether these variations will pose emerging or actual performance problems                                         | 0         | 0 | 2 | 25 | 3.93 | 106    | 0.981 | 1    |
| Determining the effect the proposed variation will have on the contract price.                                                                                           | 0         | 0 | 5 | 22 | 3.81 | 103    | 0.954 | 2    |
| Assessing the impact of the proposed variation to the contract, particularly whether the variation is actually required and whether it was part of the original contract | 0         | 2 | 4 | 21 | 3.70 | 100    | 0.923 | 3    |
| Considering the authority for making the variation.                                                                                                                      | 1         | 3 | 3 | 20 | 3.56 | 96     | 0.889 | 4    |
| Proper procedure for obtaining and documenting the required approvals.                                                                                                   | 3         | 3 | 3 | 18 | 3.33 | 90     | 0.833 | 5    |
| Proper documentation of details of variations and its impact.                                                                                                            | 3         | 5 | 3 | 16 | 3.19 | 86     | 0.796 | 6    |
| Following all procedures required by the contract.                                                                                                                       | 3         | 5 | 4 | 15 | 3.15 | 85     | 0.787 | 7    |
| Meeting reporting requirements such as updating the entity's contract register.                                                                                          | 4         | 7 | 1 | 15 | 3.00 | 81     | 0.750 | 8    |
| Variations are not to be instructed after completion unless it is meant for dealing with defects.                                                                        | 6         | 8 | 1 | 12 | 2.70 | 73     | 0.676 | 9    |

Rank: [1-Not at all, 2-Seldom, 3-Frequent, 4-At all times]

Source: Field Survey, 2015

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The Relative Importance Index (RII) result of table (4.8) shows that the 8 major variation principles employed by the Electricity Company of Ghana Limited in managing the level of variations in the construction projects of the company include: (1) Assessing the reasons for the proposed variations and whether these variations will pose emerging or actual performance problems (RII = 0.981); (2) Determining the effect the proposed variation will have on the contract price (RII = 0.954); (3) Assessing the impact of the proposed variation to the contract, particularly whether the variation is really necessary and whether it was originally catered for (RII = 0.923); (4) Considering the authority for making the variation (RII = 0.889); (5) Proper procedure for obtaining and documenting the required approvals (RII = 0.833); (6) Proper documentation of details of variations and its impact (796); (7) Following all procedures required by the contract (RII = 0.787); and (8) Meeting reporting requirements such as updating the entity's contract register (RII = 0.750).

However, ensuring that variations are not to be instructed after completion unless it is meant for dealing with defects is not part of the principles employed by the company to minimize the level of variations in the construction projects of the company as this principle produced an RII value of 0.676, a value below the relative importance threshold value of 0.700.

#### **4.7 GAP ANALYSIS OF LEVEL OF KNOWLEDGE AND LEVEL OF USAGE OF THE VARIATION PRINCIPLES**

This section of the study assesses the level of knowledge and usage of the variation principles in managing variations in the construction projects of ECG. To achieve this objective, the gap analysis using percentage variation coefficient (i.e. standard deviation divided by mean multiplied by 100) was adopted. The outcome of the section is represented in Table 4.9.

**Table 4.9: Gap between variation principles knowledge and application**

| Code  | VP  | Mean |      | Std. Dev. |      | % Gap |    | K-U (Gap %) | Rank            |
|-------|-----|------|------|-----------|------|-------|----|-------------|-----------------|
|       |     | K    | U    | K         | U    | K     | U  |             |                 |
| K-U 1 | FPR | 4.18 | 3.93 | 0.58      | 0.93 | 14    | 24 | -10         | 4 <sup>th</sup> |
| K-U 2 | ARP | 2.13 | 3.81 | 1.03      | 0.96 | 48    | 25 | 23          | 7 <sup>th</sup> |
| K-U 3 | AIP | 2.19 | 3.70 | 1.06      | 0.93 | 48    | 25 | 23          | 7 <sup>th</sup> |
| K-U 4 | DEP | 3.43 | 3.56 | 0.82      | 0.97 | 24    | 27 | -3          | 5 <sup>th</sup> |
| K-U 5 | CAM | 3.25 | 3.33 | 0.97      | 0.99 | 30    | 30 | 0           | 6 <sup>th</sup> |
| K-U 6 | PPO | 4.15 | 3.19 | 0.32      | 0.99 | 8     | 31 | -23         | 3 <sup>rd</sup> |
| K-U 7 | PDD | 4.09 | 3.15 | 0.25      | 0.95 | 6     | 30 | -24         | 2 <sup>nd</sup> |
| K-U 8 | MRR | 2.17 | 3.00 | 1.26      | 1.01 | 58    | 33 | 25          | 9 <sup>th</sup> |
| K-U 9 | VNI | 4.31 | 2.70 | 0.45      | 1.09 | 10    | 40 | -30         | 1 <sup>st</sup> |

VP: Variation Principles

Source: Field Survey, 2015

To give a truer picture of the importance and evidence of performance of the level of knowledge and level of usage of the nine given variation principles in line with the public procurement, a gap analysis between the knowledge and usage was performed. The gaps obtained for the respective variation principles are presented in Table 4.9. This was based on results obtained from percentage variation coefficient. From the results, it is clear that there are gaps (ranging from -30 to 25) existing in the level of knowledge and level of usage of the variation principles in the construction projects of ECG. With regards to ensuring that variations are not instructed after completion unless it is meant for dealing with defects [VNI], the percentage gap was -30 (ranked 1<sup>st</sup>); ensuring proper documentation of details of variations and its impact [PDD] produced a percentage gap of -24 (ranked 2<sup>nd</sup>); ‘Proper procedure for obtaining and documenting the required approvals [PPO]’ (-23%; ranked 3<sup>rd</sup>), ‘Following all procedures required by the contract [FPR]’ (-10% gap; ranked 4<sup>th</sup>), ‘Determining the effect the proposed variation will have on the

contract price [DEP]' (-3% gap; ranked 5<sup>th</sup>), 'Considering the authority for making the variation [CAM]' (0% gap; ranked 6<sup>th</sup>), 'Evaluating the reasons for the proposed variations and whether these variations will pose emerging or actual performance problems. [ARP]' (23% gap; ranked 7<sup>th</sup>), 'Assessing the impact of the anticipated variation on the contract, specifically whether the variation is really necessary and whether it was originally catered. [AIP]' (23% gap; ranked 7<sup>th</sup>), and 'Meeting reporting requirements such as updating the entity's contract register [MRR]' (3% gap; ranked 9<sup>th</sup>).

The results from the gap analysis, clearly point to a situation that leads one to conclude that contract variations of ECG projects are not properly managed using all the necessary variation principles in line with the legal framework of the Public Procurement Act. There is a very wide gap between the level of knowledge and level usage of five of the variation principles in the construction projects of ECG and this gap has to be bridged. This should serve as a source of worrying to the firm if it desires to effectively manage its construction project variations.

## **CHAPTER FIVE**

## **SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

### **5.1 INTRODUCTION**

This chapter represents a summation of the outcome of the study, draws inference based on the key findings and also makes recommendations and suggests areas for further research.

### **5.2 SUMMARY OF FINDINGS**

The research sought to explore the effective management of contract variations within the legal framework of public procurement in Ghana in the case of Electricity Company of Ghana Limited through the achievement of several objectives including: (1) ascertain the adequacy of the Public Procurement Act, Act 663 (2003) in managing contract variations in ECG works procurement; (2) identify the root causes of variations and their effects on ECG works contracts; and (3) identify controls to manage the occurrence of variations in ECG works procurement.

#### **5.2.1 Adequacy of the PPA in managing contract variations in ECG works procurement**

To begin with, the respondents were found to have very good knowledge in some areas of the public procurement legal framework including following all procedures required by the contracts of ECG, ensuring proper procedures for attaining and authenticating the requisite approvals, proper documentation of particulars of variations and its effects. The respondents also have working knowledge in other areas of the public procurement framework including identifying the adverse impact the planned variation could have on the contract figure and taking into account the authorization for instructing the variations. However, the respondents were found to be ill-equipped in certain aspects of the public procurement framework including evaluating the reasons and relevance of the planned variations and whether these variations will pose problems, evaluating the effect of the

planned variation on the contract, specifically whether the variation is actually needed and whether it was originally catered for under the contract and meeting reporting obligations such as updating the contract register of the acquiring body.

Based on the knowledge acumen of the respondents in handling the procurement works of ECG in line with the legal framework of the public procurement, some of the major variation principles followed all the time by the ECG included evaluating the need and relevance of the proposed variations and whether these variations will pose problems, determining the effect the proposed variation will have on the contract price, assessing the impact of the proposed variation to the contract, particularly whether the variation is actually required and whether it was part of the original contract, and considering the authority for making the variation. The variation principles that are also frequently employed by ECG in line with the legal framework of the public procurement were ensuring proper procedure for attaining and documenting the requisite approvals, proper documentation of particulars of variations and its effects, following all procedures required by the contract and adhering to reporting prerequisites such as updating the contract register of the acquiring entity. Irrespective of the application of these variation principles in adherence to the legal framework of the public procurement, there are still variations in the construction projects of ECG indicating the inadequacy of the legal framework in terms of eliminating variations in works procurement.

However, the least applied variation principle that is in line with the legal framework of the public procurement is that the variations are not instructed after completion unless it is meant for dealing with defects.

The gap analysis provides evidence of non-usage of five of the required variation principles in line with legal framework of public procurement in managing construction

variations. ECG rarely ensures that variations are not instructed after completion unless it is meant for dealing with defects. The division also neither ensures proper procedure for obtaining and documenting the required approvals nor ensures proper documentation of details of variations and its impact. The Company barely follows all procedures required by construction contracts.

### **5.2.2 Causes of variations in ECG construction contracts**

The critical root causes of the variations in the construction projects of ECG in their order of ranking or magnitude of occurrence include discrepancy in design details and Bills of Quantities, differing site conditions, client's financial constraints, change in economic conditions, lack of coordination between parties to the contract, lack of communication, mistakes and omissions in design, defective workmanship, contractor's financial constraints, change in design, change in specification, nonconforming design with owner's requisition, inadequate drawing details, conflicts in contract documents, lack of strategic planning, replacement of materials, obstruction to expeditious decision making process, technology change, unavailability of skills, weather conditions, change in contract schedule by the client, ambiguous design details, inadequate scope of works for contractor, contractor's lack of judgement and experience, unforeseen problems, design complexity, poor procurement process, complex design and technology, long lead procurement, lack of consultant's knowledge of available materials and equipment, noncompliance design with government requirement, and unavailability of equipment.

### **5.2.3 Effects of the construction contract variations**

The study found several adverse impacts of the variations in the construction projects of ECG including increases in project cost, completion schedule delay, work progress is affected but without any delay, demolition and rework, dispute between parties to the

contract, additional payment for contractor, increase in overhead cost, delays in payment, decrease in productivity, and decrease in quality.

#### **5.2.4 Controls to manage the occurrence of variations in ECG works procurement**

The study found several control measures that could be employed to control the occurrence of variations in the ECG construction contracts. These control measures included clarity of procedural approach to variation order, documenting approvals, variation order scope, prompt approval procedures, variation logic and justification, review of contract documents, team effort by stakeholders (Client, Consultant & Contractors) to control variations, value engineering at conceptual phase, professionals involvement at initial stages of project, involvement of clients at planning and design phases, continuous coordination and direct communication between parties to the contract, control of the occurrence of variation order potential through contractual clauses, thorough detailing of design, clear and thorough project brief, comprehensive site investigation, and comprehensive documentation of variation orders.

However, other control measures that can be employed to effectively manage the variations in the construction projects of ECG included ability to negotiate variations, freezing design (no changes after final design), client involvement during construction stage, and the usage of project scheduling techniques.

#### **5.3 CONCLUSION**

Notwithstanding the persistent and continual application of some major variation principles such as evaluating the need and relevance of the planned variations and whether these variations will pose problems, determining the impact the projected variation will have on the contract figure, assessing the impact of the projected contract variation, specifically whether the variation is really needed and whether it was originally catered

for, considering the authorization for instructing variations, proper procedural approach for attaining and documenting the requisite approvals, proper documentation of variation particulars and its effects, following all procedures required by the contract and adhering to reporting requirements such as updating entity's contract register in conformity with the legal framework of the Public Procurement in Ghana, there are still several variations in the construction contracts of the Company. There is evidence of non-usage of five of the required variation principles in line with legal framework of public procurement in managing construction variations. ECG rarely ensures that variations are not instructed after completion unless it is meant for dealing with defects. The company also neither ensures proper procedure for obtaining and documenting the required approvals nor ensures proper documentation of details of variations and its impact.

The variations in the construction projects of the Electricity Company of Ghana Limited are perceived to be caused by several factors including change of plans by the client, discrepancy in design details and bills of quantities, differing site conditions, client's financial constraints, change in economic conditions, lack of coordination between parties to the contract, lack of communication, mistakes and omissions in design, defective workmanship, contractor's financial constraints, design changes, change in specification, nonconformity design with owner's requisition, inadequate drawing details, conflicts in contract documents, lack of strategic planning, replacement of materials, obstruction to prompt decision making process, technology change, unavailability of skills, weather conditions, change of schedule by the client, ambiguous design details, incomprehensive scope of works for contractor, contractor's lack of judgement and inexperience, design complexity, poor procurement process, complex design and technology, long lead procurement and many others.

These causal factors of the variations in the construction works of ECG have led to several effects including increases in project cost, completion schedule delay, project progress is affected but with no delays, rework and demolition, dispute between parties to the contract, additional payment for contractor, increase in overhead costs, delays in payment, decrease in productivity and decrease in quality. These adverse impacts attributed to the several root causes of the variations in the construction works of ECG provide evidence to indicate that irrespective of the adherence of the Electricity Company of Ghana Limited to the variations principles stipulated by the legal framework of the Public Procurement Act, there are still variations in the construction works of the Company.

#### **5.4 RECOMMENDATIONS**

Based on the summary of findings and conclusions, the study makes numerous imperative managerial recommendations to ensure adequate reduction in the major causes of variations in construction projects in ECG.

##### **5.4.1 Adherence to agreed plans by all stakeholders**

To begin with, based on the finding that changes in the plans of clients are the highest root causative factor of variations in ECG construction contracts, it is essential that all agreed plans of all stakeholders of a construction project are adhered to the latter.

However, in the case of need for change, adequate meeting should be held among all stakeholder to ensure synchronization in ideas and plans.

##### **5.4.2 Synchronization and compliance to all design details**

Based on the findings that some of the key causative factor of variations in ECG construction contracts include discrepancy in design details and Bills of Quantities, change in design, and non-compliance with owners' design requirement; there is the need for adequate meeting and communication between all stakeholders of a construction project

to ensure synchronization of designs. The requirement of all stakeholders to follow agreed designs should be stipulated in the project contract to ensure compliance to all design details.

#### **5.4.3 Ensure financial adequacy**

Based on the finding that variations in the construction projects of ECG are partly credited to client's financial constraints and contractor's financial difficulties, adequate and reliable funds should be sought by all stakeholders before the initiation of construction projects to ensure avoidance of changes in agreed design due to financial difficulties. Moreover, the stakeholders should take into consideration potential changes in the economy in terms of inflation and exchange rate to avoid financial difficulties that could impair adherence to the agreed design details.

#### **5.4.4 Adequate coordination among stakeholders of projects**

Based on the finding that the lack of coordination between parties to the contract could cause variations in the construction projects, there is the need for adequate coordination among all stakeholders of construction projects to avoid discrepancies in design, plans and conflicts.

#### **5.4.5 Proper communication among stakeholders**

Based on the findings that the lack of communication and conflicts in contract documents serves as root causative factor of variations in ECG contracts, there is the need for proper communication among all stakeholders of a construction project.

#### **5.4.6 Provision of adequate details on drawings**

Based on the finding that inadequate drawing details from design consultant serve as root causative factor of variations in ECG contracts, there is the need for the design consultant to provide all possible design details to ensure adequate understanding and adherence.

### **5.5 LIMITATIONS AND AREAS FOR FURTHER STUDIES**

The current study is more descriptive and limited to respondents' perception and so generates perception biases that could affect findings and conclusions. Therefore, future studies should employ inferential analytical tools like multiple regression to assess the effect of the root causes of construction variations.

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## **APPENDIX**

### **KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI**

#### **COLLEGE OF ARCHITECTURE AND PLANNING**

#### **DEPARTMENT OF BUILDING TECHNOLOGY**

#### **QUESTIONNAIRE**

#### **Introduction:**

The researcher, Dennis Bio, is a graduate student pursuing MSc. Procurement Management at the Kwame Nkrumah University of science and Technology, Kumasi. This research questionnaire has been designed to solicit your view and information regarding the topic: *“Managing contract variations within the legal framework of public procurement in Ghana – A case study of Electricity Company of Ghana Limited”*.

The study is aimed at:

- iv. Ascertaining the adequacy of the Public Procurement Act, Act 663 (2003) in managing contract variations in ECG works procurement.
- v. Identifying the root causes of variations and their effects on ECG works contracts.
- vi. Identifying controls to manage the occurrence of variations in ECG works procurement.

The questionnaire is in three sections:

- Part A - Respondent data
- Part B - Industry Characteristics
- Part C - Causes, Effects and Controls
- Part D – Knowledge of variation provisions and its application

All information provided is strictly for academic purpose and shall be kept confidential. Your anonymity shall be highly ensured.

In case of any further questions or contributions, do not hesitate to contact me on 0243970696 or email: [dionysius711@gmail.com](mailto:dionysius711@gmail.com).

I appreciate your time spent in completing the questionnaire.

Kindly read through the following questions, tick [✓] and/or provide answers where appropriate and applicable. **Part A: Respondent's Particulars**

1. Age Group:

- a. 25 -35years [ ]      b. 36 - 45years [ ]      c. 46 - 55years [ ]      d. 56 -60years [ ]

2. Indicate your level of education:

- a. Msc/MBA [ ]      b. BSc [ ]      c. HND [ ]      d. CTE [ ]

Others, Specify.....

3. Indicate number of years spent with the Division.

- a. 0 - 5 years [ ]      b. 6 - 10years [ ]      c. 11-15years [ ]      d. above 15 years [ ]

4. Tick to indicate your position with the directorate.

- a. Director [ ] b. General Manager [ ] c. Manager [ ] d. Supervisor [ ]

Others, Specify.....

5. How many years have you been in the above position?

- a. 0-5 years [ ] b. 6-10 years [ ] c. 11-15 years [ ] d. 15-20 years [ ]

### **Part B: Industry Characteristics**

The following questions relate to variations in general. Please indicate your professional assessment of the following (Tick only one box in each set):

1. Please indicate the appropriate type of contract form for your building projects:

- a. Design Build [ ] b. Traditional (Design or Construction only) [ ]  
c. Construction Management [ ] d. Others, Specify.....

2. Design of corporate buildings are done by:

- a. In-House Professionals [ ] b. External Professionals [ ]  
c. Joint Venture (Internal and external) [ ] d. Others,  
Specify.....

3. The average amount of variation in building projects as a percentage of the contract value is:

- a. 0 – 5% [ ] b. 6 – 10% [ ] c. 11 – 15% [ ] d. More than 15%

4. The delay in completion schedule due to variation as a percentage of the original schedule is:

- a. 0 – 10% [ ] b. 11 – 20% [ ] c. 21 – 30% [ ] d. More than 30% [ ]

5. The main originator of variations in construction projects is:

- a. The Consultant [ ] b. The End user [ ] c. The Contractor [ ] d. Equal contribution  
of all parties [ ] e. Others,  
specify.....

6. The tender awarding system is mostly based on:

- a. Lowest tenderer [ ] b. Negotiated offer [ ] c. Selective tendering [ ]  
d. Other, specify.....

7. Valuation of variations is based on:

- a. Unit price as stated in the tender [ ] b. Adjusted unit price/Pro rata [ ]  
c. Actual cost plus a margin [ ] d. Negotiated fixed price [ ]  
e. Others, specify.....

8. Type of variations implemented without formal written approval:

- a. Below a certain price limit [ ] b. Urgent changes [ ] c. None [ ]  
d. Others, specify.....

9. Key personnel assigned to the project are:

- a. Kept on the job until completion [ ] b. Changed sometimes [ ]  
c. Changed frequently [ ] d. Others, specify.....

10. Which area has more tendencies towards variation in construction projects?

- a. Electrical & Mechanical [ ] b. Structural [ ] c. Finishes [ ]  
d. Others, specify.....

### **Part C: Causes, Effects and Controls**

The following are the possible causes of variations in construction projects. Considering your experience, please indicate the intensity for the following causes of variations.

**1 –Not often;**

**2 – Often;**

**3 – Most often;**

**4. – Not at all**

| Potential Causes of Variations       | SCALE |   |   |   |
|--------------------------------------|-------|---|---|---|
|                                      | 1     | 2 | 3 | 4 |
| 1. Change of plans by the client.    |       |   |   |   |
| 2. Change of schedule by the client. |       |   |   |   |
| 3. Client's financial constraints.   |       |   |   |   |

|                                                  |  |  |  |  |
|--------------------------------------------------|--|--|--|--|
| 4. Inadequate project objectives.                |  |  |  |  |
| 5. Replacement of materials.                     |  |  |  |  |
| 6. Impediment in prompt decision making process. |  |  |  |  |
| 7. Change in specification.                      |  |  |  |  |
| 8. Change in design.                             |  |  |  |  |
| 9. Errors and omissions in design.               |  |  |  |  |
| 10. Conflicts in contract documents.             |  |  |  |  |
| 11. Inadequate scope of works for contractor.    |  |  |  |  |
| 12. Technology change.                           |  |  |  |  |

| Potential Causes of Variations                                          | SCALE |   |   |   |
|-------------------------------------------------------------------------|-------|---|---|---|
|                                                                         | 1     | 2 | 3 | 4 |
| 13. Lack of coordination between parties to the contract.               |       |   |   |   |
| 14. Design complexity.                                                  |       |   |   |   |
| 15. Inadequate drawing details.                                         |       |   |   |   |
| 16. Lack of consultants knowledge of available materials and equipment. |       |   |   |   |
| 17. Ambiguous design details.                                           |       |   |   |   |
| 18. Discrepancy in design details and Bills of Quantities.              |       |   |   |   |
| 19. Non-compliance design with owner's requirement.                     |       |   |   |   |
| 20. Non-compliance design with government requirement.                  |       |   |   |   |
| 21. Contractors financial difficulties.                                 |       |   |   |   |
| 22. Lack of contractor's involvement in design.                         |       |   |   |   |

|                                                    |              |          |          |          |
|----------------------------------------------------|--------------|----------|----------|----------|
| 23. Unavailability of equipment.                   |              |          |          |          |
| 24. Unavailability of skills.                      |              |          |          |          |
| 25. Contractor's desired profitability.            |              |          |          |          |
| 26. Differing site conditions.                     |              |          |          |          |
| 27. Defective workmanship.                         |              |          |          |          |
| 28. Poor procurement process.                      |              |          |          |          |
| 29. Lack of communication.                         |              |          |          |          |
| 30. Contractor's lack of judgement and experience. |              |          |          |          |
| 31. Long lead procurement.                         |              |          |          |          |
| 32. Complex design and technology.                 |              |          |          |          |
| 33. Lack of strategic planning.                    |              |          |          |          |
| <b>Potential Causes of Variations</b>              | <b>SCALE</b> |          |          |          |
|                                                    | <b>1</b>     | <b>2</b> | <b>3</b> | <b>4</b> |
| 34. Weather conditions.                            |              |          |          |          |
| 35. Change in government regulations.              |              |          |          |          |
| 36. Change in economic conditions.                 |              |          |          |          |
| 37. Unforeseen problems.                           |              |          |          |          |

The following are the possible effects of variations in construction projects. Considering your experience, please indicate the intensity for the following effects of variations.

**1 –Not often;**

**2 – Often;**

**3 – Most often;**

**4. – Not at all**

|                                        |              |
|----------------------------------------|--------------|
| <b>Potential Effects of Variations</b> | <b>SCALE</b> |
|----------------------------------------|--------------|

|                                                | 1 | 2 | 3 | 4 |
|------------------------------------------------|---|---|---|---|
| 1. Increases in project cost.                  |   |   |   |   |
| 2. Increase in overhead expenses.              |   |   |   |   |
| 3. Progress is affected but without any delay. |   |   |   |   |
| 4. Delays in payment.                          |   |   |   |   |
| 5. Quality degradation.                        |   |   |   |   |
| 6. Productivity degradation                    |   |   |   |   |
| 7. Procurement delay.                          |   |   |   |   |
| 8. Rework and demolition.                      |   |   |   |   |
| 9. Additional payment for contractor.          |   |   |   |   |
| 10. Dispute between parties to the contract.   |   |   |   |   |
| 11. Tarnish of consultant reputation.          |   |   |   |   |
| 12. Completion schedule delay.                 |   |   |   |   |

The following are the possible controls of variations in construction projects.  
Considering your experience, please indicate how effective the following controls of variations are:

**1 – Ineffective;      2 – Neither effective nor ineffective;      3 – Very effective;**

| Controls of Variations                    | SCALE |   |   |
|-------------------------------------------|-------|---|---|
|                                           | 1     | 2 | 3 |
| 1. Clarity of variation order procedures. |       |   |   |
| 2. Written approvals.                     |       |   |   |
| 3. Variation order scope.                 |       |   |   |
| 4. Prompt approval procedures.            |       |   |   |
| 5. Ability to negotiate variations.       |       |   |   |

|                                                                                          |  |  |  |
|------------------------------------------------------------------------------------------|--|--|--|
| 6. Variation logic and justification.                                                    |  |  |  |
| 7. Review of contract documents.                                                         |  |  |  |
| 8. Freezing design (no changes after final design).                                      |  |  |  |
| 9. Team effort by stakeholders (Client, Consultant & Contractors) to control variations. |  |  |  |
| 10. Value engineering at conceptual phase.                                               |  |  |  |
| 11. Involvement of professionals at initial stages of project.                           |  |  |  |
| 12. Client involvement at planning and design phase.                                     |  |  |  |
| 13. Client involvement during construction stage.                                        |  |  |  |
| 14. Continuous coordination and direct communication between parties to the contract.    |  |  |  |
| 15. Control of potential for variation orders to arise through contractual clauses.      |  |  |  |
| 16. Thorough detailing of design.                                                        |  |  |  |
| 17. Clear and thorough project brief.                                                    |  |  |  |
| 18. Use of project scheduling techniques.                                                |  |  |  |
| 19. Comprehensive site investigation.                                                    |  |  |  |
| 20. Comprehensive documentation of Variation orders.                                     |  |  |  |

**Part D: Knowledge of variation provisions and its application**

The following are the principles for managing and instructing variation within the legal framework of public procurement in Ghana. Kindly rank your level of *knowledge* of the following provisions.

1 –Not at all;                      2 – Limited;                      3 – Working knowledge;                      4. –  
Very good knowledge

| Variations principles | SCALE |   |   |   |
|-----------------------|-------|---|---|---|
|                       | 1     | 2 | 3 | 4 |

|                                                                                                                                                                              |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| 1. Following all procedures required by the contract.                                                                                                                        |  |  |  |  |
| 2. Assessing the reasons for the proposed variations and whether these variations will pose an emerging or actual performance problems.                                      |  |  |  |  |
| 3. Assessing the impact of the proposed variation to the contract, particularly whether the variation is actually required and whether it was part of the original contract. |  |  |  |  |
| 4. Determining the effect the proposed variation will have on the contract price.                                                                                            |  |  |  |  |
| 5. Considering the authority for making the variation.                                                                                                                       |  |  |  |  |
| 6. Proper procedure for obtaining and documenting the required approvals.                                                                                                    |  |  |  |  |
| 7. Proper documentation of details of variations and its impact.                                                                                                             |  |  |  |  |
| 8. Meeting reporting requirements such as updating the entity's contract register.                                                                                           |  |  |  |  |
| 9. Variations are not to be instructed after completion unless it is meant for dealing with defects.                                                                         |  |  |  |  |

The following are the principles for managing and instructing variation within the legal framework of public procurement in Ghana. Kindly rank the level of *application* of the following provisions.

**1 –Not at all;      2 – Seldom;      3 – Frequent;      4. – At all times**

| Variations principles                                                                                                                   | SCALE |   |   |   |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------|---|---|---|
|                                                                                                                                         | 1     | 2 | 3 | 4 |
| 1. Following all procedures required by the contract.                                                                                   |       |   |   |   |
| 2. Assessing the reasons for the proposed variations and whether these variations will pose an emerging or actual performance problems. |       |   |   |   |

|                                                                                                                                                                              |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|
| 3. Assessing the impact of the proposed variation to the contract, particularly whether the variation is actually required and whether it was part of the original contract. |  |  |  |  |
| 4. Determining the effect the proposed variation will have on the contract price.                                                                                            |  |  |  |  |
| 5. Considering the authority for making the variation.                                                                                                                       |  |  |  |  |
| 6. Proper procedure for obtaining and documenting the required approvals.                                                                                                    |  |  |  |  |
| 7. Proper documentation of details of variations and its impact.                                                                                                             |  |  |  |  |
| 8. Meeting reporting requirements such as updating the entity's contract register.                                                                                           |  |  |  |  |
| 9. Variations are not to be instructed after completion unless it is meant for dealing with defects.                                                                         |  |  |  |  |

