UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

IMPROVING COST PERFORMANCE OF PUBLIC SECTOR CONSTRUCTION PROJECTS IN GHANA. (A CASE STUDY OF GREATER ACCRA AND ASHANTI REGIONS)

THOMAS ADUSEI

NOVEMBER, 2016

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

IMPROVING COST PERFORMANCE OF PUBLIC SECTOR CONSTRUCTION PROJECTS IN GHANA. (A CASE STUDY OF GREATER ACCRA AND ASHANTI REGIONS)

THOMAS ADUSEI

(8131760007)

A Dissertation in the Department of CONSTRUCTION AND WOOD TECHNOLOGY EDUCATION, Faculty of TECHNICAL EDUCATION, submitted to the school of Graduate Studies, University of Education, Winneba in partial fulfillment of the requirements for the award of Master of Philosophy (Construction Technology) degree

NOVEMBER, 2016

DECLARATION

STUDENT'S DECLARATION

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

SIGNATURE: ……

DATE: ……

SUPERVISOR'S DECLARATION

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

NAME OF SUPERVISOR: Dr. Nongiba A. Kheni

SIGNATURE: ……

DATE: ……

DEDICATION

This dissertation (thesis) is dedicated to my precious wife Vivian A. Adusei, Mrs. Olivia Nsiah, my wonderfully made mother and Mrs. Mabel Owusu, headmistress of Kotwi D/A Junior School for their support, sacrifices and encouragement. God richly bless you.

ACKNOWLEDGEMENT

My unquantifiable appreciation goes to the Almighty God for his kind forbearance towards my life. “I will sing a new song unto the Lord, for he has dealt bountifully well with me in my academic pursuits.” My profound gratitude also goes to my selfless and proactive supervisor Dr. Nongiba A. Kheni, and my gifted brother from another mother Mr. Frank Ackon who guided and motivated me greatly in making sure this thesis became a reality.Other personalities worth mentioning here are Dr. Francis Bih, Dr. Martin Amoah and Dr. Peter Yalley at the Faculty of Technical Education-UEW (Kumasi-Campus), Ing. Emmanuel Kantamanto Kyei (Architectural and Engineering Service Limited, Kumasi) and Mr. William Ofosuhene (China Geo. Company Limited-Kumasi.), who in diverse ways contributed to this project in terms of ideas and suggestions.

I wish to also express my appreciation and thanks to Mr. Aidoo Johnson as well as my brothers, Collins Adusei formerly at Ghana Armed Forces (Michel Camp-Tema), Ebenezer Adusei, Michael Gyamfi, Samuel Asante and ever loving and dedicated sisters (Faustina Adusei and Doris Adusei) for their inconceivable supports. Words cannot commensurate your good deeds, so I say ‘bravo and God bless you quantumly’.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Over the years, there have been improvements in the management of construction projects; however, globally, the problem of cost overruns is still a critical issue in the construction industry especially in developing economies which Ghana is no exception. The aim of this study was to examines the critical factors affecting cost performance in construction projects in Ghana. The study adopted a quantitative survey approach. The questionnaires were distributed via email. Out of three hundred and eighty (380) questionnaires distributed, one hundred and ninety four (194) usable questionnaires were retrieved from respondents representing 51 percent. The data was analyzed using descriptive statistics, factor analysis and multiple regression technique for analyzing relationships between variables. The findings revealed that the underlying construct of the numerous critical factors of cost overruns are directly linked to five (5) main themes; managerial-related issues, financing-related issues, cost estimate-related issues, political-related issues, and market-related issues. The study also revealed that, the main causes of cost overruns are: poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices. The study further revealed that the critical factors that can prevent or minimize cost overruns in construction projects, in Ghana are directly linked to five themes: namely; adequate planning-related, financing-related, effective collaboration-related, adequate project team capability-related, and motivation-related. Moreover, the results further revealed that the most significant success factors that can help prevent cost overruns in construction projects, in Ghana are early involvement of the contractor, provision of adequate funds, good project team relations, use of competent managers/supervisors, and provision of incentives/ bonuses to project participants. It is recommended that; training courses and workshops should be conducted to improve managerial skills of project participants.

CHAPTER ONE

INTRODUCTION

This chapter covers the background to the study, the general objective and specific objectives of the study, the research questions, the significance of the study, the scope, limitation and the organization of the study.

1.1 Background to the Study

One of the critical issues in construction projects is cost estimation. The importance of cost estimation lies in the fact that; the success of construction projects greatly hinges on the availability of substantial funds to complete the projects. However, several studies reiterate the difficulty in estimating construction costs due to uncertainties and uniqueness of projects that could influence sufficiency of the budget (Flyvberg et al., 2003; Arcila, 2012). The significant observation made by many other studies is that; the probability that budgets may be exceeded far out-passes the likelihood that projects will be completed below the cost estimate. According to Baloi& Price (2003), a sizable majority (63%) of 1778 construction projects funded by the World Bank exceeded their budgets. The case is further aggravated when it comes to large infrastructure projects such as rail and road construction in which Flyvbjerg et al. (2003), reports that a large share of such projects exceed their initial budgets with cost increases of 50–100% being commonplace and increases beyond 100% not unheard of. In stating these figures, Flyvbjerg et al. not only shed light on the severity of the problem, but also its global implications. The data upon which the study is based has been gathered from a range of different geographical locations, spanning five continents, 20 countries, both developed and developing nations, from late 20's to the late 90's. This shows that the challenge of cost overruns is clearly a

global phenomenon and although there are minor differences depending on the geographical location, the problems persist in every continent. Studies indicate that the situation is even direr in the developing world where corruption has a significant impact on actual costs and accounts for 10-30% of the value of a single construction contract (World Bank, 2012).

Cost estimates are prepared to help clients to make an informed decision regarding economic feasibility and justification of a project. However, large uncertainties in cost estimates can make such decisions grossly and systematically misleading (Flyvberg et al., 2002). This is because, early project estimates are often prepared on limited scope definition and little information regarding the specific parameters that are needed in the completed facilities. Therefore, inaccurate estimates often become the basis upon which all future estimates are judged and the project success is also measured by comparing final costs to these inaccurate estimates.

In some cases, project budgets may be on point and contingency budgets may be made but uncertainties could still lead to undesired project cost overrun. Conceptually, uncertainty exists when there is more than one possible outcome.

Osipova (2008) illustrates that, inflation rates, which create uncertainties in prices of construction supplies and subsequently lead to under-budgeting, cannot be directly controlled by construction firms. Moreover, changes in policies on government borrowing from central banks, environmental policies, and building regulation policy frameworks, which create uncertainties in their own rights, can neither be directly controlled by construction firms.

Construction costs as a term can be defined as the costs of all component activities from the initiation of the project proposal to finalization. These include the cost of developing the concept, investigations, developing the design, acquiring land, altering public utility plant, construction, project administration and handover. Humphreys (2005, in Ofosu, 2014) found that the cost of a project is typically contingent on several uncertainties that are related to factors including the competence of human resources, partner relationships, quality and sources of materials, distribution and delivery channels, as well as the general economic conditions, such as inflation within the economy.

Globally, the construction industry contributes immensely to the development of nations. Construction is a key sector of the national economy for countries all around the world, as it employs a large proportion of the labour force of nations. Successful delivery of well-planned infrastructure investments gives developing economies and for that matter Ghana, an opportunity to compete in the global marketplace. The construction industry in Ghana, as in other parts of the world, is a huge and crucial segment in economic development (Ofori, 2012; Osei, 2013). Construction infrastructure has a substantial effect on total factor productivity. The construction industry is therefore considered an economic backbone and major contributor to the gross domestic product (GDP) of Ghana. For instance, its contribution to GDP has shown an increasing trend from 8.5% to 11.8% from 2010 to 2013 respectively; Osei (2013), reported in his study that the construction sector remains one of the key sectors in the economy in terms of its share of GDP (i.e. 9.1% for 1993-2011 period) and the overall industrial output (i.e. 35.9% for 1993-2011 period); A sign of its growing importance in the development of the nation. It is the mechanism through

which infrastructure is delivered. No matter what one does, there is construction, as it cuts across all sectors. Apart from these essential roles, the contribution of the construction industry to the development of nations could be summed up through it forward and backward linkages with other sectors and industries of the economy. By forward linkages, the output (product) of the construction industry serves as inputs (raw materials) of other industries. For instance, construction output including all types and forms of infrastructure like buildings, roads and dams, etc. are used as inputs by the financial, transport and energy sectors and industries. However, many local construction projects report poor performance due to many causes such as:

- Poor contract management
- Delayed payment
- Escalation of material Prices
- Lack of adequate design before contract award
- Excessive approval procedures (Frimpong et al., 2003; Laryea, 2011; Ofosu, 2014)

The above causes might have been triggered by the current economic instability. Ghana inflation rate is high 17.3% compared to many developing countries like Nigeria, Uganda, Pakistan, Kuwait and South Africa with inflation index between 3.00-9.60 in 2015 (GSS, 2015). Also the government of Ghana has increased the pump prices of fuel by 24.3% which in no small way has increased inflation rate in the country. The banks interest rate in Ghana also varies from (27% - 32%), which is high compare to other developing countries which makes borrowing for construction projects very difficult. It is therefore clear that the construction industry which invests mostly in long term investment is faced with a lot of financial challenges. While

studies indicate that cost overrun is a major problem in Ghanaian construction industry, very few studies have been conducted to investigate it and most importantly to identify critical success factors for enhancing the cost performance of construction projects.

1.2 Statement of the Problem

Construction can be considered a dynamic industry which is constantly facing uncertainties. These uncertainties and the greater number of stakeholders in these kinds of projects, make the management of costs difficult which consequently cause cost overruns (Arcila, 2012). Therefore, cost overruns are considered one of the most critical issues during the execution of construction projects (Chan, et al., 2004; Doloi, 2011). Studies show that the problem of cost overrun, especially in the construction industry, is a worldwide phenomenon and very widespread in developing countries of which Ghana is not an exception (Creedy et al., 2010; Mahamid & Dmaidi, 2013; Ofosu, 2014).

A construction project is considered successful if it is completed on time, within budget and to specification or quality standard (Arcila, 2012). The achievement of this objective however is a major problem in the construction industry especially in developing countries (Ofosu, 2014). According to Kaliba et al. (2009) the presence of cost overruns can be a reason for project failure. However this idea has been refuted by many authors who considered that project success depends on many other factors that should be assessed to conclude the success or failure of a project (Chan, et al., 2004). Moreover, there have been many studies that suggest that the success of a project depends on the presence of certain critical factors which can also change

depending on the objective to be met (Iyer & Jha, 2005). In other words, some authors ascertained that; there are some critical success factors that help to improve cost performance and prevent cost overruns.

Although there have been studies focused on Critical Success Factors (CSF's) that helped improve cost performance of projects in some developed countries like U.K, Australia, Malaysia, China, Singapore (Chua et al., 1999; Hwang & Lim, 2012; Arcila, 2012), however, there is paucity of similar research in Ghana as much of the existing research is not focused specifically on those critical success factors that influence the cost performance of construction projects (Imbeah, 2012; Fobi, 2014). Also, researchers maintain that important factors vary from one geographical region to another (Apolot et al., 2011); the critical factors identified by researchers in other countries may not be relevant in the Ghanaian scenario due to the different socio-cultural, political and economic environment in Ghana. The aforementioned arguments underscore the aim and objectives of this study.

1.3 Aim of the Study

The main aim of the study is to examine factors affecting cost performance of public sector construction projects in Ghana.

1.4The Specific Objectives of the Study are to:

- to identify the main causes of cost overruns in public sector construction projects, in Ghana;
- to identify the critical factors (CFs) that can prevent or minimize cost overruns in construction projects, in Ghana;
- to evaluate the effects of the identified critical factors on cost performance;

1.5 Research Questions

The following research questions will guide the study:

- What are the main causes of cost overruns in public sector construction projects in Ghana?
- What are the critical factors (CF's) that can prevent or minimize cost overruns in public sector construction projects, in Ghana?
- What are the effects of the identified critical factors on cost performance of public sector projects?

1.6 Assumptions of the Study

Leedy and Ormrod (2010) explain that "…assumptions are so basic that without them the research problem itself could not exist". It is evident from the background of the problem that the following assumptions may be presumed:

- Cost is a key parameter of the project's success or failures for any client wishing to commence with a project;
- Public sector projects are mainly undertaken for social reasons where the public will be the ones using the assets rather than for profit;
- Public sector projects tend to experience more cost overruns than private ones due to the fact that they are not built for profit.
- Contractors are always involved in construction projects and therefore are in the best position to contribute to minimising the recurrence of cost overrun.

1.7 Significance of the Study

The research attempts to provide stakeholders in the Greater Accra and Ashanti regions of Ghana with a broader understanding on the causes of cost overruns in

construction projects. The study is important as it also sheds light on how construction professionals can implement cost control measures to avoid recurrence of these problems. The attainment of effective cost control measures for government development projects is a prerequisite for the successful completion of such projects, which are vital for the country's socio-economic advancement.

1.8 Scope of the Study

The study focused on construction firms operating in Ashanti and Greater Accra regions of Ghana. These regions were selected because they are the major regions in Ghana where contractors and construction activities are highly concentrated (Ankomah, Boakye & Fugar, 2010). The conceptual issues of the study are limited to project management, cost management, and project costs.

1.9 Organization of the Study

The rest of the study is sectioned as follows: Chapter Two reviews theories and concepts, which are related to the study. It presents theoretical and empirical perspectives of risk management and its effects on construction projects. The conceptual framework that guides the study is also discussed in the second chapter. Chapter Three focuses on the research methodology, and describes the study organizations, study population and sampling, as well as the data collection and analysis. Chapter Four presents the findings of the study. Chapter Five discusses the findings of the study and Chapter Six highlights the summary of the major findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

This chapter provides a literature review; it discusses how cost overruns are critical in construction projects and the way in which this problem is perceived as "business-as-usual" and not an exception. The chapter also reviews some studies that have been carried out in the last few years, which aimed to find the main causes of cost overruns. This review is important for the purpose of this research as one of the main objectives of this research is to identify the main causes of cost overruns in construction projects, in Ghana. It also reviewed some studies that focused on critical success factors that have an impact on cost performance, and can prevent cost overruns in construction projects. For this reason, this section will review three studies that are concentrated on this subject.

2.1 Construction Costs Estimate

Construction cost is a factual process designed to give a reliable estimation or prediction of its financial cost (Bari, 2012). In this process, cost estimation is of key significance as it is a fundamental activity which combines a mechanical process and subjective expertise to assess and predict the total cost of executing construction works (Khodakarami & Abdi, 2014). It consists of application of appropriate methods of estimation to the measure of finished quantities of appropriate building. The estimated costs then become the benchmark for evaluating the cost objectives of the project. Thus, an underestimation or over-estimation would obscure the actual measure of cost performance of the project.

The fundamental issue remains that, construction costs occur as the balance between estimated and actual expenditure. The purpose of construction cost estimation is to provide information for construction decisions including areas in the procurement and pricing of construction, establishing contractual amount of payment, and controlling actual quantities (Jelen & Black, 1983). Pricing transforms the cost estimate into what the firm wishes to charge for the scope. The basic characteristics of effective estimating include: clear identification of task, broad participation in preparing estimates, availability of valid data, standardized structure for the estimate, provision for program uncertainties, recognition of inflation, recognition of excluded costs, independent review of estimates, and revision of estimates for significant program changes **(**ASPE, 2004).

One way to make estimates is by determining the resources needed, such as the amount of construction material quantities that are required, and then multiplying the estimated construction material quantities by the corresponding unit cost (Aziz, 2013). One advantage of making estimates in this way is that it allows for the segregation of quantities and costs. This way they can be updated separately as new information becomes available. They can also be tracked separately allowing decision makers to make better decisions about the project during its conceptual phase (Chimwaso, 2001).

2.2 Cost Performance in Construction Projects

Construction has been considered as a dynamic industry which is constantly facing uncertainties in its budgets, processes and technology (Chan et al., 2004). These uncertainties, the complexity of projects and the increase of stakeholders make the

management of costs difficult in a construction project. These facts result in cost overruns in the project (Doloi, 2011). Even though there have been improvements in the management of construction projects, the problems of overruns are still a critical issue in the construction industry (Arcila, 2012). Due to the excessive cost and time overruns, construction projects usually have poor reputation (Ahmed et al., 2003).

Construction cost overruns may be defined as an extra cost beyond the contractual cost agreed to during the tendering stage of a project life cycle (Monyane, 2013). Cost overruns may also be called "cost increases" (Koushki *et al*., 2005), and "budget overruns" (Zhu & Lin, 2004). Cost overrun is defined as the change in the contract amount divided by the original contract amount. This calculation may be converted to a percentage for ease of comparison (Jackson, 1999 cited in Al-Najjar, 2008).

Cost overruns occur when "the final cost of the project exceeds the initial estimate or budget" (Arcila, 2012). Nevertheless, the estimate or initial budget is constantly changing during the execution of the project. For this reason, it is important to be careful with the budget that is going to be taken into account to calculate the overrun of the project (Arcila, 2012). Some authors consider that, the initial budget is created when the decision of commencing building is made (Flyvbjerg, et al., 2002; Odeck, 2004). On the other hand, some other authors uphold the idea that cost overrun should be found comparing the original contract value with the final cost of the project at the time of completion (Amoa-Abban & Allotey, 2014). The difference between cost overrun definitions may cause a difference in the magnitude of cost overruns that have been reported over the years (Love et al., 2012).

Le-Hoai et al. (2008) also considered that the magnitude of cost overruns may or may not vary depending on the size of the project, the location of the project and the type of project. For example, Eden et al. (2005) pointed out that although there is more information about cost overruns in public projects, this does not mean that there are no cost overruns in the private industry. In fact, the authors uphold the idea that projects of private sector tend to have larger cost overruns. On the other hand, Koushki et al. (2005) expressed that cost overruns are common not only in large projects, but also in small and simple projects. This issue was also discussed by Frimpong et al. (2003) who stated that overruns are more frequent and significant in large projects than small projects. Gkritza and Labi (2008) supported this idea and they also added that cost overruns are also more common in long duration projects. Nevertheless, Odeck (2004) contradicted this statement. He considered that large projects have fewer cost overruns because managers pay more attention to the management of these types of projects than the attention they usually pay to small projects.

2.3 Cost Overruns as a Rule not an Exception

Ramabodu and Verster (2010) opine thatcost overrun factors affect the whole project development cycle beginning with the conception/planning phase to the completion/commissioning phase. There are causal factors which would span the whole project development cycle. A degree of change can be, and to a certain extent should be expected in construction, as it is difficult for clients to visualize the end product that they procure. Cost overrun is also known as “change orders” (Zawawi et al., 2010). As mentioned, percentage cost overrun is defined as the deviation from the

amount agreed, as per the contract sum divided by the agreed, original amount of the contract:

$$\text{Cost overrun} = \frac{\text{Final Contract Amount} - \text{Original Contract Amount}}{\text{Original Contract Amount}}$$

Cost overruns are common in different types of projects and locations. In addition, cost overruns have become a norm, rather than an exception in the construction industry (Baloi & Price, 2003, Ofosu, 2014). According to Arcila (2012), it is normal to expect that the final cost of a project exceed the initial budget by 10 -20 percent. This assertion is supported by (Ofosu, 2014; Mahamid et al., 2012; Zarooni et al., 2000) findings. For instance, Ofosu (2014) indicated that cost overrun in highway construction projects is a major problem, in Ghana; 77% of the respondents in his study indicated that the average cost overrun in highway construction projects they have experienced is between 40% and 60% of the project's original estimated cost while only 23% of the respondents indicated the cost overruns in highway construction they have experienced to be between 20% and 40%.

Mahamid et al. (2012) conducted a study to investigate the statistical relationship between actual and estimated cost of road construction projects using data from Palestinian road construction projects awarded over the years 2004 to 2008. The study was based on a sample of 169 road construction projects. The findings reveal that 100% of projects suffer from cost diverge, it is found that 76% of projects have cost under estimation and 24% have cost over estimation. The discrepancy between estimated and actual cost has average of 14.56%, ranging from -39.3% to 98%.

Regarding the cost overrun in building construction projects, Mahamid and Dmaidi (2013) reveals that 100% of their respondents indicated that the average cost overrun in building construction projects that they have experienced is between 10% and 30% of the original estimated cost of a project, in the West Bank in Palestine. These findings above corroborates with Al-Momani (1996) studies on construction projects in some developing countries which indicated that by the time a project is completed, the actual cost exceeds the original contract price by about 30%.

Koushki et al. (2005) indicated that public and private sector projects exhibit similar patterns of cost overruns. They go on to reveal that the three main causes in order of frequency, severity, and impact are contractor-related problems, material-related problems and owners' financial constraints. This research further found that cost overrun is mainly influenced by project complexity, characteristics of the client or their representative and payment modality. In addition, the research reveals that cost overruns appear to be greatly influenced by both procurement and non-procurement related factors.

Azhar, Farooqui and Ahmed (2008) confirmed that a majority of cost overrun factors (88%) lie in the medium severity impact range in the Pakistani study that they undertook. The research also brought to light that large firms experienced 40% of cost overruns. Azhar et al. (2008) pointed out that the leading factor of cost overruns related to the business and regulatory environment, which encourages corner costs and unsound construction methods, is the prevailing practice of Pakistan Government to implement its lowest bid price method. This method contains inbuilt problems and does not produce the best value for money. Problems encountered with this method

were that the actual bid price was 50% of the estimated price. Ali and Kamaruzzaman (2010) concluded that cost performance of construction projects in Malaysia is a critical issue in that country and the recurrence of this problem indicated a need for research to clarify what should be done to mitigate the said problem.

There are a number of factors, about which several research studies have been conducted to investigate the causes and extent of overruns, which may influence cost.

2.4 Causes of Cost Overruns in Construction Projects

This section aims to understand the main causes of cost overrun. For this reason, it presents some results of different studies over the years of cost overruns in different types of construction projects in many different countries. Generally, the factors that have an impact on cost performance of the project are present from the estimating stage to the completion stage of the project (Baloi & Price, 2003). Therefore, understanding the main factors that cause cost overruns is important due to the fact that it helps to minimise the impact and create a strategic plan to face uncertainties in all stages of the project (Reichelt & Lyneis, 1999).

Several studies have been conducted to investigate the causes of cost overrun in construction projects; Jackson (2002) indicated that poor project management, unexpected ground condition, design development, information availability, design brief, estimating method, design team performance, time limit, claims, commercial pressure, procurement route, external factor and people are the main causes of cost overrun in construction projects, in UK.

A study made in Turkey by Arditi, et al. (1985 in Amoa-Abban &Allotey, 2014) showed that the causes of construction cost overruns were attributed to inflationary pressures, increases in material prices and workmen's wages, difficulties in obtaining construction materials, construction delays, deficiencies in cost estimates prepared by the consultants and the unexpected sub-soil conditions.

Mansfield et al. (1994), found out that cost overruns were attributed to problems in finance and payments arrangements, poor contract management practices, material shortages, changes in site conditions, design changes, mistakes and discrepancies in contract documents, mistakes during constructions, price fluctuations, inaccurate estimating, delays, additional works, shortening of construction periods, and fraudulent practices and kickbacks.

Iyer et al. (2005), conducted a study to identify the factors affecting cost performance of Indian construction projects. 55 factors were identified. They concluded that the top affecting factors are: conflict among project participants, ignorance and lack of knowledge, presence of poor project specific attributes and non-existence of cooperation, hostile socio- economic and climatic conditions, reluctance in timely decision, aggressive competition at tender stage and short bid preparation time.

According to Cox (2007) identified five reasons for project cost overruns. They were incomplete drawings, poor pre-planning processes, escalating cost of materials, lack of timely decision and excessive change orders.

Azhar et al. (2008) conducted a study in order to identify the major cost overrun factors in construction projects in Pakistan. 42 factors were identified. They found that the top ten affecting factors are: fluctuation in prices of raw materials, unstable cost of manufactured materials, and high cost of machineries, lowest bidding procurement procedures, poor project (site) management or poor cost control, delays between design and procurement phases, incorrect or inappropriate methods of cost estimation, additional work, improper planning, and unsupportive government policies.

In a further study conducted in Australia, Creedy et al. *(*2010) established that of particular concern are changes in project designs and scope changes during project development. Similarly, Ameh et al. (2010) reported that the factors which ranked the highest under related factors were economic stability, inadequate production of raw materials by the country and government policies (law and regulations) . The factors ranking highest in the "construction-related" category were lack of contractor experience, incorrect planning and poor financial control on site. All these factors resulted in cost overruns in telecommunication projects in Nigeria.

Furthermore, Ameh et al. (2010) discovered that factors which ranked the highest, under the variables that caused cost overruns in the "cost estimating" factors category, were the cost of materials, fluctuation of prices of materials and high interest rates charged by banks on loans received by contractors. Al Gwaiz et al. (2006) undertaken research in Saudi Arabia and identified factors interviewing different professionals involved in the projects. They reported the following:

- For consultants, changes in design and duration of contract are equally the most influential cost factors.
- Contractors consider local laws and regulations to be the most influential cost factor, followed by project planning and scheduling.
- Developers regard on-site disputes as the most influential cost factor followed by work experience.

Le-Hoai et al. (2008) in their research argue that in general, poor site management and supervision, poor project management assistance, financial difficulties of an owner, financial difficulties of a contractor and design changes are the five most frequent, severe and important causes of cost overruns in the construction industry.

Ramabodu and Verster (2010) reported the main five very critical causes of cost overruns on public projects as:

- changes in scope of work on site,
- incomplete design at time of tender,
- contractual claim, that is, extension of time with cost claims,
- lack of planning and monitoring of funds, and
- delays in costing variations and additional work.

Mahamid and Bruland (2011) conducted research on road construction in the West Bank in Palestine and discovered that the top five influencing factors from the consultants‟ point of view were: materials‟ price fluctuations, insufficient time for estimation, experience in contracts, size of contract and incomplete drawings.

Mahamid and Dmaidi (2013) identified the risk map for factors affecting cost overrun in building construction projects in the West Bank in Palestine from the consultants' perspective, indicate that the top five affecting factors are: political situation, fluctuation of prices of materials, economic instability, currency exchange, and level of competitors.

Memon et al. (2010), observed that cash flow and financial difficulties faced by contractors, contractor's poor site management and supervision, inadequate contractor experience, shortage of site workers and incorrect planning and scheduling by contractors were significant.

Ganiyu and Zubairu (2010), showed that project cost depends largely on factors related to adequacy of contractor's plant and equipment, contractor's experience on similar types of project, time allowed for project bid to be evaluated, level of technological advancement and client commitment to timely completion of the project, percentage of repetitive work, level of design complexity, importance for project to be delivered, project scope, percentage of special issues, communication among project team, level of construction complexity, contractor experience on similar size of project and contractor's prior working relationship with clients.

Mahamid and Bruland (2011), undertook a study of the causes of delays in West Bank, reported that Palestine road construction projects reveal that the top five influencing factors from consultants' point of view are: materials' price fluctuation, insufficient time for estimate, experience in contracts, size of contract, and incomplete drawings.

Amusan (2011) discovers that lack of experience on the side of contractors is largely responsible for cost overruns on a Nigerian project. The same study by Amusan (2011) argues that inadequate planning, inflation, variation orders, and design changes constitute major factors contributing to cost overruns.

In the same context, Odeyinka et al. (2010) concluded that significant risk factors affecting the variability between tender sum and final account relate to the level of design information or lack of it at the pre-construction stage of a project. Such risk factors include changes in design, variations by the client, changes in scope of works and unexpected site conditions. A closer look at the study by Odeyinka et al. (2010) further indicates that for the commercial projects, the mentioned factors were significant.

However, for educational project variations requested by the client, extremely bad weather, changes in scope of work and unexpected site conditions constitute major factors in this regard. Similarly, Kaliba, Muya and Mumba (2009) suggest that bad weather and scope changes alongside delayed payments are major factors that bring about cost overruns in Zambian road construction projects.

Kaliba et al. (2009) conclude that cost escalation of construction projects in Zambia are caused by factors such as inclement weather, scope changes, environment protection and mitigation costs, schedule delay, strikes, technical challenges and inflation. Al-Juwairah (1997), listed cost of materials, incorrect planning, contract management, wrong estimation method, and previous experience in contract as the main causes of cost overrun.

Abdullah et al. (2010), pointed out that cash flow and financial difficulties faced by contractors; their poor site management and supervision; inadequate contractor experience; a shortage of skilled site workers and incorrect planning and scheduling by contractors were significant factors affecting construction costs.

Bubshait and Al-Juwairah (2002) list the following as factors that cause cost overrun on construction projects in Saudi Arabia: effects of weather, number of projects going on at the same time, social and cultural impacts, project location, lack of productivity standards in Saudi Arabia, level of competitors, supplier manipulation, economic stability, inadequate production of raw materials by the country, absence of construction cost data.

In their study of Infrastructure project in Nigeria, Omoregie and Radford (2006) concluded that price fluctuation, financing and payment for completed work, poor contract management, delay, change in site condition, inaccurate estimate, shortage of materials, imported materials and plant items, additional works and design change in Nigeria.

In another study undertaken by Enhassiet al. (2010), they rated the top ten most important causes of variation orders in construction projects in Gaza Strip. These, according to survey respondents, included: the lack of construction materials and equipment spare parts due to closure and siege; changes in design by the consultant; the consultant's lack of knowledge of available materials and equipment; errors and omissions in the design; conflicts between contract documents; owner's financial problems; lack of coordination among parties involved in the project; international

consultant using inadequate specification to be followed in local conditions; internal political problems, and change in specifications by owner. The lack of materials and spare parts of equipment because of closure is the most important cause of variation in orders in construction projects in Gaza Strip.

Nega (2008) affirmed in his study that parties blamed each other for encountered cost project escalations in the Ethiopian construction industry. Nega (2008) then suggests that it was important to identify the stakeholders who are responsible for causing cost overruns in public building construction projects in order to evolve corrective measures. Nega (2008) reported that there were claims made by clients concerning issues related to design, specifications and contract documentation. Table 2.1 indicates causes and corresponding, responsible parties, for cost overruns according to the literature (Nega, 2008).

Table 2.1 Causes of Cost Overrun

No	Causes of Cost Overrun	Responsible Party
1	Inflation or increase in the cost of construction materials	Government & others
2	Lack of planning and co-ordination or less emphasis on planning	Client & consultant
3	Fluctuations in the cost of labour and/or material or any other matter affecting the cost of the execution of the works and subsequent legislation that affect the project	Government & others
4	Insufficient geotechnical investigation	Consultant
5	Additional costs due to variations work	Consultant
6	Change in foreign exchange rate (for imported materials)	Government & others
7	Change orders and/or lack of control on excessive change orders	Client & consultant
8	Costs due to special risks which very often include outbreak of war, hostilities, contamination and other such risks	Government & others
9	Delay of drawings and/or order requested by the contractor	Consultants
10	Changes in plans and drawings	Clients, end user, & consultants
No	Hypothesized Causes of Cost Overrun	Responsible Party
11	Inappropriate/inexperienced contractor	Clients, consultants & Contractor

No	Causes of Cost Overrun	Responsible Party
12	Encountering of unforeseeable physical obstructions and conditions	Consultants & others
13	Failure to identify problems and institute necessary and timely design and programming changes.	Consultant & contractor
14	Failure on the part of the employer to hand over possession of the site in accordance with the terms of the contract	Client
15	Inaccurate quantity estimate or excess quantity during construction	Consultant
16	Unclear specifications or changes to specification	Consultant
17	Contractor's bankruptcy	Contractor
18	Cost underestimation	Client, consultant & contractor
19	Additions and/or enhancements required by clients or end users	Client & end user
20	Difficulties in obtaining construction materials in the local market	Government & contractor
21	Errors in setting out which are based on incorrect written data supplied by engineer	Consultant
22	Ambiguities or discrepancies of documents	Consultants
23	Loss or damage due to excepted risks or employer's risk	Government, client & others
24	Suspension of work ordered by the engineer	Consultant
25	Complexity of construction projects	Consultant &contractor
26	Poor communication among contractor, consultants and the client	Client, consultant and Contractor
27	Mistakes during construction or defective work	Consultant & contractor
28	Supplementary/additional agreement	Client & consultant
29	Cost associated with test samples not provided in the contract	Client & consultant
30	Funding problems or client's shortage of finance or delayed payments to contractors	Client
31	Lack of End user involvement	Client, consultant & end user
32	Executive bureaucracy in the client's organisation	Client
33	Uncovering of works that have already been completed, but they are found to have been executed in accordance with the contract	Client & consultant
34	Acceleration required by the owner (shortening of contract time)	Client & end user
35	Indemnities that the employer has contractually undertaken to assume	Client & others
36	Different consultants for design, supervision & contract administration	Consultant
37	Increase in tax/change in government fiscal/monetary policies	Government

Source: Nega (2008)

Apolot et al. (2011) conclude that change in scope, delayed payment to contractors, poor monitoring and control, high inflation, and high interest rates are the main causes of delay and cost overruns in public construction projects in Uganda. Evaluating the

impact of risk factors on construction projects cost in Nigeria, Tipli and Ilyasu (2014) found that the five most critical factors causing construction projects cost overrun in Nigeria are: design variation, variation by client, price inflation, incomplete or inaccurate cost estimate, and inadequate program schedule.

Potty et al. (2011) also conducted several case studies as part of a study that made use of opinion surveys for data collection. Insights from the cases and the opinion survey are detailed below:

The contractors reported that the reasons for cost overruns include but are not limited to:

- The widespread project location that caused logistics related challenges while transferring resources to the site at the time of requirement.
- Continuous changes in design and drawings due to incomplete initial drawings prepared with insufficient design data.
- Change of construction drawing during execution of construction works.
- The lack of progress of specialist work due to inefficient planning.
- Limitation of consultants‟ working hours and having the supervision team to work with overtime charges.
- The delay in land and property acquisition obstructed and prevented progress in the construction work.
- The interference of the local community and their unreasonable demands on the contractor.
- Inclement weather due to the change in weather patterns
- Fluctuation in cost of construction materials and fossil fuels.

- Shortage of materials in the local markets, causing delays in delivery and excess costs for additional transportation.
- Delay in approval of material by consultant.
- Monopolisation of special machinery and equipment.
- Mistakes in quantity take off provided at the time of tendering.

Ijigah et al. (2013) assessed risk management practices in Nigerian construction industry toward establishing risk management index; listed financial related risk indicators (fluctuation of inflation rate, fluctuation of interest rate, rise in fuel prices, fluctuation of exchange rate, change in bank formalities/regulation); management risk indicators (improper planning budgeting, poor communication, improper project feasibility studies, improper project organization structure, internal management problems, absence of team work, change of top management); political risk indicators (change of government policies, bureaucracy, corruption/ bribery); market risk indicators (increase of labour cost, increase of material cost, competition from other companies, and inadequate forecast about market demand) in order of severity.

Frimpong, et al. (2003), pointed out that the main the causes of delay and cost overruns in the construction of groundwater projects in Ghana are similar to those in other developing countries. These factors are: the increase of cost of the materials, poor contractor management, problems with agencies' payments, poor technical performance and inaccurate estimation of costs.

Laryea (2011), identified tight project schedule, design variation, excessive approval procedures and high performance/quality expectations as the top five construction-

specific risks. Amoa-Abban and Allotey (2014), list additional works, variation orders, fluctuations, delays, and inadequate provisional sum up the causes of cost overrun in their study of cost overruns in building construction projects: a case study on a government of project in Accra, Ghana.

Danso and Anti (2012), in their study of factors influencing the time and cost overruns in Ghana telecom construction projects, identified 14 major factors. These factors were listed as:

- Price fluctuations;
- Ineffective cost control systems;
- Lack of coordination at design phase;
- Design scope changes;
- Inadequate review of drawings and contract documents;
- Frequent breakdown of plant and equipment;
- Deficiencies in prepared cost estimates;
- Planning and scheduling deficiencies;
- Inadequate project preparation;
- Planning and implementation;
- Delay in issuing information to the contractor during construction;
- Lack of cost planning / monitoring during pre and post contract stages;
- Delays in costing variations, and
- Additional works.

Abidin and Bambang (2008), emphasised the notion that many construction firms in Indonesia seem to be placing a greater focus on project cost rather than concentrating

on other factors that might reduce these costs. The implication of their research findings is that that these construction firms tend to neglect time and quality, which are also important targets needing to be taken into consideration. For these reasons, Yusuf et al. (2008), contend that in developing countries such as Indonesia, many construction project failures occur as a result of poor monitoring and control; lack of documentation on project lessons learned; by their not being adaptive to information technology development as well as delays and mistakes in decision making. Therefore by virtue of being more concentrated on project cost at the expense of other key project considerations, cost overruns are often manifested in Indonesia.

Yusuf et al. (2008) illustrate their assertion by mentioning the causes of project material cost overruns in terms of 58 events and 57 causes, furthermore with regard to their analysis; they identified the sources of risks that cause most events on material cost overruns as purchasing and material usage. Eight events that exercise the most influence on such cost overruns, which are related to purchasing, are:

- Project delay, which is largely caused by schedule variance and purchasing of materials in contravention of the stipulated specifications and requirements;
- Increased material costs, caused mostly by delay in purchasing and poor strategy in selecting sellers;
- Change order changes and excess materials, which are mainly due to materials that are not purchased in accordance with specifications and requirements;
- Delay in material procurement, which is mostly caused by shortages in the market, changes in materials' sources that are related to project location, delay in payment, and delay in purchasing;

- Delay in project works execution, which is largely due to the same factors; Increased procurement cost which is mostly caused by a supply shortage in the market, and
- Delay in delivery of materials to project site, which is most commonly due to poor strategy in selecting sellers.

Baloyi and Bekker (2010) identify the causes of cost overrun related to the stadia built or refurbished for the 2010 FIFA World Cup in South African. The top ten causes in order of importance included:

- Increase in material cost;
- Inaccurate material estimates;
- Shortage of skilled labour;
- Client's late contract award;
- Project complexity;
- Increase in labour cost;
- Inaccurate quantity take-off;
- Difference between selected bid and the consultant's estimate;
- Change orders by client during construction, and
- Manpower shortage

Ofosu (2014), concludes that the top five factors leading to cost overrun in highway construction projects in Ghana are: use of line diagram for highway construction projects, lack of adequate designs before contract award, underestimation of quantities in BOQ, delay in payment, and inadequate contingency allowance in BOQ.

Some studies on cost overruns in megaprojects have been carried out in the past years. Megaprojects have been defined as those construction projects that cost more than one billion dollars (Jergeas & Ruwanpura, 2010). Flyvbjerg, et al. (2003), defined megaprojects in the same way and they also mentioned that the main reason for cost overruns in construction megaprojects is the underestimation of costs and length of delays during the planning stage. Other factors mentioned by the authors were: the absence of a plan that takes into account not only the geological risks, but also the design and specification changes that the project can have in the construction phase, the lack of knowledge about changes in exchange rates between currencies and safety and environmental risks during the execution. These results were reinforced by Jergeas and Ruwanpura (2010) who aimed to find the reasons for cost and scheduled overruns in oil sands megaprojects in Canada. The author's surveyed 87 international senior project managers and the conclusion regarding the main reasons for cost overruns were similar to those expressed by Flyvbjerg et al. (2003). The main reasons were: the lack of knowledge of the project and its complexity, inaccurate estimation of costs, the absence of a plan that copes with the changes in design and execution requirements and the lack of managerial strategies.

2.5. Causes of Cost Overrun in Public Sector Projects

Many researchers have attempted to identify the causes of cost overruns in infrastructure projects. One of the prolific and influential writers includes Flyvbjerg et al. (2009). There are also other authors who have covered the factors that influence cost overruns in infrastructure projects; Kasimu (2012), lists the following critical factors that do so:

- Market conditions

- Fluctuation in foreign exchange
- Inflation
- Delay in payment
- Lack of financial management and planning
- Method of estimating adopted
- High loan interest rate charges levied by banks
- Tax increases
- Insurance costs
- Personal experience in the contract works
- Poor financial management and control
- Improper coordination and interaction within parties involved in works
- Lack of a qualified project manager
- Lack of application of risk management process
- Knowledge of clients and consultant play a crucial part
- Financial status of the client
- Government policy.

Summary of Factors Influencing Cost Overruns in Public Sector Construction Projects in Ghana

Table 2.2: Main causes of cost overruns in Ghana (Adapted from Frimpong et al, 2003; Laryea, 2011; Amoa-Abban & Allotey, and Ofosu, 2014)

Main causes of cost overruns	Frimpong et al. (2003)	Laryea (2011)	Abban & Allotey (2014)	Ofosu (2014
Increase of cost of the materials	√			
Poor contractor management	√			
Funding/delay payment	√		√	√
Poor technical performance	√			
Inaccurate estimation of cost	√			
Tight project schedule		√		
Design Variation		√	√	
Excessive approval procedures		√		
High performance/quality expectations		√		
Lack of adequate designs before contract award		√	√	√
Use of line diagram for highway construction projects				√
Underestimation of quantities in BOQ.				√
Inadequate contingencis				√
Inadequate Contingency				
Allowance in BOQ				
Fluctuations				

2.6 Effects of Cost Overruns

Costs are considered to be the most crucial factor that contributes to the success of a project, and in reality are the only factors on which everything hinges, and are the most critical factor in the decision on whether a project commences or is shelved.

According to Amoa-Abban (2014) cost overruns have obvious effects for the key stakeholders in particular and the building construction in general. To the client, cost overruns implies added costs high over and above those initially agreed upon at the pre-contract phase, resulting in less returns on investment. To the end user, the added costs are passed on as higher rental or lease costs. To the professionals, cost overruns imply inability to deliver value for money and could well tarnish their reputations leading to loss of confidence reposed in them by clients. To the contractor, it implies

loss of profit for non-completion and defamation that could jeopardize his/her chances of winning future contracts, if at fault. To the industry as a whole, cost overruns could bring about project abandonment and a drop in building activities, bad reputation and inability to secure project finance or secure projects at higher costs due to added risks (Raftery, 1994; Mbachu & Nkado, 2004). All these consequences undermine the viability and sustainability of the building construction industry.

2.7 Implementation of Cost Control

Oosthuizen et al. (1998 as cited in Dibonwa, 2008) describe project cost control as a process of gathering, analysing, comparing and monitoring the costs of a project and reporting the results continuously during the development cycle of a project. Keong (2010) in turn elaborated on the fact that cost control requires searching out the "whys" of both positive and negative variances. Cost control must be thoroughly integrated with the other control processes: scope change control, schedule control and quality control. The control system for construction costs should include the purposes in the following terms (Keong, 2010):

- To provide immediate warning of uneconomic operations, in the short and long term.
- To provide the relevant feedback, to the estimator who is responsible for establishing the standards in the past and future, giving carefully qualified and detailed information, concerning all the conditions under which the work has been carried out,.
- To provide data to assist in the valuation of those variations that will arise during the course of the work.
- To promote cost consciousness and summaries of progress.

- Performing an adequate constructability review to minimise unexpected costs.
- Establishing a construction cost cash flow plan.
- Monitoring cost performance to detect and understand variances from plan.
- Ensuring that all appropriate changes are accurately recorded in the cost baseline.
- Preventing incorrect, inappropriate, or unauthorised changes from being included in the cost baseline.
- Informing appropriate stakeholders of authorised changes.
- Acting to bring expected costs within accepted limits.

2.8Contingency Budget Provisions

Cantarelliet al. *(*2012), describe a contingency as an allowance that a cost estimator makes in order to allow for unforeseen costs or to allow for things that may go wrong. Furthermore, they point out that cost contingency reserves are required and need to be budgeted for. According to Dibonwa (2008), the use of budgetary provisions to cover cost escalations, price fluctuations and inflation have become a common practice. These have also received sharp criticism from the unwilling-to-spend clients, resulting in excessive costs due to limited budget provisions. However, project managers should base their cost proposals on precise measurements of a degree of risk and uncertainty (Dibonwa, 2008).

Generally, projects with a high-risk profile will typically have a large contingency budget, although the amount of contingency allocated in a project budget is a function of the risks identified in the risk analysis process, contingency is typically managed as one line item in the project budget. In some projects, contingency budget is allocated

to the items in the budget that have high risk rather than developing one line item in the budget for contingencies. According to Figueiredo and Kitson (2009), this approach allows the project team to track the use of contingency against the risk plan, also allocates the responsibility to manage the risk budget to the managers responsible for those line items. Most project managers, especially on more complex projects, will manage contingency funds at the project level, with approval of the project manager required before contingency funds can be used.

In construction, Smith and Bohn (1999), asserted that contingency may be conceptualized as an estimated value of the risks which are not covered by contract terms or insurance but may be encountered during the project's implementation. In studies such as Smith and Bohn (1999), and Ghahramanzadeh (2013), it is emphasized that a fixed value of five to ten percent of total costs is often added to project cost, as the contingency cost. However, given the complicated nature of construction projects, the common traditional practice of allocation of a fixed percentage (5% to 15%) of the estimated budget or the contract value as the contingency may not be appropriate (Hillson & Murray-Webster, 2004). Moreover, Ranasinghe (1994) mentions that factors, such as the attitude of involved people towards risk (risk averse, risk neutral, risk taking), the expected return, the scope of the project, the type of contract chosen for the project, and the economic situation of the country in which the project is taking place, conditions the contingencies of risks. Figueiredo and Kitson (2009), therefore, advise that contingency estimation should be considered as one part of the risk management process and the contingency cost should be large enough to cover the impacts of cost risks, but not to exceed the needs of the project.

2.9 Critical Success Factors that can Prevent Cost Overruns

Critical Success Factors: are those factors that determine the success of the achievement of project objectives with respect to Budget, quality and schedule (Iyer & Jha, 2005; Arcila, 2012).

CSFs that influence cost performance: are those factors that have a direct impact on cost performance and can prevent cost overruns. Impliedly, the presence of these factors in the planning and execution of the projects improve the cost performance (Chua, et al. (1999).

Good cost performance project: Project in which the cost overrun of the project does not exceed 10 percent of the initial budget (Arcila, 2012).

According to Chua, et al. (1999) the allocation of resources of time, manpower and money in a project, can be facilitated by the identification of critical success factors. For this reason, the authors carried out a study to identify the critical success factors (CSF's) for construction projects and attempted to understand if these CSFs change for three different project objectives. In this case, the authors considered that the three main objectives were: budget, schedule and quality. The authors revealed that Adequacy of plans and specifications, Constructability, Economic risks, Realistic obligations/clear objectives, Project manager competency, Adequacy of funding, Budget updates, Project manager commitment and involvement, Contractual motivation/incentives, Risk identification and allocation as the top ten critical success factors that can prevent cost overrun.

Kog and Loh (2012), carried out a research in many different countries: United Kingdom, Australia, Singapore, Malaysia, Hong Kong, Vietnam, Indonesia, Myanmar, China, India, Maldives and Seychelles. The authors indicated that the ten CSFs for the overall performance, which were mostly agreed on were: Constructability, Economic risks, Adequacy of plans and specifications, Project manager competency, Realistic obligations, Adequacy of funding, Budget updates, Pioneering status, Project manager commitment and involvement, Contractual motivation/incentives, Construction control meetings, Technical approval authorities in order of significance.

Hwang and Lim (2012) carried out a survey questionnaire with the main aim of determining the CSFs of a construction project in Singapore. The authors indicated that Adequacy of funding, Adequacy of plans and specifications, Adequate planning and control techniques, Budget updates, Constructability, Contractual motivation/ incentives, Economic risks, Owner's involvement and frequent feedback, Owner's commitment to established schedules and budget were the most critical success factors that can help prevent cost overruns; in order of significance.

Arcila (2012) postulated that:

- Project manager competency,
- Contractor's competency,
- Client commitment to getting the job done,
- Good relationship between project parties ,
- Accuracy of plans and initial information,
- Adequate specifications ,
- Early involvement of the contractor,

- Accurate selection of form of contract,
- Client's involvement and feedback,
- Availability of funding,
- Initial identification of all the risks,
- Architect's competencies are CSFs that influence cost performance in construction projects in the UK.

Table 2.3: Comparison of the CSFs identified by Hwang and Lim (2012), Chua, et al (1999), Kog and Loh (2012), Arcila (2012) [Created by the author]

Factors	Hwang and Lim (2012)	Chua, et al (1999)	Kog and Loh (2012)	Arcila (2012)
1. Adequate of funding	√	√	√	
2. Adequate of plans and specifications	√	√	√	
3. Adequate planning and control techniques	√			
4. Budget updates	√	√	√	
5. Constructability of the project	√	√	√	
6. Contractual motivation/incentives		√		
7. Economic risk	√	√	√	
8. Client involvement and frequent feedback	√			
9. Owner's commitment to established schedules and budget				√
10. PM commitment and involvement		√	√	
11. PM competency/experience		√	√	√
12. Realistic obligations/clear objectives	√	√	√	
13. Risk identification and management	√	√	√	
14. Pioneering status			√	
15. contractor's competency				√
16. good relations between project parties			‘	√
17. Accuracy of plans and initial information.				√
18. Early involvement of the contractor				√
19. Initial identification of all the risks				√
20. Architects competency.				√

2.10: Conceptual Framework and Hypotheses

Independent Variables

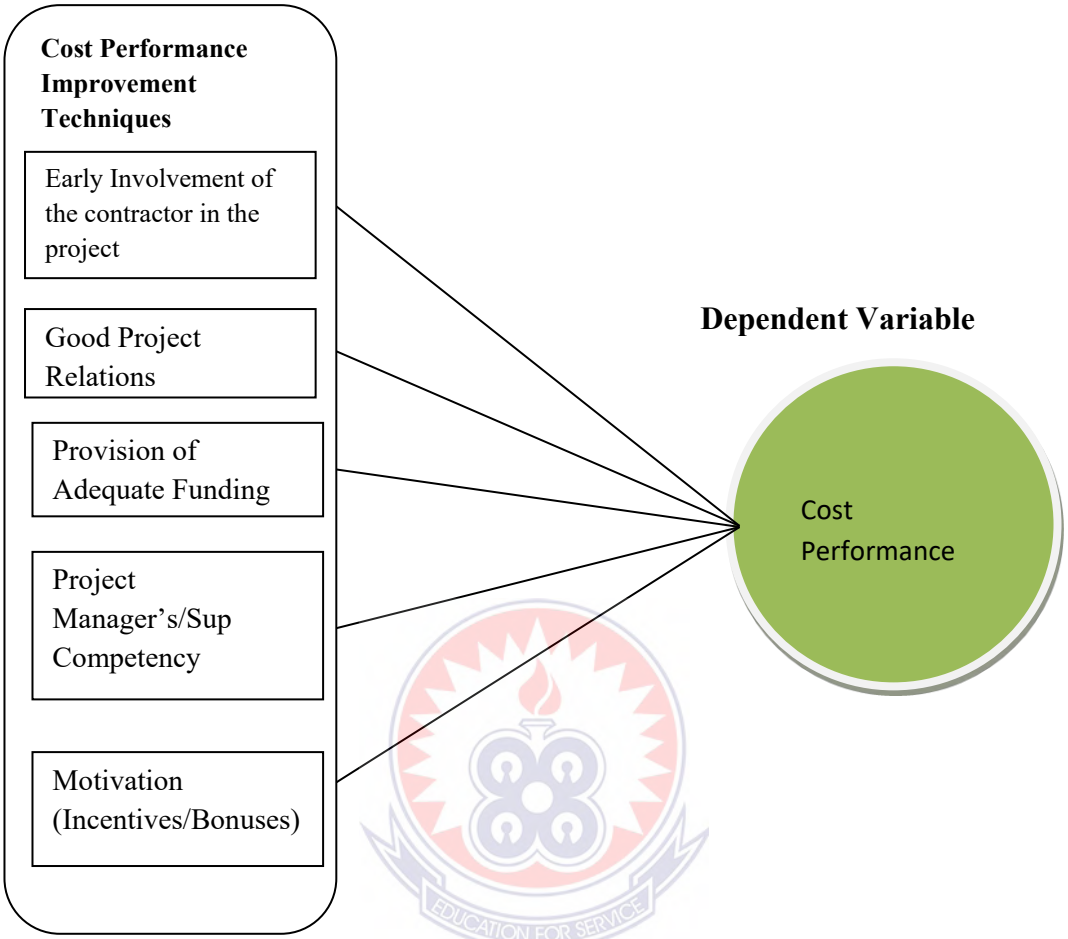

Figure 2.1:Conceptual framework

2.11 Hypotheses

The following hypotheses will guide the study;

H1. Early involvement of contractors improves cost performance (Arcila, 2012; Hwang & Lim, 2012; Koh, 2012)

H2. Good project relations improves cost performance (Arcila, 2012; Hwang & Lim, 2012; Zaghlloul & Hartman, 2003)

H3. Provision of adequate funding improves cost performance (Mccord, 2010; Arcila, 2012; Hwang & Lim, 2012; Koh, 2012)

H4. Project Manager's competency improves cost performance (Chua et al., 1999; Koh, 2012).

H5. Motivation (Incentives/Bonuses) of workmen improves cost performance (Chua et al., 1999; Arcila, 2012).

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter presents the various methods and techniques used to collect and analyze the data collected for the study. Consequently, this section provides information such as the research design, targeted population, sample techniques, sample frame, sample size determination, sample size, sources of data, and method of data collection. It also examines the questionnaire design, validity and reliability of the instrument that was used to collect data for the study and how the data was analysed.

3.1 The Research Design

According to Naoum (2007), if a research is to be conducted in an efficient manner and make the best of opportunities and resources available, it must be organized. Again, if it is to provide a coherent and logical route to a reliable outcome, it must be conducted systematically using appropriate methods to collect and analyze the data. Research design can be defined as the way in which the research objectives can be questioned (Naoum, 2007). There are two types of research strategies, namely, 'quantitative research' and 'qualitative research'. Deciding on which type of research to follow, depends on the purpose of the study and the type and availability of the information which is required.

Quantitative research involves numbers, graphs and charts. Popular quantitative methods of data collection and analysis include correlation analysis, regression analysis, mean, mode and median and others. The most popular qualitative methods of data collection and analysis in business studies are interviews, focus groups, observation, case studies, games and role playing (Saunders et al. 2007). Holten and

Burnett (1997), also indicated that qualitative research is concerned with the quality and texture of experience rather than the identification of cause-effect relationship. It does not look at variables (something that can change and affect result or change quantity) but interested in the meaning attributed to events by research participants themselves. Quantitative research is 'objective' in nature and is an inquiry into a social or human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers, and analyzed with statistical procedures, in order to determine whether the hypothesis or the theory hold true (Naoum, 2007). On the other hand, Fraenkel and Wallen (2000), point out that quantitative researches are keen to say why things are the way they are. They are likely to want to explain things which mean examining its causes. In quantitative approach, the use of inferential statistics as techniques for the sample data to make statements about population that the sample was drawn from requires the use of probability sampling.

Mahamid and Dmaidi (2013) in their study "Risks Leading to Cost Overrun in Building Construction from Consultants Perspective" used quantitative-survey approach in their study. Apolot et al. (2011), in their investigation into "Causes of Delay and Cost overrun in Uganda's Public Sector Construction Projects" and Frimpong et al. (2003), in their study "Causes of Delay and Cost Overrun in Construction of Ground Water Project in Ghana" also adopted the questionnaire survey method in their study. This study also adopted a quantitative approach. The views from Ghanaian building contractors were collected via a questionnaire survey.

This strategy was adopted in this research due to the fact that quantitative research follows a deductive approach in relation to theory and is concerned with the design

measurement and sampling (Naoum, 2002). The strategy employs the use of statistical techniques to identify facts and casual relationships. Quantitative research is also objective in nature (Naoum, 2002). Hard and reliable data are often collected in quantitative research and, therefore, emphasizes on quantification. Results can be generalized to a larger population within acceptable error limits.

A survey study was deemed appropriate for this research for three reasons:

- Survey research involved data collection from contractors, generalizing the result of study to predict the attitude of the population of interest;
- The survey questionnaire was structured to elicit information from the population of interest in a systematic and unbiased manner; and
- They permitted statistical analysis of data and generalization to a larger population, which made them suitable to construction management research (Amoako, 2011).

To add to the above reasons, Naoum (2007), stressed on two circumstances under which quantitative research is selected for this study;

- When you want to find facts about a concept, a question or an attribute.
- When you want to collect factual evidence and study the relationship between these facts in order to test a particular theory or hypothesis.

3.2. Study Population

Given that the study sought the perspectives of construction contractors on cost-related issues in Ghana's construction industry, it was necessary to identify and target a group of construction contractors from different firms and different parts of the country. This resulted in targeting members of the Association of Building and Civil Engineering Contractors (ABCECG), which has memberships from different

construction firms across the country and also serves as a merging point of construction contractors from different firms. The target population covered registered members of ABCECG in the Ashanti Region, and Greater Accra Regions of Ghana. These two regions were purposively sampled for the study because they are the major regions in Ghana where contractors and construction activities are highly concentrated (Ankomah, Boakye & Fugar, 2010).

3.3. Sample Size and Techniques

The sample size is a small group of people chosen from the targeted population and getting a sample in a research is very important. This is because all members of the study area cannot be studied. In research where the population is large you cannot study everyone everywhere, because of this a sample was selected from the two regions in Ghana (Greater Accra and Ashanti) where the registered contractors and construction activities are highly concentrated for the study. Greater Accra has a membership of (300), while Ashanti region has (150) given a total membership of 450 for the two regions (ABCECG, 2016). According to Krejcie and Morgan's (1970) sample size estimation table, a sample of 277 is representative of a population of 450 (see Table 3.1). However, this estimate represents the minimum sample size required. In order to cater for non-response rate associated with postal questionnaires, all those with valid email addresses (380) were contacted.

Table 3.1: Details of Sample Population and Sample Size

Region	Membership	Sample
Ashanti	150	108
Greater Accra	300	169
Total	**450**	**277**

3.4 Instruments for Data Collection

Questionnaires were used to solicit primary data from the project managers, because the study assumes that these groups of people are literate and can therefore read, understand and also answer the items on the questionnaire accordingly. The questionnaire was divided into four sections. Section 1 covered the demographic profile of the respondents. Section 2 focused on analyzing the cost performance of construction firms on public sector projects. The factors that cause construction cost overrun was covered in the third section while the critical success factors for improving cost performance was the focus of fourth section of the questionnaire.

All the questionnaires were designed to be answered using a five-point likert scale with responses ranging from '1' to '5'.

In section C, the respondents were required to indicate the extent of influence of the 27 identified factors that cause cost overrun on public sector construction projects using the definitions:

1= Least influence, 2= Little influence, 3=Neutral, 4= Moderate influence, and 5= High influence. In section (D), the respondents were implored to respond to the 15 factors raised as critical success factors for improving cost performance in Ghana; using the definitions:

1= Not critical, 2= Least critical, 3=Neutral, 4= critical, and 5= Most critical.

3.5 Validity

According to Conca et al. (2004) validity is the degree to which a test or an instrument measures what it purposes to measure. In other words validity is the extent to which an instrument measures what it is supposed to measure. It also means that

the question of validity only applies to the conclusion or inference we make from what we observe. This is sometimes called face validity. Issues such as the length of the questionnaire, order of questionnaires and general state of the cluster are some of the factors that may affect the face validity of the questionnaire. To ensure that the instrument covered all the relevant areas of cost performance in construction projects and the whole proposed survey instrument was well worded and understood; thus, content validity, the questionnaire was sent to two lecturers well versed in construction management studies, and a project manager to check the comprehensiveness of the items under each construct. This helped to improve the content, eliminate ambiguity and ease understanding.

3.6 Pre-test

The instruments for the data collection were tested in one construction firm in the Ashanti Region. This was done to serve as the preliminary testing of the research questions for their ability to generate the needed responses for the study. The pre-test enabled the researcher to revise the instruments to achieve the reliability and validity standards required in scientific research.

3.7 Reliability

Reliability refers to the extent to which an instrument measures the same way each time it is used under the same conditions with the same subjects (Naoum, 2007). Pallant (2007) explains reliability to mean that scores from an instrument are stable and consistent, scores should nearly be the same when researchers administer the instrument multiple times and that scores need to be consistent.

Cronbach's Coefficient (α) was calculated to estimate the internal consistency reliability of the measurement scale (see Table 4.7). Cronbach's alpha is widely used in social science research to estimate the internal consistency of reliability of a measurement scale. All the cronbach's alpha values of the measurement used exceeded the cut-off threshold of 0.7 (Hair et al., 2003; Pallant, 2007).

3.8 Distribution of the Questionnaires and Collection

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

3.9 Method of Data Analysis

Completed questionnaires from the respondents firms were edited and coded appropriately to make effective meaning out of the data. Editing was done to correct errors, check for non-responses, accuracy and corrects answers. Coding was done to facilitate comprehensive quantitative analysis of the data. The data was analyzed and interpreted by using Statistical Package for Social Science (SPSS) version 16. In addition to descriptive statistics such as tables and charts, the following inferential statistical tools; Factor Analysis and Multiple Regression technique were employed (Amoah, Ahadzie & Dansoh, 2012, Amande et al., 2015).

3.9.1 Factor Analysis

Factor analysis is a method of quantitative multivariate analysis with the main aim of representing the interrelationships between a set of continuously measured variables (usually represented by their interrelationships) by a number of underlying linearly independent reference variables called factors (Akintoye, 2000; Hardcastle, et al 2002; Pallant, 2007; Guar & Guar, 2009). The method seeks to collapse various variables into a few dimensions of interrelated attributes called principal components. The Eigenvalue determines the principal components, which are orthogonally varimax, and are rotated to obtain more evenly distributed factor loadings within the components. The factor analytical approach was adopted to identify the critical factors affecting cost performance of the surveyed firms.

3.9.2 Multiple Linear Regression

Multiple linear regression was applied to find out the effect of relationship between the identified critical success factors and cost performance; to predict the relationship between the variables involved in the mediation.

3.10 Ethical issues

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

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF RESULTS

In this section the results of the empirical analysis are reported and presented. The presentation proceeds with an analysis of the descriptive statistics on the variables under consideration. The data is analyzed and interpreted by using Statistical Package for Social Science (SPSS) version16. In addition to descriptive statistics, Factor Analysis and Linear Multiple Regression Analysis were employed.

4.1 Response Rate

A total of 380 questionnaires were sent to surveyed contractors through their e-mail. A total of 206 questionnaires were received, resulting in 54 percent reply rate (see Table 4.1). However, a total of 12 invalid data received were discarded. Hence, the usable response rate was 194 (51 percent see Table 4.1). The reason to discard the data was incompleteness and invalid responses. This response rate is considered adequate as according to Imbeah (2012), Kheni and Ackon (2015), a response rate of 30 percent is good enough in construction studies in Ghana. A telephone survey of 20 non-respondents was conducted. These non-respondents were asked the questions from the questionnaire. No significant response bias was detected by using t- test.

It can be noted that the higher proportions of responding firms came from Ashanti region (67% representing 87 out of 130 questionnaires distributed). This can be explained by the more frequent contact and the intimate relationship with the majority of the respondents.

Table 4.1 Statistical Data of Questionnaires Sent and Received

Questionnaires	Accra	Ashanti	Total	Percentage
Total Questionnaire Sent	250	130	380	
Total Questionnaires Received	116	90	206	54%
Invalid Data	9 3	12		3%
Usable Data	**10787**	**194**		**51%**

4.2. Demographic Characteristics of the Respondents

The demographic characteristics of the respondents were established to know the nature of the respondents and their company characteristics as related to their gender, age, qualification, experience, position, number of health sector projects executed. The next subsections summarize the demographic characteristics of the developers.

4.2.1 Gender Distribution of Respondents

Table 4.2, indicates that out of the one hundred and ninety four (194) respondents, one hundred and eighty (180) representing 93 percent were male while fourteen (14) representing 7 percent were female. This result suggests that the construction industry in Ghana is male-dominated.

Table 4.2 Respondents based on Gender

Gender	Frequency	Percentage
Male	180	93%
Female	14	7%
Total	**194**	**100%**

4.2.2 Respondents' Professional Qualification

Figure 4.1 provides the professional qualification of the respondents. The results show that most of the respondents had Bachelors and HND level of education i.e. 65 percent and 23 percent respectively; a good number had CTC level of education i.e. 8 percent; whereas a small proportion of the respondents had Masters level of education

i.e. 4 percent. The data indicates that majority of the respondents (92 percent) possess higher level of education required of the industry; hence, had a better understanding of the questions and answered them accordingly.

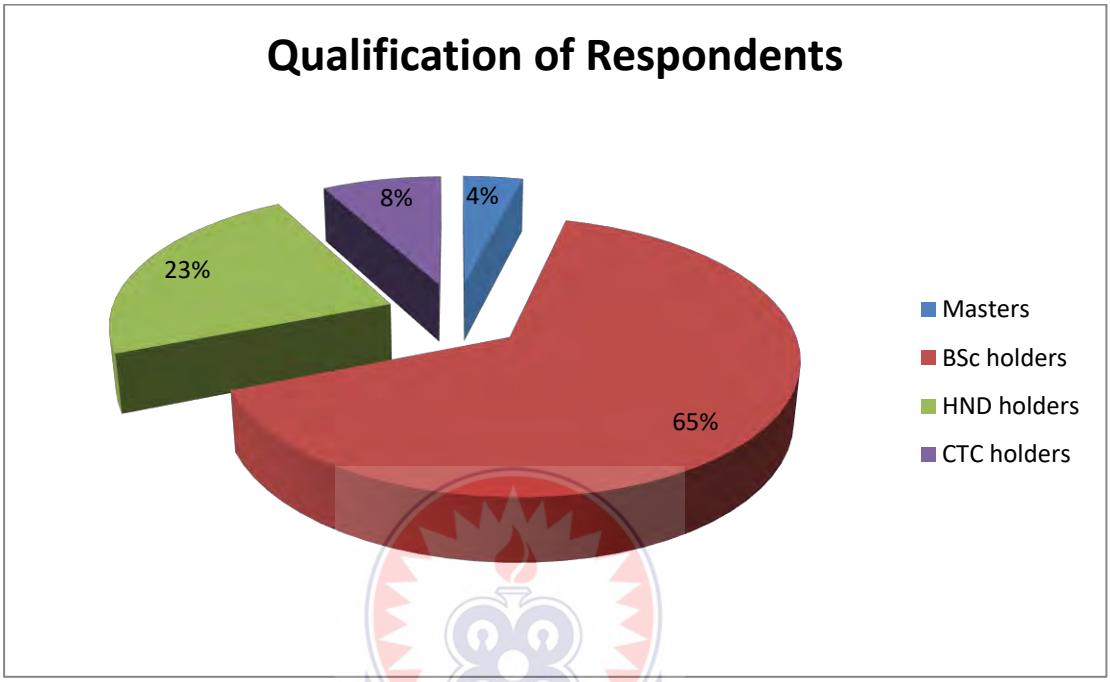

Figure 4.1: Professional Qualification of Respondents

4.2.3 Respondents' Working Experience

Table 4.3 shows that thirty seven (37) of the respondents accounting for 19 percent have less than 5years working experience; while one hundred and fifty seven (157) accounting for 81 percent have more than 5years working experience. This is an indicative that majority of the respondents have greater working experience which is a necessary requirement for the construction sector; and also have credible bases for the data elicited.

Table 4.3 Respondents' Working Experience

Experience	Frequency	Percentage
Under 5years	37	19%
5 – 10 years	107	55%
Above 10 years	50	26%
Total	**194**	**100%**

4.2.4 Respondents' Position

Figure 4.2 indicates that, thirty nine (39) of the respondents representing 20 percent were senior level managers. One hundred and fourteen (114) of the respondents representing 59 percent were mid-level managers; while forty one (41) representing 21 percent were Supervisors (Technical).

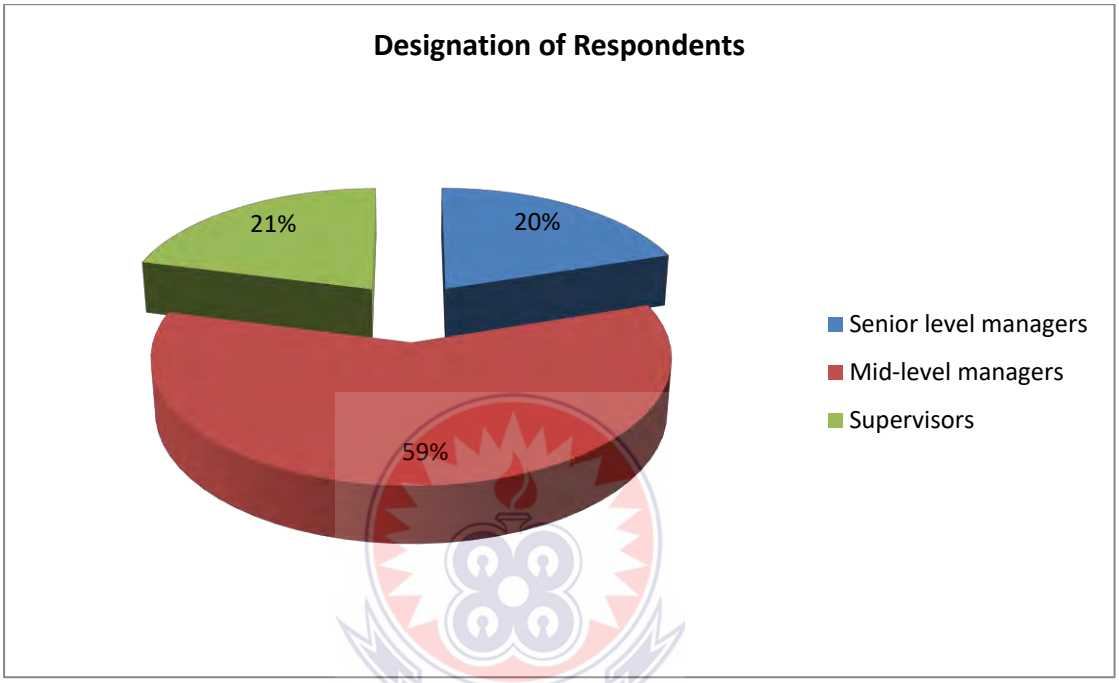

Figure 4.2: Designation of Respondents

4.2.5: Average Contingency Sum

Table 4.4 shows that majority of the respondents (i.e. 117 (60 percent)) allow a contingency sum above 20 percent. This may be attributable to the high inflation of construction materials and the instability of the Ghanaian currency in recent years.

Table 4.4: Average Contingency Sum

Contingency	Frequency	Percentage
Less 10 percent	27	14%
10-20 percent	50	26%
21-30 percent	76	39%
Above 30 percent	41	21%
Total	**194**	**100%**

4.3 Formats of Estimates for Construction Projects

Table 4.5 indicates that thirty one (31) of the respondents representing 16 percent make a one-off estimate of construction costs during tendering; while one hundred and sixty three (163) representing 84 percent reviewed periodically based on market trends. This may be attributable to the high inflation of construction materials and the instability of the Ghanaian currency in recent years.

Table 4.5 Formats of Estimates for Construction Projects

Format of Estimates	Frequency	Percentage
A one-off estimation of construction cost during tendering	31	16%
Reviewed periodically based on market trends	163	84%
Others, specify	---	---
Total	**194**	**100%**

4.4 Performance of the Construction Firms in terms of Project Cost

Table 4.6 indicates that majority of the respondents (i.e. 108 (55 percent)) usually have their actual project costs exceeding the budgeted cost more than 10 percent. This is an indicative that cost overrun is a problem in the construction industry.

Table 4.6: Performance of the Construction Firms in terms of Project Cost

Experience	Frequency	Percentage
Usually actual cost are below budgeted cost	15	8%
Usually within budgeted Costs	44	23%
Usually actual costs exceed budgeted costs < 10%	27	14%
Usually actual cost exceed the budgeted cost by10%-30%	88	45%
Usually actual cost exceed the budgeted cost by more than 30%	20	10%
Total	**194**	**100%**

4.5 Validity

The validity of the instrument; senior academicians were consulted to evaluate the contents of the research instrument. The instrument was later administered to some senior professionals in the construction industry whose response was able to help in shaping the instrument's face validity, relevance and clarity before being administered to the respondents.

4.6 Reliability Analysis

The scale of Cronbach's coefficient alpha value is the most widely used statistics to determine the reliability of a measurement; to ensure the statistical reliability of the measurement; the factors were tested for reliability, and the Cronbach alpha values are shown in Table 4.7. The overall value of Cronbach's alpha for factors influencing project cost overruns is 0.892. The overall value of Cronbach's alpha for the critical success factors for project cost performance is 0.876; while the alpha value of the cost performance' is 0.91. This means that all the cronbach's alpha values of the measurement used exceeded the cut-off threshold of 0.7 (Hair et al., 2003). Impliedly, all the measurement used has internal consistency.

Table 4.7 Reliability Analysis

Variables	Cronbach's Alpha	No. of items
Factors influencing project cost overruns	0.89	27
Critical Success Factors for project cost performance	0.87	18
Project Cost Performance	0.91	5

4.7 Critical Factors Influencing Project Cost Performance

Factor analysis was used to establish the underlying interrelations existing among the very many variables identified from literature and field experts. This makes it possible to reduce the variables to a more meaningful framework to support effective management and policy decisions (Amoah, Ahadzie & Dansoh, 2012).

4.7.1: Factor Analysis of Factors Influencing Cost Overruns

The following tests are required for the appropriateness of the factor analysis for the factor extraction, including the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, anti-image correlation, and Bartlett test of spericity. The results of these tests are shown in Table 4.8. The 27 factors were subjected to factor analysis, with

principal component analysis and varimax rotation. The first stage of the analysis is to determine the strength of the relationship among the variables, based on correlation coefficients of the variables. Bartlett's test of sphericity, which tests the hypothesis that the variables are collinear, was significant at the $p < 0.01$ level (see Table 4.8). The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy which measures the degree to which variables are measuring a common concept, achieved a high of 0.837. Furthermore, the communalities achieved were also 0.60 or higher (see Table 4.10). Hence, PCA was found to be a suitable data reduction technique. PCA was conducted and five (5) components were extracted using Kaiser's criterion, which retains only those components whose variance is greater than 1.0.

A Varimax rotation was applied to the components to ensure the components were uncorrelated. Observation of the correlation matrix of the critical factors influencing cost overruns indicate that they all have significant correlation at the 5% level, indicating that there would be no need to eliminate any of the variables for the principal component analysis. These five (5) components explained 79.568% of the variation in the data (see Table. 4.9 and Appendix D). Table 4.10 shows the extracted components and the variables most strongly correlated to each one. With respect to component 1, poor contract management emerged highest with a factor loading of (0.879). This is followed by frequent changes in scope (0.869); lack of coordination between project participants (0.862), poor project planning (0.855), lack of knowledge of the projects and it complexities (0.853), tight project schedule (0.789), incompetency of the project team (0.786), inadequate project supervision/monitoring (0.765), presence of unskilled labourers (0.759), slow decision making from the

owner or his representative (0.751), conflicts among project participants (0.743), as well as poor relationship between managers and labourers (0.730) follow in that order.

Delayed payment of completed works emerged highest in component 2 with a factor loading of (0.947). This is followed by high inflationary rate (0.931), high interest rate (0.885) while fluctuation of currency exchange rate (0.682) and rise in fuel prices (0.593) follow in that order. Inaccurate cost estimate emerged highest in component 3 with a factor loading of (0.797); this is followed by underpricing of tender due to competition (0.770) while inadequate contingency allowance in BOQ (0.701) and incomplete design information (0.673) follow in that order. Government policy emerged highest in component 4 with a factor loading of (0.748); this is followed by economic instability (0.623), excessive approval procedure (0.619) and fraudulent (corruption) practices (0.507). Escalation/Inflation of construction materials prices emerged highest in component 5 with a factor loading of (0.794); this was followed by increase of labour prices (0.755).

The initial eigenvalues (see Table 4.9) indicates that, if all the factors are ranked, factor 1 accounts for 49.74% of the variance, factor 2 accounts for 13.22% of the variance, factor 3 accounts for 7.38% of the variance, factor 4 accounts for 6.21% of the variance while factor 5 accounts for 4.01% of the variance. Together, the five identified critical factors causing cost overruns account for 79.57% of the variance.

Given that most of the variables in factor 1 are directly linked to managerial issues, hence, this factor is interpreted as managerial-related. A cursory look at factor 2 shows that the variables are linked to financing issues, hence, the researcher named it

Financing-related. Similarly, the variables in factor 3 are directly linked to cost estimating issues; therefore, this factor is labelled cost estimating-related. The variables in factor 4 are directly linked to political issues, the researcher labelled this component political-related. The variables in factor 5 are directly linked to market issues, the researcher labelled this component market-related. This output suggests that the factors causing project cost overrun in Ghana in the perspective of construction project managers unlock separately unto managerial-related issues, financing-related issues, cost estimating-related issues, political-related issues and market–related issues. From the factor analysis the potential causes of cost overruns in the opinion of the project managers (the variables that emerged highest in each component) are poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices.

Table 4.8: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.837
Bartlett's Test of Sphericity	Approx. Chi-Sre	4.2076E3
	Df	351
	Sig.	.000

Table 4.9: Total Variance Explained

Factors Influencing Cost Overruns	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	13.160	48.740	48.740	13.160	48.740	48.740	9.337	34.582	34.582
2	3.570	13.221	61.961	3.570	13.221	61.961	4.111	15.226	49.808
3	1.993	7.383	69.344	1.993	7.383	69.344	3.312	12.267	62.075
4	1.677	6.210	75.554	1.677	6.210	75.554	2.657	9.839	71.914
5	1.084	4.014	79.568	1.084	4.014	79.568	2.067	7.654	79.568
6	.874	3.238	82.806						
7	.708	2.621	85.427						
8	.570	2.113	87.540						
9	.473	1.751	89.291						
10	.451	1.671	90.962						
11	.396	1.467	92.429						
12	.348	1.290	93.719						
13	.290	1.076	94.795						
14	.260	.963	95.757						
15	.229	.847	96.604						
16	.180	.668	97.272						
17	.142	.526	97.798						
18	.120	.446	98.244						
19	.096	.356	98.601						
20	.086	.318	98.919						
21	.070	.261	99.180						
22	.061	.225	99.405						
23	.051	.188	99.593						
24	.039	.145	99.738						
25	.031	.115	99.853						
26	.027	.098	99.951						
27	.013	.049	100.000						

Extraction Method: Principal Component Analysis.

Table 4.10: Rotated Component Matrix[a]

Factors Influencing Cost Overrun	Communalities	Component 1	2	3	4	5
Poor Contract Management	0.904	**.879**	.116	.072	.055	.331
Frequent changes in scope	0.901	**.869**	.158	.191	.279	-.086
Lack of coordination	0.896	**.862**	-.042	.223	.300	.105
Poor project planning	0.832	**.855**	-.014	.221	.159	.161
Lack of knowledge of the projects and its complexities	0.827	**.853**	.115	.141	.251	.053
Tight project schedule	0.783	**.789**	.029	.317	.226	-.089
Incompetency of the project team	0.847	**.786**	.432	.006	.202	.032
Inadequate supervision/monitoring	0.821	**.765**	.156	.171	-.022	.425
Presence of unskilled labour	0.772	**.759**	-.026	.265	.203	.291
Slow decision making from the client or his representative	0.610	**.751**	.015	.183	-.025	.046
Conflicts among proj. participants	0.728	**.743**	.164	.014	.363	-.131
Rel. btn managers and labourers	0.858	**.730**	.209	.411	.118	.313
Delayed payment	0.929	.070	**.947**	.056	.094	.125
High inflationary rate	0.922	.050	**.931**	.101	.153	.135
High interest rate	0.848	-.005	**.885**	.183	.034	.173
Currency exchange rate	0.723	.167	**.682**	.439	.168	.099
Rise in fuel prices	0.896	.559	**.593**	.109	-.135	-.028
Inaccurate cost estimate	0.774	.291	.206	**.797**	-.047	.097
Under pricing due to competition	0.838	.166	.245	**.770**	.369	-.147
Inadequate contingency in BOQ	0.798	.266	.279	**.701**	.398	-.008
Incomplete design information	0.873	.601	-.035	**.673**	.224	.081
Government policy	0.846	.432	-.078	.120	**.748**	.280
Economic instability	0.879	.585	.247	.280	**.623**	-.102
Excessive approval procedures	0.631	.188	.222	.274	**.619**	.297
Fraudulent practices	0.616	.228	.167	.387	**.507**	.171
Escalation of const. materials prices	0.764	.046	.150	-.066	.317	**.794**
Increase of labour cost	0.680	.211	.246	.060	.034	**.755**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 8 iterations.

4.7.2 Factor Analysis of CSF for Project Cost Performance

Eighty six (86) of the respondents firms that indicated good average cost performance (cost performance with cost overrun less than 10 percent of the budgeted cost (Arcila, 2012), were selected for the third part of the analysis; in order to address objective two and three of the study. Similarly, the factor analytical approach was adopted to assess the most significant factors for the fifteen (15) critical success factors for construction project cost performance. The rotated component matrix is presented in Table 4.11. The correlation matrix of the 15 variables reveals that 84 of the 105 correlations (81 percent) are significant at the 0.01 level, thus ensuring that the data matrix has sufficient

correlations to justify the application of factor analysis (Hair et al., 2003). The value of the KMO statistic is 0.732, which according to Hair et al. (2003) is good for factor analysis. Bartlett's test of sphericity, which tests the hypothesis that the variables are collinear, was significant at the $p < 0.01$ level (see Table 4.11). The communalities achieved were also 0.60 or higher (see Table 4.13). In a nutshell, these tests show that factor analysis is appropriate for the factor extraction.

In Table 4.13, the rotated component matrix indicates that, the 15 variables could be the underlying themes of five main factors (using a cut-off point of 0.50). With respect to factor 1, early involvement of the contractor emerged highest with a factor loading of (0.862), followed by planning, scheduling of works and budgeting (0.753), initial identification of all risks (0.714), adequate specification (0.670) in that order. The combined effect of the above variables on project cost performance is 23.19%. (see Table 4.12 & Table 4.13). For factor 2, good project team relations emerged highest with a loading of (0.816), followed by effective interaction between project participants (0.779) and client involvement and commitment (0.668) in that order. The combined effect of the above variables on project cost performance is 16.17%. For factor 3, provision of adequate funding emerged highest with a loading of (0.926), followed by timely payment of work done (0.898). The combined effect of the above variables on project cost performance is 12.93%. For factor 4, project manager's capability emerged highest with a factor loading of (0.811), followed by Architect's competency (0.680), accuracy of plans (0.669) and accurate budgets (0.522) in that order. The combined effect of the above variables on project cost performance is 11.15%. For factor 5, provision of incentives/bonuses to employees emerged highest with a loading of (0.971), followed by adequate training of employees (0.969). The

combined effect of the above variables on project cost performance is 9.33%. Together, the five identified critical success factors account for 73.28% of the variance.

Given that most of the variables in factor 1 are directly linked to effective adequate planning, the researcher decided to name this factor as adequate planning related. The variables in factor 2 are directly linked to effective collaboration; hence, it is interpreted as collaboration-related. The variables in factor 3 are directly linked to financing; hence, this factor is interpreted as financing-related. The variables in factor 4 are directly linked to adequate project team capability; hence, it is interpreted as project team capability–related. A cursory look at factor 5 shows that the variables are directly gauged to motivation; hence, the researcher named it motivation–related. The results therefore reveal that the critical success factors for project cost performance in Ghana could be categorised into five (5) main themes; namely: adequate planning-related, effective collaboration-related, financing-related, project team capability-related and motivation-related.

Table 4.11: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.732
Bartlett's Test of Sphericity	Approx. Chi-Square	297.286
	Df	96
	Sig.	.000

Table 4.12: Total Variance Explained (CSF)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.478	23.190	23.190	3.478	23.190	23.190	2.475	16.499	16.499
2	2.503	16.690	39.880	2.503	16.690	39.880	2.252	15.012	31.511
3	1.939	12.926	52.806	1.939	12.926	52.806	2.139	14.262	45.773
4	1.672	11.146	63.952	1.672	11.146	63.952	2.110	14.067	59.840
5	1.399	9.325	73.277	1.399	9.325	73.277	2.015	13.436	73.277
6	.962	6.411	79.688						
7	.782	5.215	84.903						
8	.569	3.795	88.698						
9	.478	3.184	91.882						
10	.379	2.523	94.405						
11	.291	1.942	96.347						
12	.242	1.612	97.959						
13	.148	.988	98.947						
14	.100	.669	99.615						
15	.058	.385	100.000						

Extraction Method: Principal Component Analysis.

Table 4.13: Summary of Rotated Component Matrix(CSF)

Critical Success Factors	Component				
	1	2	3	4	5
Early involvement of the contractor	0.864	**.862**	.078	.132	.313	-.001
Planning, schedule of work and budgeting	0.740	**.753**	-.026	.100	-.324	-.239
Initial identification of all risks	0.604	**.714**	.049	.049	.181	-.083
Adequate specifications	0.786	**.670**	.469	.292	-.137	.118
Good project team relations	0.714	.214	**.816**	.028	.034	-.001
Effective interaction between project participants	0.654	-.045	**.779**	-.164	.002	.132
Client involvement and commitment	0.609	.048	**.668**	.382	.114	.025
Provision of adequate funding	0.881	.143	.027	**.926**	.003	-.047
Timely payment of work done	0.835	.166	.037	**.898**	.002	-.011
Proj. manager's competency	0.701	-.085	.167	-.047	**.811**	.069
Architect's competency	0.682	.288	-.165	.042	**.680**	.086
Accuracy of plans	0.737	.036	.479	-.215	**.669**	-.111
Accurate budgets	0.624	.019	-.072	.367	**.522**	-.112
Incentives/bonuses	0.956	-.061	.097	-.014	.023	**.971**
Training of employees	0.955	-.111	.036	-.055	-.009	**.969**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

4.7.3 Impact of the Critical Success Factors on Construction Project Cost Performance

The results of the principal component analysis indicated existence of relationship between the identified critical success factors and the project cost performance of public sector construction projects but did not indicate the contribution of the factors. To achieve this objective, Stepwise Multiple Regression technique was used to find out the effect of the relationship between the identified most critical factors and the project cost performance of the respondents (86 good cost performance firms) in the application of the factors; to predict the variables involved in the mediation.

4.7.4. Multiple Regression Analysis

The results of the multiple regression is shown in Table 4.14. Table 4.14 displays the results of the multiple linear regression between the identified success factors and project cost performance with standardized betas (β) and t – statistics (t) which are both indicative of the relative importance of each variable contained in the model. Table 4.14 revealed that the R^2 adjusted value was 0.854. This indicates that the five most critical success factors (early involvement of the contractor, Good contract relations, provision of adequate funding, Project manager's competence and provision of incentives/bonuses to the employees) together can explain 85.4 percent of the variation in cost performance of the respondents as a dependent variable. The F- ratio was 144.002 ($p < 0.01$). This indicates that the regression of project managers project cost performance on the variables assessed, expressed through the adjusted R- squared is statistically significant.

The beta coefficient, which is the standardized regression coefficient, is used as a direct comparison between coefficients as to their relative explanatory power of the

dependent variable. Early involvement of the contractor made the greatest impact on the project cost performance of public sector construction projects (dependent variable) with a beta coefficient of **0.317** ($p < 0.05$). The regression weight denotes that early involvement of the contractor in construction projects account for 31.7% variation in influencing the cost performance of public sector construction projects.

Provision of adequate funding made the second greatest influence on the cost performance of public sector construction projects with a beta coefficient of **0.275** ($p < 0.05$). The regression weight denotes that provision of adequate funding account for 27.5% variation in influencing the cost performance of public sector construction projects.

Good project team relations made the third largest impact on the cost performance of public sector construction projects with a beta coefficient of **0.272** ($p < 0.05$). The regression weight denotes that provision of good contract relations account for 27.2% variation in influencing the cost performance of public sector construction projects.

Use of competent manager made the fourth acceptable contribution to the cost performance of public sector construction projects with a beta coefficient of **0.154** ($p < 0.05$). The regression weight denotes that use of competent manager/supervisor account for 15.4% variation in influencing the cost performance of public sector construction projects.

Provision of incentives/bonuses to the employees made the fifth acceptable contribution to the cost performance of public sector construction projects with a beta

coefficient of **0.141** ($p < 0.05$). The regression weight denotes that use of competent manager/supervisor account for 14.1% variation in influencing the cost performance of public sector construction projects.

The integrity of the residual plot (fig.4.4) indicated less spread out or dispersed. This implies that the model is credible and can be used to measure construction project cost performance within the data range.

Table 4.14: Model: Summary of Multiple Regression Analysis between Most Critical Success factors and Cost Performance.

Dependent Variable	R	R-Square	Adjusted R Square	Standard Error
Cost Performance	0.927	0.860	**0.854**	1.187

Analysis of Variance

	Sum of squares	Df	Mean square	F	Significance
Regression	1013.839	1	202.768	**144.002**	**0.000**
Residual	169.747	85	1.408		
Total	1178.585	86			

Standard Coefficients

	Beta	T	Significance	Collinearity Statistics	
				Tolerance	VIF
EINVC	**0.317**	6.379	**0.000**	0.658	3.577
PAF	**0.275**	5.223	**0.000**	0.431	2.319
GCR	**0.272**	4.843	**0.000**	0.638	1.520
PMC	**0.154**	3.957	**0.000**	0.794	1.259
PI/B	**0.141**	2.227	**0.028**	0.300	3.334

EINVC= Early involvement of the contractor; AF= Provision of adequate funding; GCR = Good contract relations; PMC= Project manager's competence; PI/B=Provision of incentives/bonuses

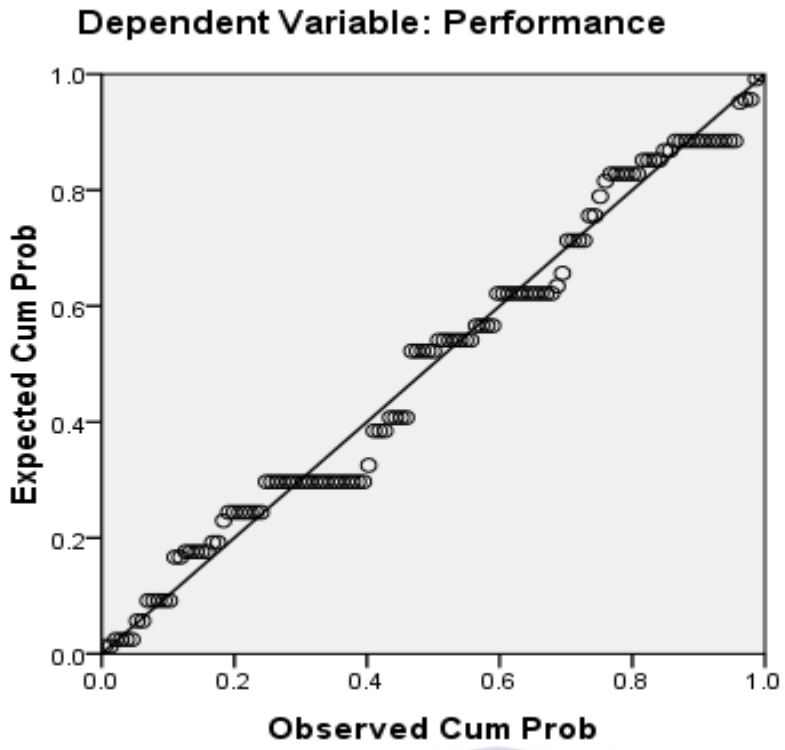

Figure 4.3: Normal P-P Plot of regression standardized residual

CHAPTER FIVE

DISCUSSION OF RESULTS OF THE STUDY

This chapter presents the discussion of the results of the study. It is organized into four sections. The results are discussed with regard to the objectives of the study and also in the context of the literature reviewed in chapter 2, to further explain the findings of the factors affecting cost performance in public sector construction projects, as perceived by construction project managers in Ghana; which is regarded to having relevance to other developing countries.

5.1 Cost Performance of the Respondents Firms

The results of the study revealed that majority of the respondents firms (108) representing 55% experience an average cost overrun exceeding 10 percent. The results further indicated that out of the 108 respondents with poor cost performance, 88 of them representing 45% of the total respondents experience an average cost overrun between 10%-30%; while the remaining 20 representing 10% experience an average cost overrun above 30%. This finding corroborates with (Avotos, 1983; Baloi &Price, 2003; Mahamid & Omaidi, 2013; Ofosu, 2014) assertion that cost overrun is a problem in the construction industry. This finding may be attributable to poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices.

5.2Critical Factors Influencing Cost overrun in Public Construction Project in Ghana

It is clear from the factor analysis that the underlying construct of the critical factors influencing cost overruns in public sector construction projects; in the perspective of

project managers, are directly linked to five (5) main constructs; namely: Managerial-related issues, Financing-related issues, Cost estimating-related, Political-related issues and market-related issues (see Table 4.10).

The study further revealed that the potential causes of cost overruns in the opinion of the project managers (the factors that emerged highest in each component) are poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices.

5.2.1 Managerial-Related Issues

The result of the study revealed that in the opinion of the respondents, managerial-related issues is the most critical factor causing cost overruns in public sector construction projects in Ghana. This implies that poor contract management, frequent changes in scope, lack of coordination, poor project planning, lack of knowledge of the projects and its complexities, tight project schedule, incompetency of the project team, Inadequate supervision/monitoring, presence of unskilled labour, slow decision making from the client or his representative, conflicts among project participants, and poor relationship between managers and labourers significantly cause project cost overruns in public sector construction projects.

This finding corroborates with similar studies in Ghana and other developing countries. For example, Frimpong et al. (2003) found that poor contractor management was the second most important causes of delay and cost overrun in the construction of groundwater projects in Ghana. Al-Juwairah (1997) concluded that poor contract management is the third most important causes of cost overruns in

construction project in Saudi-Arabia. Azhar et al. (2008) also found that poor project (site) management was the fifth major causes of cost overruns of construction projects in Pakistan. Omoregie and Radford (2006) in a similar study in Nigeria infrastructure project found that the third most important cause of cost overrun is poor contract management.

Poor contract management may be attributed to the way contracts are awarded in Ghana and most developing countries. Most cases, projects are awarded to the lowest bidder; some of the lowest bidders may lack management skills also less attention is paid to contractor's plan, cost control, overall site management, and resource allocation, ie, human, financial and material resources (Frimpong et al., 2003; Sambasivan & Soon, 2007) . Wahab (1997) and Frimpong et al. (2003) postulated that many contractors in developing countries are entrepreneurs who are in the business of making money at the expense of good management. They pay low wages, submit very low bids and have very little, if any, ability to plan and coordinate contracts.

Another area of great concern in this category is frequent changes in scope of the project. Change in scope may be due to incomplete designs, and inadequate information to clients leading to delay in taking decisions which leads to variations (Alinaitwe, 2008). This can be reduced when adequate time is devoted during pre-contract stage for proper designing and documentation and also adequate briefing to client before final design.

5.2.2 Financing-Related Issues

The result of the study revealed that in the opinion of the respondents; financing related issues is the second most important causes of cost overruns in public sector construction projects in Ghana. The result of the study show that delayed payment, high inflationary rate, high interest rate, fluctuation of currency exchange rate and rise in fuel prices ranked as the most financial risk indicators affecting construction project cost performance.

This finding also agrees with similar studies in Ghana and other developing countries. For example, Frimpong et al. (2003) found that financial problems are the main factors that cause delay and cost overruns in the construction of groundwater projects in Ghana. Amoa-Abban and Allotey (2014) concluded that delay or non-payment of certified certificates by the funding agency and limited cash flow of the client were among the causes of cost overruns in a case study of a government of Ghana building project in Accra. Apolot et al. (2013) found that delayed payment to contractors was the second most important causes of cost overruns in a study of Uganda public sector construction projects. Ijigah et al. (2013) concluded that financial risk is the most cost overrun risk in construction projects in Nigeria. Omoregie (2006) in a similar study in Nigeria infrastructure project found that the most important cause of cost overrun is financing and payment for completed work. Koushki et al. (2005) and Le-Hoai et al. (2008) indicated that financial problems were the main factors causing cost overrun in public construction projects in Kuwait and Vietnam respectively.

Like most developing countries, public sector projects in Ghana are financed either through domestic savings or foreign funding. Public sector construction projects funds

may be from capital allocation from Ministry of Work and/or foreign assistance which have been budgeted. However, there is delay in payment for the completed work due to bureaucracy in governments departments and lack of proper documentation, and at times deficiency in transparency (Frimpong et al. 2003; Apolot et al. 2013).

Amoa-Abban and Allotey (2014), postulated that in Ghana, most contractors are subjected to tremendous difficulties before they receive payment for work done. The long and complex bureaucratic processes involved in checks and re-checking of all certified certificates for completed projects by the various departments involved, in a bid to avoid any financial loss to the state tend to have a negative impact on the contractor's cash flow. In effect the contractor has no further option than to abandon the site and move in and out of offices in an attempt to get his certificate honoured. This ultimately has a negative effect on the completion time of the project. Failure to provide adequate funding resources to contractors for the job done will make it difficult for the contractors to meet project objectives. According to Apolot et al. (2013) delayed payment to contractors has knock on effects on many activities of the contractors, subcontractors and suppliers. Contractors tend to transfer the burden of accumulated interest to the client, hence causing cost overrun. Regular monthly payment to contractors for work done removed constraints which otherwise may have impeded project progress to cause delay and cost overruns.

Ghana inflation rate is high 17.3% compared to many developing countries like Nigeria, Uganda, Pakistan, Kuwait and South Africa with inflation index between 3.00-9.60 in 2015 (GSS, 2015). Also the government of Ghana has increased the pump prices of fuel by 24.3% which in no small way has increased inflation rate in

the country. The interest rate in Ghana also varies from (27% - 32%), which is high compare to other developing countries which makes borrowing for construction projects very difficult. It is therefore clear that the construction industry which invests mostly in long term investment is faced with a lot of financial challenges and this requires aids from government to formulate beneficial economic policies. This could be achieved by strengthening of the existing financial policies and regulatory framework. Also, price fluctuations and inflation may be reduced by saving the project funds in a more stable currency (Lukas, 2004).

5.2.3 Cost Estimating-Related Issues

The result of the study further revealed that in the opinion of the respondents, cost estimating-related issues is the third most significant causes of cost overruns in public construction projects in Ghana. This finding implies that inaccurate cost estimate, under-pricing due to competition, Inadequate contingency in BOQ and incomplete design information causes cost overruns in public construction projects.

This finding corroborates with similar studies in other developing countries. For example, Le-Hoai et al. (2008), ranked inaccurate estimation as the second most important factor causing cost overrun in construction projects in Vietnam. Omoregie (2006) in a similar study in Nigeria infrastructure project found that the fifth most important cause of cost overrun is poor cost estimate. Azhar et al. (2008), and Al-Juwait (1997), found incorrect method of cost estimation as one of the most important causes of cost overruns of construction projects in Pakistan and Saudi-Arabia respectively. It is also consistent with Flyvbjerg et al. (2003), Zou et al. (2006), and King (2012) findings. According to Zou et al. (2006), cost overrun is attributable to

imperfect estimation techniques and lack of data at the early stages of the project. In other words cost overruns are due to 'genuine' mistakes on the part of government officials. Inaccurate estimation of a project cost can be very expensive to the client.

Poor estimation of the construction cost may also be attributed to construction cost under-estimation. According to Amoa-Abban and Allotey (2014), in other to get the project approved for construction, some parties to the contract deliberately underestimate the cost of the project only to be faced with the actual costs as construction proceeds. This negative practice affects the project cost.

Another important factor in this category is inadequate contingency allowance in the BOQ. A contingency can be defined as a reserve amount of money or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization (Ofosu, 2014). It is important for project stakeholders to note that not all risks can be avoided or fully mitigated; therefore if an owner accepts a risk, it is prudent to maintain adequate contingency in case the risk occurs. Likewise, the contractor must reserve adequate contingency for risks that have been allocated to its organization in the contract. A consistent mistake is that adjustment for myriad factors are often not made (Bill et al., 2006).

Additionally, when enough feasibility studies are not conducted and all items of work not fully priced in the Bills of Quantities (BOQ) before works commences, the actual costs of these items of work are determined during construction. These costs which are usually rather higher than the provisional estimates allowed in the BOQ are added to the tender price thus high cost overruns. The implication of this finding is that

project stakeholders may hire an expert to review the technical plans or the cost estimate on a project to increase the confidence in that plan and reduce the project estimate risk (Davis & Hobday, 2008).

5.2.4 Political-Related Issues

The result of the study further revealed that in the opinion of the respondents, political-related issues is the fourth most significant causes of cost overruns in public sector construction projects in Ghana. This finding implies that weak government policy, economic instability, excessive approval procedures and fraudulent (corrupt) practices significantly cause cost overrun in public sector construction projects. This finding is consistent with similar studies in Ghana and other developing countries (Ijigah et al., 2013; Azhar et al., 2008; Al-Juwairah, 1997; Al-Najjar, 2008; Tipli & IIyasu, 2014).

In Ghana, if the government/party changes, the policy will therefore change and many of the construction projects will be abandoned. Abandonment of project by government is always present in most developing economies; especially in Africa (Ijigah et al., 2013). Also some of the government officers deliberately delay the approval of interim valuation by the contractors to delay projects that are not beneficial to them (Ijigah et al., 2013). Continuation of policies and projects, of past government and transparency in the award of construction contracts should be encouraged in the construction industry.

Although, the country has signed a three- year aid deal with the IMF to help fix its economic problems, and increase credibility among investors, yet the economy is

unstable. A more stability in the exchange rate is required to lower the import prices and the production cost of building materials. This requires strengthening the existing financial policies and regulatory framework. Also, in procurement of a project, segregation of duties and multiple signatories to expenditures will reduce the risk of embezzlement (Mumtaz et al., 2011).

5.2.5 Market-Related Issues

The result of the study revealed that in the opinion of the respondents, market-related issues is the fifth most significant cause of cost overruns in public sector construction projects in Ghana. This finding implies that escalation/inflation of construction materials prices and increase of labour cost significantly cause cost overrun in public sector construction projects. This finding also agrees with similar studies in Ghana and other developing countries (Frimpong et al., 2003; Ijigah et al., 2013; Tipli & Ilyasu, 2014; Azhar et al., 2008; Al-Juwairah, 1997; Al-Najjar, 2008). For example, Frimpong et al. (2003), found that escalation of material prices was the fifth most important factors that cause delay and cost overruns in the construction of groundwater projects in Ghana.

The escalation of material prices may be attributable, principally to the high and unstable inflationary trend in Ghana. According to Ghana Statistical Service (2015), the inflation rate in Ghana averaged 17.12% from 1998 – 2015. GSS further indicated that the inflation rate has been in the upward trend for the last 3 years due to demand exceeding supply, which creates scarcity of goods and fiscal crises which has led to a sharp drop in the Cedi against the US dollar raising import prices. It is also evident in the GSS report that the upward pressure on materials is partly fuelled by frequent rise

in utility prices and transport fares as a result of frequent fuel increases. These unpredictable inflationary trends are readily observed in many developing countries and may have aided inaccurate projection of construction costs in such areas (Ijigah, 2013).

It is estimated by Achuenu and Ujene (2006), that Material constitutes (42% and 79%) of total cost of projects for private and public projects respectively. This implies that any increase in price of material, shortage or wastage of material have a high impact on the construction cost. The implication of this finding is that the government should vigorously regulate and monitor the prices of essential construction materials like (cement) and make it available and affordable to the users. This can be done by creating enabling environment conducive for the producers of building materials. Also, there should be adequate contingency allowance in order to cover increase in material cost due to inflation.

5.2 Critical Success Factors for Construction Project Cost Performance .

It is evident from the factor analysis that the underlying construct of the critical success factors for public construction project cost performance in the perspectives of project managers are directly linked to five (5) main constructs; namely: adequate planning-related, effective collaboration-related, financing-related, adequate project team capability-related and motivation-related.

5.3.1 Adequate Planning-Related

Adequate planning-related according to the opinion of the respondents should be the most critical success factor for public sector construction project with effect of

23.19% on construction project cost performance. This finding implies that early involvement of the contractor (especially at the designed phase of the project), planning/scheduling and budgeting, adequate specifications and initial identification of all the risks greatly improve construction project cost performance. This finding corroborates with various authors such as (Chua et al., 1999; Hwang & Lim, 2012; Arcila, 2012) assertion.

5.3.2 Effective Collaboration-Related

Effective collaboration-related in the opinion of the respondents should be the second most critical success factor for public sector construction project with effect of 16.17% on construction project cost performance. This finding implies that good project team relations, effective interaction between project participants and client involvement/ commitment significantly influence construction project cost performance. This finding is consistent with (Hwang & Lim, 2012; Arcila, 2012) findings.

5.2.3 Adequate Financing-Related

Adequate financing-related in the opinion of the respondents should be the third most critical success factor for public sector construction project with effect of 12.93% on construction project cost performance. This finding implies that provision of adequate funds and timely payment of work done influence construction project cost performance. This finding is in agreement with (Chua et al., 1999; Arcila, 2012; Hwang & Lim, 2012) findings.

5.3.4Adequate Project Team Capability-Related

Adequate project team capability-related in the opinion of the respondents should be the fourth most critical success factor for public sector construction project with effect of 11.15% on construction project cost performance. This implies that using competent project managers/supervisors or experts, competent Architects, accuracy of plans/initial information and accurate budgets influence construction project cost performance. This finding is also in agreement with (Chua et al., 1999; Davis & Hobday, 2008; Arcila, 2012) findings

5.2.5 Motivation-Related

Motivation-related in the opinion of the respondents should be the fifth most critical success factor for public sector construction project with effect of 9.33% on construction project cost performance. This finding implies that provision of incentives/ bonuses and training of employees influence construction project cost performance. This finding is in agreement with (Chua et al., 1999; Arcila, 2012; Mahamid & Dmaidi, 2013) assertions.

5.3 Impact of the Identified Most Critical Success Variables

The five most critical success variables (variables that emerged highest in each factor component) were further subjected to Multiple Regression Analysis in order to evaluate their effect on construction project cost performance and to know the variables involve in the mediation.

5.3.1 Early Involvement of the Contractor

The results revealed that early involvement of the contractor should be the most significant variable for public sector construction project. This implies that if the contractor works very closely with the client in the conception stage, to produce adequate plans, specifications, drawings and in getting a robust cost plans; it can help to close out all the risks which decrease the possibility of future problems (Arcila, 2012). The implication of this finding is that contractor, client and architects should work together in the pre-construction stage to get the design right, so that the construction starts with the right design information which will reduce client's changes during the execution of the project. All the plans, the initial information, designs, form of contract and ways of communication between parties should be sorted out before starting the construction. This will help reduce the possibility of future changes to the design and improve the control of the project. This assertion is in agreement with (Hwang & Lim, 2012; Arcila, 2012) findings.

5.3.2 Provision of Adequate Funds

The result of the study also indicated that provision of adequate funds should be the second most significant variable for public sector construction projects. This means that provision of adequate funds has significant influence on cost performance of public sector construction projects. This implies that client or funding agency should ensure that adequate funds and other sources of funds are available before construction work starts. This will ensure that, contractors are paid according to the contract agreement. Contractors must also make sure they have a sound financial backing. Provision of adequate funds will ensure timely payment to labourers. Timely payment undoubtedly, motivates the project participants to work hard to enhance the success of the project.

In Ghana most labourers avoid working for contractors with poor payment record. A delay payment often leads to adversarial relationship with the client/contractor and consequently affects the progress and the cost performance of the project (Mccord, 2010). This assertion is in agreement with (Mccord, 2010; Hwang & Lim, 2012; Arcila, 2012) findings.

5.3.3 Good Project Team Relations

The result of the study revealed that in the opinion of the respondents the third most significant success variable for public sector construction projects should be good contract relations. This implies that good project team relations effort of project stakeholders improves construction project cost performance. According to and Arcila (2012) good project team relations promotes teamwork, effective communication between project parties and also helps to smoothly run the planning and execution stages of the project; avoids conflict between parties and consequently, helps improve the cost performance of the project. This relationship is often built on trust and is more strengthened if the project team had worked together in past projects (Zaghloul & Hartman, 2003; Arcila, 2012). The implication of this finding is that there should be good project team relations with the entire project team. This assertion is in agreement with (Zaghloul & Hartman, 2003; Lyons & Skitmore, 2004; Hwang & Lim, 2012; Arcila, 2012) findings.

5.3.4 Competent Manager/Supervisor

The result of the study revealed that in the opinion of the respondents the use of competent manager/supervisor should be the fourth most significant success variable for public sector construction projects. This means that the use of efficient

manager/supervisor effort of contractors influence project cost performance. The implication of this finding is that the selection of a manager/supervisor should be based on expertise, experiential knowledge, and practical and leadership skills; not merely on the basis of fraternal acquaintances. This finding is in agreement with (Chua et al., 1999; Kog, 2012) findings.

5.3.5 Provision of Incentives/Bonuses

The result of the study further revealed that in the opinion of the respondents the fifth most significant success variable for public sector construction projects is provision of incentives/bonuses. Impliedly, provision of incentives/bonuses to contractors and employees of the project significantly improve the cost performance of the construction project. The practical implication of this finding is that contract should include clauses of incentives/bonuses for quality and early completion this will motivate the contractor and the project team and avoid cost overrun due to delay or rework. This assertion is also in agreement with (Chua et al., 1999; Arcila, 2012) findings.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary, conclusion and recommendations of the study. The first section presents the summary of the study; the second section presents the conclusion of the study based on the study's findings followed by sections that present the recommendation for improving the cost performance of public sector construction projects in Ghana, and recommendations for future research.

6.1 Summary of the Findings of the Study

Over the years, there have been improvements in the management of construction projects; however, globally, the problem of cost overruns is still a critical issue in the construction industry especially in the developing economies of which Ghana is no exception. This study attempted to identify the main causes of cost overruns in construction projects, in Ghana, and the Critical Factors (CFs) that can help prevent these causes.The study adopted a quantitative structured questionnaire survey approach. Using empirical data obtained from administration of questionnaires to project managers in Ghana; the factors affecting cost performance of public sector construction projects were analyzed using factor analysis and multiple regression technique.

The following were the major findings from the empirical data:

- The study revealed that most public sector construction projects in Ghana are characterized by overruns in cost.
- The findings revealed that the underlying construct of the numerous critical factors of cost overruns in the perspectives of construction project managers are directly linked to five (5) main themes; managerial-related issues,

financing-related issues, cost estimate-related issues, political-related issues, and market-related issues.

- The main causes of cost overruns associated with managerial-related issues included poor contract management, frequent changes in scope, lack of coordination between construction participants, poor project planning and lack of knowledge of the projects and its complexities.
- The financing-related issues are delayed payment of the completed work, high inflationary rate, high interest rate, fluctuation of currency exchange rate and rise in fuel prices.
- The cost estimating-related issues included inaccurate cost estimate, under-pricing of tender due to competition, inadequate contingency allowance in BOQ, and incomplete design information when estimating.
- The political-related issues are weak government policy, economic instability, excessive approval procedures and fraudulent practices,
- The market-related issues included escalation/inflation of cost of materials prices and increase of labour cost.
- The study further revealed that the potential causes of cost overruns in the opinion of the project managers (the factors that emerged highest in each component) are poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices.
- The study also indicated that the critical success factors for public sector construction projects are directly linked to five themes: namely; adequate planning-related, financing-related, effective collaboration-related, adequate project team capability-related, and motivation-related.

- The results further revealed that the most significant success factors for public sector construction projects are early involvement of the contractor, provision of adequate funds, good project team relations, use of competent managers/ supervisors, and provision of incentives/bonuses.

6.2 Conclusion

- In developing countries like Ghana, financial resources are so scarce that issues related to cost are very sensitive. The identification of the causes of cost overruns in construction projects is a pre-condition to minimize or avoid it. Clients, consultants, main contractors and project managers should be more concerned and expedite action to address the problems of poor contract management, delayed payment, inaccurate cost estimate, weak government policy, and escalation of materials prices.

- Project practitioners should be more concerned about early involvement of the contractor, provision of adequate funds, good project team relations, use of competent managers/supervisors, and provision of incentives/bonuses to project participants in order to minimize or avoid cost overruns.

6.3 Recommendations

Based on the analysis of the results and findings of the study, the following recommendations are made towards improving the project cost performance in Ghana. These recommendations could form the basis for interventions designed to improve cost performance of public sector construction project.

- Training courses and workshops should be conducted to improve managerial skills of project participants
- Change orders and design errors should be avoided as much as possible. These factors can be costly and time consuming if the work has been done. Work sequences can also be affected due to rework. This problem could be reduced by integration of contractors at the conception phase of the project;
- The client or funding agency should ensure that adequate funds and other sources of funds are available before construction work starts. This will ensure that, contractors are paid according to the contract agreement;
- There should be more communication and coordination between project participants during all project phases;
- The selection of a contractor should be based on expertise, financial standing, capacity and experience; and not strongly on low bidding as well as fraternal acquaintances.
- General contractors should make it a priority to employ and retain qualified, experienced and competent project managers to efficiently manage their projects site to enhance their project delivery; to avoid or minimize their cost overrun.
- Government must help stabilize the cedi against the major trading currencies. This will eventually help keep prices of materials and labour stable. Also, price fluctuations and inflation may be reduced by saving the project funds in a more stable currency.
- Contract should include clauses of incentives/bonuses for quality and early completion this will motivate the contractor and the project team and avoid cost overrun.

6.4 Future Research

Further similar studies are recommended to be conducted in other developing countries. Also the current research study was limited to the perception of only project managers in the construction industry in Ghana. Future study could be done using other construction practitioners (i.e.: Consultants) and a larger sampling size.

REFERENCES

Abdullah, M.R., Abdul, R.I. & Azis, A.A.A. (2010). Causes of delay in MARA management procurement construction projects, *Journal of Surveying, Construction & Property,* 1, (1).

Abdul-Rahman H, Takim R, & Wong, S. M. (2009). Financial-related causes contributing to project delays, *Journal of Retail & Leisure Property*, 8, (3), 225–238.

Abdul-Rahman, H. Yahya, I.A., Berawi, M.A., & Wai Wah L. (2008). Conceptual delay mitigation model using a project learning approach in practice. *Construction Management and Economics*, 26, (1), 15-27

Abidin, I. & Trigunarsyah, B. (2008). *Knowledge-based material cost control for building construction project using Expert System Approach. In: Haigh, Richard and Amaratunga, Dilanthi, (Eds)*. Proceedings CIB International Conference on Building Education and Research 2008, pages pp.1969-1978, Heritance Kandalama, Sri Lanka.

Ahmed, S., Azhar, S., Kappagantula, P., & Gollapudi, D. (2003). *Delays in: A brief study of the Florida construction industry*. Proceeding of the 39th Annual Conference of the Associated Schools of Construction. Clemson, South Carolina: Clemson University, Miami, USA.

Akintoye, A. (2000). "Analysis of Factors Influencing Project Cost Estimating Practice". *Construction Management and Economics, 18*, 77-89, Taylor and Francis Ltd.

Akomah, B. B., Boakye, N. & Fugar, F. (2010). Safety on Ghanaian Construction Sites: The Role of the Employer and the Employee In: Laryea, S., Leiringer,

R. and Hughes, W. (Eds). *Proceedings West Africa Built Environment Research (WABER) Conference*, 477 – 487. Ghana: Accra.

Al-Gwaiz, A., Al Dihan, K., & Al Ankary, F. (2006). *CEM* 520 Construction contracting & administration, term project, The factors governing housing construction costs in Saudi Arabia. Unpublished

Ali, A. S., Kamaruzzaman, S. N. (2010). *Cost performance for building construction projects in Klang Valley*. *Journal of Building Performance ISSN*: 2180-2106, (1) 1.

Alinaitwe, H. M. (2008). *Improvement of labour performance and productivity in Uganda's building Industry*. PhD Thesis, Lund University, Sweden.

Al-Juwairah, Y. (1997). *Factors Affecting Construction Costs in Saudi Arabia*. Master thesis, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia.

Al-Momani A. H. (2000). *Examining Service Quality within Construction Processes, Technovation*, 20, PP. 643.651

Al-Najjar.(2008). *Factors Influencing time and cost overruns on construction projects in the Gaza Strip.* ISLAMIC UNIVERSITY OF GAZA. Unpublished

Amande, B., Ubani, E. C., & Omajeh, O., E. & Njoku, U. P. A. (2014). Critical Success Factors for Public Sector Construction Project Delivery: A Case of Owerri, Imo State. *International Journal of Research in Management, Science & Technology*. 3, (1).

Amande, B., Ubani, E. C., Omajeh, E. O-M. & Njoku, U. A. P. (2015). Critical Success Factors for Public Sector for Construction Project Delivery: A case of Owerri, Imo State. *International Journal of Research in Management, Science & Technology*, 3 (1)

Ameh, O., J., Soyingbe, A., A., & Odusami, K., T. (2010). Significant Factors Causing Cost Overruns in Telecommunication Projects in Nigeria. *Journal of Construction in Developing Countries*, 15, (2), 49–67.

Amoa-Abban, K., & Allotey, S. (2014). Cost overruns in Building Construction Projects: A Case Study of a Government of Ghana Project in Accra. *Developing Country Studies*. (4), (24).

Amoah, P., Ahadzie, D. K. & Dansoh, A. (2012). The Factors Affecting Construction Performance in Ghana: The Perspective of Small Scale Building Contractors. *The Ghana Surveyor.* Available at http://dspace.knust.edu.gh:8080/jspui/ bitstream/123456789/3417/1/Surveyor%20Journal%202.pdf41-48,Accessed on 15th January, 2014.

Amoah, P., Ahadzie, D. K. & Dansoh, A. (2012). The Factors Affecting Construction Performance in Ghana: The Perspective of Small Scale Building Contractors. *The Ghana Surveyor.* Available at http://dspace.knust.edu.gh:8080/jspui/ bitstream/123456789/3417/1/Surveyor%20Journal%202.pdf41-48,Accessed on 15th January, 2014.

Amusan, L. M. (2011). *Study of factors affecting construction cost performance in Nigerian construction sites.* Unpublished.

Ankomah, B. B., Boakye, N. & Fugar, F. (2010). Safety on Ghanaian Construction Sites: The Role of the Employer and the Employee In*:* Laryea, S., Leiringer, R. and Hughes, W. (Eds). *Proceedings West Africa Built Environment Research (WABER) Conference*, 477 – 487. Ghana: Accra.

Apolot, R., Alinaitwe, H., &Tindiwensi, D. (2011). *An Investigation into the Causes of Delay and Cost Overrun in Uganda's Public Sector Construction Projects*.

Second International Conference on Advances in Engineering and Technology.

Arcila, S. G. (2012). *Avoiding Cost Overruns in Construction Projects in the United Kingdom*. A Dissertation Submitted in partial fulfilment for the Degree of Master of Science in Programme and Project Management. The University of Warwick: Warwick Manufacturing Group

ASPE (2004). The 2004 HHS American Poverty Guidelines https://aspe.hhs.gov.

Avotos, I. (1983). Cost-Relevance Analysis for Overrun Control. *International Journal of Project Management, 1,* (3), 142-148.

Azhar, N., Farooqui, R., & Ahmed, S. (2008). *Cost Overrun Factors In Construction Industry of Pakistan.* Proceedings of the First International Conference on Construction in Developing Countries, Karachi, Pakistan.

Azis, A.A.A, Memon A.H, Rahman I.A, Latif Q., & Nagapan, S. (2012). *Cost management of large construction projects in South Malaysia*. IEEE Symposium on Business, Engineering and Industrial Applications.

Aziz, R.F. (2013). *Factors causing cost variation for constructing wastewater projects in Egypt.* Alexandria Engineering Journal 52, pp. 51–66.

Bailey, C. A. (2007). *A Guide to Quantitative Field Research,* (2nd Ed.).Thousand Oaks, California: Sage Publication.

Baloi, D. & Price, A.D.F. (2003). Modelling global risk factors affecting construction cost performance. *International Journal of Project Management, 21,* (4), 261-269.

Bari, N.A.A. Yusuff, R, Ismail, N, Jaapara A. & Ahmad, N.(2012). *Factors Influencing the construction cost of industrialised building system (IBS) Projects*, Asia Pacific International Conference on Environment-Behaviour

Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus, 7-9 December 2011, Procedia - Social and Behavioral Sciences 35 (2012) 689 – 696.

Cantarelli, C.C., Flyvbjerg, B, & Buhl, S.L. (2012). Geographical variation in project cost performance: the Netherlands versus worldwide, *Journal of Transport Geography*, 24, 324–331.

Cantarelli, C.C., Van W., B., Molin, E.J.E., & Flyvbjerg, B. (2012). Different cost performance: different determinants? The case of cost overruns in Dutch transport infrastructure projects. *Journal of Transport Policy*, 22(2012)88–95.

Chan, A.P.C., Scott, D. & Chan, A.P.L. (2004).Factors affecting the success of a construction project. *Journal of Construction Engineering and Management 130*, 153.

Chan, D.W.M. & Kumaraswamy, M.M. (1997). A comparative study of causes of time overruns in Hong Kong construction projects. *International Journal of Project Management, 15,* (1), 55-63.

Cheng, M.Y., Tsai, H.C., & Hsieh, W.S. (2009). *Web-based conceptual cost estimates for construction projects using Evolutionary Fuzzy Neural Inference Model*, *Journal of Automation in Construction*, 18, 164–172.

Chimwaso, D. K. (2001). *An evaluation of cost performance of public projects: case of Botswana,* Proceedings of the 2nd International Conference of the CIB, http://buildnet.csir.co.za/cdcproc/docs/2nd/chimwaso_dk.pdf.

Chua, D.K.H., Kog, Y.C. & Loh, P.K. (1999). Critical Success Factors for Different Project Objectives. *Journal of Construction Engineering and Management, 125,* (3), 142-150.

Conca, F. J., Llopis, J., & Tari, J.J. (2004). Development of a Measure to Assess Quality Management in Certified Firms. *Journal of Operational Research, 156*, 683-697.

Cox, H. K. (2007). Understanding stakeholders' perspective of cost estimation in project management, *International Journal of Project Management,* 29 (2011) 622–636.

Creedy, G. D., Skilmore, M. & Wong, J.K.W. (2010). Evaluation of Risk Factors Leading to Cost Overrun in Delivery of Highway Construction Projects. *Journal of Construction Engineering and Management, 136*, 528 -537.

Danso, H. & Antwi, J.K. (2012). *Evaluation of the factors influencing time and cost overruns in telecom tower construction in Ghana*, Civil and Environmental Research ISSN 2222-1719 (Paper) ISSN 2222-2863 (Online) 2, (6).

Davies, A., Hobday, M. (2005, 2008). *The Business of Projects Managing Innovation in Complex Products and Systems*. Cambridge University Press, Cambridge

Dibonwa, P. (2008). *Identifying causes and remedies for cost overruns in Botswana's public construction projects.* UNIERSITY OF WITWATERSRAND. MSC Unpublished

Doloi, H.K. (2011). Understanding stakeholders' perspective of cost estimation in project management. *International Journal of Project Management, 29*, (5), 622-636.

Eden, I. R., Akintoye, A. & Kelly, J. (2005). *Cost and time overruns of projects in Malaysia.* Unpublished

Enhassi, A, Arain, F. & Al-Raee, S. (2010). Causes of variation orders in construction projects in the Gaza Strip, *Journal of Civil Engineering and Management*, 16:4, 540-551.

Enshassi, A., Mohamed, S. & Abushaban, S. (2009). Factors affecting the performance of construction projects in the Gaza strip. *Journal of Civil Engineering and Management, 15,* (3), 269-280.

Farooqui, R.U, Umer, M, & Hussain, E. (2012). *Factors affecting construction cost in the Pakistani construction industry,* Third International Conference on Construction in Developing Countries (ICCIDC–III). "Advancing Civil, Architectural and Construction Engineering & Management" July 4-6, 2012, Bangkok, Thailand.

Flyvbjerg, B, Bruzelius, N, & Rothengatter, W. (2004). Megaprojects and risk: an anatomy of ambition*, Journal of the Transportation forum*, 43, (1), 143-145.

Flyvbjerg, B, Garbuio, M, & Lovallo, D. (2009). Delusion and deception in large infrastructure projects: two models for explaining and preventing executive disaster*, California Management Review*, 51, (2), 170-193. DOI: 10.1225/CMR423.

Flyvbjerg, B, Mette, K, Holm, S, & Buhl, S. I. (2003). How common and how large are cost overruns in transport infrastructure projects*? Transport Reviews*, 23, (1), 71-88, ISSN 0144-1647 print/ISSN 1464-5327.

Flyvbjerg, B., Bruzelius, N. & Rothengatter, W. (2003). *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge, U.K: Cambridge University Press.

Flyvbjerg, B., Holm, M.K. S. & Buhl, S.L. (2002). Cost estimation in public works projects: Error or lie? *Journal of the American Planning Association, 68*(3), 279-295.

Fobi, Y. D. (2014). *Key Causes of Delay in Construction Projects –Views of Ghanaian D3K3 and A3B3 Contractors*. A Dissertation Submitted to the

Department of Building Technology in Partial Fulfilment of the Award of Master of Science in Construction Management. Knust-Ghana.

Fraenkel, J. R & Wallen, N. E. (2000). *Educational Research*: A Guide to the process. New York: McGraw-Hill.

Frimpong, Y., Oluwoye, J. & Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study. *International Journal of Project Management, 21*(5), 321-326.

Ganiyu, B.O, & Zubairu, I. K. (2010). *Project cost prediction model using principal component regression for public building projects in Nigeria*, Journal of Building Performance, 1 (1). http//www.tembalodges.co.uk, [accessed 15 September, 2015.]

Ghana Statistical Service (2014). *Gross Domestic*. Accra. Available at: *Http://www. Statsghana.Gov.Gh/Docfiles/GlssReportPdf*, Accessed on 15th February, 2014.

Ghana Statistical Service (2015). *Gross Domestic*. Accra. Available at: *Http://www. Statsghana.Gov.Gh/Docfiles/GlssReportPdf*, Accessed on 5th September, 2015.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2003). *Multivariate Data Analysis*. New Jersey: Prentice-Hall, Inc., Upper Saddle River.

Hardcastle, C., Edwards, P. J., Akintoye, A. & Li, B. (2002). "*Critical Success Factors for PPP/PFI Projects in the UK Construction Industry: A Factor Analysis Approach*". Pp 1-9.

Holten, E.H & Burnett, M. B. (1997). *Qualitative Research Methods in R.A. 133 Swanson and E.F Holton Ed, Human Resource Development Research*

Handbook: Linking Research and Prentice. San Francisco: Berrett-Koehler publishers

Hwang, B.-G. & Lim, E.S.J. (2012). Critical Success Factors for Key Project Players and Objectives: Case Study of Singapore. *Journal of Construction Engineering and Management, 1,* (1), 446-446.

Ijaola, I.A, & Iyagba, R. O. (2012). A comparative study of causes of change orders in public construction projects in Nigeria and Oman, *Journal of Emerging Trends in Economics and Management Sciences (JETEMS),* 3(5): 495-501.

Ijigah, E. A., Jimoh, R. A., Bilau, A. A. & Agbo, A. E. (2013). Assessment of Risk Management Practices in Nigerian Construction Industry: Toward Establishing Risk Management Index. *International Journal of Pure and Applied Science and Technology,* 16, (2), 20-31.

Ijigah, E.A, Ogunbode, E.B. & Ibrahim, O.I. (2012). *Analysis and prediction of cost and time overrun of Millennium Development Goals (MDGS) Construction Projects In Nigeria,* Developing Country Studies, SSN 2224-607X ISSN 2225-0565 (Online) 2 (10).

Imbeah, K. A. (2012). *Framework for the Implementation of Total Quality Management (TQM) in Real Estate Firms in Ghana.* Available a http://ir.knust.edu.gh/bitstream/123456789/4675/1/KOBINA%20AFOAH%20IMBEAH.pdf. Accessed on 20th October, 2014.

Iyer, K.C. & Jha, K.N. (2005). Factors affecting cost performance: evidence from Indian construction projects. *International Journal of Project Management, 23*(4), 283-295.

Jackson, S. (2002). *Project cost overruns and risk management*. The University of Reading.

Jelen, F.C., Black, J.H., & American Association of Cost Engineering (1983). Cost and optimization engineering.

Kaliba, C, Muya, M & Mumba, K. (2009). Cost Escalation and Schedule Delay in Road Construction Projects in Zambia, *International Journal of Project Management*, 27, (5), 522-531.

Kasimu, M. A. (2012). Significant factors that causes cost overruns in building construction project in Nigeria, Interdisciplinary Journal of Contemporary Research in Business. *Institute of Interdisciplinary Business Research*. 775 (3), 11.

Keong, W. W. (2010). *A study into effectiveness of project cost control in overcoming cost overruns for turnkey project in Malaysia.* UNIVERSITY OF HERIOTT WATT, Dissertation MSC, Unpublished.

Kheni, N. A., & Ackon, F. (2015). Impact of Total Quality Management Practices (TQMPs) on Construction Project Quality Performance in Developing Countries: Study of Construction Businesses in Ghana. *International Journal of Management Science, 2*(3): 35-51.

Khodakarami & Abdi (2014). *Internal Journal of Project Management*, 31, (7), 1085-1284.

King, R. (2012). 'White elephant' London 2012 Olympics runs £2bn over budget as security costs double due to 'poor planning' since 7/7, The Daily Mail, Main Section ed, dailymail.co.uk.

Kog, Y.C. & Loh, P.K. (2012). Critical Success Factors for Different Components of Construction Projects. *Journal of Construction Engineering and Management 138*, (4), pp.520-528.

Koushki, P. A, Al-Rashid, K. & Kartam, N. (2005). Delays and cost increases in the construction of private residential projects in Kuwait, *Journal of Construction Management and Economics*, 23, 285-294.

Krejcie and Morgan (1970), http:www.kenpro.org/sample size determination.

L. & Bekker, M. (2011).*Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa, Journal of Acta Structilia* 18(1).

Laryea, S. (2011). *University of Reading*. UK, School of Construction Management and Engineering.

Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: Planning and design,* (9th Ed.). Upper Saddle River, NJ: Prentice Hall.

Le-Hoai, L., Lee, Y. & Lee, J. (2008). Delay and cost overruns in Vietnam large construction projects: A comparison with other selected countries. *KSCEJournal of Civil Engineering, 12,* (6), 367-377.

Love, P.E.D., Wang, X., Sing, C.-P. & Tiong, R.L.K. (2012). Determining the Probability of Project Cost Overruns. *Journal of Construction Engineering and Management, 1*, (1), 438-438.

Mahamid, I, & Bruland, A. (2011). *Cost overrun causes in road construction projects: Consultants' perspective*. 2nd International Conference on Construction and Project Management IPEDR vol.15 (2011) © (2011) IACSIT Press, Singapore

Mahamid, I. & Bruland, A. (2012). "Cost Deviation in Road Construction Projects: The Case of Palestine.'' *Australasian Journal of Construction Economics and Building, 12*(1), 58 – 71.

Mahamid, I. & Dmaidi, N. (2013). Risk Leading to Cost Overrun in Building Construction from Consultants' Perspective. *Organization, Technology and Management in Construction, 5*, 860 -873.

Mahamid, I. (2013). Effects of project's physical characteristics on cost deviation in road construction*, Journal of King Saud University – Engineering Sciences,* 25, 81–88.

Mccord, P., J. (2010).*Subcontractor Perspectives: Factors that Most Affect their Relationships with General Contractors - A Pacific North-West Study*. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Architecture Washington State University School of Architecture and Construction Management.

Memon, A.H., Rahman, I.A, Aziz, A.A & Abdullah, N.H. (2013). Using structural equation modelling to assess effects of construction resource related factors on cost overrun, *World Applied Sciences Journal 21 Mathematical Applications in Engineering*, pp.06-15, ISSN 1818-4952.

Memon, A.H., Rahman, I.A., Abdullah, M.R, &Azis, A.A.A. (2010). *Factors affecting construction cost in Mara large construction project: Perspective of Project Management Consultant.* Unpublished

Memon, A.H., Rahman, I.S, &Azis, A.A.A. (2011). Preliminary study on causative factors leading to construction cost overrun, *International Journal of Sustainable Construction Engineering & Technology*, 2, (1).

Monyane, T. G. (2013). *Identifying Causes of Cost Overruns and Effective Cost Control Measures of Public Projects in the Free State Province.* Submitted to Tshwane University of Technology

Naoum, S. G. (2002, 2007). *Dissertation Research and Writing for Construction Students*. Oxford: Butterworth-Heinemann.

Nawaz, P., Azman, N., Shamil, M.B., & Kamar, S. (2010). *Sustainable construction practice: A review of change orders (co) in construction projects,* Proceedings of the International Conference on Environment 2010 (ICENV 2010).

Nega, F. (2008). *Causes and Effects of Cost Overrun on Public Building Construction Projects in Ethiopia*. Master thesis, Addis Ababa University, Addis Ababa, Ethiopia.

Nunnally, J.C., (1978). *Psychometric Theory*, (2nd ed.). New York: McGraw-Hill.

Odeck, J. (2004). Cost overruns in road construction—what are their sizes and determinants? *Transport Policy, 11,* (1), 43-53.

Odeyinka, H., Weatherup, R., Cunningham, G., McKane, M., Larkin, K. (2010). *Assessing risk impacts on the variability between tender sum and final account,* The Construction, Building and Real Estate Research Conference of the Royal Institution of Chartered Surveyors Held at Dauphine Université, Paris, 2-3 September 2010.

Ofori G. (2012). *Developing the Construction Industry in Ghana: The Case of a Central Agency*. Singapore National University, Singapore. Available at http://www.buildingcontractorsgh.com/Developing%20the%20Construction%20Industry%20in%20Ghanapdf, Accessed on 16th November, 2015

Ofosu, J.A. (2014). Cost Overruns in the Delivery of Highway Construction Projects in Ghana. A Project Report Submitted to the Department of Building Technology in Partial Fulfilment of the Award of Master of Science in Construction Management. Knust-Ghana.

Omoregie, A. & Radford, D. (2006). *Infrastructure Delays and Cost Escalation: Causes and effects in Nigeria*. Proceeding of Sixth International Postgraduate Research Conference, Delft University of Technology and TNO, the Netherlands. 3rd-7th April, 2006.

Osei, V. (2013). The Construction Industry and its Linkages to the Ghanaian Economy-Polices to Improve the Sector's Performance. *International Journal of Development and Economic Sustainability*, 1(1), 56-72

Osman, Z., Omran, A., & Kim Foo, C. (2009). *The potential effects of variation orders in construction projects,* Journal *of Engineering Annals of Hunedoara, Tome VII, Fascicule 2*, (ISSN 1584 – 2665).

Ospivo, A. (2008). *Foreword to the Overview of Provincial Revenue and Expenditure for the 2012/2013 MTEF.* Department of Free State Treasury Budget report. Unpublished.

Pallant, J. (2001, 2003, 2007). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS*.

Potty, N.S., Irdus, A.B.,& Ramanathan, C.T. (2011). *Case study and survey on time and cost overrun of multiple D&B projects*, 978-1-4577-1884-7/11/$26.00 ©2011 IEEE.

Raftery, J. (1994). *Risk Analysis in Project Management*. Taylor & Francis.

Rahman, I.A., Memon, A.H, & Karim, A.T. (2013). Significant causes causing cost overruns in large construction projects in Malaysia, *Journal of Applied Sciences* 13 (2): pp. 286-293, ISSN 1812 -5654 / DOI: 10.3923/jas. 2013.286.293.

Ramabodu, M.S, & Verster, J.J.P. (2010). *An evaluation of cost overruns in public sector projects: In the Free State province of South Africa*. Fifth Built

Environment Conference held at the Southern Sun, Elangeni in Durban from 18 – 20 July 2010.

Sambasivan, M. & Soon, Y.W. (2007). Causes and Effect of delay in Malaysian Construction Industry, *International Journal of Project Management, 25,* (5), 517-526.

Saunders, M., Lewis, P. & Thornhill, A. (2007).*Research Methods for Business Students.* Harlow: Prentice Hall.

Tipili, L. G. & Ilyasu, S. M. (2014). Evaluating the Impact of Risk Factors on Construction Projects Cost in Nigeria. *The International Journal of Engineering and Science (IJES), 3,* (6), 10-15.

Wahab, K. A. (1997). *Improving efficiency in the building sector*. West Africa Tech Rev:81–9.

Zaghloul, R. & F. Hartman. (2003). Construction contracts: the cost of mistrust. *International Journal of Project Management, 21*: 419-24.

Zawawi, N.A.W.A., Nik-Azman, F.I.B.N., Muhammad, S.B., & Kamar, S. (2010). *Sustainable construction practice: A review of change orders (CO) In: Construction projects,* International Conference on Environment 2010 (ICENV).

Zhu, K., & Lin, L. (2004). *A stage-by-stage factor control frame work for cost estimation of construction projects,* Owners Driving Innovation International Conference. http:/flybjerg. Plan.aau.dk / JAPAASPUBLISH ED.pelf.World Bank (2012).Construction Sector Transparency Program Goes Global. [Online]Availableat:http://www.worldbank.org/en/news/feature/2012/11/08/construction-sector-transparency-program-goes-global [Accessed 14 08 2014].

Zimina, D., Ballard, G., & Pasquire, C. (2012). Target value design: using collaboration and a lean approach to reduce construction cost, *Journal of Construction Management and Economics*, 30:5, 383-398.

APPENDIX A

Questionnaires

The purpose of this questionnaire is to investigate factors influencing cost performance of construction projects in Ghana.

SECTION A: PERSONAL INFORMATION

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

Q2.What type (s) of academic or professional qualification (s) do you have? (Please tick [√or write in the appropriate boxes)

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

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

Other [ ] Please state .....

Q3.What is your working experience? [√]

(a) Under 5 years [ ] (b) 5- 10 years [ ] (c) Above 10 years [ ]

Q4. Please, state your current position with your company. (Please write in the box)

COMPANY CHARACTERISTICS

Q5. What percentage of contingency sum do you allow in your budget?
(a) Less than 10 percent (b) 10 – 20 percent (c) 21-30 percent (d)Above 30 percent

Q6. Which of these options best describe the format of estimate for your construction projects?

(a) A one-off estimation of construction cost during tendering

(b) Reviewed periodically based on market trends (c) Others, specify

Q7. Which of the following indicate the **performance of your firm in terms of Project Cost?**

1) Usually actual cost are below budgeted cost
2) Usually within budgeted Costs
3) Usually actual costs exceed budgeted costs < 10%
4) Usually actual cost exceed the budgeted cost by10%-30%
5) Usually actual cost exceed the budgeted cost by more than 30%

SECTION B

Factors Influencing Project Cost Overruns

Based on your overall experience in construction project in Ghana, please indicate the extent to which the following factors contribute to the project cost overruns:

(5 = Most Critical, 4 = Critical, 3 = Neutral, 2 = Least Critical, and 1 = Not Critical)

Factors Influencing Cost Overruns		2	3	4	5
Poor Contract Management					
Frequent changes in scope	1	2	3	4	5
Lack of coordination	1	2	3	4	5
Poor project planning	1	2	3	4	5
Lack of knowledge of the projects and its complexities	1	2	3	4	5
Tight project schedule					
Incompetency of the project team	1	2	3	4	5
Inadequate supervision/monitoring	1	2	3	4	5
Presence of unskilled labour	1	2	3	4	5
Slow decision making from the client or his representative	1	2	3	4	5
Conflicts among project participants					
Relationship between managers and labourers	1	2	3	4	5
Delayed payment	1	2	3	4	5
High inflationary rate	1	2	3	4	5
High interest rate					
Currency exchange rate					
Rise in fuel prices					
Inaccurate cost estimate					
Under pricing due to competition					
Inadequate contingency in BOQ					
Incomplete design information					
Government policy					
Economic instability					
Excessive approval procedures					
Fraudulent practices					
Escalation of const. materials prices					
Increase of labour cost					

SECTION C

Section D: Critical Success Factors for Project Cost Performance

These are factors that contribute to the success of construction cost performance. Please rate the following factors from 1-5, where 1 has least influential on construction cost performance and where 5 has the highest influence on construction cost performance. Please tick the appropriate box below;

1. Least influence 2. Little influence 3. High
4. Higher influence 5. Highest influence

No	CSF	1	2	3	4	5
1	Early involvement of the contractor					
2	Planning, schedule of work and budgeting					
3	Initial identification of all risks					
4	Adequate specifications					
5	Good contract relations					
6	Effective interaction between project participants					
7	Client involvement and commitment					
8	Provision of adequate funding					
9	Timely payment of work done					
10	Proj. manager's competency					
11	Architect's competency					
12	Accuracy of plans					
13	Accurate budgets					
14	Incentives/bonuses					
15	Training of employees					

Appendix B

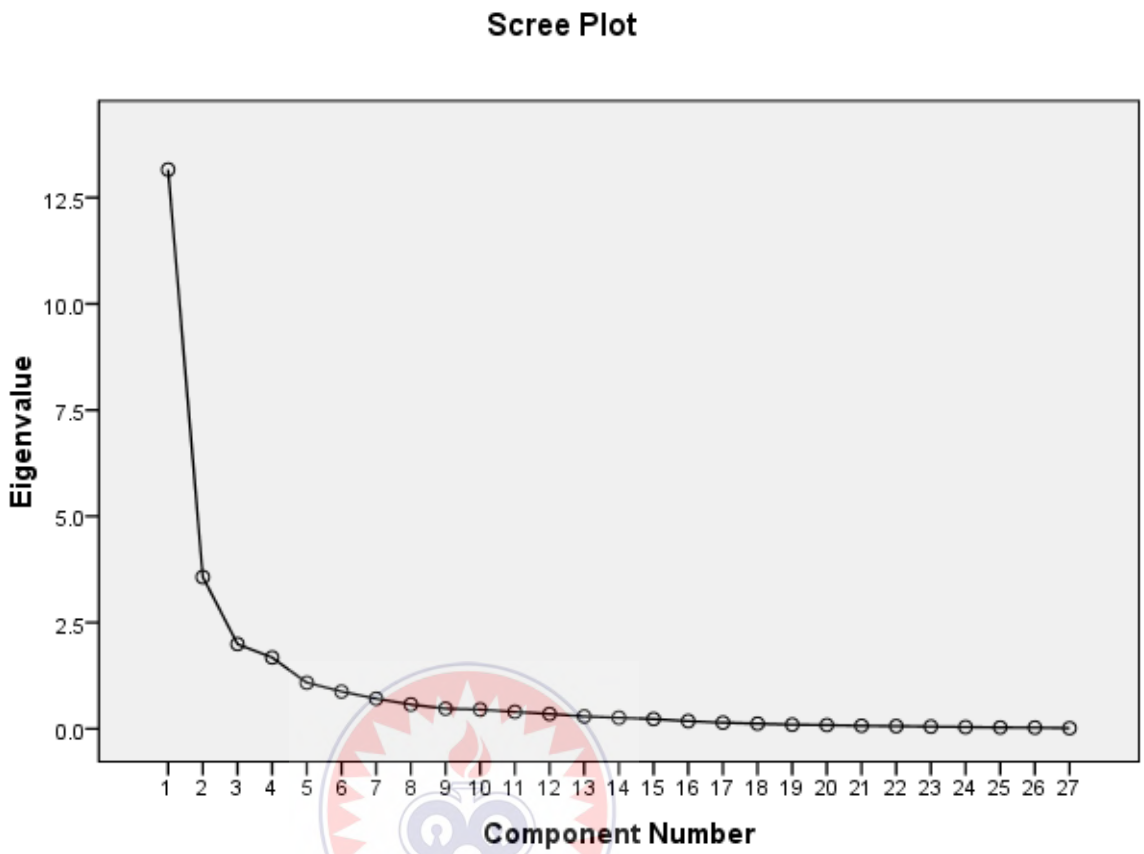

Fig. X :Scree plot of factors causing construction project overruns

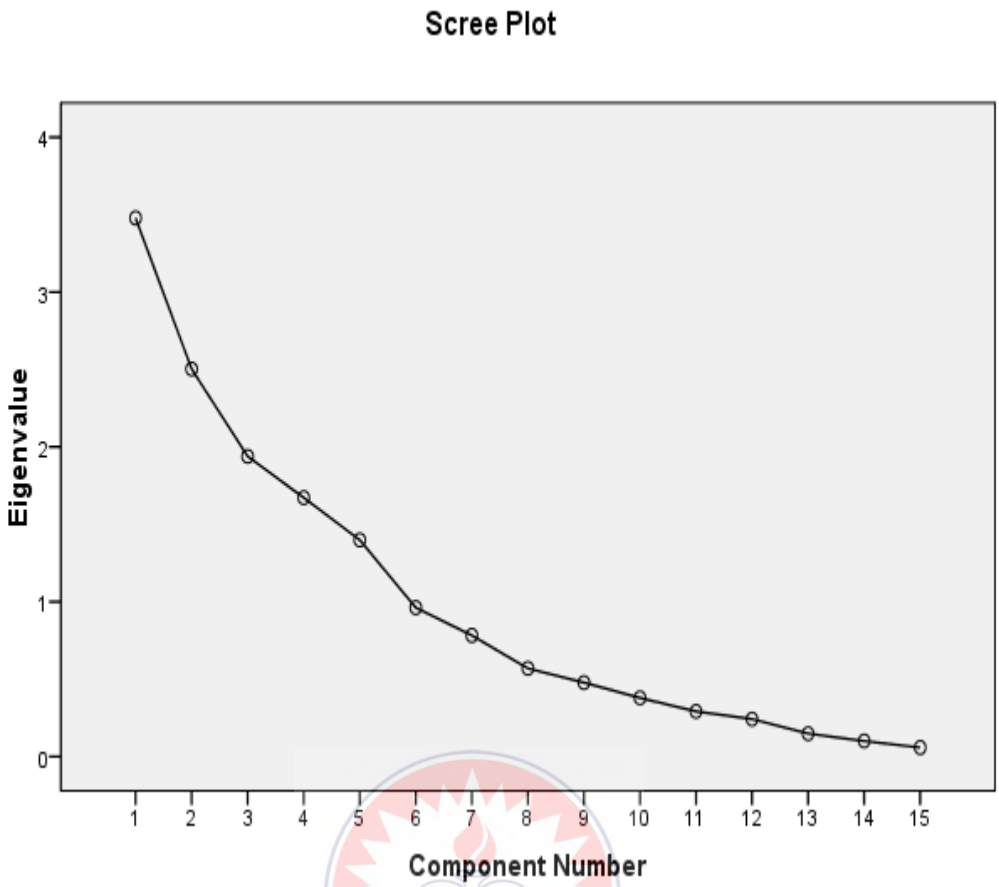

Fig. X:Scree plot of critical success factors for construction project overruns

APPENDIX C

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*