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Construction Cost Control Mechanisms by Contractors in Ghana.

By

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MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT.

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DECLARATION

I hereby declare that this submission is my own work towards the MSc. Construction Management and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text. However, it is likely for readers of this work to identify some errors or omissions. In view of this, I duly accept being responsible in that regard.

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ABSTRACT

Cost is a fundamental component of any construction project. It is of much essence that the construction industry has control on cost performance of construction projects to ensure that construction cost is within the estimated budget constrain. The aim of the study is to explore the factors affecting construction cost control by Contractors in Ghana. The study was carried out along the tenets of a preliminary literature review and followed by a survey using a structured questionnaire. Thirty two (32) questionnaire were retrieved out of the 39 distributed. The data collected were analyzed using Relative Importance Index (RII) and mean score. The study revealed that, Earned Value Analysis, Actual versus forecast reconciliation, budgetary planning or control, Variance analysis, Reserve analysis, Unit Costing, Program Evaluation and Review Technique (PERT/COST) and Project Cost-Value Reconciliation are the mostly and frequently used Construction cost control techniques by contractors. Lack of cost planning/monitoring during preand-post contract stages, Poor Project planning, Delay payment to contractors, Cash flow and financial difficulties faced by contractors, Inflation pressure, Fluctuation of prices of materials, Poor financial control on site, Project location, Complexity of projects, Wrong Estimation Methods, Inexperience of Project Leaders are the major factors that affect construction cost performance. It was revealed that the effective ways to control construction cost are; Contingency / Risk Management, controlling costs throughout the projects, selecting appropriate procurement options, Plans of Work and Periodic Reviews, Value Management / Engineering, Budgetary Control, Cash Flow Monitoring.[1]

[1] **Keywords:** Cost, Construction, Control, Contractors, Project

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DEDICATION

I dedicate this work firstly to the Almighty God for the gift of life and how far he has brought me. In addition, I dedicate this work to my wife Mrs. Promise Adjavor and my Children and Dr. Gabriel Nani of Department of Construction Technology and Management, KNUST for their encouragement and support.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Cost is a fundamental component of any construction project. Cost management is one of the project management knowledge areas which has cost control as one of the processes under the monitoring and control process group (PMI, 2017). Azhar et al. (2008) established that, "cost is among the major consideration throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success". It is of much essence that the construction industry has control on cost performance of construction projects to ensure that construction cost is within the estimated budget constrain. Project Management Institute (PMI, 2004) gave a concise definition of project management as "application of knowledge, skills, tools and techniques to project activities to meet the project objectives and requirements". The success of a project depends on the fundamental constraints which are cost, scope, time, and quality and customer satisfaction. Ramli (2003) noted that in the construction Industry, cost management is less effective compared to schedule management. One of the prime factors of project success is cost (Azhar et al., 2008).

According to PMI (2017) cost is one of the key performance indicators for projects. The processes involved in controlling costs are cantered around planning, estimating, budgeting, financing, funding and managing costs so that the project can be completed within the approved budget.

Akeem (2017) posited that, the major objective of every organization is to maximize profit, however the major constraint organizations face are the increase in the cost of operation. As a result, production cost increases and this many a time results to the need to control cost.

Dury (1985) defines control as a way of discovering that the activity of an organization follows the standards outline to ensure the organizations' goals are met. Cost control involves means and proceedings that enable the cost of operation of an activity to ensure that cost overrun is at a minimal (Sikka, 2003). Akeem (2017) again defined cost control as the process of avoiding wasteful use of organizations valuable resources and promoting efficiency and cost consciousness. The study again posited that, to control cost effectively, managers and supervisors have the greatest responsibility to allocate activities, provide statement on schedule, actual cost and perform frequent Earned Value Analysis. The cost control deals with identifying the individual costs, an act of measuring or correcting of the accomplishment of Subordinates to ensure the goals of the company are achieved in a more economical manner. (Lockey, 2002). Cost control essentially regulate the operating costs of a company, which is within budget. These are usually stated as the acceptable models of cost within any deployment outline. In other to effectively control cost, some techniques need to be employed. These techniques are called cost control techniques. The above discussions indicate the known ways patronized by organizations in curbing cost. Cost control cannot be effective without these techniques. Therefore, to achieve the aim of this research, the research will seek to identify construction cost control techniques used by contractors at Oforikrom municipality, the barriers to construction cost control and to suggest effective cost control measures.

1.2 STATEMENT OF PROBLEM

According to the status report of the South African construction industry in 2004, construction accounted for more than 10% the world economy (CIDB, 2004: online). According to the Ghana

Statistical Service, construction activity contributed $ 3.8 billion to GDP in 2014. As main indicator in economic activity, the construction sector does not only contribute significantly to the upwards rising of an economy but aid also uplift an economy in recession. The construction sector generates huge sums of money and ensure efficient use of the tax payers money especially when time and cost are closely considered (Baloyi and Bekker, 2011).

Despite the proven importance of cost control, construction projects often fail to achieve their objectives within the specified budget constrain. Very rarely are construction projects in Ghana finished within estimated project cost. The problem of construction cost exceeding budget is very rampant and can be easily identified in majority of construction projects. The phenomenon is termed as construction cost overrun. Avots (1983) defined cost overrun as when the final cost of the project exceeds the original estimates. According to a research conducted by Flyvbjerg (2002) on global construction, it was established that, for every 10 projects, 9 had cost overrun. Hartley and Okamoto (1997) established that, construction projects are often faced with an increase in cost of about 33% on average.

Since project cost plays a major role in a successful delivery or execution of a project, a study to investigate the control of construction cost is worthwhile. There are several factors that affect construction cost. In a study conducted by Memon et al. (2011), the study revealed that, cash flow and financial difficulties faced by contractors, contractor's poor site management and supervision, shortage of site workers, inadequate contractor experience and incorrect planning and scheduling by contractors are the major factors affecting construction cost.

Therefore, in other to overcome these changes, effective cost management planning and control needs to be undertaken by contractors. Charoenngam and Sriprasert (2001) asserted that, many construction projects use low quality materials and as such this cause higher construction cost than

expected, as materials is lost during construction. This results from a lack of standards for materials and management systems. The lack of ability to prevent cost overruns or control construction costs is leading to the failure of many Thai construction companies.

Proper strategies, best practices and careful judgment are required to meet the estimated costs and timelines for construction projects. However, the reluctance of owners, contractors and consultants has led to significant delays in many projects, exceeding the initial time and cost estimates. This problem is more pronounced in the case of traditional or adversarial contracts where the contract is awarded to the lowest bidder. This is the strategy for most public projects in developing countries (Enshassi et al., 2009). It is of much essence that the construction industry has control on cost performance of construction projects to ensure that construction cost is within the estimated budget constrain. To effectively control cost of construction projects, it is very vital bringing to bear the techniques and factors affecting cost performance of construction projects. Therefore, there is the need to carry out research on the reasons and factors affecting construction project cost performance. This study therefore seeks to investigate construction cost control by contractors of Ghana: a case study of the Oforikrom Municipality of Ashanti Region, Ghana.

1.3 AIM AND OBJECTIVES

1.3.1 Aim

To explore the factors affecting construction cost control by Contractors in Ghana.

1.3.2 Objectives

1. To identify construction cost control techniques used by contractors.
2. To identify factors affecting construction cost performance.
3. To suggest effective cost control measures to contractors.

1.4 RESEARCH QUESTIONS

The key research questions for this study are:

1. What are the construction cost control systems or techniques contractors employ?
2. What are the factors affecting construction cost performance?
3. What are the effective cost control measures to be implemented by contractors?

1.5 SCOPE OF STUDY

The study was geographically confined to the Oforikrom municipality in the Ashanti region of Ghana as a case study. The study was focused on D1K1 to D4K4 contractors working or have once undertaken a construction work in the Oforikrom Municipality. The study considered construction professional employed by construction companies with the requisite knowledge and expertise in construction cost control.

1.6 RESEARCH METHODOLOGY

The study employed a quantitative research approach. Firstly, a literature review of existing literature was used to collect data and information related to the research discipline. Based on previous study, a structured questionnaire was design for the study. Three weeks were allocated to gather primary data whiles secondary data were obtained from both published and unpublished sources and the timing was the entire period of the study. The tool for analyzing the quantitative data that gathered was descriptive statistics.

1.7 SIGNIFICANCE OF THE STUDY

This study provide valuable source of information to stakeholders in the construction industry in Ghana, especially those operating in the Oforikrom municipality in the Ashanti Region, on construction cost control measures to be employed to minimize issues of construction cost overrun which is considered dangerous for construction projects. The study identified construction cost control techniques used by contractors at Oforikrom municipality, identify the barriers to construction cost control by contractors and also suggest effective cost control measures to contractors. Also, it would provide information on present trends in construction cost control in Ghana. More importantly, this research will add knowledge to the already existing literature in the field of construction cost control in the construction industry

1.8 THESIS STRUCTURE

This research work was divided into five (5) chapters. Chapter one (1) covers background of the study, statement of the problem, the methodology that was employed, and how significant the research is, aim of the research, the research questions, objectives of the research and finally, the research scope, chapter two encompasses comprises the requisite literature review, which conveys lucidity to the cost control systems employed by a contractor during the execution of a construction project, the barriers towards construction cost control by contractors then the effective cost control measures to contractors. The third chapter identified and unruffled the methodology of the study. The fourth chapter accounted for the outcome of the data and eventually discuss the results. Lastly, the fifth chapter embodies and details out summary of the discoveries, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

The chapter reviews relevant literature relating to the topic including online data, journals, and articles relating to identify factors affecting construction cost control by Contractors in Ghana. Bahaudin, et al. (2012) indicated that, there are no effective cost control mechanism most construction companies use, this cut across almost all countries globally. Companies rather focus on the conventional cost control approaches, which is not helping. On the whole, we have three parties in any construction process: the client, the designer and the contractor. All the parties play a major role in controlling the cost of a project (Nassar et al., 2005, Chan and Park, 2005). The study will review literature on the circumstance or factors leading to construction cost performance, construction cost control techniques used contractors and the effective cost control measures to contractors.

2.2 CONCEPTUAL REVIEW

2.2.1 COST MANAGEMENT

Managing cost basically focuses on all cost related in procuring the needed resources towards the accomplishment of a project work activity. According to the Institution of Project Management (2017), "cost management is the process of estimating, allocating and controlling the costs in a project" and firms or businesses can anticipate expenditure and avoid over budgeting. The anticipated costs are taking into consideration during the preliminary phase of the project and approval of the budgeted amount is sought before construction starts. During the execution phase of the project, expenditure is carefully being track and the necessary documentation put in place to ensure effective cost management. At the completion the stage of the project the anticipated cost

is compared to actual execution cost of the project. This gives management a benchmark cost planning in future resulting in a realistic future cost of a project (PMI, 2017).

2.2.2 CONSTRUCTION COST CONTROL

Cost control involves controlling expenditure to prevent over expenditure which reduces profit. Controlling cost for any construction project ought to start from the inception stage of the project, through to the construction stage and even beyond. Controlling cost must be critically considered at the infant stage of the project where major cost expenditure has been committed. When construction has begun, any cost changes are most likely to delay the project (Bahaudin *et al*., 2012). Otim *et al*. (2007) emphasised that many projects have suffered as a result of poor cost control techniques. Philip (2004) stated that every project has an ultimate cost, which is the basic principle of any project. Therefore, cost control is the hallmark of a successful project and this is much dependent on the size of the project.Larger construction companies usually have a clear guidelines and strategies to cost control. Primavera and other sophisticated softwares are mostly adopted for planning cost control (Bahaudin *et al*., 2012).

2.3 NEED FOR A COST CONTROL

Controlling cost requires a lot of devotion and commitment in order to succeed in the following area:

- By allowing the client's anticipated expenditiure before work began to be within budget. In others word, the amount submitted during tender should not deviate from the final account. (Kirun &andShibi , 2015)

- By ensuring that the design does not go beyond the clients budget when coordinating the individual components of the building (Kirun and Shibi , 2015).
- When the project is finally being completed, value-for-money should be at its peak. The clients has the right to require for the total-cost approach utilized. The client can also state the maximum anticipated expenditure or made aware to the design team his brief who in turn then estimate the cost of the project (Kirun and Shibi , 2015).
- To be able to construct at the cheapest possible costs consistent with the project objectives (George et al., n.d.)
- To ensure the projects finish on time, within budget and achieving other project objectives as well (Olawale and Sun, 2012).
- A construction cost control system should enable a construction manager to compare actual costs and use the figures to make a comparison with a standard plan (Lefa et al., 2015).

2.4 DRIVERS OF CONSTRUCTION COST

The major cost divers of any building project are: cost of materials, cost of labour, cost of plant and equipment and finally consruction overheads, which include both job site management and the contractors' standard cost of executing the project (Odediran and Windapo, 2014, Birchall and Griffiths, 2006). Windapo et al.,(2017), further classified these drivers as resource factors and project factors. The resource factors of any project are the labour, materials, equipment/plant and sub-contractors while the project factors include: contracting practices, location of the project, size of project, project duration, tenderperiod,quality of market information, variation in materials, labour productivity, equipment usage, weather, soil conditions, quality standard expected, method

of construction and site constraints (Stoy and Schalcher, 2007, Aftab et al., 2010, Bari, et al., 2011, Aziz , 2012, Hiral et al., 2013).

Researchers identified the above factors directly affect the cost of a project ranging from project estimation to project completion (Aftab et al., 2010, Chan and Park, 2005, Stoy and Schalcher, 2007).

2.5 THE ROLE OF A CLIENT, CONSULTANT AND A CONTRACTOR IN COST CONTROL

Doloi1(2013) purported the roles of the contractor in managing or controlling cost in a construction project. He spells out what each paerty of the project ought to understand clearly.

Table 2.1 shows the role of all parties in a construction project

Client	Consultant	Contractor
Clarity of scope, defining the specification, feedback decorum, devoid of alteration of scope, appropriate agreement on the project, adequacy of budget	simplifying the design complexity, buildability of design consideration, requirements of specialized resources, feedback decorum, appropriate requirement analysis	Proper project scope understanding, interpretation of design , the specific method of construction, the exact resources need, preparation of programme of works, observing and following the right protocols
involvement of consultant at the preliminary stage development of pre-contract design, documentation of contract document,	Design devoid of errors Simplifying analysis, agreeing with clients on design brief, Updates on design	Evaluating the bulidabilty of design, planning of the construction
	Proper documentation of the project	

Proper documentation of contract and issuance, timely approval of invoices for regular payment, adequate cash flow,	production of efficient design, clear definition of specification, settle dispute between client and contractor	Documentation of construction activities, managing site resources, proper handling of site competent management and supervision labour and productivity, progress report of work Proper cash flow management, Taking only appropriate risk
Defining clear lines of communicating, effective utilization of communication platform	attending weekly site meetings, defining clear lines of communicating and utilization of medium of communicating	defining clear lines of communicating and utilization of medium of communicating, effective site management and supervision, management of subcontractor
Fair knowledge on technical issues associated with the project, selecting the suitable contractor,	precise knowledge of technical issues in relation to the project, regular communication with the parties.	precise knowledge of technical issues in relation to the project, regular communication with the parties. Accuracy of estimates, adequate financing
Determination of project location	Design of structure, determination of the soil conditions,	Accurate understanding of design and specification, ensuring safety of workers and visitors,
Performing duties as expected, precise contract agreement with parties,	Carrying out duties responsibly	Clear understanding of byelaws, conducive environment for workers and sub-contractors

Source: (Doloi1, 2013).

2.6 AREAS OF COST CONTROL IN A CONSTRUCTION PROJECT

Cost control in construction can be shared in the following areas;

a. Cost control during pre-contract stage (during the development of the project awarding the project to contractor: by the client (Liang, 2005).
b. Cost control during post contract stage (during the project execution; by the contractor (Liang, 2005).

2.7 CONSTRUCTION COST CONTROL TECHNIQUES

Cost control techniques refer to the various methods applied in controlling cost by various organisation (Akeem, 2017). Cost control can be defined as a practice of managing or achieving cost of a construction project by using the best procedures, methods or systems resulting in the profitability of a contractor without losses during the execution of the project (Otim, et al., 2007).

2.7.1 TYPES OF COST CONTROL TECHNIQUES

Akeem, (2017),Olawale & Sun, (2012.), and Yakubu and Ming, (2010) identified the types of cost control techniques as well as varieties of software packages that are available and can be equally be applied. When properly design,maintained and used, they are the crystal ball that arrows management to forcast the future (Jason et al., 2007).

The techniques include: Earned Value Analysis, Unit Costing, Actual cost versus the Anticipated Reconciliation (Materials, Labour and Plant), Program Evaluation And Review Technique (PERT/cost), leading perameter method, Activity based ratios, Budgetary planning or control, Reconciliation of Project Cost Value.
Some software packages used as cost control techniques include the following:, Microsoft Project,

Microsoft Excel, Construction Industry Software, Project Costing System (PCS), Asta Power Project, Primavera Sure track, Bespoke in house systems, WinQs. These software packages can be used alongside the above stated techniques (Jason et al., 2007).

2.7.1.1 EARNED VALUE METHOD OR TECHNIQUE

Earned Value Method or technique is very important for managing or controlling cost of a project as well as determining project duration management or project schedule, although sometimes variation orders are involved during the progress of the project. EVM is very flexible and adjustable even the core shape is dynamic making it suitable for the built environment, as professionals experience realistic management of construction project at the site. This system incorporates the cost and scope alongside measuring the schedule. The accounting technique makes it easy to figure out the total cost of work completed. (Mubarak, 2010, Czemplik, 2014).

EVM does aid management of site in timing and cost detail in achieving the preceding values: ACWP less BCWP. Another important value is the Budgeted Cost of work schedule (BCWS)– which is the start point of work with reference to all schedule works and their anticipated cost. (Czemplik, 2014).

This technique therefore considers the submitted tender figure alongside schedule to determine the cash in and cash out at any particular time. During work execution, the variances can be calculated while the executed work is evaluated comparing the bid figure and the budgeted value of works executed (Al-Jibouri, 2003).

2.7.1.2 USING EARNED VALUE ANALYSIS

Split or share the project into convenient sections and sub-section. That is drawing up the work break down structure or WBS. Ensure proper definitions of sections and subsections to aid the allocation of cost and time to each activity.

Assign cost and energy or determination to sections of the whole construction project. In effect produce a baseline.

When all the above underlining processes are carefully carried out Earned Value Analysis has stated. The simple and repeated process has been outlined below.

1. Update the schedule based upon the current progress.
2. Update the actual cost associate to current progress.
3. Calculate and graph key values, variance and ratio
4. Analyse the result and take corrective actions (Jason et al., 2007).

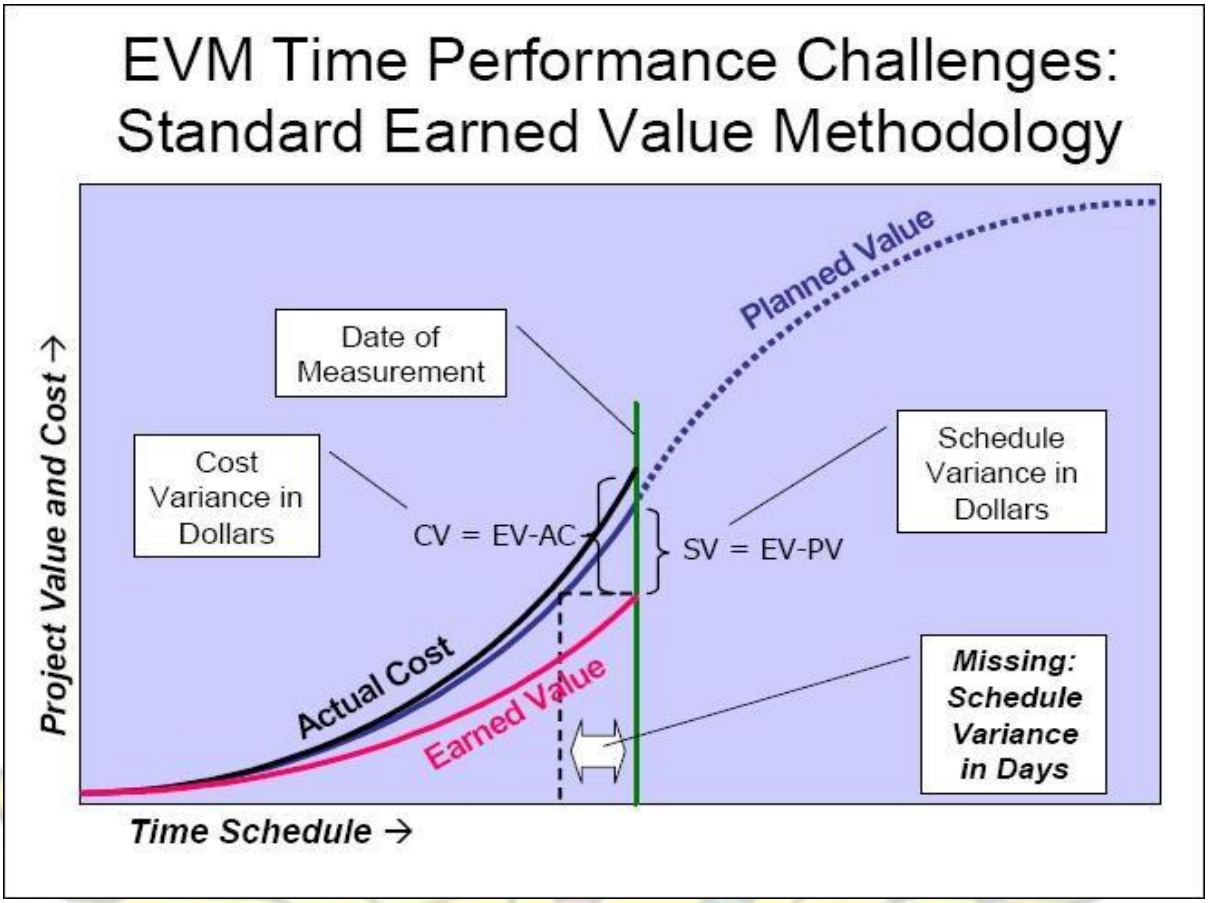

Figure 2.1 Earned Value Methodology Source

(Bower, 2006).

2.7.1.3 BUDGETARY CONTROL OR PLANNING

"According to the Institute of Cost and Management Accountants, budget is defined as a financial and/or quantitative statement, prepared earlier for a specified period of time, of the course of action to be carried out during that period of attaining a given objective". Budgetary control is focuses on the effective utilization of resource to accomplish a target aim or objective (Lucey, 1996).

Budgetary control therefore make use of forecasting and monitoring cost of activities. Budgeting emphasis on previous achievement and going into the future the successes to lionize while bearing in mind the intended objective is attained with any material deviation. Budgetary control technique

monitors cost without excluding budget preparation, actual performance versus budgeted or anticiparted, integrating the various units or department while assigning specific responsibilities. To each with the sole aim of maximizing profit (Akeem, 2017). The project Budgets Cost can be attached to responsibility centres with work targets to be accomplished. It's used in relation to schedules makes it the best tool for cost control (George et al., n.d.).

2.7.1.4 PROJECT COST-VALUE RECONCILIATION

Cost Value Reconciliation identifies a realistic and accurate of the finacial position at any current stage by projecting the profitability of the company under a giving project (Potts and Ankrah, 2013). Before the start of any project, estimation of the project cost done base on: Net cost of production (NCP), mark-up, in the process of executing the works, cash-in and cash-out are evaluated on monthly basis, and the evaluated cost and value is matched against the initial analysis and forecasted performance. This appraisal is called "cost value reconciliation"; or in some cases termed "profit and loss account".

Upon the approval of an interim valuation, by the Quantity Surveyors represnting the client and the contract, an internal assessment of all works completed on site is produced for inclusion in the cost value reconciliation.

CVR leads to the identification of factors or militants that hampers the successful delivery of a project, necessitating corrective measures to be taken. Cost valuation reconciliation is done on a monthly basis as agreed for interim valuation (Potts and Ankrah, 2013). The table below shows Cost Value Reconciliations - Forecast Breakdown s department and the site management team. The table 2.2 shows cost value reconciliation forecast.

Table 1.2 Cost value reconciliation forecast

NAME OF CONSTRUCTION COMPANY Management account						Date			
	Month			Year to date			Total project		
	Actual	Budget	Forecast	Actual	Budget	Forecast	Actual	Budget	Forecast
Tendered contracts									
Negotiated contract									
Previous year updates									
Total									
Net cost of production									
Tendered contracts									
Negotiated contract									
Previous year updates									
Total									
Gross Profit									
Tendered contracts									
Negotiated contract									
Previous year updates									
Total									
Overheads									
Tendered contracts									
Negotiated contract									
Previous year updates									
Total									

Net operating profit									

Source (Potts and Ankrah, 2013).

Information gotten from the reconciliation is required to be disseminated back to the department in charge of estimations to enable them identify any inconsistencies when estimating future projects. Cost and value should be properly evaluated on the same period to ensure accurate appraisal.

2.7.1.5 UNIT COSTING

A unit cost is simply the "average total cost" of producing one unit of output. A unit cost is calculated by dividing the total cost of production by the total number of units of output produced. The unit cost technique, this system each type of work to recording separately such concrete casting. The system therefore utilizes tools to forecast the cost involvement in providing services. This technique spells out the specific activity or involvement that would be profitable to the agency from its outtlays, and provide them with clear mechanisms towards understanding the entire cost of their service (Sergio, 1990).

The unit costing methodology is based on two principles. These are; Consistent treatment of like costs and Documentation; back up documentation ought to be present in order to directly allocate the workforce time, or planned line-item expenses, to an explicit service or services (Lesong and Damian, 2004). According to Lesong and Damian (2004) the following were outlined as the content of the unit cost technique.

- Activity/Product – The label/classification of the particular unit of the project
- Duration of the project – The allocated working hours as calculated in the project section.

- Other Expenses – The allocated costs/expenses as calculated in the "Other Expenses" section.
- Allocated Admin Expenses – The admin expenses (employee expenses and other expenses) are allocated depending on the proportion of the output hours on each services/product.
- Total Expenses – The sum of allocated administration expenses, construction expenses and other expenses on the project.
- Number of Units – The number of allocated working/output hours of each unit, working/output hours on administration are not taken into consideration.
- Unit Cost – Total expense divided by the number of units.

Also, Lesong and Damian (2004) established reasons to perform unit costing. These includes but not limited to; Identifying costs, Cost cutting, Revenue projection and Pricing strategies.

2.7.1.6 PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT)

Program Evaluation and Review Technique (PERT): this is a managerail tools that can be employed to carry out any scheduling, harmonization or coordination and organize, tasks within a project (Stefan, 2007). The performance evaluation and review techniques (PERT) is best for new and complex projects with extreme degree of uncertainty (Anyanwu, 2013).

The development of a PERT several steps as discussed below:

Determination of the particualr activity and indicators**.** All tasks that aid in the final execution of the project is called activity. The indicators or milestone on the other hand marks the starting and termination point of an actiivty or activites. Tabulation of all the task is off great significance as other necessary information on the series and sequence as well as the during can be added later (Stefan, 2007).

- **Identification of the correct flow and sequence of activities.** Here, this is usually joined with determination of the particualr activity and indicators at some point of an activity, while other task maybe complicated and require additional task to be carried out. With the aid of an activity sequence information, a network diagram can be built. The diagram would indicate the serial and parallel activities. The indidual activity epitomizes a node in the network, and the arrows signify the linkage between activities (Stefan, 2007).
- **Construct a network diagram**. Constructing of a network diagram to indicate the sequence of the serial and parallel activities with the aid the activity sequence information, tabulation of activites can easy be done using a Software packages simplify this step by automatically transforming it into a network diagram (Stefan, 2007).
- **Project the duration of the individual**. Activity duration completion can be measured using weeks as a unit. But other prefered unit of time can be equally be applied (Stefan, 2007).
- **Defining the critical path**. This can be done by icluding the durationfor the activity in each sequence and identifying the longest path in the project. The critical path spells out the entire duration for the project. Any activity that falls outside the critical path does not in anyway affect the entire project. Slack duration is simply the extend of duration that a non – critical path activity can be delayed without the project being affected (Stefan, 2007).

2.7.1.6.1 CONSIDERATION OF COST IN PERT

Project cost: The inclusion of the cost aspects in project scheduling ought to be clearly defined. The following need to be distinguished; cost duration for several activities in the project.The cost of any project is affected by direct and indirect costs.

The network diagram can be used to identify the activities whose duration should be shortened so that the completion time of the project can be shortened in the most economic manner. The crash time (tc) represents the minimum activity duration time that is possible and any attempts to further crash would only rise the activity cost without reducing the time. The activity cost corresponding to the crash time is called crash cost (Cc) which is the minimum direct cost required to achieve the crash performance time. The normal cost (Cn) is equal to the absolute minimum of the direct cost required to perform an activity. The corresponding time duration taken by an activity is known as the normal time (tn) (Stefan, 2007).

2.7.1.7 STANDARD COSTING

Accurate standard cost control technique minimizes costs (Tomasi , 2018). This system allows cost to be predetermined or anticipated with respect to the various elements of cost, mark-up and the cost of materials for the work executed or service rendered. (Nweze, 2010). Cost standardization enables an organization or company to maximize its profit (Tomasi , 2018). When implementing standard costing technique, it has to be strategically analysised leading to profitability of a company, this system indeed maximize profit (Tomasi , 2018). Companies or organizations can make excellent use of this system for full attainment of revenue. Cost planning, control or coordination is more beneficiary when it is anticiparted or predetermined. Regulating cost of a particular task or activity enables a targeted planned cost to be attained efficiently, effectively and resourcefully (Adeniji, 2009).

2.7.1.8 LEADING PARAMETER TECHNIQUE

This technique is cost control system working on the principle of selecting any one or more of a major task. The task or activity chosen performance is measured and generalized. Taking into

consideration concreting work, where it constitutes a larger proportion of the work, the quantity of concrete casted at any particular time of the work can be measured and generalized as performance of the entire work. Finding the actual cost of the work, the cost of the leading parameter and the cost of the entire project is compared with planned cost during the same time.

Leading parameter system is more appropriate for works which comprises of different sections and sub-sections with diverse kind of work within each section. The difficulty with this system is arising from the fact that most projects are not a constitutuent of any one major activty, and selection is one major task mifgt misleading and various within stipulated time. However, this challenge is sometimes overcome by employing not just one parameter but more throughtout the project duration. At the same time, the difficulty is not overame because it poses the difficulty of changing major actvities. This technique again does not indicate the cause of project deviation from performance (Al-Jibouri, 2003).

2.7.1.9 ACTIVITY BASED RATIOS

This is a financial control technique that employs the ratios between the earnings and expenditures of the project activities as measures of performance. The three ratios the system relies on for the calculation of performances are:

$$\text{Planned Performance} = \frac{\text{Planned Earning}}{\text{Planned Expenditure}}$$

$$\text{Actual Performance} = \frac{\text{Actual Earning}}{\text{Actual Expenditure}}$$

$$\text{Efficiency} = \frac{\text{Actual Performance}}{\text{Planned Performance}}$$

During the evaluation of both planned and actual work executed, a baseline rate must be set to make the comparism between the two. If the cash –in rate is gotten from tendered figure or

estimate, the actual performance as shown above in the fomula, indicates the measure of performance against the estmated while efficiency evaluates the project performance against planned or anticiparted. Theorotically, the values ought to be similar even though during planning proces plans are made with a bits of optimitism. Activity Based Ratios is more appropriate for short term project applications (Al-Jibouri, 2003).

2.8 FACTORS THAT DETERMINE THE CHOICE OF COST CONTROL SYSTEM

The price tag for the control method,, technical knowhow, project constriants, the scope and complexity of the project, ease of using the system, rigidity of flexibility of the method, precision, effectiveness and efficency (Olawale and Sun, 2012)

2.9 CHARACTERISTICS OF A PROJECT CONTROL SYSTEM

1. A control system needs to centre on the objectives of the particular project in mind. That is, the mision and aim of the project must be accomplished. Designer of a cost control system bears the following questions in mind

a.What are/ is priorities or significant to an institution or organization?

b. Which section of the project needs to be tracked?

c. At which point is it critical to bring in cost control technique?

2. The technique should be able to measure corrective action -: any control technique should have some emphasis on the use deviation to carry out corective actions. For the technique to be efficiently effective, the end product of the data should be action othwise the system only plays the role of monitoring.

3. The system should be guided by time -: Data control ought to be done on time. Improper timing of a system renders it ineffective. (Balip et al., 2019).

2.9.1 PROCESS OF COST CONTROLLING

According to Balip et al., (2019) the processes leading the buildup of a system involves these steps:

1. Determination of factors inducing or influencing cost
2. Determination of mitigated schemes or strategies applicable at various
3. Site selecting
4. Gathering of data concerning the specific site
5. Interactions with contractor and the challenges confronting him
6. The use of techniques to enhance the system
7. Finally recommend the best system to the contractor

2.11 FACTORS AFFECTING CONSTRUCTION COST PERFORMANCE

Rahman et al., (2013) Identified a total of 20 factors affecting the construction cost which are been classified into material, manpower, machinery and money.

2.11.1 MATERIAL RESOURCE

The construction any project cannot be executed without materials. Construction materials represents a substantial proportion of the total value of the project. The following contribute to the material cost in projects: Fluctuation of prices of materials, shortages of materials, changes in material specification and type, delay in delivery of material (Ameh et al., 2010, Enshassi, et al., 2009, Le-Hoai, et al., 2008, Omoregie and Radford, 2006). This brings about low levels output per

man hour, delay and escalation of the cost of construction within construction projects. The cost and management of materials must be done efficiently (Rahman et al., 2013).

2.11.2 MANPOWER RESOURCE

The available resources available the contractor are vital for a successful delivery of a project especially the human resources. Obtaining a successful project requires availability of both skilled and unskilled labour with attention being paid to the following: a decline of technically know personnel, output per man hour, decline in general site workers, abstinence from work (Ameh et al., 2010, Azhar et al., 2008, Creedy, 2005). Ineffective management of the human resources result in high labour cost hence, needs proper management to result in low cost and maximize profit for the company (Rahman et al., 2013).

2.11.3 MONEY OR FINANCE

Finance resources is critically needs to execute any construction work, without the needed capital in place any project cannot be completed. The quality of design and specification is affected by financial resources. The management of financial resource should be taking with all seriousness or else renders any other available resources useless and ineffective. Financial Factors include, ownership difficulties, payment delay either to suppliers or subcontractors, client's delaying payment, contractors' cash flow problems and financial difficulties, project financing method, bonds and payments, inadequate control of finance at site (Koushki et al., 2005, Le-Hoai, et al., 2008, Long, et al., 2004, Moura et al., 2007, Oladapo, 2007).

2.11.4 EQUIPMENT RESOURCES

The quality and kind of plant or equipment to be use on the site plays an integral role of the project total plan. However, the type and number of plant use on any particular site is dependent on the nature of the project. Equipment or plant affects the financial cost of the project greatly. The following factors contribute to cost of equipment in construction project: how available a particular equipment is, the delivery time of the equipment, equipment inadequacy, cost of hiring, purchasing or maintaining the equipment (Latif et al., 2008, Creedy, 2005, Moura, et al., 2007, Ameh et al., 2010). Kasimu (2012) categories project cost causes as embodied in following: factors influenced by the environmental, parties to the construction work, factors relating to financing of the work, factors arising from government, the kind of items use for the construction work. Kasimu, (2012) however identified sub-factors contained within the above stated factors.

2.11.5 ENVIRONMENTAL FACTORS

The sub-factors affecting resulting from environmental factors are: how competitive it is, how involvement or complex the project is, conditions arising from the economy, the location of the site, the socio-cultural factors, the quantity of construction works currently on-going, the climate or atmospheric condition (Kasimu, 2012).

2.11.6 FACTORS RELATED TO CONSTRUCTION PARTIES

Developing a plan for works, how the contract is to be managed, the time interval between the design and tendering, contract management, long period between design and time of tendering, total cost of skilled and unskilled labour, how complex or simply is the procedure of the contract, the level of compliance and assignment of duties between contractor and the designer, lack of

coordination and allocation of responsibilities between designers and contractors, the kind of relationship that exist among the various labour and the management , policies from government side (guidelines and directions), ineffective handling of money on site, the establishment of the tendering process, lack of the required quality of labour, conflict or disagreement on site,. These factors were identified to be affecting construction parties in construction cost performance (Kasimu, 2012).

2.11.7 FACTORS RELATED TO CONSTRUCTION ITEMS

Kasimu, (2012) argues the following as sub factors relating to construction items: prices of the needed materials, plant and equipment cost, cost involved in transportation, contract duration period, works that were added, the project size, cost of running equipment, alteration of design, managing waste on-site, and lack of unfinished product or raw materials.

2.11.8 FINANCIAL FACTORS

The rise and fall of material prices (inflation), funding of the project, payments methods and bonds, use of adulterated estimation procedures, Inflation pressure, Insurance Cost, Currency exchange. These were identified to be associated with financial factors (Kasimu, 2012).

2.11.9 POLITICAL FACTORS

Few factors were identified to be affecting cost of construction politically, which are; government controlling supply or the supplier, bureaucracy of governmental activities (Kasimu, 2012).

Kasimu et al., (2013), Kirun and Shibi, (2015) stated the following as critical factors that affect project cost,

1. Design not complete or sufficient to enable proper tendering.

2. Added works by owner.
3. Client changing his or brief.
4. Ineffective planning and control at the pre-contract and post- contract stage.
5. The nature of soil at the site.
6. Changes to prime sum and provisional sum.
7. Provisional works re-measurement.
8. The quality of logistic affected by the sighting of the site.
9. Inability to report during the progress of works.
10. Ineffective planning.
11. Design change.
12. Cost of materials
13. Projects planning

2.12 MEASURES OF EFFECTIVENESS OF A COST CONTROL TECHNIQUES

Cost performance is a fundamental feature or norm of measuring project success (Aftab, et al., 2014**).** Al-Jibouri (2003), purported that, any proper cost control technique should be a yardstick for measuring performance; when compared to standardized procedures and the involvement of a good control action. How efficient a cost control system depends the combinations of each of the feature. The content of a cost control technique is standardized and efficient depends on the quality of information the system gives out when monitored. Cost control technique can display its effectiveness or otherwise in many ways. An effective cost control system brings to the knowledge of the management of the work to problem areas. The consistency or trustworthiness in which a

system carries out this function is means of measuring its efficiency. A technique that only shows profit or loss is one of less efficient compared to a system that indicates the output of a particular labour. In some cases, effectiveness in one's direction might not influence the choice of system or technique to use.

A cost control system should detail out the information needed in a report, but might vary depending the level of management these reports are introduced. Management with clear knowledge of the system may demand in the general performance of the entire project. But a project manager a more informed report but not demanded by a site agent or site engineer

The measurement of efficiency of a cost control system aid the estimation department with information. This does not leave out the details of cost of jobs with details of working conditions.

A cost control technique should give out information for evaluating variations that may arise during the execution of the project. Information provide by a cost control technique must be clear to all the various levels of management as any action will be taking based on that. (Al-Jibouri, 2003).

2.12.1 MODEL STRUCTURE OF COST CONTROL TECHNIQUE

Construction project can be simulated by a model. Any cost control system developed or adopted is require to have the following features;

- **THE SCHEDULAR**: this model schedules the day-to-day activities and ensure the allocation of resources and time or duration.
- **REPRESENTATION OF RESOURCES**: Physical resources in the model which could be divided into three categories: Operatives skilled and unskilled, machines, subcontractors. The quantity of resources utilized in each model is calculated by making comparism between all the resources utilized and the total resources provided (Al-Jibouri, 2003).

- **REPRESENTATION OF MATERIALS**: Materials in a model can be categorized as usable, distinctive (special) or re-usable materials use during the duration of the project are usable or consumable resources. These materials have a one-time use and become part and parcel of the work. Materials used for specific activities only are termed special materials or resources. Example of such material is bridge bearings. Re-usable resources or materials can be applied to more than just one activity. Example is scaffoldings. Re-usable materials are distinctive from the others types of materials. An assumption of wastage factor can be made for each of material based on experience.

REPRESENTATION OF FINANCE

Bills of Quantities: the tendered figure forms an essential component for controlling the cost of the project.

COST HEADS: Labour, plant, sub-contractors, materials, supervision, and overheads constitute cost heads. This model encompasses information needed to undertake correct estimation of the project.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter entails the research methodology applied in answering the research questions of this study. The framework for the collection and analysis of data for this study is explained. In addition, the techniques and instruments for data collection analysis are explored in this chapter.

3.2 RESEARCH PHILOSOPHY

The concept of the paradigm plays a central role in all research undertakings (Mangan et al., 2004). Deciding on a strategy to be used for a research, the foundations of the philosophy have to be on

critical check. Knox (2004), stated that finding the relationship that exist between philosophy or the research and the research methodology is paramount. Foundations of the philosophy maybe ignited by beliefs and assumptions of nature (Wangombe, 2013). Kuhn (1977) however indicated that paradigm of a research is the culture of the research involving a particular set of beliefs, norms and value as well as assumption that researchers of a specific community have in common. Every research falls within the following scopes: Methodology, Ontology and Epistemology (TerreBlanche and Durrheim, 1999).

Ontology make enquiries about natures reality, Epistemology places emphasis on the sources and nature of information or knowledge (Maykut and Morehouse, 1999) and "World view" of researchers (Carter and Little, 2007). Wangombe (2013) sees ontological hypothesis within research is concerned about truth information and knowledge and the globe. Therefore, at the ontological level, the position that is taken objectivism.

The plausible explanation is that the extent of construction cost control that undermines the effort and reach of the researcher. These effects do not form the constructs of researcher. So in dealing with the research goals, objectivism ontological stance was followed. The epistemology, on the other hand, concerns itself acquiring knowledge and finding out what exist between the research and the researcher (Wangombe, 2013). Research epistemology hovers around positivism and interpretivism.

The positivist style makes the assumption that total knowledge is unachievable or unreachable. (Wangombe, 2013). However, according to the positivists, the universe operates in a particular established laws of cause and effect; and the utilization of systematic reasoning approach verify or test theories and either accept or reject them (Carter and Little, 2007). Therefore, research was of

the opinion that the construction cost control in the construction industry must be run impartially (free from researcher effects) which can be replicated.

3.3 RESEARCH STRATEGY

Research strategy is the general orientation by which this study would be carried out. It provides the resources required to complete the study on time, ensure the design of the study is appropriate to achieve the research objectives and makes sure that the appropriate software to manage and analyse the data is available (Bryman, 2016). The research strategy employed for this thesis is survey research strategy. This kind of research strategy deals with structured research tools in gathering data from a sample or the reaction of respondents as observed and defined. (Babin and Zikmund, 2015). Survey research approach is linked to deductive research approach. This is one of the commonest approaches deployed within the business and management research strategy. (Saunders et al., 2009).

Survey research allows the gathering of a substantial number of respondents from a considerable population at minimum cost. Questionnaires are allowed to be issued out to respondents from the sample, allowing for comparism and standardized as well (Saunders and Lewis, 2012). This survey made use of one of the commonest methods of collecting data called the Likert scale. Further, the researcher gathered information from respondents through one on one interaction data collection approach by issuing questionnaire as specified in kind of approach of research strategy.

3.4 DESIGN OF THE RESEARCH

Saunders et al. (2012) define research design as the general plan of providing intensive results to the research questions, data collection and finally analyzing the data. Thus, it explains the overall plan of the research. Burns and Grove (2003) added that, it is the general process of undertaking

the research. Through a well formulated research design, researchers are able to gain maximum control over several thwarting factors that undermines the validity of the study. According to Creswell and Clark (2017), selecting appropriate research design is based on the nature of research problem or issue being addressed, the experience of the researcher, and the respondents for the study. The main types of research design are the descriptive and correlational research design.

Descriptive research design is designed to give a clear picture of a situation as it naturally happens (Burns and Grove, 2003). Thus, situations are usually described using descriptive research design. Respondent's profile, situations or events serves as the primary points of measuring descriptive research. It is also employed for the justification of current practices, make judgment and to develop theories. Again, it tackles the clarification any linkage that exist between two or more features of situation or phenomenon and anticipating future occurrences.

Research questions or hypothesis measures this, which specifies the direction and nature of the relationship between the variable being examined.

Correlational research design comes in where there is the need to possibly investigate the relationships among variables without trying to influence those variables. However, the degree of relationship between the variables is of much concern. Correlational study deals with measuring two variables and then determining the degree of relationship that exist between them (Christensen et al. 2011). The study employed a descriptive research design to justify the current practices, make judgment and to develop theories.

3.5 RESEARCH METHOD

Quantitative approach was employed in this research in finding answers to the research questions. This approach leads to numeric description of the perceptions or opinions of the sampled

population, trends and attitudes (Creswell, 2009). In addressing the objectives, this research made use of quantitative research design. The justification for this method use include: the gathering of precise and accurate data that exist between facts and relationship with reference to theory. Prior to this study, a review of published literature by various authors was undertaken. The review publications of literature hovers extensively on materials surrounding the discipline; especially wider synopsis of cost control techniques, factors affecting cost performance and the effective measures to control cost.

3.6 POPULATION AND SAMPLING

Population is termed as a group of units with special similarities in a geographical area with a common interest at a specific time (Taylor-Powell, 1998).

The geographical location of this research will be Kumasi in the Ashanti region of Ghana. Contractors with classification of D1K1 to D4K4 and registered with the ministry of water resources works and housing.

The sample frame of the research will be D1K1 to D4K4 contractors having a project ongoing in the Oforikrom Municipality of Kumasi, Ghana. The Oforikrom Municipality was chosen because there are most construction projects been executed in this municipality and as well the place will be convenience for the researcher to gather data with ease. The population of contractors executing works in this area is not known, therefore a convenience sample of thirty two (32) D1K1 to D4K4 firms having works under construction in the Oforikrom Municipality are selected.

3.7 SAMPLING TECHNIQUE

Sampling is an act of choosing or selecting a few out of the total population with the aim of gathering data in relation to the phenomenon of interest. Sample is a sub-section of the entire population, which is chosen to be part of the research. According to Polit & Hungler (1995) sampling is of two types; probability and non-probability sampling techniques. Probability sampling is where all respondents have equal chance of been selected. Non-probability sampling is where the probability of being selected is not defined. This study uses convenience sampling method of the non-probability sampling to select the sample size. This is because the sample frame was not known. A convenient sample consists of using the most readily available (construction firms) for the sample. The method is simple, practical, economical, quick and do not require an elaborate sampling frame. The snowball sampling was utilized in attaining the sample size because of the difficulties encountered in assessing the population size of the contractors working in the said area.

Snowball sampling is a technique used to by the researcher in reaching out to the other potential respondents. Snow ball allows one subject to redirect the researcher in other area, thereby challenges such as hard to reach the population or concealed appointment.

3.8 SAMPLE SIZE

According to Naoum (1998), the term "sample" means a part of a whole (population) drawn to reflect the remaining. The act of taking a part of the entire population to represent that exact population is known as sampling (Strydom *et al*., 2007). Also, Taylor-Powel (1998) stipulated that sample will be irrelevant if the population minute. A portion of the population is often taken to

represent it due to limited nature of time frame as well as financial and logistical constraints and also it is not feasible if research is conducted on the whole population. The sample frame used for this study is the D1K1 to D4K4 contractors in the Oforikrom municipality. Therefore, the sample size for this study was 32 but 39 questionnaires were distributed. The addition of the 7 extra questionnaire was to make for unresponsiveness and incomplete questionnaires which cannot be analysed.

3.9 SOURCES OF DATA

This research employed the use of both primary (field survey) and secondary data (literature search). The data gathered was intended to cover every phase of the research. Neville (2007) suggested that research works should include empirical research. Thus primary data are therefore obligatory for conducting research. Primary data sources for this research was from the D1K1 to D4K4 contractors who were sampled as part of this study.

The drive for this research is to collect information that would be analyzed, enable interpretation and contribute to researchers to have first-hand information.

3.10 QUESTIONNAIRE DESIGN AND DEVELOPMENT

With the sole intention of involving the entire sample population and increase respondents' rate of responding to the questionnaire. It was designed to be respondent friendly, encouraging a large respondent to answer the questionnaires. Technical words with the exemption of those used but explained to respondents' understanding, plain language was the other of the day in the questionnaires. These questionnaires were designed devoid of opened ended questionnaires. The

researcher carefully considered the layout of the questionnaire to attract the respondents. The researcher gave instructions at the commencement of main section for filling the questionnaire. The questionnaire comprises of two section: section A and Section B. Section A pay attention to respondent profile. While the research objectives were anchored in the section B. the section B was based on the literature review, bearing in mind the cost control systems or techniques contractors employ, the factors affecting construction cost performance and the effective cost control measures by contractors

3.11 DATA PRESENTATION AND ANALYSIS

The designed questionnaire has the full grip of the following; consistency, completeness as well as reliability. The arrangement of the questionnaire made it easy for analytical purpose. The answered questionnaire entered into statistical package for social sciences (SPSS version 25).

Expounding the discussions, the retrieved data was presented graphically and tabulated.

Respondents' profile depicting the background of the study are shown in pie chart and bar graphs. Consequently, the data was statistically analyzed using the Relative Importance Index (RII) to obtain the severity.

The RII value displays the weight or importance of one factor in comparism to the other variables within same or similar category. The formula for calculating the RII is stated below:

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{AN}$$

W represents the range of weights (1 to 5) given to each factor by the respondents, where 1 is low and 5 is very high

A represents the highest weight in this case which 5

N represents the number of respondents

The Mean Score Ranking was not left out, as it was used to make comparison between the sample mean and the known population

3.12 ISSUES OF ETHICS

The study was assembled with ethics that aim to protect the confidentiality of every single person who participated in this study by providing personal or commercial data who responded or answered the questionnaire referred to as the subject. All subject has prior to answering the questionnaire were made aware of objectives, approach and expected results or any other hazard. All subjects have forth knowledge prior or else he or she would not be allowed.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

The fourth chapter focuses on organizing, structuring and characteristics of the data gathered from the field survey. The analysis and interpretation of the objectives of this study is all done in this chapter. The final results are compared with the review literature as well as the researcher running a commentary through. This chapter as well deals with the analysis and discussion of the data collected.

4.2 DATA ANALYSIS

The data analysis was carried out in two parts. The first part concentrated on the background of the respondents which was based on information carried in the section A of the questionnaire, section B comprises of the construction cost control techniques used by contractors, the factors affecting construction cost performance and the effective cost control measures to contractors.

4.3 PRESENTATION OF RESULTS AND DISCUSSIONS

To give weight to the results of the study the researcher deems it relevant to probe the background of his respondent. The researcher used descriptive statistics to analysis section A, which is about the profile of the respondents. Percentages and frequencies has been assigned to each variable depending the responses.

The section A focused on their position in their firm, experience and level of education. Section A was to identify the credibility, validity, reliability and precision of the responses provide the respondents. The result is presented in table 4.1

4.3.1 Firm's Classification

The respondents were asked to indicate their firm's classification base on the ministry of water resources works and housing classification. The results revealed that approximately 28% of the firms were in the Class D1 & K1 (N=9), 22% were Class D2 & K2 (N=7), 31% were Class D3 & K3 (N=10) and 19% were Class D4 & K4 (N=6). The classification of the firms is very necessary since the techniques of cost control may differ from firm to firm base on their class. The results indicated that there are a considerable number of firms from each classifications and this gives confidence in the data gathered as representing all classes of firms in the construction industry. The results are tabulated in Table 4.1

Table 4.1 Classification of firm

DEMOGRAPHIC DATA	FREQUENCY	PERCENTAGE
Class D1 & K1	9	6%
Class D2 & K2	7	6%
Class D3 & K3	10	31%
Class D4 & K4	6	19%
Total	**32**	**100%**

Source: field survey, 2019

4.3.2 Status in your organization

Table 4.1 shows that Majority of the respondents of the survey were either holding the position of Project Manager, Contractor, Quantity Surveyor and Engineer. Nearly, 16% were Project Managers (N=5), 40% were Contractors (N=13), 28% were Quantity Surveyors (N=9) and 16% were Engineers. The reason for adding the status of the respondent is to ensure the degree of reliability. Since all the respondents hold key positions in the firms and are abreast with issues of cost control, this clear from this point that all respondents were credible and reliable.

Table 4.2 Status in your organization

DEMOGRAPHIC DATA	FREQUENCY	PERCENTAGE
Project Manager	5	16%
Contractor	13	40%
Quantity Surveyor	9	28%
Engineer	5	16%
Total	**32**	**100%**

Source: field survey, 2019

4.3.3 Years of Professional Practice

The intention of this question was to identify the level of experience of the respondents in the construction industry since how long they have been in the industry will affect the quality of the response given. From the Table 4.1, bulk of the respondents have been in the construction industry for more than 6 years representing 91% (N=10+13+6). Approximately, 9% indicated level of less than 5 years' practice in the construction industry. One can confidently say or deduced that majority of respondents have had a lot of experience within the industry. This therefore justify the point that respondent gave an in-depth knowledge on the issues. But for generalization and balance of different experience would grant permission for realistic and general view of the research.

Table 4.3 Years of Professional Practice

DEMOGRAPHIC DATA	FREQUENCY	PERCENTAGE
Less than 5 years	3	9%
6 to 10 years	10	31%
11 to 15 years	13	41%
Above 16 years	6	19%

Source: field survey, 2019

4.3.4 Educational level of respondent

Table 4.1 shows that Majority of the respondents of the survey were either Holders of Master's Degree (MSc, MPhil, and MBA), Bachelor of Science or Higher National Diploma. None of the Respondents hold PhD, 47% are holders of a Master Degree, 31% holds a Bachelor's Degree, and whiles 22% were holders of Higher National Diploma. The results indicate that majority of the respondents are highly educated and well qualified. The respondents work for well-established

firms that have a lot of experience. They therefore, fall within the targeted group the researcher intended to study.

Table 4.4 Level of Education

DEMOGRAPHIC DATA	FREQUENCY	PERCENTAGE
Professional Diploma	7	22%
Bachelor's Degree	10	31%
MBA/MSc/MPhil	15	47%
Total	**32**	**100%**

Source: field survey, 2019

4.4 ANALYSIS AND DISCUSSION OF MAIN OBJECTIVES

4.4.1 Construction cost control techniques;

The respondents were asked to indicate by ticking the appropriate cost control techniques used in their firms. The results of the analysis as presented in Table 4.2 revealed that, 30 out of the 32 firms uses Earned Value Analysis as a technique for cost control representing 94%. This was followed by Actual versus forecast reconciliation with 88% of the respondent agreeing to its usage in their firms. The other techniques in the decreasing order of usage by the firms are budgetary planning or control, Variance analysis, Reserve analysis, Unit Costing, Trend analysis, Program Evaluation and Review Technique (PERT/COST), Project Cost-Value Reconciliation and Leading Parameter Method. The least ranked techniques of cost control is Leading Parameter Method with 38% of the respondent confirming its usage in their firms as a construction cost control technique. Czemplik (2014) supported by stating that, obtaining the value any work executed, the accounting system such as the Earned Value Analysis. That in order to identify the value of the work that has been carried out thus far, it is very helpful to use this accounting technique such as Earned Value

Analysis (EVA). Applying the EVM techniques within the construction sector to control cost necessitate the registration cost information and time usually one week. When this done the following can be achieved; actual cost of work carried out or performed and budgeted cost of work performed (Mubarak, 2010).

Akeem (2017) supported the fact the planning a budget, coordination of the various departments and assigning duties, comparison of actual performance to with. PMI (2017) established that projects that are devoid of earned value analysis, variance analysis can be measured by comparing anticipated or planned cost against actual cost to aid figure out any variance the baseline of cost and the actual project performance. This can be carried out using cost and schedule variance.

PMI (2017) again supported that, for the monitoring emergency or contingency management for a construction project to identify if any reserve is required or other contingencies are required reserve: reserve analysis is the best option to use. In the process of executing the project reserve may be utilized as risk cover or other contingencies. Lesong and Damian (2004) established that the unit costing methodology is based on two principles. These are; Consistent treatment of like costs and Documentation; all subsidiary records have to be in place to directly assign staff time, budgeted line-item expenditures to an explicit service.

Table 4.5 Construction cost control techniques

COST CONTROL TECHNIQUE	Frequency	Percentage	Rank
Earned Value Analysis	30	94	1
Actual versus forecast reconciliation	28	88	2
Budgetary planning or control	25	78	3
Variance analysis	23	72	4
Reserve analysis.	22	69	5

Unit Costing	20	63	6
Trend analysis	20	63	7
Program Evaluation and Review Technique (PERT/COST)	18	56	8
Projec Cost Value Reconciliation	15	47	9
Leading Parameter method	12	38	10
Activity based ratios	9	28	11

Source: Field Survey, 2019

4.4.2 Factors affecting construction cost performance

On the factors affecting construction cost performance, mean scores of 16 factors affecting construction cost performance were investigated and their rankings are presented in Table 4.3 for professional (Project Manager, Contractor, Quantity Surveyor and Engineer) working within the construction sector. The mean scores of majority of the factors affecting project cost performance are greater than the neutral value of 3.50, indicating that they are all important variables. Lack of cost planning/monitoring during pre-and-post contract stages was first, having a mean score of 4.489 it has a standard deviation of 0.661. The second ranked factor was “Poor Project planning” and the mean score of 4.200 with Std. deviation of 0.661. The result further revealed that, Complexity of projects, Wrong Estimation Methods, Inexperience of Project Leader, Unrealistic Provisional Sums, Human Error and Incorrect quantities are the factors affecting construction cost performance. The least ranked variables with a mean score value less than 3.500 were Delay in delivery of material and Shortages of materials.

Kasimu et al. (2013) identified unavailability of cost planning and control during pre-and-post contract stages and Poor Project planning as critical factors that affect construction cost performance. Their findings therefore support the current findings from this research which ranks these two variables at both first and second by the respondents. Kirun and Shibi, (2015) also supported that, for projects which lack proper planning and undefined baselines (especially cost baselines) are always plague with contingencies and risk management issues since the scope which will help prepare Work Breakdown Structure (WBS) and subsequently preparing cost estimate is undefined.

On the Delany payment to contractors and Oladapo (2007) was of the view that, availability of funds is directly linked to the kind design and the specification, and project completion. Without proper management of the money or finance, the management of other resource becomes useless, therefore the delay in paying contractors greatly have impact on the cost performance on the project. This therefore leads to Cash flow and financial difficulties faced by contractors (Koushki et al., 2005). Ameh et al. (2010) found delay in delivery of material and Shortages of materials as some of the factors affecting construction cost performance. However, these factors were ranked insignificant. The possible explanation to this will be that if proper project planning and proper cost planning are undertaken at the beginning of the project, these issues will fall on the contingency reserves. Omoregie and Radford (2006) found out that Inflation pressure and Fluctuation of prices of materials affect construction cost performance and this shows consistency with the findings of this research which respondents ranked these variables as significant.

Table 4.3 Factors affecting construction cost performance

Factors affecting construction cost performance	Mean	Std. deviation	Ranking
Lack of cost planning/monitoring during preand-post contract stages	4.489	.661	1
Poor Project planning	4.200	.661	2
Delay payment to contractors	4.178	.535	3
Cash flow and financial difficulties faced by contractors	4.133	.661	4
Inflation pressure	4.111	.438	5
Fluctuation of prices of materials	4.067	.618	6
Poor financial control on site	4.044	.672	7
Project location	4.044	.673	8
Complexity of projects	3.911	.733	9
Wrong Estimation Methods	3.778	.704	10
Inexperience of Project Leader	3.600	.580	11
Unrealistic Provisional Sums	3.580	.753	12

Human Error	3.532	.710	13
Incorrect quantities	3.509	.833	14
Delay in delivery of material	3.470	.716	15
Shortages of materials	3.225	.987	16

Source: Field Survey, 2019

4.4.3 Effective cost control measures to contractors

From Table 4.4, Relative importance index was used to determine cost control measures to contractors, the studies revealed that, none of the variables mean score was less than 3.50 and all RII value were also above 7.00 and therefore all these variables are significant. However, Risk Management was ranked first with a mean and an RII value of 4.38 and 0.898 respectively. The other effective cost control measures in order of ranking from high to low significance are; Controlling costs throughout the projects, Selecting appropriate procurement options, Plans of Work and Periodic Reviews, Value Management / Engineering, Budgetary Control, Cash Flow Monitoring, Dealing with variations, Elemental Cost Planning, precision of estimated cost, experienced personnel to monitor and control cost, Effective communication, paying careful attention to bill of Quantities and tender documents and Controlling the Consultants.

PMI (2013) established that Project risk management includes the process of conducting risk management planning, identification, analysis, response planning, response implementation, and

monitoring risk on a project with the major objective of increasing the probability and the impact of positive risks and decreasing the probability and impact of negative risk in order to optimize the chances of project success. Therefore, effective and proper risk management helps to identify potential risks to the project and appropriate contingencies established to mitigate those risks. PMI (2013) further noted that most problems which arise as a result of cost overruns are due to improper risk management and response plans, therefore this current finding support by Project Management Institute. According to Project Management Institute, controlling process must be done throughout the projects from initiating to closing. Therefore, controlling cost throughout the project is very vital for ensuring effective cost performance (PMI, 2017).

Table 4.4 Effective cost control measures to contractors

Effective cost control measures to contractors	Mean	RII	Ranking
Risk Management	4.38	0.898	1
Controlling costs throughout the projects.	4.34	0.840	2
Selecting appropriate procurement options	4.200	0.836	3
Plans of Work and Periodic Reviews	4.178	0.827	4
Value Management / Engineering	4.133	0.822	5
Budgetary Control	4.111	0.813	6
Cash Flow Monitoring	4.067	0.809	7
Dealing with variations	4.044	0.809	8
Elemental Cost Planning	4.044	0.782	9
Accuracy of the building cost estimates	3.911	0.776	10
Experienced personnel to monitor and control cost	3.778	0.752	11
Effective communication	3.600	0.735	12
Review and checking the accuracy of the bill of Quantities and tender documents.	3.580	0.729	13

Controlling the Consultants	3.532	0.703	14

Source: Field Survey, 2019

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The final chapter (chapter five) summarizes all the finding geared toward the aim and objectives of the study. Lastly, presenting limitation encountered in the course of the research and suggesting direction for future research.

5.2 SUMMARY OF FINDINGS

The study was instigated with the sole aim of investigating the factors affecting construction cost control by Contractors in the sub region of Ghana. With the intention of achieving this aim, three objectives were set out. The achieved objectives as set out are discussed in the following subsections.

5.2.1 Construction cost control techniques used by contractors

The study reveals that, Earned Value Analysis, Actual versus forecast reconciliation, budgetary planning or control, Variance analysis, Reserve analysis, Unit Costing, Trend analysis, Program Evaluation and Review Technique (PERT/COST) and Project Cost-Value Reconciliation are the mostly and frequently used Construction cost control techniques by contractors. These were supported by Czemplik (2014), Mubarak (2010), Akeem (2017), PMI (2017) and Lesong and Damian (2004). On the other hand, the least ranked technique of cost control was the Leading Parameter Method.

5.2.2 Factors affecting construction cost performance

Subsequently, respondents were asked to rate the factors affecting construction cost performance. The results shows that, Lack of cost planning/monitoring during pre-and-post contract stages, Poor Project planning, Delay payment to contractors, Cash flow and financial difficulties faced by contractors, Inflation pressure, Fluctuation of prices of materials, Poor financial control on site, Project location, Complexity of projects, Wrong Estimation Methods, Inexperience of Project Leader, Unrealistic Provisional Sums, Human Error, Incorrect quantities are the major factors that affect construction cost performance. However, Delay in delivery of material and Shortages of materials were not ranked as factors affecting construction cost performance. The findings were supported and argued by Kasimu et al. (2013), Kirun and Shibi, (2015), Oladapo (2007), Koushki et al. (2005), Ameh et al. (2010) and Omoregie and Radford (2006).

5.2.3 Effective cost control measures to contractors

The respondents were asked to indicate the degree at which these measures can be used to effectively control cost. The results showed that all the variables are significant to be considered

cost control measures. These measures include; Risk Management, controlling costs throughout the projects, selecting appropriate procurement options, Plans of Work and Periodic Reviews, Value Management / Engineering, Budgetary Control, Cash Flow Monitoring.

Dealing with variations, Elemental Cost Planning, Accuracy of the building cost estimates, experienced personnel to monitor and control cost, Effective communication,

Review and checking the accuracy of the bill of Quantities and tender documents and controlling the Consultants. The findings of these study was supported by PMI (2013) and PMI (2017).

5.3 CONCLUSION

This study explored the factors affecting construction cost control by Contractors in Ghana. In attempt to achieve this aim, three objectives were set which includes; identify construction cost control techniques used by contractors, identify the factors affecting construction cost performance and to suggest effective cost control measures to contractors. The study revealed that, Earned Value Analysis, Actual versus forecast reconciliation, budgetary planning or control, Variance analysis, Reserve analysis, Unit Costing, Trend analysis, Program Evaluation and Review Technique (PERT/COST) and Project Cost-Value Reconciliation are the mostly and frequently used Construction cost control systems or techniques by Ghanaian contractors.

Considering the factors affecting construction cost performance, it was established that, Lack of cost planning/monitoring during pre-and-post contract stages, Poor Project planning, Delay payment to contractors, cash-in and cash-out difficulties confronting a contractor, Inflation pressure, the rise and fall of material prices (fluctuations), improper monetary control at site,

Project location, Complexity of projects, Wrong Estimation Methods, Inexperience of Project Leader, Unrealistic Provisional Sums, Human Error, Incorrect quantities are the major factors that affect construction cost performance

Further, a number of effective ways of controlling construction cost were proposed by the respondents to be important. These includes; Risk Management, controlling costs throughout the projects, selecting appropriate procurement options, Plans of Work and Periodic Reviews, Value Management / Engineering, Budgetary Control, Cash Flow Monitoring

Dealing with variations, Elemental Cost Planning, level of estimating with precision, experienced personnel to monitor and control cost, Effective communication, paying attention to the accuracy of the bills of Quantities and tender documents and controlling the Consultants

5.4 RECOMMENDATION

Upon concluding with the research, the following recommendations are therefore prescribed to support the effective ways of controlling construction cost in Ghana. These includes;

- Construction firms should perform risk management as part of their planning process. This will help identify potential risk in advance and risk response plans prepared to handle those risks (negative risk) should they happen. This will as well plan for contingencies during the execution face of construction projects.
- Construction firms should make cost control core business value by employing professional or assigning professionals to handle cost control issues by employing appropriate cost control techniques depending on the situation at hand.
- Cost control should be done throughout the project life and not only at a point during the project lifecycle.
- Procurement of goods and services is seen to have great impact on cost, therefore, construction firms should select the appropriate procurements methods for procuring goods and services.

- Firms should practice value management or engineering by defining, maximising and achieving value for money, Control budget from unplanned expenditures, and monitor cash flows

5.5 SUGGESTION FOR FURTHER STUDY

This study combined the responses of all the contractors' classes that is, D1K1 to D4K4, therefore a further study is recommended to investigate the problems of cost overrun encounter by each of the contractor's classes, the effective cost control techniques to employ to mitigate the problems.

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APPENDIX A

QUESTIONNAIRE SURVEY

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
COLLEGE OF ART AND BUILT ENVIRONMENT DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

(MSc. Construction Management)

Topic

CONSTRUCTION COST CONTROL MECHANISM BY CONTRACTORS IN GHANA.

Dear Sir/Madam

Many thanks for your participation. This questionnaire survey aim to explore the factors affecting construction cost control by Contractors in Ghana. Please fill in the questionnaire using the instructions, which will only take you about 10 to 15 minutes. Please be noted that all the information you provide is anonymous and will only be used for academic purpose. Thank you again for your valuable time. If you have any queries, please feel free to contact:

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SECTION A

BACKGROUND INFORMATION

1. Which of these classifications apply to you?

a) Class D1 & K1 ☐

b) Class D2 & K2 ☐

c) Class D3 & K3 ☐

d) Class D4 & K4 ☐

2. Kindly indicate your status in your organization:

a) Project Manager ☐

b) Contractor ☐

c) Quantity Surveyor ☐

Others (please specify)……..…

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

a) Less than 5 year ☐

b) From 5 – 10 years ☐

c) Between 10 - 15 years ☐

d) 15 years and above ☐

4. Level of Education

a) Professional Diploma ☐

b) Bachelor's Degree ☐

c) PGD/Master Degree ☐

d) Doctorate Degree ☐

SECTION B: CONSTRUCTION COST CONTROL TECHNIQUES

Please which cost control techniques is used by your firm in controlling construction cost. Please tick as many as applicable.

COST CONTROL TECHNIQUE	TICK
1. Earned Value Analysis	☐
2. Project Cost-Value Reconciliation	☐
3. Actual versus forecast reconciliation	☐
4. Program Evaluation and Review Technique (PERT/COST)	☐
5. Leading Parameter Method	☐
6. Unit Costing	☐
7. Activity based ratios	☐
8. Budgetary planning or control	☐
9. Variance analysis	☐
10. Trend analysis	☐
11. Reserve analysis.	☐
Others, please specify	☐
	☐
	☐
	☐
	☐

SECTION C: FACTORS AFFECTING CONSTRUCTION COST PERFORMANCE

In your experiences, which of the following factors affect Construction cost performance. Please indicate the level of severity each factor has on the cost performance by ticking the appropriate boxes.

1= Least, 2 = Lower, 3 = High, 4 = Higher, 5 = Highest

Factors	Level				
	1	**2**	**3**	**4**	**5**
1. Fluctuation of prices of materials					
2. Shortages of materials					
3. Delay in delivery of material					
4. Complexity of projects					
5. Incorrect quantities					
6. Human Error					
7. Delay payment to contractors					
8. Cash flow and financial difficulties faced by contractors					
9. Poor financial control on site					
10. Wrong Estimation Methods					
11. Inflation pressure					
12. Project location					
13. Inexperience of Project Leader					
14. Poor Project planning					
15. Lack of cost planning/monitoring during pre-and-post contract stages					
16. Unrealistic Provisional Sums					
Others, please specify					

SECTION D: EFFECTIVE COST CONTROL MEASURES

In your experience, indicate the degree at which these measures can be used to effectively control cost by ticking the appropriate boxes.

1= Not important, 2= Less important; 3= moderately important; 4= Important; 5= Very important

Effective cost control measures	**1**	**2**	**3**	**4**	**5**
1. Review and checking the accuracy of the bill of Quantities and tender documents.					
2. Selecting appropriate procurement options					
3. Budgetary Control					
4. Accuracy of the building cost estimates					
5. Dealing with variations					
6. Providing a realistic contingency to cover risks.					
7. Controlling costs throughout the projects.					
8. Cash Flow Monitoring					
9. Value Management / Engineering					
10. Experienced personnel to monitor and control cost					
11. Carry out value management procedures.					
12. Elemental Cost Planning					
13. Plans of Work and Periodic Reviews					
14. Controlling the Consultants					
15. Effective communication					
16. Risk Management					
Others, please specify					

THANK YOU