

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

**IMPROVING COST CONTROL ON CONSTRUCTION PROJECTS IN SEKONDI-
TAKORADI METROPOLIS OF THE WESTERN REGION OF GHANA**

BY

ACHEAMPONG JOSEPH AGYA

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DECLARATION

I hereby declare that this submission is my own work towards the MSc Project 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 acknowledgement has been made in the text.

JOSEPH AGYA ACHEAMPONG (PG (1143317)

.....
SIGNATURE

.....
DATE

Certified by:

PROFESSOR THEOPHILUS ADJEI-KUMI
SUPERVISOR'S NAME

.....
SIGNATURE

.....
DATE

Certified by:

PROFESSOR BERNARD KOFI BAIDEN
Head of Department's Name

.....
Signature

.....
Date

ABSTRACT

Project cost control has obtained much attention in the construction industry as a result of excessive cost increase and losses incurred by contractors in Ghana. Over the decade, poor cost control management and overrun on project are problems which have caused significant project cost overrun in both developed and developing countries. This needs mitigation measure to improve cost performance and help projects to be executed within budgeted estimate.

In recent times, researchers have been working on the causes of project cost overrun and problems associated with it; however, their research is normally geared towards after max findings, leaving out the managerial project cost principles which are needed in the life cycle of the project execution as preventive measures. This paper seeks to address these by accessing the extent of use of project cost control tools, and the problems project managers face during implementation. Contractors of D1K1/A1B1, D2K2/A2B2/D3K3/A3B3 and D4K4/A4B4 are the main target for concentration in this research.

Thirty one (31) set of structured questionnaires were used to solicit information through snowball sampling from expert on the field. All questionnaires issued were retrieved representing 100% for the analysis. The mean score ranking technique and discussion using text and tables were adopted for data analysis.

The findings show, that, profit and loss based on progress payment was the most frequently used cost control techniques by contractors, with Overall Profit and loss, and Earn Value Analysis, following respectively. Regarding the problems faced by contractors on implementation of cost control techniques, Lack of Management Policy on Control Practices raked highest with Improper Estimates, Inadequate Work Break-down Structure, Poor Standards and Budgeting Techniques following in this order.

Recommendation, Project managers' knowledge on cost control tools and techniques should be improved through in-service training for both fresher's and existing ones. The education should be based on control principles such as Earned Value Analysis, Cost Value Reconciliation and Forecasting. Since they minimize cost better than the traditional method, that is profit and loss and profit and loss on progressive payment based and unit cost

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DEDICATION

I dedicate this project work to the Lord God Almighty in the Name of Christ Jesus for the wisdom and strength he granted me throughout my course at the university.

Secondly, I dedicate it to my dear wife and children for their support encouragement and forbearance

Finally, to my parent for their training and guidance.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Project Cost Control has occupied centre stage in the Construction Industry in recent times because its absence leads to excessive cost increases and poor profit margins of several contraction project *Ansah et.al(2010)*. According to *chimwaso* (2001), Poor cost management and cost overrun in construction projects are serious problems in almost all the developed and developing countries requiring proper attention for improvement, the construction works cost monitoring is rarely completed within budget estimated. As stated in the World Banks report on infrastructure development, (2010) on the projects executed in these countries, on an average, 63% of the 1,778 construction projects financed suffered poor cost controls, with overrun in their budgets at an average of 40% as cited by *Ameh et al. (2010)* and *Zujo et al. (2010)*. In Ghana, 75% of projects executed exceeded their original project costs whereas only 25% were completed within the budget estimate, According to *Frimpong et al. (2003)*.

This shows categorically that globally, cost engineers in the construction industry are confronted with problems of cost control techniques leading to cost overrun issues. This research problem to evaluate project cost control practices by various contractors and make suggestions for the improvement of project cost control systems specifically on the cost control tools and techniques employed by project cost engineers and their application during their planning and execution this, by contractors and the problems they encounter in implementation of the cost control tools and techniques in Sekondi -Takoradi metropolis of Ghana. It captures the contractors registered

under the Ministry of Water Resource Works and Housing under the class D1K1/A1B1, D2K2/A2B2/D3K3/A3B3 and D4K4/A4B4 for general building works and civil engineering works.

This can be achieved through an extensive literature review, finding's from other researchers and analysis of primary data collected through questionnaires to help assess current practices executed by project cost engineers to help make relevant suggestions on problems identified.

In spite of all the efforts made to control cost such as, the use of basic rate, variances and earn value analysis, other factors of project peculiarities of size continue to negatively impinge negatively on implementation; some contractors still fail to realize their expected profit margins at the end of their works execution, this is because many cost control systems are disjointed. For effective cost control on contractors perceptive, cost control should be continuous from the inception stage up to completion stage; this will ensure that all activities involved are executed and monitored side by side to prevent unnecessary cost overruns.

1.2 STATEMENT OF PROBLEM

Over the past years, cost overrun has become prominent in the construction entity. Akinci and Fisher, (1998), hence that, the mere mentioning of capital project of an above average size catches media attention and rings the bells of cost exceeding budget and stalling time of execution contrary as predetermined projections, Siemiatycki. (2009).

Ineffective cost control management practices, is one of the factors which lead to triggers off overrun cost of construction projects in the developed and developing countries, hence leading to a halting of several projects both in the private and public sectors. Thus confirming the results of

the survey on five continents on this issue. Flyvbjerg *et al.* (2003). Thus, there is the need to improve on cost control practices in the developed and developing countries, on both private and public sectors construction projects.

In Ghana, the lowest responsive evaluated successive bidder wins the contract. Thus contractors are left with no alternative than to reduce cost arbitrarily in order to make them more competitive. Eventually, contractors are made to work on small profit margins thus more work will have to be executed on hung projects in order to make good returns on investment. Consequently, financial risk on the project to be executed becomes high. Hence project cost control tools and techniques need to be realistically enforced to reduce the risk.

Over the past years software engineers have developed a number of programs and applications which are used on project control and performance such as Asta power project, primavera, Microsoft projects etc. Yet many project are faced with poor cost control practices leading to cost and budget overrun. Olawale and Sun (2010). In other case, some project managers use critical path, Gantt chart, program evaluation and review techniques to check their progress and project performance. Nicholas, (2001). According to Mansfield *et al.* (1994) most of the factors which cause delays and cost overrun, are poor financial management, contractors not being paid properly after execution of work, variation on site condition, resource Scarcity, materials and plant items, and variation of designs. Kaming *et.al* (1997) also under took a research on factors which influence construction time and overrun on a huge building in Indonesia he consequently established, that design variation, ineffective labour productivity, poor planning, improper material storage, and inadequacies in labour performance also contributed significantly to the state of affairs. Researchers were focused on analyzing factors influencing project cost and budget overrun and delay;

But this project proposes to focus, on evaluating project cost control system practice by contractors, by identifying the extent of use of the various cost control tool and techniques available and make suggestions for their improvement. Some of the studies are which have existed within the past 10-20 years ought to be reviewed. All these research projects were executed outside Ghana and their findings and solutions may not fit our situation well enough which cause cost overrun and delay.

Over the years, Civil engineers and Building Contractors in Ghana have underlined the fact that, cost control managers are faced with the issue of project cost control which has led to budget overrun. Some Civil Engineers and Building Contractors have with no or very little insight into controls tools and techniques. Hence there is the need to ensure that contractors receive an insight into cost control tools and techniques practices to enable them control cost overrun on projects that they execute.

1.3 AIM AND OBJECTIVES OF THE STUDY

The overall purpose of the study is to evaluate project cost control system practiced by contractors, through assessing their understanding and application level and make suggestions for their improvement of project cost control system.

Hence relevant necessary literature and findings from other similar researches on these was used to establish this: specifically this project seeks to

- a. To identify the extent of usage of the various cost control tool and techniques in the Ghanaian construction industry;

- b. To assess the level of understanding implementers have on cost control tools and techniques.
- c. To evaluate the problems associated with controlling cost on construction sites in the Ghanaian construction industry.

1.4 RESEARCH QUESTION

The main research question was centered on the following;

- 1 What type of cost control tools and techniques available in the construction industry in Ghana?
- 2 What is the level of understanding, of the implementers on the cost control tools and techniques they employ?
- 3 What problems do contractors face during project execution when controlling cost?

1.5 DELIMITATION

This research was carried out in Sekondi-Takoradi metropolis of Ghana and it captured the contractors who had registered under the Ministry of Water Resource Works and Housing under the (Classification D1K1/A1B1, D2K2/A2B2/D3K3/A3B3 and D4K4/A4B4 for general building works and for civil engineering works). The cost control system which was investigated covered the planning and execution of the awarded contract. It because, at the construction stage contractors execute the physical work of the contract, and it is here that the project is prone to cost overrun as stated by Halpin and Woodhead (1998) and cited by Bahandin., et.al. (2012). Cost incurred during the pre-construction and post construction stages by buyer and consultants

was not included in this study. Cost accounting and financial management procedures which relate cost control are also not included

1.6 JUSTIFICATION OF THE RESEARCH

In Ghana, Construction plays one of the major roles in the country's economic growth and infrastructure development. Consequently Construction Companies need to stay in business to help the country achieve this purpose.

Indeed, client satisfaction will be met, if projects are executed as planned. Therefore the completion of projects within the stated technical performance, and budget are needed for project success. Chileshe., et.al (2010).

Donor agencies such as The British Government and Danish International Development Agency (DANIDA) fund some of the infrastructure project in Ghana. Unfortunately the purposes are restrained by the cost overruns in construction projects which have been executed by Danso, et.al (2010).

The sustainability of Construction companies depends on one of the factors which include but is not limited to effective cost control management measures in project executions. Moreover, Contractors sustainability will help reduce unemployment in the country. With reference to other businesses, Building Contractors and Estate Developers have to plan and organise their daily routine activities on site to ensure more effective management. Cook and Williams (2004)

Finally, this study seeks to establish the need for sustaining the activities of construction companies since they contribute to the economic growth in Ghana's development.

1.7 METHODOLOGY

Both primary and secondary information was collected from contractors; project cost engineers and works supervisors on projects, to help achieve the objectives of this study.

Questionnaire survey, the questionnaire developed was self-administered and delivered and collect type, this was done to solicit views of the respondents on the topic under study.

The snowball, a Non probability sampling techniques was adapted for this study , from Thompson (2002) , the respondent in the sample were are asked to come up with other individuals for affixed number of stages, to help assess the number of mutual relationship, as cited by *Xetural and Lockard, (2016)*.

In this context, Statistical products for social scientists, analytical program application was used. With help of application the demographics was analyzed for it frequencies and was discussed using text and tables. For every question answered to help read meanings to each question. The likert scale of numbering was also be used. The respondents level of understanding and significant was very important for the purpose of the questionnaire issued out. The essence was to use the ranges from 1-5. The respondent needed to choose from one of the ordinance scale, in teams of their understanding and significance of the question.

The scale ranges from 5 to 1 in descending order.

5 4 3 2 1

Decreasing degree of agreement. Likert, (1932).

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This section begins with the introduction; aims of project cost control; importance of project cost control; some facts bordering on cost control; cost control management planning; it also outlines mechanical plant cost control; cost estimating is also explained; unit cost is discussed; cost budgeting; and finally contractors cost control and monitoring.

2.2 PROJECT COST CONTROL

From the project management point of view, PMBOK sixth edition, project status monitoring to help update cost on project managing and changes to the baseline is termed as cost control. However, it is the act of controlling project expenses in a way to overcome project cost overrun. *Jamaludin, et.al (2015)*. Again it is an act which is aimed at controlling the overall cost through a reasonable analysis in that, the upholding of the real cost in accordance with the predetermining standards. Moreover, it checks that, cost incurred during project lifecycle do not exceed the pre-determined cost.

The series of functions carried out in the project planning and execution stages such that budget for activities and real work differentiation can be evaluated for variance or why the same and helps finally to carry out the needed corrective action for the discrepancies.

It is expected that construction projects are executed as planned in terms of budget, scope of work and duration.

2.3 AIMS OF PROJECT COST CONTROL

The success of construction project, largely dependent on the excellence of the project cost control systems and the class of commitment worker assigned to the work. Failure to control these functions will loom the success of the project *Burke (2002)*.

According to *A. Ashworth, (2004)* the aims of project cost control are to;

- a. To retain spending within the amount allowed by the client;
- b. Help attain a well-balanced spending between the various essentials of the proposed project;
- c. Offer essential data to secure payment for any variation orders;
- d. Provide the buyer with value for-money, ensuring that resource are used to his best advantage;

2.4 THE SIGNIFICANCE OF PROJECT COST CONTROL TO THE CONSTRUCTION INDUSTRY

Currently, it appears that construction engineers have understood the essentials of construction economics and cost at the design stage of projects. The importance is enshrined in reports of studies conducted by *Ashworth and Hogg, (2000)* as;

1. The eradication of waste which is due to the worlds' scarce resources has necessitated a desire for improved methods of forecasting of control of costs.
2. In the past decade, contractor's profit margins have been reduced in real terms. Hence this has made them in alert and cost-conscious in an attempt to redress possible losses

3. Due to new techniques and innovation, material and methods of project construction, gives the architect a broader chooses of products and components which he can specify for the production on varieties of construction. The ancient methods of estimating for projects are not able to cope with prevailing conditions to achieve value for money for more balanced designs.
4. The buyer of the industry often represents large organizations and financial institutions. This is as a result of takeover, mergers and some public ownership. There has thus been an increased emphasis on accountability in both the public and the private sector of industry. The efficiency of these organizations at construction works sites are only as good as their advisers.

2.5 STATEMENT OF FACTS IN COST CONTROL

According to *Ashworth,(2004)* a design project which is constructed to the estimated budget can be termed as cost control, all the techniques employed by management to manage the cost of the project within predetermined amount, throughout the design and construction stage are very essential in accessing project performance.

The determination of cost variance through compering actual cost to the budgeted cost can be termed as cost control.

From *Al-jibour.,(2003)*, on execution of project, deviations from the original plan will occur; therefore, projects should have a control cycle of, designing the work schedule, implementing the schedule, Observing the actual output and noting it, comparing the actual output with

designed schedule for checking variance and taking correct action on the variance so as to complete the project within the stipulated time and estimate budget.

The traditional method of controlling cost, according to *Ballard (2000)* is based on implementing relevant corrective action. As a result, the traditional method of cost control has been more useful in projects management than production *Howell and Ballard (1996)*.

According to *Harris and Mc caffer (2002)* as cited by *Otim. et al (n.d)* Cost control involves how the project cost is managed with best practices and techniques such that project executers do not incur losses when executing the activities of the project. It also involves ensuring not only that, the income and expenditure are in accordance with budgets but also that, the period of each transaction is appropriate and in line with the scheduled cash flow. *Stenzel, C and Stenzel, J, (2002)*

The aim of the project cost control is to carry out the works at minimum cost consistent with the project objectives. Ultimately, Cost control is also used by project cost engineers to decrease client's expenditure to fall within agreed budget. In simple terms it is used to control the actual cost occurring such that, the tender sum and the final account will approximately equal the budgeted estimate, *Flanagan and Tate (1997)*.

2.6 PROJECT COST MANAGEMENT

This involves the planning, estimating, budgeting, financing fund management and controlling cost such that project can be executed within the predetermining budget. *PMBOK Guide 5th edition*.

2.7 COST MANAGEMENT PLANNING

The PIMBOK sixth edition state that, cost management plan is a component of project management plan which shows how project cost will be planned, structured, and control.

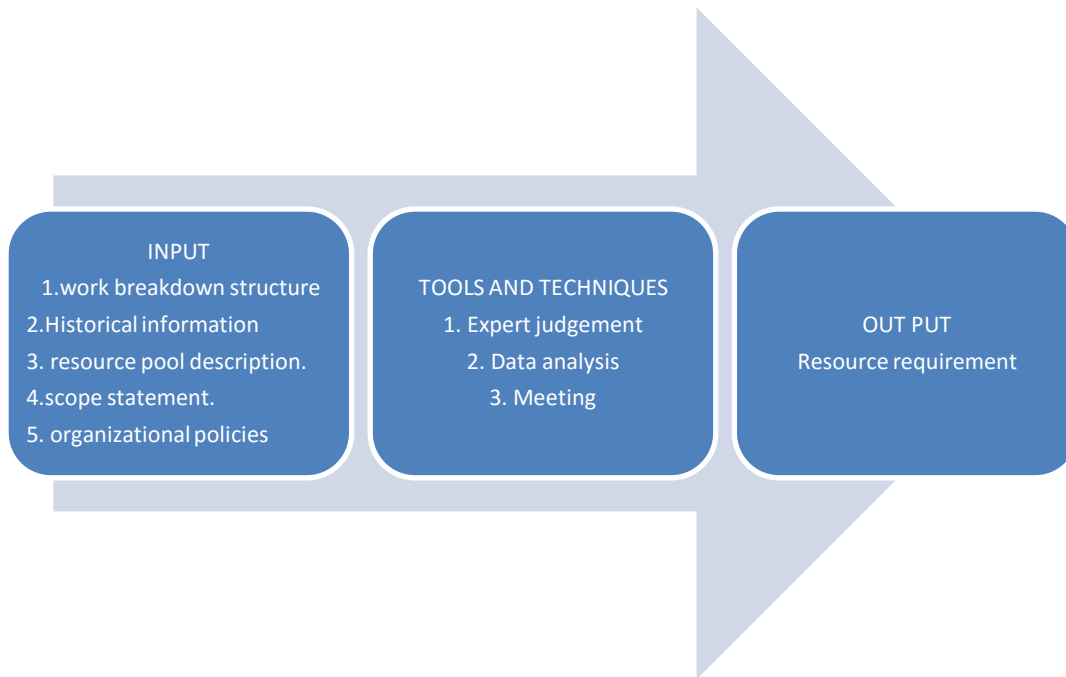


Figure 2.0 Cost Management Chat

Adopted from project management Guide (1996) pp 74 figure 7-1

2.8 PLANNING PROJECT RESOURCES

Men, materials, machinery and money are the resources used for production on construction project site. The success of a project depends on the performances of these inputs resources whilst controlling cost *Hendrickson (1998)*. Cost increments which are on projects are linked to waste by client and management which need to be avoided. Planning of project inputs on the project cost control can be as follows but are not limited;

2.9 ACTIVITY DURATION ESTIMATES

The time spent on activities is very essential for the project manager. The project team can consider the cost and benefit of employing more efforts to reduce activity duration where possible. The activity duration estimate should be readily available before the time management begins. *Hendrickson, (1998)*

According to the PIMBOK 5th edition, activity duration estimate is the calculation of the number of working time required to execute individual activities with the budgeted resources. The essence of this process is to come out with the quantum of period each activity is allocated with.

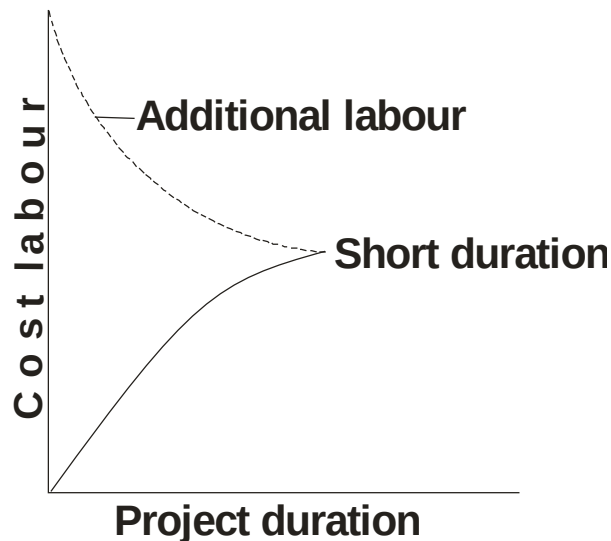


Figure 2.1 Activity Duration Estimates

Source: Hendrickson (1998) Adopted activity duration graph

Activity duration estimate can be done properly by the adoption of scope of work, resource required type, calculated resource quantum, and resource schedules. Other influential factors which may affect the duration estimates include constrain imposed on duration, work involved, or the type of resources and the schedule network analysis technique adopted. The efficiency

based on familiarity of the persons forming the project team has influence on the input of estimate of duration. Duration calculation is progressively elaborated, quality and availability of the input data. However, the improvement of estimate duration is based on the detailed and preciseness of data which are available on project engineering and design work. PIMBOK 6TH edition. Page 196, part1-Guide. On the other hand, the quantum of materials, human resources capacity and activities expected to be executed will also determine the activity duration. PIMBOK 5TH edition.

2.10 WORK BREAKDOWN STRUCTURE

According to *Hendrickson, (1998)*, these depend on the work component and the work content of the project. It helps the project manager and the project team to identify the components required, and specific resources such as plant, material and labour. This is a basic input for any resource planning. It is also the planned layout to be used to manage and execute the project *Venkataraman and Pinto (2008)*.

The work Breakdown Structure categorically creates a network which joins the project scope, the schedule, cost resources and acts as the basis for the project information structure.

It comes with a network that covers all project work information movement, again as a system for following schedule of projects and progress. It helps in cost data reporting and outlining, *Venkataraman and Pinto (2008)*.

For effective project execution, project work breakdown structure plays one of the major roles, project works are subdivided into work packages which are easily managed for the project

deliverables. *ProjectManagementDocs.co (n.d)*. Its purpose is to provide a structural outlook which provides its deliverables. PIMBOK 5th edition.

Schedule and timelines provide the schedule base line which is used by project managers as reference on checking progress. Microsoft Project can be used in the creating a schedule base lines and work breakdown structure, *ProjectManagementDocs.co (n.d)*. In the WBS, work package should not exceed 40 hours of man work and at least 4 hours of man work. Again work packages should be formulated through the collaboration of the project team members, stakeholder and functional managers input in conjunction with lessons learnt from past projects.

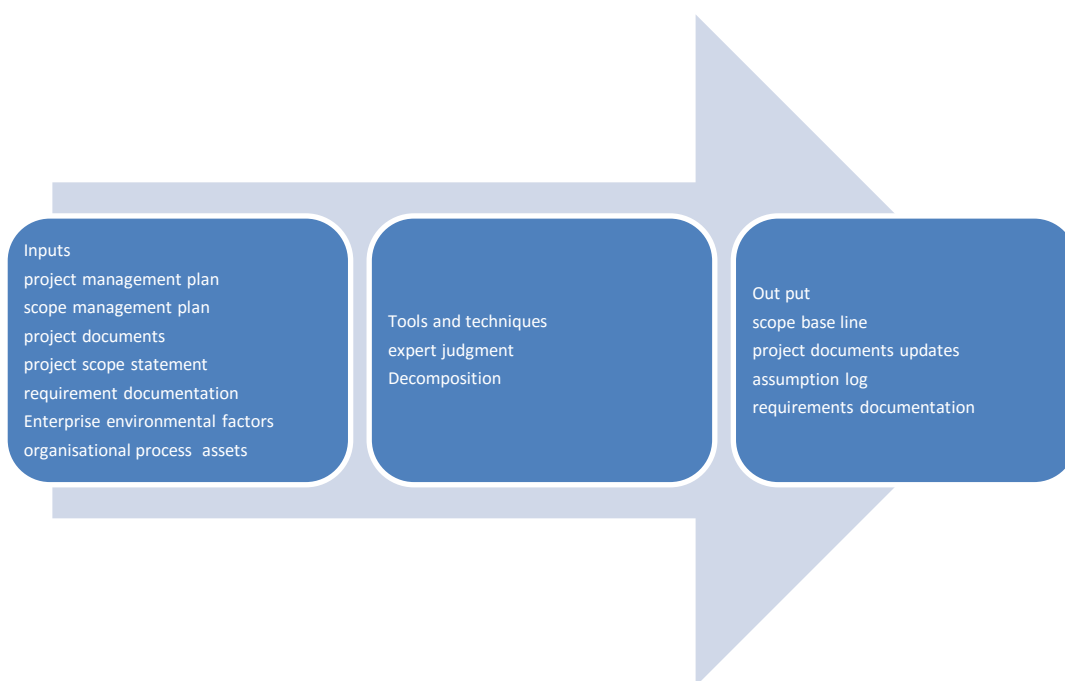


Figure 2.2 Work Breakdown Structure

Source: PIMBOK 6th edition Adopted., create WBS

For effective execution of work contain in the project scope with respect to its project deliverables, the project scope should further subdivided into a smaller and more manageable section which is termed **Decomposition**. At the lowest level of the work breakdown structure (WBS), the work package is established to help calculate the cost value of activity and its period needed. PIMBOK 6th edition pp158

The size and complexity has effect on the decomposition of project scope. The breaking down of project work into work packages involves the following and not limited,

- Finding and evaluating the deliverables and related work;
- Forming and organizing the WBS;
- Break further the upper WBS levels into lower-level comprehensive component;
- Establish identification code to the WBS components; and
- Validating that the amount of decomposition of the deliverables is fitting.

A typical work breakdown structure

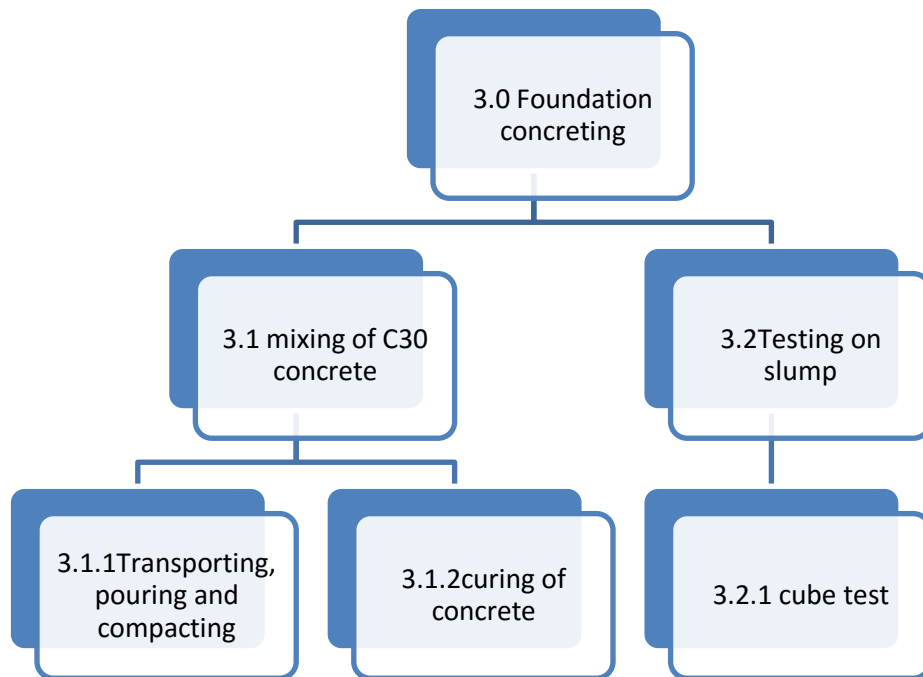


Figure 2.3 A typical work breakdown structure

Source: PIMBOK 6th edition Adopted

The following *according to Venkataraman and Pinto (2008)*. Are guidelines for designing Work breakdown structure and it not limited.

- Deliverables are to have references at every level in Work breakdown structure as work packages activity thus all work package will be captured executed.
- Every work package of the Work breakdown structure should be decomposed to smaller section at the immediate lower level. Note that when there are mandatory on procedural requirement then it an exceptional go by it.
- Every decomposed work package at it level should be the responsibility of particular department, or persons.

- To help effectively handle risk aspect of the project, proper detailing of the work package the more it is to identify and deal with hiding risk.

Numerous ways can be used in creating the Work Breakdown Structure, that is the top-down method and the bottom-up method.

The designing of the Work Breakdown Structure can be in a number of forms,

- The use of project life cycle at the second level of the breakdown of which the product and project deliverables are placed at the third level
- The use of main deliverables as the second level of the breakdown.

2.11 HISTORICAL INFORMATION

Based on projects executed by the company under similar conditions, the input resources used to execute the project will be considered. If the historical information is available, it should be used since it more factual than the use of the assumptions. Again it also consents past similar work executed by the project manager in terms of scope and deliverables and the type of resources which was required. *Project Management Institute (1996)*

2.12 SCOPE STATEMENT

For effective resource planning, the project scope statement is very vital tool. The scope defines the project work. It is used to steer the resource planning process, as it identifies why the project was executed and the required work to complete the project, again with the required work to be executed it helps identify the required resources needed.

According to the PIMBOK 6th edition, project scope comprises of a developing detail statement of the project requirement, milestones and the products pp.126

One of the important actions of the project team is to assess in wider perspective the main activities to execute.

This must high light all the activities which needs to be done to get work executed. By documenting a developed detailed description of activities to be completed, then project scope statement is formed, *Venkataraman and Pinto (2008)*.

The project objectives should be precisely and exactly describe by the scope statement, in addition a detailed list of project deliverables and all activities required for the projects execution should be spelt out. This help project team members assigned to an activity to understand the contents of work to be executed, comes up with proper estimate, budget for material plant and activity duration needed.

It's done during the early stage of work planning; it normally goes through extreme revisions throughout the life cycle, as a result of variation. These changes must go through proper change control system, by keeping stakeholders informed on project scope changes, such that schedules, resources and budget can be influenced. *Venkataraman and Pinto (2008)*. A project scope statement, which is well defined, leads to project success.

2.13 RESOURCE POOL DESCRIPTION

The availability of resources which are at hand should be made known to project managers for resources planning. These include labour, material and equipment's, the effectiveness of labour,

and the quantum of materials and quality should be of concern to managers. Are resource likely to be in constrain with time especially when the project is at its peak stage? PMI (1996)

The pool of resource also varies per the project execution period, such that the initial stage resource needed are of less quantum as compare to the resources needed for the middle part where more work is been executed. At the later part, activities on work reduces, labour is cut down normally material usage also drops in quantity.

2.14 ORGANIZATIONAL POLICES

The organizational policies regarding staff employment must be taken into consideration. The procurement policies to ascertain lease or rent equipment before planning resource must be spelt out. Time invested in identifying resource may be lost if the process conflicts with organizational policies, and which is called Organisational Process Assets, PIMBOK 6th edition.

2.15 LABOUR

The output per hour constitutes labour productivity. Labour turns to take the highest part of cost with regards to of construction projects. Hence management is more concerned with the quantity of labour hours to execute a project than the cost of material or capital.

According to (*AdeAsmi Abdul Asis el al, (2013)*).on project execution, success does not depend on the number of labour engaged by the project. Hence staid attention should be given to labour management in other to avoid cost overrun.

Functional units are used to express construction output. In management, labour productivity is associated with units of product per labour hour. It comes in the form of cubic meter, meter

square placed per hour, area of block work built per hour and by the value of construction, the labour can be extracted. Labour productivity in this way needs considerable care in explanation. *Chitkara (2005)* as cited by *Otim et.al (n.d)* is of the view that, labour employed for work activity, its productivity measure is based on the efficiency and effectiveness to achieve the specified task. *Alinaintwe (2006)* as cited by *otim et.al (n.d)* emphasizes that, close to 40% of man's hours engaged on activity are the production bases whereas 33% or less is for unproductive activity. Again, as said by Rain (1999), Providing supervision and work environment of good type by projects managers as cited by *Otim et.al (n.d)* will reduce cost on production

According to *Koushki et al. (2005)*, *kaming et, al., (1997)*, In Indonesia, labour is a major related cause of cost over run which needs to be monitored closely.

2.16 NON-PRODUCTIVE ACTIVITIES

The examination of non-productive hours associated with the project is important to help define the productivity yield; this is defined as the ratio of direct labour devoted to the completion of a project to the potential labour hours.

Direct labour hours are estimated on the basis of the best possible condition at the work site. It's by elimination of all the factors which may reduce productivity labour yield.

Bambeng .et.al (2016) are also of the view that, productivity measurement in terms of work in the construction industry is very important requirement for the drafting of national and regional constructional labour improvement program in a country. He is also of the view that, the

economics might have useful information on a single company's measure of productivity. But it cannot be used for a decision and actions implementation.

Site productive level is enhance when set target of production level are met by implementing companies. To do this companies need to tie productivity indices to that of executing project, and compering their value, make analysis to establish the variance in order to access problem areas and the possible resolution for implementation. *Abidin, et.al, (2006)*

Productivity is also affected by certain factors such as expert on the job, skill personal, age, the leadership skills, and project conditions, motivation of work force and other factors such as project size and complexity, labour availability, contract agreement and other Enterprise environmental factors. *Soepandji, et.al. (2016)*

The productivity can be expressed as = (output units /input resources)

2.17 MATERIAL CONTROL

Gulghane and Khandve (2015) stated that, in the construction industry globally, cost of material is of 60% of the total cost of the project executed and those prudent measures, on materials control will lead to project success. Different type of waste is characterised by construction management, which affect the environment with which the project is been carried out as stated by *Patal K.V, et.al (2011)*. And cited by *Gulghane & Khandve (2015)*

Butler (1982), as cited by *Otim et.al.(n.d)* is of the view that, one of the problems faced on site by site foremen and engineers is the high amount of material wastage due to different site conditions. Supervisors are required to carry out an effective control system to stream line the losses.

Hendrickson, (1998), also admit that material wastage can occur in the course of purchasing, storage and material utilization. Although, labour and plant forms major cost elements in construction projects, material is also another important of cost item which needs attention. *Ade Asmi Abdul Asis et al, (2013)*.

Importantly material plays an essential roll, which needs to be well controlled on construction projects. Managing material in project planning and control is an essential activity; on the other hand, reducing purchasing cost is an essential way to cut down cost. Large and avoidable cost encountered during construction can be as a result of poor material management. Effective management of material is very important for the achievement of successful project execution since issues concerning poor material control will contribute to cost overrun *Koushki et al., (2005)*. However, *Gulghane and Khandve (2015)* emphasis that, delay in construction delivery has one of the contributing factor to poor material management. The early purchase of material can lock up capital and the interest charged on this capital puts stress on the inventory of material. Moreover, Poor storage may lead to deterioration of material eventually, to cost increment.

The control system is not only to check during usage but also, plans for procurement during the initial stage of the project. It's done with the intention of getting just in time delivery and fixing to save time and labour.

Planning to receive timely procured and delivered material will also lead to proper material management. The procured materials should be of the right specification, quality and quantities as excess and shortage can equally affect the project budget negatively *Gulghane and Khandve (2015)*.

Purchasing of materials of the wrong specification, above specified quantities to cover up for unforeseen circumstances, purchasing materials which are not due for immediate use and of short-life, are all ways in which materials can go waste.

Wastage during construction can also be as a result of unnecessary double handling of material. Moreover, it can also be as a result of breakages and damages in the period of handling, deterioration due to incorrect storage. The short shelf life of the material and losses due to fire are also a factor.

Other causes of wastage of material on site are as a result of theft and extreme climate exposure. Improper storage, over storage of material at the store shelves, refusal to send back unused material and surplus to the store. Due to the capital needed for project execution, care must be taken when planning for material as it contributes to the organisational performance either positive or negatively, *Gulghane and Khandve (2015)*.

Unpreventable wastage does occur during execution of works but wastage in excess is of major importance to management as it leads to cost overrun *Chitkera (2005)*.

Keeping precise control of materials is a very difficult task and that material cost can be divided into price variance and quantity variances

Price variances are changes in the purchasing situation after the preparation of estimates due to inflation and price fluctuations. Quantity variances, these can occur as a result of wastage and breakages, theft, and losses and short deliveries, inaccurate site measurement of executed works is also a factor.

2.18 CONTROL PLANNING OF MATERIALS

From the Bill of Quantities or the work break down structure, quantity of work to be executed is extracted, estimation is carried out to obtain quantum of material, labour, and plant and time required for the work activities. These are done on site, frequently control planning should be review to check if work is being executed as planned *Khyomesh, (2011)*.

Proper material control can start from; material estimation, budgeting and planning. Period for procurement, receiving from buyer and inspection from the buyer the buyers inventory control, and storage at the ware house. Proper handling by the seller on transportation, and warehouse to reduce waste *Chetna, (2011)*.

2.19 CONTROL ON INVENTORY

According to *Sunderson,(2007)* cited by *Patel (2011)*, it's the total summation of value of purchased materials planned to be used for the execution, store materials may include, cement, fuel and lubricants spare part, tiles etc.

2.20 INSPECTION OF DELIVERY MATERIALS

This can be categories in two parts;

- Inspection from the sellers end; the agent in charge should inspect all material if there are in conformity to the specification, quality and quantity

- Inspection at the buyers end; he is the responsibility for material quantity control check all material delivered to site by sellers or agent. The inspection should cover quantity, quality and the timing. This is done to reject damage materials during transportation.

2.21 SITE STORAGE AND STACKING.

Various materials come with their own way of storage and stacking the space available is a factor.

Material storage can be best done by coding system as stated by IS coding 4082. As cited by Vyas, (2011).

- i. Material should stacked such that it quality is not contaminated by impurities such as dirt's and leaves;
- ii. Cement at site should be stacked off ground on pallets in an air tight room; the system of first in first out should be adopted;
- iii. To prevent rusting on mild steels and other metals, it should be kept under shield preventing it from moist air and rains, also keep it off from oils and lube; and
- iv. For easy issuing, bars of various sizes and specification should be segregated.

2.22 CONTROLLING MATERIAL ISSUING

Sunderson,(2007) as cited by Vyas,(2011) state that, it can be in two forms, issuing to manufacturing department and to supply for processing. In the case of the construction industry, on site issuing is not relevant on materials such as sand and stone. They are used based on the

type of the execution. Some materials are issued based on the execution or activity begin performed, material bill and activity order are printed stating material quantity to be issued against the activity material bill. This helps usage of material.

2.23 MECHANICAL PLANT COST CONTROL

In construction projects, man power and plant are sometimes requiring for activity performance. Most of these actual works and their associate labour are accounted for by the supervisor in charge, the equipment and the productivity control is under taken to determine its employment time, the output achieved and its productivity at site *Hendrickson,(1998)*. The purpose of plant cost is to facilitate execution by cutting down time to prevent delay, *chitkara, (2005)*. Moreover, it also increases the rate of output, reduces overall construction cost, activities which cannot be carried out by manual means. To increase productivity, and maintain a planned rate of production in time of shortage of either skilled labour or unskilled labour. Again, according to *Kaliba et al, (2009)* plant assists manpower resources in facilitating the efficiency of the project by reducing the amount of time and cost. There are numerous ways by which a company can own a plant or obtain it, this according to *Ashworth (2004)* are by total ownership through buying , by hiring , by leasing and others .etc

2.24 ADVANTAGES OF OWNING PLANT

The contractor obtains the use of an item of plant through the full payment of the cost of the plant. Hence the total ownership of the plant is transferred to the contractor or the buyer.

According to *Ashworth, (2004)* the contractor enjoys the following

- a. Plant is always available when needed or required

- b. Cost of idle time is reduced considerably
- c. The cost of the plant can be spread over a number of projects

The availability of plant at all time will help obtain its effective use and ensure a well-executed job. The rushing type of work to avoid extra payment will be eliminated. Secondly, when contractors anticipate obtaining new contracts following the completion of the one at hand, the content of work involved in a project in terms of plant which is based on the estimator's analysis. The period which the plant is required, which turns to be short is paid for by the contractor to the plant pool. This system presents a very useful and cost effective option for small companies. For large companies, where the work involved is very small they will also find it attractive. It also becomes very good and vital where cash required for outright purchase can be used to invest in other parts of the projects

Moreover the hiring firm is solely responsible for the cost of repairs and replacement.

2.25 FACTORS AFFECTING PLANT HIRING RATE.

According to *Ashworth, (2004)* with the plant hiring rate all the cost associated with the acquisition and operation of plant must be taken into account.

- a. Capital cost for plant are normally loans, these loans also attract interest which need to be paid for over time. All this needs to be factored into the pricing of the rate. Even if the owner is the contractor who self-financed the purchase, an interest should be allowed to cover up for cost if he had obtained it from a different source.

- b. Depreciation can be expressed as the loss in value of the item due to its usage. To retrieve this loss, contractors normally include a sum of money which is equivalent to the depreciation cost in the rates for doing the work. Capital deduction is made from the company's cash flow.
- c. Running cost, is the cost incurred during engagement of the plant. It also includes maintenance, repairs, fuel and lubricants.
- d. Overheads, is concern with the charges due to administrative activities and other service functions related to the use of the hired plant
- e. Licenses and insurances, these are statutory fees which are normally charged to the plant which uses the public road, due to the risk associated with the use of plant on the high way, it also affects the insurance policy to be selected.

2.26 COST ESTIMATING

The act of assessing cost through quantitative analysis to predict the required cost to complete a project. Cost on all resource requires for the successful completion of work may include but not limited the following; labour, material, equipment, services, facilities, cost of financing, and contingency reserve. PIMBOK 6TH (2017)

This is used to determine cost of resources which are needed for the completion of the project according to *Jason Owens, (2007)*.

2.27 BASIS OF ESTIMATE

Supporting document which was used in the built up rates in arriving at the estimated value should be made available for future reference and budgeting. Supporting details for the built up rate may include

- Documentation of the basis of the estimate
- All assumption made files
- All known constraints document
- All risk identified during cost estimate should be documented
- Identification of the precision and accuracy of the estimate PIMBOK 6TH (2017)

The following are methods used for cost estimating;

According to the PIMBOK (2017) estimation of cost need to be carried out by expert. This can be individual with good knowledge or training on the project to be executed

Thus might have had previous similar projects, have adequate information on the discipline and the practical know how.

2.28 ANALOGOUS ESTIMATING

This method used the following substances that are based on past projects executed in a similar manner to the current project to be executed. it attributes can includes the following cost, scope, budget duration and size or weight. Based on these substance and attribute analysis can be drawn to establish a good measure for the current project.

2.29 BOTTOM-UP ESTIMATING

Based on the work breakdown structure, each work package has its own estimate done to details at each level on the work breakdown structure and a summation of all activity estimates are done. This will help track cost and expenditure at each level.

2.30 PARAMETRIC ESTIMATING

It's also called the Comparative method of estimating; this is established where historical data from previous project activity is used as the frame of reference for current estimates. Once this method is used it creates a parametric estimation which holds the same specification, scope and features to help produce the same estimate, according to *Ashworth and Hogg's, (2000)* and again it uses statically bases to analysis important historical data and other variables in the course of application. Examples are area per square meter, volume of concrete linear length of cables for the determination of cost project to be executed. PIMBOK 6TH edition (2017).

2.31 THREE-POINT ESTIMATING

To help increase the accuracy of a single-point estimate the three points was established, which handles the uncertainties and all associated risk through it application, an approximate estimate is obtained for activity cost.

- Most likely cost of estimate (cM). The activity cost at this end is realistic for required work and predicted expenses.
- Optimistic cost (cO). The cost analysis of an activity based on it best scenario
- Pessimistic cost (Cp). The cost analysis of an activity based on the worst scenario.

Based on the output of the three variables above, the expected cost of the project can be estimated.

The commonly used formulas are,

a. Triangular distribution. $cE = (cO + cM + cP) / 3$

b. Beta distribution. $cE = (cO + 4cM + cP) / 6$

By the use of the above mentioned methods in estimate calculation, uncertainties and risk on the project to be executed is reduced drastically. PIMBOK 5th edition

2.32 APPROXIMATE ESTIMATE

Is also known as preliminary estimate, it is used to prepare a forecast of the would-be cost of a future projects before they are designed in detail. This helps the client to have a fair knowledge about the project in terms of cost according to *Ashworth (2004)*,

For approximate estimates to be accurate, it basically depends on the information which is at the disposal of the quantity surveyor and the design team

Depending on the client needs, approximate estimate can be in the following terms

- a. Units cost method
- b. Cube method
- c. Superficial method
- d. Elemental analysis method
- e. Comparative estimate method

- f. Interpolation method
- g. Conference method
- h. Financial method and
- i. Approximate quantities method
- j. Definitive method

2.33 UNIT COST METHOD

The unit methods of approximate estimating consist of choosing a standard unit of accommodation and multiplying it by an approximate cost per unit. The costs of the project and the number of functional units have a relationship. The standard unit can represent the cost per stadium seat, theatre seat, hospital bed space or car park space. Estimates like this can only be carried out by approximation and varies according to the type of construction and the standard of finishing;

2.34 SUPERFICIAL METHOD

According to *Pinto, (2004)* by this method, it is easy to calculate, the cost is presented such that it can be followed by the client. It is also known as the area method. The area of the floor of the proposed building is measured and then multiplied by the cost per square meter. This is done by taking the measure from the internal face of the wall surrounding an area. However, past working records from a past project can give the quantity surveyor the edge to accuracy and a guide;

2.35 APPROXIMATE QUANTITIES

The approximate estimate under this provides the best and detailed cost than that of the rest of the methods. Broad measurement is carried out here; important items of cost significance are measured and cost. Some of the items can include strip foundation which is measured and linearly includes excavation, concrete and block wall up to damp proof course and membrane. Through this a unit rate can be built by using cost database price book or from past project priced bill of quantities.

Normally internal and external wall finishes, and the cost of windows and doors are taken as an extra over item. With this method a realistic approximate estimate is obtained. Much time and resources are needed, which turns to be a disadvantage of it. This is used by various Quantity Surveyors in determining the budgeted cost for project before the actual cost is detected.

Table 2.1. Methods of Budget Determination

Method	Notes
Conference	Based on a consensus viewpoint, often of the design team.
Financial methods	Used to determine cost limits or the building cost in a developed budget.
Unit	Applicable to projects having standard units of accommodation. Used as a basis to fix cost limits for public sector building projects.
Superficial	Still widely used, the most popular method of approximate estimating can be applied to virtually all types of building and is Easily Understood by client and designers.
Superficial perimeter	Never used in practice. Used in combination of floor area and Perimeters.
Cube	This used to be a popular method amongst architects but now in disuse.
Story-enclosed	is largely unused in practice
Approximate quantities	still a popular method on difficult and awkward contracts where time Permit

Element estimating	not strictly a method of approximating, but more associated with cost planning used widely in both the public and private sections for Controlling costs.
Resource analysis	used mainly by contractors for contract estimating and tendering Purposes. Requires more detailed information on which to base costs.
Cost engineering	mainly used for petrochemical engineering projects'
Cost models	Mathematical methods which continue to be developed.

Source; Ashworth, (2004). Adopted

2.36 UNIT COST

One of the very important ways of analysing cost is the use of the unit cost. The unit cost can be specified for a component or an operation which can be classified under direct cost for a single unit of measurement for that component or operation Ashworth (2004). Hence it is necessary to carry out the measurement of operation and the built component to the specified quantities and quality accurately. For the calculation of the unit rate, strict measures should be taken to consider the operation or component under construction by the supervisor. Much attention should be given, to the of recording of hours; non- productive hours should not be recorded

Moreover, unit cost should be marked in hourly- rate rather than in monetary terms. This because hourly rate can be sustained in the overall cost of the project for years whilst wages and overhead can be a very risky venture

There are four categories of cost according to (Ashworth 2006), namely;

Direct cost: These are cost which have direct cost connotation with the construction project and cannot be distributed among construction projects. (Air fare, hotels and long distance charges and so on);

Variable cost: Depending on the condition applied in the project these costs are encountered.

Example, (Number of meetings, participants, supply and demand of material and so on);

Fixed cost: Constant cost throughout the project execution the cost of a piece of rented equipment for the project and the cost of a consultant brought on the project are few examples.

Indirect cost: These costs are incurred in more than one project, utilities charges for the performing organization, access to the training room, project management software license, insurance are few examples.

Normal cost: This cost occurs, if construction projects are executed as planned without extra cost to management.

Crash cost: It's a cost which occurs as a result of management pushing forward for the completion of work been executed earlier than schedule.

Recurring cost: These are cost on projects being executed which keeps on repeating in the project life cycle example are cost on materials and labour.

Non-recurring cost: These are cost on project being executed which appears once either in the beginning or at the completion of the construction project.

2.37 SIGNIFICANT OF COST ESTIMATING

Cost estimating is done for future price of a project. According to *Vankateranman and Pinto (2007)* the following are said to be the importance of cost estimating

- i. It provides the basis for a review of activity duration on the project.

- ii. Due to the scarcity of resource on some construction projects, it gives the project managers the chance to plan for allocation for such resources.
- iii. In the case of decision making on returns on investment of project, in terms of cash flow it help stakeholders to make concrete decision.
- iv. It helps project managers to assess the economic viability of a project in terms of revenues expected through feasibility studies.
- v. It help set baseline to which cost of project expenditure can be used to compare for variance to control cost.

2.38 REASON FOR COST OVERRUN

As stated by *Pinto and Vankateranman (2007)* analysis made at the industrial level on project being executed to meeting their estimated budget, become impossible because the finding suggest that cost overrun is now a norm instead off a different thing.

The following are said to be the reason for cost overrun but are not limited

- i. Enterprise environmental factors
- ii. Initial cost of estimate being low
- iii. Intermittent changes in specification
- iv. Unforeseen technical difficulties.

I. Enterprise environmental factors

These can be factors such as inflation on rate of currency, and environmental issues. The rampant changes of the currency rate will cause the real project cost to move higher than expected on construction project, when the project is troubled with environmental issues like vegetation clearing (trees etc), and where other resettlement issues are problems compensation can really delay the project.

II. Initial cost of estimate being low

In compromising of the extent of magnitude and complexity to the project to be executed, and the analysis of the work breakdown structure for resources required and duration are done in isolation without taking into account other enterprise environmental factors around the work. The risk of failure is not also considered, the project manager thinks that all will go well with the project. They also bid lower in order to become more competitive in their bid. When the bases of cost estimate is compromised, cost overrun will be a must gain result. *Pinto and Vankateranman (2007)*

III. Intermittent changes in specification

It's also called **scope creep** when the initial cost estimate is made inactive by losing its value; it becomes a recipe for cost overrun. When external stakeholders request for changes without additional resources allocation, some factors like unstable market conditions and mandatory legislative concerning the projects can contribute to budget overrun.

IV. Unforeseen technical difficulties.

Unfortunately, after a detailed analysis on designing, the project might suffer defect after completion, which needs to be rectified before the project can be deemed successful. Example is

the synchronous foot fall of the wobbling millennium bridge, the budgeted cost of project was \$ 25 million dollars but after the defect, the project was still in the defect liability period total cost of rectification was \$15 million dollars before the bridge was re-opened to traffic. It can be considered as a technical risk. *Pinto and Vankateranman (2007)*.

V. Improper scope definition

If the project deliverables required is not certain with clear direction, goals and features the project is said to be improperly scoped. If the statement of work, scope statement and work breakdown structure are not well established through inception development stage, the cost estimate that will be obtained will lose its credibility. *Pinto and Vankateranman (2007)*

2.39 COST BUDGETING

The planning and controlling of income and expenditure are obtained through the use of budget. Company's plans and objectives can be converted into quantitative and monetary terms through budgeting. The budget provides a rate of expenditure and rate of income throughout the project for the contractor. According to *Jason Owens (2007)*, the addition of cost estimates and combining them to develop a total cost and baseline is also termed as cost budgeting.

Project cost budgeting is the process of allocating the overall project cost estimate to individual work items to establish a baseline for measuring project performance.

A cost baseline is defined as cumulative time-phased budget that will be used to measure and monitor the current and future project cost performance PMI PMBOK, (2004). Over here the S-curve is used in graphical representation. It is a very essential monitoring tool. Over a period of

time, cash flow for the project can be analysed based on the present. According to *Neale and Neale (1989)*, the S-curve defines the amount of spending on budgeted construction project. It a good tool for cost management. It can produce different cost analysis that will make a manager obtain cost trend, *Kere and Formose (2004)*, the figure below shows the S-curve typically used in project budgeting. It is based on an accumulation of cost estimates

Consider the project (kms) which made up of four activities, (clearing of site, excavation of trenches, cast of concrete, and testing) by *Venkataraman and Pinto, (2008)*.

The duration was 100 days; the estimated budget was \$200,000 us dollars. A breakdown of the projects cumulative is as shown below in terms of time and activities.

In the case of time cost analysis, a clear representation is made on the graph by having the time on the x- axis whiles the expenditure of money on the y- axis, with the use of the S-curve, helps depict the value of expenditure at the initial stage and as the project progress deeper, the expenditure will also rise and then at the tail end it will again start to move constantly level.

Table 2.2 Time-phase budget: activity duration in weeks

Work activity	10	20	30	40	50	60	70	80	90	100	total
Clearing of sit	8	4	6								18
Excavatio n of trench		6	10	10	10	8					44
Casting of concrete				6	22	8	8				44
Curing						4	8	6	4	6	28
Total	8	10	16	16	32	20	16	6	4	6	134
Cumulati ve	6	16	32	48	80	100	116	122	128	134	134

Time and cost monitoring of project.

Source: Venkataraman and Pinto, (2008). Adopted

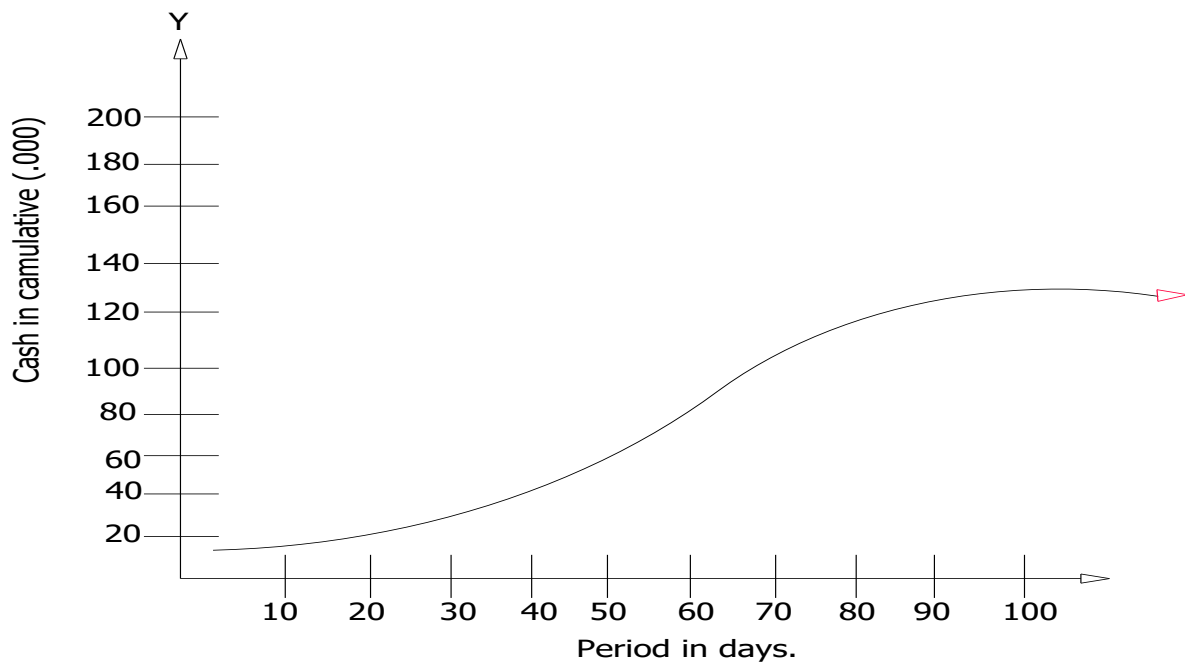


Figure 2.4 Time-phase budget

Source: Venkataraman and Pinto, (2008). Adopted Time-phase budget graph

2.40 DETERMINE BUDGET

From the project management point of view, this is the process of aggregating all cost contained in the work breakdown structure, which contains all the individual activities or work packages to

established an authorised cost baseline. For the purpose of monitoring, control and evaluation, the established cost baseline is used to check performance. PIMBOK 6TH (2017). This can be

done at various stages of the project or ones in the life cycle. The total funds allocated for execution of work is called the project budget.

The approved version of time-phase budget of a project includes contingency reserves, with the exception of management reserves.

2.41 IN PUT ON BUDGETING

Activity cost estimates: This is cost involve in an activity execution. Technically, if those doing the work prepare it or expert on the job does it, then the risk of defect on the cost obtained will be reduced.

Basis of estimates: According to the PIMBOK 6TH edition (2017), the cost estimate varies by virtue of area of application, in terms of value of the work and additional details supporting it. Based on the supporting documents clear and precise cost estimates are derived.

Supporting details which helps in cost estimate may include

1. How the cost was develop through method statement
2. Assumption made documentation
3. Any known constrains

4. The range of possible estimate $\pm 10\%$ it indicating that the cost is estimated in a certain range. Again it indicates the validity of the final estimate and the documented risk that can affect the project in the risk register.

Scope baseline: from the scope statement, the project requirement is spelt out. The use of the work breakdown structure comes in operation to categorise various items of work package and following the work activities systematically to obtain all major deliverables. The funding is also obtained through the cost estimate established.

Project schedule: based on the work breakdown structure, the decomposition of each major activity is done, resource requirement and its timing are obtained through scheduling. This will help monitor and control cash flow and of work to be done, human resource, plant and equipment which will be needed, materials usage and its expected cost.

Contracts: when the entire project is to be contracted, the contract sum becomes the basis of budgeted of the project. With this, contract documentation need to be clearly spelt out. The drafting of the agreement should be done by an expert on the field to reduce the risk aspect of the project, such claims and litigation which can delay the project and throw off board the budget.

Organisational process assets: The Company's existing policies on budget is also a major concern. Some may have working template, standard format and reporting format that exist to be used by cost engineers during estimating to create budget.

From the project management point of view, budget can be established through the use of various tools and techniques

Cost aggregation: This is done through the design work break down structure. The structure are decomposed to obtain work package and further to work activities. At every stage in the work breakdown structure, the human resources, material resources, plant and equipment, financial resources which are required to help produce the expected deliverables are obtained. The sum of these cost are aggregated to create the project cost.

Reserve analysis: This can be categorised in to two phases, establishing contingency and management reserves.

Contingency reserves: After the formation of the project cost, through the use of work breakdown structure, resource content, other risk factors on the project which when occurs will shatter the foundation of the budget are considered. They are the known risk, with the known probability of occurring, and the possible resource allocation to mitigate it should it occur. Cost baseline is obtained by summing of the contingency reserve and the project.

Management reserves: After the creation of the contingency reserve, which took care of the known Risk, the unknown should also be considered. A typical example is the London wobbling bridge which was budgeted to cost \$25million dollars after construction surfed a synchronous foot fall within the defect liability period. Additional money of \$ 15 million dollar was used to rectify the defects which push off board the budget of the project. *Pinto and Vankateranman (2007)*. This funds are in the control of management of the project not project manager. The summation of the management reserves and cost baseline create the cost budget.

Expert judgment: Expert on the job is very essential to obtain accurate estimate for the creation of the budget. Expert might use pass budget template and other lesson learnt records to help in their decision on the project budget.

Funding limit reconciliation: Base on the aggregated sum from activities cost, work package cost, control account project, contingency reserve cost baseline and management reserve in obtaining cost budget. The cost budget is compared with the project funding expenditure. This is done to access if the project can be executed or additional funds will be needed or scope need to changed.

2.42 THE OUT PUT OF DETERMINE BUDGET ARE BUT NOT LIMITED

Cost performance baseline: for the purpose of effective cash flow managing and project performance in terms of cost and deliverables are checked. That is the resource need for the execution will be issue out as planned, deliverable will be ready as planned to achieve each milestone. In the case of monitoring and control over cost if expenditure exceeded a predetermine limit, quick check is carried out to cover cost and probably delays.

Project funding requirement: With the establishment of the cost baseline total founding requirement are derived.

Project documentation update: Throughout the process, other changes might have been carried out in terms of project schedule, scope statement and funding requirement. The project team document ought to be updated for record purpose.

2.43 CONTINGENCY AND ALLOWANCE BUDGETING

For a proper amount of budget to be established and to accommodate risk or unforeseen cost increases, contingency and allowance cost is necessary. If factor Such as these, are not inculcated they can hamper the effective execution of the project. Budgeters face problems such as information/ influence gap, as shown in figure 2.5

Karslen and Ierein (2001) state that the initial budget of project activities, that have high cost influence the project cost; having relatively low amount of information available to make good budgeting decision.

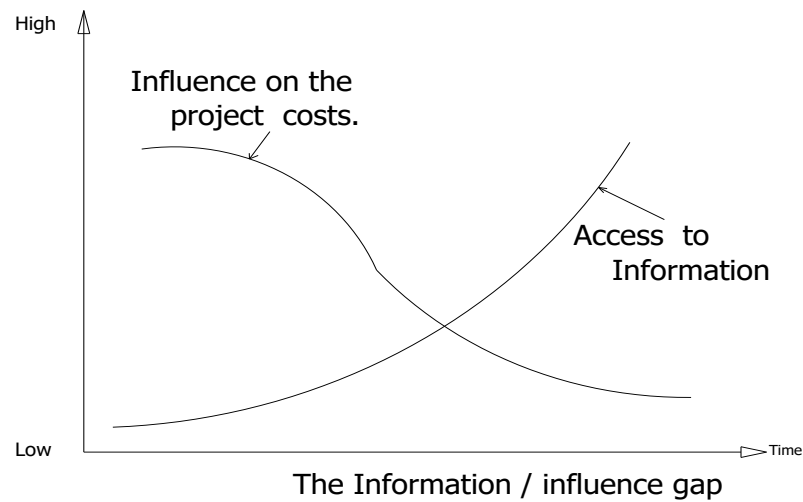
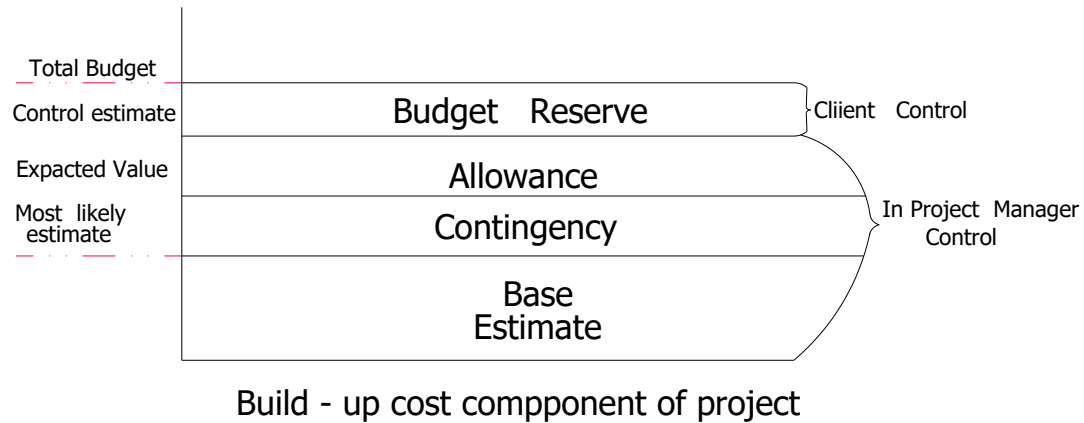


Figure 2.5 The Information/Influence Gap Graph

Adopted from Jason Owens (2007) pp.15 adopted

To overcome such gap in project cost management, there should be team work to develop and inform the cost build-up process of the organization. One should have a perfect in depth knowledge of the budgeting component that includes the budgeted reserves, allowance, contingency estimate and base estimate.



source : jansonowens and co. budgeting systems

Figure 2.6 Budgeting Systems

Adopted from: *Karslen and Ierein, (2001)*. This provides a graphical representation of this component. And cited by *Janson Owens et.al (2007)* **budgeting systems**

In the non-appearance of risk, the probably cost which can occur is the baseline estimate cost, which is not normal in most cases. Other additional budgeting does occur such as the contingency reserve which follows the baseline estimate to check cost overrun, additional moneys to be allocated for the project allowance.

Accuracy of budgeting is achieved by adding onto the budget sum of monies known as risk reserve. All this budget analysis is controlled by the power of the project manager. Risk analysis and assessing need to be carried out to know their impact on the project. With this project managers will realize where possible overrun exists and budget accordingly for it.

2.44 CONTRACTORS COST CONTROL AND MONITORING PROCEDURES.

Cost needs to be more detailed than merely maintaining records of expenditure and issuing cost reports. Control means to manage, so understanding how and why cost occurs and taking precise action necessary in response to all information gathered. Keeping the project within the planned budget depends on the use of an effective and exact system of cost control processes.

Bennet (2003) states the following as the essence for cost control system are;

1. To produce an information base resource for valuing variations to the contract and potential claims for additional payments.
2. For building a data base information system for future use in estimating the costs of subsequent projects;
3. Serves as an evaluation mechanism of comparing actual with budgeted expenses and thus prompting the attention of management in a timely manner, to operations that are deviating from the project budget;

Intermittent monitoring of cost is linked to two out comes

1. Looking forward to any on any work items whose actual cost are exceeding their budgeted cost, thus taking action to bring those activities in conformity with the budget;
2. Based on the cost recorded, a final estimate can be used to establish the percentage of work completed and expectations of the cost of unfinished items;

Barnes (1990) recommends these concepts as two critical factorings which should be considered in the financial control of any construction project,

1. The purpose and size of the projects are of major importance to management but also the time, cost and risk of changes need to be considered.
2. Being proactive is also part of the control, it is because the past becomes history but the present and the forthcoming can be controlled and action taken.

Oberlender (1993) also states that, cost control is not only dealing with expenditure. He states that it includes control of income, making sure that all monies due to the contractor is retrieved from the client and that, no needless expenditure is permitted to arise. For Cost control to be effective, it should have these potentials.

Management responsible, should setup a budget for the project with a contingency figure, operate a cost effective system of cost recording, actual costs should be rectified by the use of variances analysis to determine the reason for any deviation from the planned budget.

Time and quality comes with cost and it needs to be incorporated in to the decision making process.

2.45 PROJECT COST CONTROL SYSTEMS

According to *Pinto, J K and Rouhiainen, (2001)*; There are many systems of cost control in use by project managers in the art of controlling cost at the site and one of them is the standard system. The most important aspect of the standard cost control system is the identification of variances, which can be expressed by Ashworth as: Budgeted cost- Actual cost = variance.

Before cost control methods can be put in practice, there are initial steps which need to be put in place to help obtain good results as stated by *Venkataraman and Pinto, (2008)*. There are four main important activities which must be put in to place in order to measure and evaluate project

performance. These include, creating a base line plan, measurement of progress and performance of, relating real performance against plan and effecting an action.

2.46 CREATING A PROJECT BASE LINE PLAN

This is very important component for establishing measurement performance. It starts with breaking down the work structure in to various work packages and activities accompanying with the project, the personnel assigned to them and the establishment of chain of command. For the creation of the project base line plan, a layout plan of project team is done, to work on all the separate tasks from the work break down structure into project network chart, and time-phases budgets and resource.

2.47 MEASURING AND OBSERVING PROGRESS AND PERFORMANCE

Project performance measurement, is an important function for proper control system. First, it creates a project control system that monitors continuing actives and all project errands in real time and presenting them to the project manager with the essential data as early as possible. Good and accurate measurement can take place through effective weekly, monthly or quarterly reporting systems used by contractor's project manager, according to *Pinto, J. K (2001)*

The reporting system under consideration is the weekly system of recording. Here work break down structure helps in capturing the total quantity of work executed, the plant used in that work and the labour which were used. On each work break down component, the cost and the units cost are assessed in the course of the week.

Table 2.3 The schedule for cost recording on weekly basis.

ENOE contracting Ltd Weekly cost record sheet 2 of1 Contract Number : J C V 2320 Week ending 24/08 Contract:16,UNIT,CLASSROOM,BLOCK Week program 8														
code	Operation.	unit	Quantity				Cost (RM)				Unit cost(RM)			
			This Week	Perv. total	total to date	Est. overall total	This Week	Perv. total	total to date	Est. overall total	This Week	Perv. total	total to date	Est. overall total

Adopted from *weeliang (2005)*

On the other hand the Ghant chart method of recording progress depends on the type of construction and the amount of necessary detail. The Ghant chart record of progress of work executed can be in pictorial diagrams or on plan chart. These charts are coloured to depict the section of work completed hence giving a clear visual impression about the progress of the work as a whole. It consists of cursor which is used to indicate the position reached on the time scale. With the program line, it is used to represent time and quantity of work, whereas, the time line is used to indicate the start and completion for an activity.

2.48 IDENTIFY WHAT TO MEASURE

Project progress can be measured by identifying qualitative and quantitative methods and the accumulation of these systems like time and cost into the control systems. It is comparatively simple, In terms of qualitative, its measurement can be done by comparing work executed to the section. Secondly, progress monitoring can be done with the network diagram.

Moreover with the quantitative measurement on performance of project which relate to time can be used to measure project performance against budget. Hence (EVM) Earned Value Management is suitable to provide an accurate estimate on project, rather than the time-phased budget.

2.49 ANALYSING ACTUAL PROJECT PERFORMANCE AGAINST PLANNED SCHEDULE

If the actual project performance is not in accordance with the original base line schedule, Compare the two to extract the variance. This is also termed as gap analysis. This helps to obtain the project status. This is done to obtain the standing of the project manager on the project performance; it is also call gap analysis. It done by comparing the actual work performed to the planned base line, the variances is extracted for interpretation. That is if the variance is positive then the project is on course. If the variance is negative then either the project is behind time or cost overrun.

2.50 IMPLEMENTTING CORRECTIVE ACTION

In proper cost control measures, every dollar counts thus if the variance between the planned base line and real cost on performed work is very huge, and then needs to be taken to bring the

project back on tracking. Variance on the other hand can be permitted if there is a proper change control, which then changes the established base line. Consider the figure 2.7 below

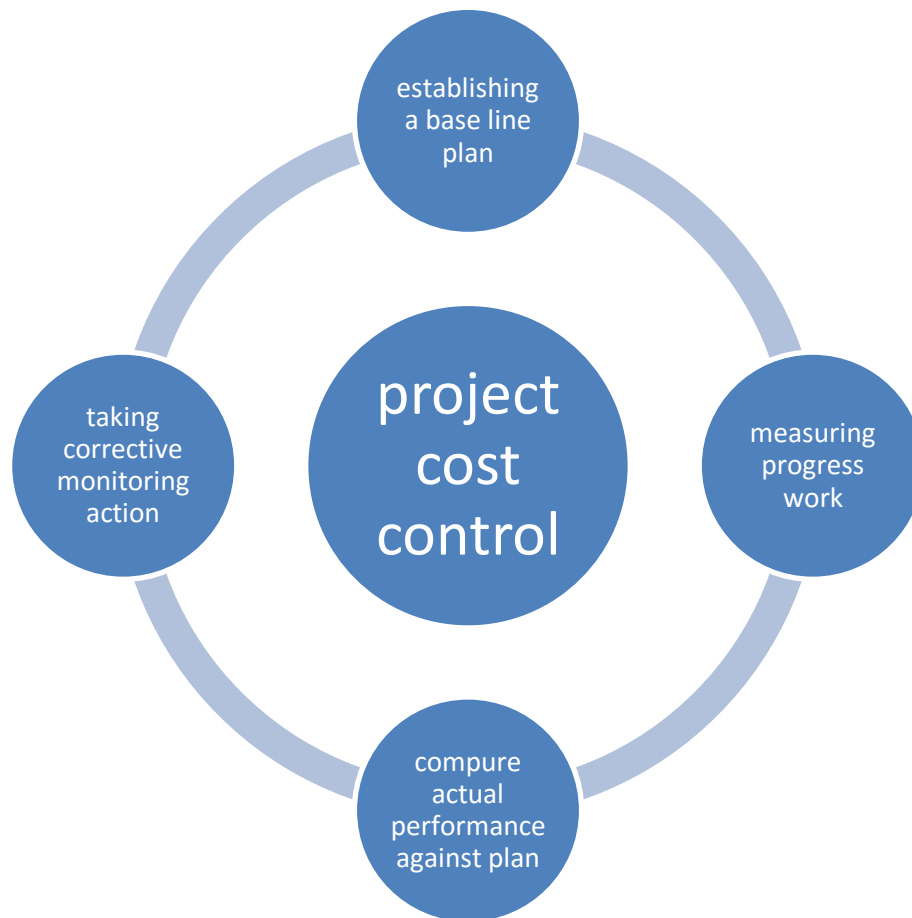


Figure 2.7 Implementing Corrective Action

Source; Pinto, (2001). Adopted implementation of corrective action

With the implementation of the above mentioned practical policies, project cost control systems can be applied to monitor and evaluate project performance.

2.51 COMMON COST CONTROL PROBLEMS ON CONSTRUCTION PROJECTS

According to the following researchers, *Abdalla et.al (2002)*, *Jaakko et.al(2014)* and *Chapman(1999)* ,concluded that, common cost control problems on construction projects are :

Improper estimates, poor standards and budgeting techniques; Unrealistic budgets; activities started or completed out of time; inadequate work break down or insufficient work break structure details; lack of management policy on control practices, reducing budgets or bidding to be competitive, inadequate planning, which is a common practice on privately funded projects ;unnoticed and uncontrolled increase in the scope of work, lack of comparison between actual and planned cost; escalation of material cost; Improper assessment of risks by the bidding team and by executive management, Excessive pressure on the bid team to WIN the project. "Must win" projects are often destined for eventual failure; Contractual discrepancies and inconsistencies. These could result in gaps and ambiguities in contracts which often result in cost increases and erosion of bargaining strength.

The following methods of cost control are used by contractors but are not limited;

- a. Earned value analysis
- b. Cost value reconciliation (used by building contractor);
- c. Contractors' variance unit costing.
- d. Forecasting
- e. overall profit and loss

(a) USING EARN VALUE ANALYSIS AS A PROJECT COST CONTROL TOOL

Earn value analysis is the traditional way of controlling project cost. From *the PIMBOK 6th edition* is the act of comparing base line of performance measurement to the cost performance and actual schedule. According to *Howe's (2000)*, earn value analysis is an established method for the evaluation and financial analysis of projects performance throughout their life cycle. it is also used in a meshed system of project cost and schedule-control which permits trend evaluation on cost schedule variance through the formation of the S-curve. One of the routine measurement tools is the earn value analysis technique. It is a program management technique that uses current work performance to predict cost and schedule forecast. It replaces the traditional way of accounting progress measures, which focuses on plan accomplishment expenditure and actual cost. It also has the ability to detect the possible risk areas. With the use of earned value analysis, management can create plan for alleviation, based on the actual cost schedule and the technical progress of the work.

Management of all capital projects in any industry can use the technique; to assess whether the project is slipping in schedule or it is being overruns. According to *Fleming and Kopplemen (2000)*, due to the reliability of the technique, private industries have adopted it since 1997, as a best- practice tool that project managers can use.

As stated in the PIMBOK 5TH edition, calculating the end value, this can effectively be done by calculating the value for each activity in the (WBS) work break structure

Planned value (PV); its initial budgeted cost of work schedule (BCWS); that part of the accepted cost estimate schedule, to be spent on the given activity during a given time. It is also the

physical work that should have been accomplished. Its totality is sometimes called the performance measurement base line (PMB) or budget at completion (BAC)

The actual cost (AC); it is actual cost of performed work (ACPW); the total cost spent on the execution of the project or the realised cost incurred on activity of work performed within a stipulated period. It is also the total cost incurred in accomplished work that it, if EV is being measured. It is expected that the actual cost will correspond in expression to the planned budget.

The earned value (EV); it is the budgeted cost of work performed (BCWP) or the measure of work performed expressed in terms of the budget authorised for the project. It is the completed authorised work in association with its budget. Earned value should have an association with the (PMB) performance measurement base line and should not be greater than the planned value (PV)

(b) THE ACTUAL COST OF WORK EXECUTED

To assess whether or not the project is being executed on planned schedule and cost, the three values are combined to achieve it.

These are namely, cost variance and schedule variance.

PV (planned Value); this is the estimated value of work planned to be done

EV (Earned Value) (BCWP): Estimated value of work actually done

AC (Actual cost)-(ACWP) – Actual cost incurred

BAC (Budget at completion)-Total Budget for the project

EAC (Estimate at completion) what the project is expected to cost currently

ETC (Estimate to complete) from this stage, to complete the project how much additional fund is needed.

VAC (Variance at completion) to what extent is expected to be over or under budget at the completion of the project?

Cost variance (CV) = EV-AC

Again, Cost influences a schedule slippage, the schedule variance in terms of cost, may be assessed as;

Schedule variance (SV) = EV –PV

From the above, an expression can be created as ratios that show the value for money.

Note that, if work is progressing or proceeding as planned these ratios will be equal to or greater than 1.0. On the other hand bad variance will be less than 1.0

How are we performing on money?

Cost performance index (CPI) =EV/AC

How well are we performing on time?

Schedule performance index (SPI) = EV/ PV

It is believed that this is earned value one of the most powerful tools for cost control in project management. The obtained data should alert management on, the performance of the project as a whole or at any time.

Figure 2.8 shows the graphical representation of the EARN VALUE ANALYSIS

(c) FORECASTING

Forecasting, at this end the future prediction is stated

Estimate at completion (EAC) = BAC/CPI OR $AC + (BAC - EV)/CPI$

Estimate to complete (ETC) = $EAC - AC$

Variance at completion (VAC) = $BAC - EAC$

With the completing performance index (TCPI)

$TCPI = (BAC - EV) / (BAC - AC \text{ or } (EAC - AC))$ which express as (work remaining to be done) / (cash remaining to finance it).

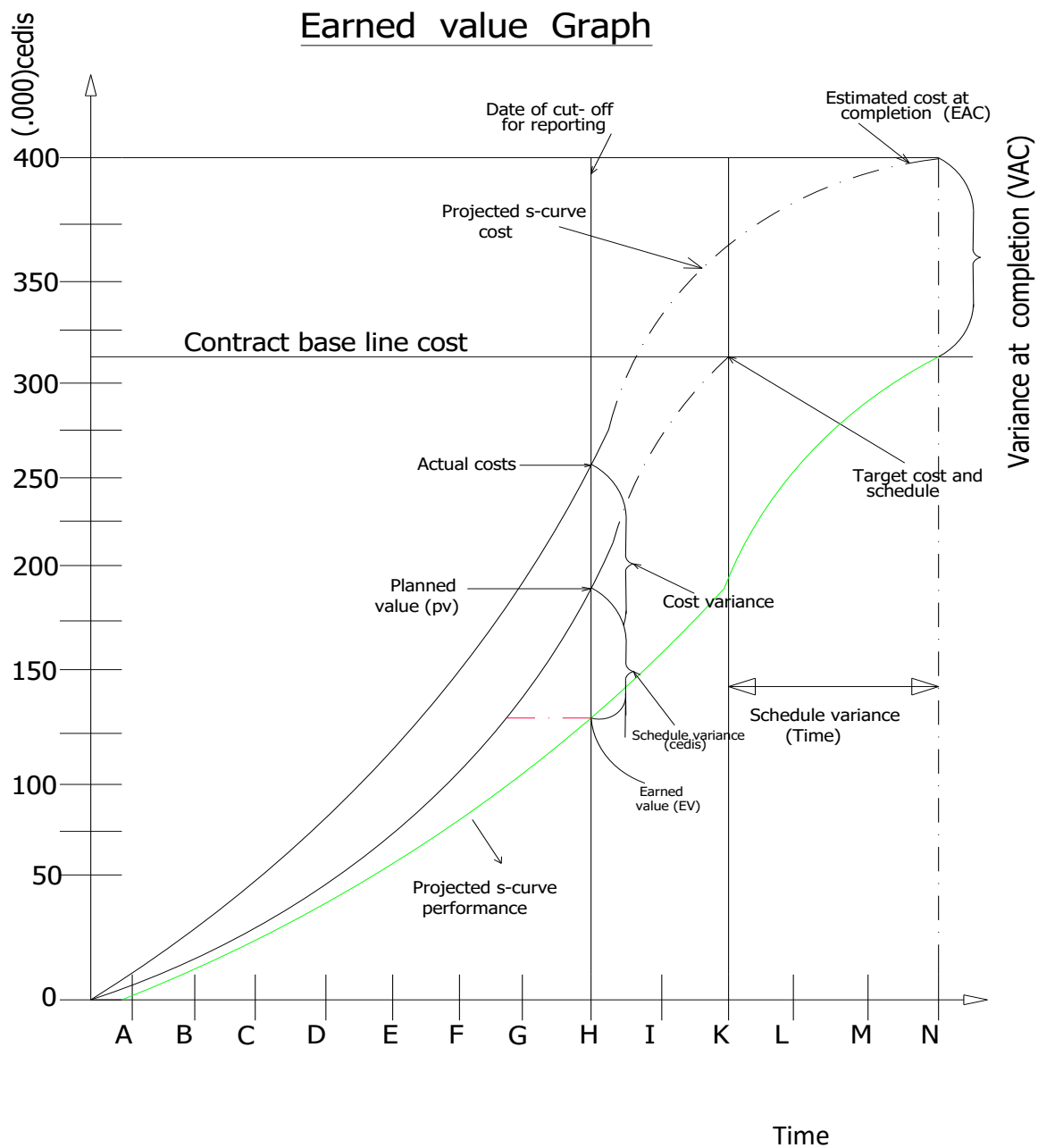


Figure 2.8 Earned Value Graph

SOURCE AEW Services, Vancouver BC (2005) adopted

(d). COST-VALUE RECONCILIATION (CVR)

This blends together budgeted total for cost and value to show profitability of a company. Its purpose is to show profit if the company's accountings are exact and factually showing its current financial position. *Barrent. (1992)*.

This CVR makes sure those statutory account regulations in correlation with the rule of standard statements of accounting practice No 9(SSAP9), ICAEW, 1998) on complied with. It state, that valuation of stock and works in progress must be followed. The CVR provides more prudent information (financial statements). Hence losses or latent losses, and would be detected early and rectified and that trends should not depict that there are doing well when actually they are not. The CVR also provide information to management in a way to spot problems, the need to create reserves, the causes of losses the measures needed to prevent such losses. The imaginative budgeted figure will be shown by it and the expected profit, together with the final spot of the project

At the end of the month where interim valuation is being done for certificate, the total valuation cost should be compared to the total cost to date this is done to check under valuation or overvaluation, hence the disadvantage of this system is such that there is no breakdown of the cost profit figures within the different phases of work within the project high guidance is required from management on such system. From the chartered institute of building (CIOB) cost valuation reconciliation approach by *Barrent (1992)* is the standard recommended approach. The CVR is normally used by quantity surveyors on monthly basis after agreement on the interim valuation. This process also requires that the quantity surveyor links with the other departments

in its completion and consideration dialogue with the rest of the project team. This system is very good for complicated and complex project.

The gross certified value is where any CVR get started; this must be supported by the architect's interim certificate. This is based on the external valuation and not the assessment of internal valuation of the work by the contractor's quantity surveyor.

Research by *Stephenson and Hill (2005)* noted that some contractors; mainly the large ones proposed the application of CVR in conjunction with an IT-based budget monitoring system (BMS) enables the incurred cost to be linked to progress as shown on the programme. Cost to complete and the anticipated financial out-turn cost are also established.

(e) CONTRACT VARIANCE-UNIT COSTING

With this system, cost of all the various types of works such as drilling piles, or concrete work, block work are recorded individually. The real cost is divided by the amount of work, that is each type has been executed. The unit cost obtained from the above is compared with those tender figures for that particular activity. There should be a comparison of the value of work done and the cost of executing it, by this the variance will be known.

This scheme helps in detecting the problems areas and trends as well as projecting the financial profit/ loss situation on the project. Effective action should be taken to correct any loss during project execution. Where a contract is in the form of recurring type, this method of cost representing is the best, but less useful on non-repetitive contracts, again it is also good for civil engineering works where there are a small numbers of high value component in the project.

(f) OVERALL PROFIT AND LOSS

The use of overall profit and loss considers categorically, the analysis of the actual cost of executed work activities contain in the work breakdown structure in the entire project at completion. A comparative analysis is made to the total monies obtained from the total certificates raised and paid by client that is after closure of the contracts. *Badu and Owusu-Manu (2010)*.

(g) PROFIT AND LOSS BASED ON PROGRESS PAYMENT

As the name implies, the system checks on interim certificate raised and paid on progress payment that's monthly or quarterly as stated in the condition of contract. The actual cost of work executed is compared to the budgeted cost of the work component for variances. Good and accurate measurement can take place through effective weekly, monthly or quarterly report used by contractor's project managers. *Pinto J. K. (2001)*. This contains a unit cost on materials, labour and plants resources used for the work executed *Ashworth (2004)*. This cost is compared with the net unit cost for the work items rate in the Bill of Quantities, as at when the certificate was being raised and check for variance. VAC (Variance at completion) to what extent is work item expected to be over or under budget at the completion of the project?

Cost variance (CV) = EV-AC. PIMBOK 6TH Edition

2.52 THE USES OF COST CONTROL

One of the duties of the client's quantity surveyor is to ensure that, the project to be executed is carefully controlled in terms of cost arising throughout the entire design and construction

process. The focus of the cost control must be balanced with the importance of value in terms of what is being provided for the client.

The cost control system can be used to identify uneconomic construction activities for proper action to be taken. This is such that, in construction, effective productivity goes with effective time management, methods and the use of quality material to achieve the desired purpose work.

In the course of execution, when an activity is delayed, it affects the cost on labour and material. If a method of executing or carrying out an activity is such that it wastes time more period will have to be added with attract additional cost.

It is again to provide information to enable management to carry out periodic statements of profits and losses made. In case the unit method of analysing cost is used, the budgeted cost be may be used to compare the actual cost, if it happens that the variance between the real cost and budgeted cost is negative then it indicates that the project is running at a loss and it needs to be checked before it gets out of hand.

2.53 IMMURGING ISSUES

Before any country obtains an economic recognition by the world it starts from the county's economic growth and infrastructure development. This infrastructure development can be attained through, the incorporation of the government, the private sector and the construction industry in the country. The construction industry has to a large extent an economic importance to the country, which includes roads construction, Construction of health facilities, educational institution and dams for power generation and distribution. If these construction industries are not managed properly through cost control systems, these companies will collapse and if they

collapse it mean the implementation of all infrastructure works will be put to halt with obvious consequences its economic effect.

In connection with housing, the construction industry plays a major role in providing shelter for both the private sector and the public sector. Due to rural and urban migration, scarcity of accommodation is a major problem in the cities and urban centres; government needs to improve housing for the state to help curb housing shortage in the country. Moreover the private individual is also in to infrastructural development such as factories and real estate development all these infrastructures is the major aims and responsibility of the construction industry

Indications are that, over the years, the construction industry has been one of the major backbones of the Ghanaian economy and it plays a major role in its infrastructure development of the state. Because of this, contractors in the building and civil engineering industries need to stay in business, to contribute their quota to the economic development of Ghana through effective cost control system and techniques employed by them during projects execution.

From the above write up, it's a clear fact that clients need to meet their main objectives of investing their resources in to projects which they are looking up to, to obtain value for money. Whereas, contractors need to stay in business to help in revenue mobilization contribution and help the state to build infrastructure to attain it development goal. This can be achieved by the use of proper cost analysis system and procedure by project executors

After project executers have effectively analysed the cost contents of the projects, proper budgeting systems ought to be used to establish a base line which project managers shall use during the execution of the projects. Moreover if base line is established, then resources such as labour, plant, and material need to be properly controlled and monitored during the execution

stage of the project to help project managers obtain a realistic cost. The actual cost of executing the value of the project is obtained through weekly, monthly or quarterly system of recording used to compare the established base line to help determine the variance between the budgeted cost of the project and the actual cost of the executing them

Consequently, a questionnaire survey need to be undertaken to help identify the cost control systems, their effective of application and problems project managers faced in their quest of implementation and help propose ways to mitigate them.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter explains the procedures and methods used in gathering my data and the types of analytical tools used in evaluating the data obtained. It also shows the importance means of obtaining the aims and objectives of the research under study. The focus of the respondent is based on contractor and consultants in the Sekondi-Takoradi metropolises of Ghana, Registered under the ministry of Water Resource, Works and House Road and Highways.

3.2 RESEARCH APPROACH

Studies conducted by some researcher, used the quantitative method with the help of questionnaire in a structured form. Which comprises of open and closed end questions as used by Sambasivan and Soon (2007) in a study on relative importance of cause and effects of delay in construction in Malaysia. He structured the questionnaire and categorised it in to three parts. Which comprises of the general information on the respondent on the causes of construction delays, and the effect of construction delay in construction industry of Malaysia respectively.

Another group of researcher used the quantitative approach with an open and closed end structured questionnaire in the quest to assess the essence of contractors in commercial project delay Alzan et.al (2011), their main respondent were sub-contractors and main constructors in the Kuala Lumpur, Selangor and it province as cited by Fobi (2014).

On the quest to ascertain the cost control techniques used on building construction site by Otim et.al (n.d) in Uganda, approximately 130 sites were earmarked for the survey, in the Nkawa Area of Kampala city. Factors such as ease access to site, availability of information, Nature of the site and, costs are what the researcher considered, 98 contractors were respondent to the study. He also stated that it was impossible for him to use a statistical approach for the designing of the research because of the non-existence of organised data. Observations, interviews and structured questionnaire was employed for the information acquisition which aided the in the research funding.

But in this context, closed and opened structured questionnaire was used. The likert scale was used, in which the respondent was asked to choice by the rate established on the scale varying in degree of intensity.

On a research of the significant factors causing cost overrun in the Telecommunication projects in Nigeria by *Oko et.al (2010)*, the basis was established on previous works by others researchers, information on the topic under study which gave The respondent the chance to mark the ratings by the level of importance of various factors that have contribute to cost overruns in the telecommunication projects, the likert scale was used for the study. As cited by *Okoet.al. (2010)* the statistical tool which was used was cronbach's Alpha. It was used to test the reliability of the likert scale used in the study.

3.3 POPULATION

According to *Bouma (1994)*, population is a large set to which individual groups of research samples are obtained.

The metropolitan assembly had not organised data of which it could help establish the population size. This would have been used in the determination of the sample size. Eventually contractors, quantity surveyors and project engineers and projects managers who are currently on projects in the metropolis were used as the sample size. The population size for the study was thirty one (31)

3.4 SAMPLING

As stated by *Webster (1985)*, a sample is a set part of a statistical population whose qualities are studied to obtain information about the whole. However, sampling is the research unit selection done based on a targeted population. According to *William (2005)* as cited by *Fobi (2014)*, if a researcher gets information from respondent in a population sample through a purposive means which is a non-probability sample where he believes that the respondent is an expert on the field of study. A non-probability sampling means such as convenience and snowball sampling was used by *sambasivan and Soon (2007)* as cited by *Fobi (2014)*. By virtue of its name based on the researcher's will and means to notice a sample element, colleagues and friends etc or the use of expert afterwards asking him to identify a prospective respondent or through referral network. The snowball, a Non probability sampling technique was adapted for this study, from *Thompson (2002)*, the respondent in the sample are asked to come up with other individuals for a fixed number of stages, to help assess the number of mutual relationship, as cited by *Xetural and Lockard, (2016)*. Through snowball sampling, we were able to reach out to our respondent.

It is very economical and quick to obtain a huge number of respondents from the sample population.

3.5 DATA SOURCE

Thirty one (31) questionnaire was distributed, both primary and secondary information were collected from contractors and from the basis of the related literature review on chapter two respectively. The primary information source was from the survey conducted on representatives of construction companies and professional in the construction industry. To obtain a feedback from the construction industry, a questionnaire survey was conducted. It was structured developed questionnaires, self-administered and deliver and collect type, this was done to solicit views of the respondent on the topic under study.

The secondary information was obtained from the basis of the literature topics presented in the chapter two of the research. This part was obtain from internet, other peoples paper publication articles in journals and relevant publish works from researches.

3.6 ANALYSIS OF DATA

Other researchers adopted other system of data analysis tools such as standard deviation, frequency index, severity index and relative importance index etc. The relative importance index was adopted by *Sambasivan and soon(2007)* as cited by *Fobi(2014)* On a research of the causes of effect of delay in construction industry in Malaysia. *Otim (n.d)* researched on cost control techniques used on building construction site in Uganda also adopted the likert scale of which generally levels of agreement or disagreement was measured based on the frequency of respondent.

But in this context, statistical product for social scientists analytical program application was used. Using application the demographics were analyzed using frequencies and discussed using

text and tables. The other two sections were analyzed using the mean score ranking technique and standard deviation and discussed using text and tables.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter analyzes and discusses data collected from thirty-one (31) respondents in the Sekondi-Takoradi metropolis. The respondents were construction firms who were executing projects in the metropolis. They included both civil and building contractors. The data was collected with the aid of a structured questionnaire. This chapter discussed the demographics of the respondents followed by the cost control techniques. The last section of this chapter discusses the challenges associated with the use of the cost control practices. The demographics were analyzed using frequencies and discussed using text and tables. The other two sections were analyzed using the mean score ranking technique and discussed using text and tables. The analysis and discussion aided in making inferences about the responses from the participants of the study and subsequently make recommendations

4.2 DEMOGRAPHICS OF RESPONDENTS

The background of the participants aided in making inferences about the reliability of the responses given by the respondents. In this section, data was analyzed on the category of the construction firm, the number of years of experience in the firm, the educational level of the participants and the average number of projects worked on. The summary of their responses is shown in table 4.1.

4.3 Category of the firm

In Ghana construction firms are categorized into D1K1/A1B1, D2K2/A2B2/D3K3/A3B3 and D4K4/A4B4. From table 4.0, it can be realized that, majority of the respondents were D2K2/A2B2. The least number was six (6) belonging to D1K1/A1B1. The responses indicate that, majority of the participants had a higher class in terms of finance and human resource personnel.

Table 4.0: Background of the respondents

NR	DESCRIPTION	FREQUENCY
Category of construction firm		
1	D1K1/A1B1	6
2	D2K2/A2B2	10
3	D3K3/A3B3	8
4	D4K4/A4B4	7
Years of experience		
1	≤ 5years	5
2	5-10years	12
3	10-15year	7
4	≥ 15 years	7
Educational level		
1	B-Tech	3
2	Technician	6
3	HND	7
4	Bsc	10
5	Postgraduate	5
Number of projects		
1	1-5 projects	4
2	6-10 projects	11

3	11-15 projects	8
4	Over 15 projects	6

4.4 YEARS OF EXPERIENCE

The years of experience in the firm gives an indication of how knowledgeable and familiar the respondent is with the processes and methods of the organization. The respondents were asked to indicate their years of experience in the firm. Majority of the respondents had with 5 to 10 years of experience in the firm. Seven (7) of the respondents had more than fifteen (15) years of experience.

4.5 EDUCATIONAL LEVEL

The educational level gives an indication of the knowledge level of the respondents. The educational level of the respondents is very significant background information to seek from the respondents as it also gives an indication of how reliable their responses will be. From table 4.0, most of the respondents had B.Sc. qualification followed by HND which was ticked by seven (7) respondents. There were five (5) respondents with postgraduate degree which was good for the research.

4.6 NUMBER OF PROJECTS EXECUTED IN THE METROPLIS

The respondents were finally asked to indicate the number of projects they have handled in the Takoradi metropolis. This was also a significant question as it gives an indication of the how

familiar the participant is with the environment. From table 4.0, it can be realized that, most of the respondents had executed within 6 to 10 projects in the district. Also, eight (8) of the respondents indicated 11 to 15 projects and six (6) indicated over 15 projects.

4.7 COST CONTROL TECHNIQUES

A number of cost control techniques were identified from literature. The respondents were asked to indicate their level of understanding and level of application of the cost control techniques. This aimed at ascertaining the extent understanding and usage of the cost control techniques.

On the first research objective, which was based on the extent of usage of cost control tools and techniques; the respondents indicated that, profit and loss based on progress payment was the most applied with 3.42 mean score ranking 1st. With this as the name implies the system checks on interim certificate raised and paid on progress payment that's monthly or quarterly as stated in the condition of contract. The actual cost of work executed is compared to the budgeted cost of the work component for variances.

Accurate measurement can take place through effective weekly, monthly or quarterly report used by contractor's project managers. *Pinto J. K. (2001)*. The system contains a unit cost on materials, labour and plants resources used for the work executed, *Ashworth (2004)*. This cost is compared with the net unit cost for the work items rate in the Bill of Quantities, as at when the certificate was being raised, to help calculate for variance.

Overall profit and loss was second with 3.12 mean score. Comparative analysis is made to the total monies obtained from the total certificates raised and paid by client that is after closure of the contracts, according to *Badu and Owusu-Manu (2010)*. The use of overall profit and loss considers the analysis of the actual cost of executed work activities contained in the work

breakdown structure in the entire project at completion. Based on the total value of cost of work paid to the contractor, variance is established. With this system, early and latent losses cannot be tracked for correction. Normally, losses are only seen at the completion of project.

The 3rd was the Unit cost with 3.10 mean score; one of the very important ways of analysing cost is the use of the unit cost. The unit cost can be specified for a component or an operation which can be classified under direct cost for a single unit of measurement for that component or operation, *according to Ashworth (2004)*. It is necessary to carry out the measurement of operation and the built component to the specified quantities and quality accurately. For the calculation of the unit rate, strict measures are taken to consider the operation or component under construction by the supervisor. Much attention is given, to the recording of hours; non-productive hours should not be recorded.

Moreover, unit cost is be marked in hourly- rate rather than in monetary terms. This is because hourly rate can be sustained in the overall cost of the project for years.

Earn value analysis was rated 4th with a mean score of 2.89. It is the traditional way of controlling project cost. According to *PIMBOK 6th edition*, it's the act of comparing base line of performance measurement to the cost performance and actual schedule. According to *Howe's (2000)* earn value analysis is an established method for the evaluation and financial analysis of projects performance throughout their life cycle.

The 5th was Cost value reconciliation with 2.36 mean score, cost value reconciliation CVR; approach by *Barrent (1992)* is the standard recommended approach. The CVR is normally used by quantity surveyors on monthly basis after agreement on the interim valuation. This process also requires that the quantity surveyor links with the other departments in its completion and

dialogue with the rest of the project team a typical example is the contract manager and the site manager. This system is very good for complex project.

The CVR only gets started when the gross certificate value is raised. This must be supported by the architect's interim certificate. The CRV can only work when assessment is under taken by an external quantity surveyor rather than the contractors' quantity surveyor.

Finally, the Forecasting was the least cost control techniques contractors apply. Project manager may design a forecast on estimate for the completion of work (EAC) which is different from the budget at completion (BAC) depending on the project performance. Estimate at completion forecasting includes, designing projections of event and condition for the project future based on current standing performance data and lessons learnt at the period of forecasting. This is done to help check performance and budget for the project.

On the specific objective

i. To identify the extent of usage of the various cost control tool and techniques in the Ghanaian construction industry;

On the extent of usage of cost control tools, the first to the third had approximately moderately high mean score as shown in the table 4.1. However, there are said to be the traditional way for cost control which doesn't check cost on the life cycle of the project and If used can be a recipe for cost overrun. It also shows that, few of the respondents are actually using the cost control tool and techniques from the first ranked mean score value to the last value. It again shows that they are not cost conscious.

The 4th to the 6th ranked had earned value analysis, Cost value reconciliation, and forecasting respectively. This show that most effective categories of the cost control tools and techniques are not been effectively used by the respondent thus leading to excessive cost overrun on project executed.

On the specific objective,

ii. To assess the level of understanding implementers have on cost control tools and techniques.

On the level of understanding, the profit and loss based on progress payment was again rated 1st with a mean score of 4.12, which was followed by overall profit and loss with a mean score of 3.74 as the 2nd. However, the earned value analysis was rated 3rd with a mean score of 3.61; it was followed by the unit cost also with a mean score of 3.45 and respectively cost value reconciliation and forecasting followed with a mean scores of 3.45 and 3.23.

On the understanding level, the mean score readings on the first predispose the fact that respondents have a high level of understanding on the Profit and loss based on progress payment, with respondents haven moderate high level on the Overall profit and loss. It followed by respondent haven high level on Earned value analysis. Per the reading of and the mean score, almost all the respondent had high understanding level on the cost control tools and techniques mentioned in the chapter two.

Table 4.1 COST CONTROL TECHNIQUES, RESPONDENT MEAN AND RANK

DESCRIPTION	MEAN	STD	RANK
Level of understanding on cost control tools and techniques			
Profit and loss based on progress payment	4.12	0.042	1 ST
Overall profit and loss	3.74	0.053	2 ND
Earned value analysis	3.61	0.120	3 RD
Unit cost	3.45	0.098	4 TH
Cost value reconciliation	3.45	0.084	4 TH
Forecasting	3.23	1.121	6 TH
Level of application on cost control tools and techniques			
Profit and loss based on progress payment	3.42	0.034	1 ST
Overall profit and loss	3.12	0.049	2 ND
Unit cost	3.10	0.444	3 RD
Earned value analysis	2.89	0.088	4 TH
Cost value reconciliation	2.36	0.120	5 TH
Forecasting	2.16	0.823	6 TH

4.8 PROBLEMS ASSOCIATED WITH COST CONTROL

The last objective of the study wanted to ascertain the problems construction firms face in cost control. Therefore, the respondents were asked to rate the identified problems associated with cost control. The first ranked factor was lack of management policy on control practices

The organizational policies regarding staff employment must be taken into consideration. The procurement policies to ascertain lease or rent equipment before planning resource must be spelt out. Time invested in identifying resource may be lost if the process conflicts with organizational policies, or Organisational Process Assets. It's followed by improper estimates for the best estimating techniques or system, the three point estimate is presumed as stated by the *PIMBOK 6TH Edition* to be the best.

To help increase the accuracy of a single-point estimate, the three points was established, which handles the uncertainties and all associated risk through it application, an approximate estimate is arrived for activity cost.

- Most likely cost of estimate (cM). The activity cost at this end is realistic for required work and predicted expenses.
- Optimistic cost (cO). The cost analysis of an activity based on it best scenario
- Pessimistic cost (Cp). The cost analysis of an activity based on the worst scenario.

Based on the output of the three variables above, the expected cost of the project can be estimated.

The commonly used formulas

- a. Triangular distribution. $cE = (cO + cM + cP) / 3$

b. Beta distribution. $cE = (cO + 4cM + cP)/6$

By the use of the above mentioned analysis in estimate determination, uncertainties and risk on the project to be executed is reduce drastically and inadequate work break-down structure which had the same mean. It is because; proper estimate has one of it bases on adequate work break-down structure. According to *Hendrickson, (1998)*, these depend on the work component and the work content of the project. It helps the project manager and the project team to identify the components requiring specific resources such as plant, material and labour. This is a basic input for any resource planning. It is also the planned layout to be used to manage and execute the project. *Venkataraman and Pinto (2008)*

Also, poor standards and budgeting techniques were ranked fourth. This is the process of aggregating all cost contained in the work breakdown structure which comprises all the individual activities or work packages to established an authorised cost baseline. For the purpose of monitoring and control, the established cost baseline is used to check performance. This can be done at various stages of the project or ones in the life cycle. The total funds allocated for the execution of the work is called the project budget.

The approved version of time-phase budget of a project should include contingency reserves, with the exception of management reserves. In the non-appearance of risk, the probably cost which can occur is the baseline estimate cost which is not normal in most cases. Other additional budgeting values which are needed are contingency reserve which follows the baseline estimate to check cost overrun, additional moneys to be allocated for the project allowance.

Accuracy of budgeting is achieved by adding onto the budget sum of monies known as risk reserve. All this budget analysis is controlled by the power of the project manager. Risk analysis

need to be assessed out to know their impact on the project. With this project managers will realize where possible overrun exists and budget accordingly for it. *Karslen and Ierein, (2001)*

The 5th was inadequate planning. Resources such as human, materials, machinery and money are used for production on construction project. The success of a project depends upon the performances of these inputs resources whilst controlling cost *Hendrickson (1998)*. Cost increments are linked to waste by client and management which need to be avoided at all cost through adequate planning. Planning consist of the following but not limited; activity duration estimate ,work Breakdown Structure, historical information, project scope statement, resource pool description, organizational policies, labour productivity, and material. If all these resources are sourced on scheduled time as budgeted, cost overrun can be reduced.

Excessive pressure on the bid team to WIN the project was rated the 13th of all with 2.90 mean score.

In Ghana, the lowest responsive evaluated successive bidder is awarded the project to execute. Thus contractors are left with no alternative than to reduce cost in order to be more competitive. Contractors are made to work on small profit margins thus more work will have to be executed on huge projects in order to make good return on investment. Thus, financial risk on the project to be execution becomes high.

They all had a very significant mean which indicates the severity of the challenges as shown in the table. 4.2.

From the findings, almost all of the problems associated with cost control implementation had very high significant on the mean score.

This shows that projects implementers may understand the tools and techniques but, in their quest of implementation, management policies on control practices prohibit them, leading to the failure of the project. If improper estimates are not corrected through the use of adequate work break-down structure, the use of effective standards budgeting, adequate planning measures on resources, proper contractual documentation, effective risk assessment, proper change request procedures and bidding with the realistic cost estimate, project cost overrun cannot be overcome.

Table 4.2 Problems Associated With Cost Control Mean Score And Rank

DESCRIPTIONS	MEAN	STD	RANK
lack of management policy on control practices	4.45	0.057	1 ST
Improper estimates	4.00	0.074	2 ND
Inadequate work break-down structure	4.00	0.043	2 ND
poor standards and budgeting techniques	3.90	0.095	4 TH
inadequate planning	3.87	0.088	5 TH
escalation of material cost	3.85	0.095	6 TH
Contractual discrepancies and inconsistencies.	3.55	0.111	7 TH
Unrealistic budgets	3.55	0.193	7 TH
Improper assessment of risks	3.50	0.104	9 TH
Reducing budgets or bid to be competitive	3.48	0.085	10 TH
lack of comparison between actual and planned cost	3.43	0.124	11 TH

unnoticed and uncontrolled increase in the scope of work	3.15	0.045	12 TH
Excessive pressure on the bid team to WIN the project	2.90	0.080	13 TH

Table 4.2

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

Upon the research analysis and discussion, and the literature review, and the chapter four. This chapter spells out the emerging issue and findings of the research. Conclusions are drawn on the basis of the finding and on the emerging issues.

Recommendations have been outlined as possible action that can help management on construction projects.

Under the study objectives, findings have been categories in,

- a. To identify the extent of usage of the various cost control tool and techniques in the Ghanaian construction industry;
- b. To assess the level of understanding implementers have on cost control tools and techniques.
- c. To evaluate the problems associated with controlling cost on construction sites in the Ghanaian construction industry.

5.2 SUMMARY OF FINDINGS.

On the first and second objectives respectively, years of experience by managers on the field had effect on their knowledge and familiarity with the subject matter at hand. 5-10 years experienced managers had the majority frequency, followed by seven (7) respondents who had over fifteen years working experience.

The mean and the standard deviation were obtained from the frequency established from the respondents on the objectives of the thesis,

On Objectives one, to identify the extent of usage of the various cost control tool and techniques in the Ghanaian construction industry;

The respondent were asked to rate the various cost control tool identified in the literature review. Their level of application with it with the likert scale rating

Based on the findings, Contractors lack the application skills on cost control tools and techniques on projects they executed; although, their knowledge on cost controls principles was averagely high.

On the extent of usage, the maximum mean score was 3.42 and minimum of 2.16 putting it at moderately high level. The level of application on Profit and Loss Based on Progress Payment; Overall Profit and Unit cost are moderately high, but these control tool and techniques assess project performance only at the completion stage. Cost control practices in the life cycle are not considered. These tools are good but they turn to be one of the factors of cost overrun.

On Objectives two, to assess the level of understanding implementers have on cost control tools and techniques.

The respondents demonstrated that their level of understanding were averagely high by their mean score of 4.12 maximum and minimum of 3.23. They also have the profit and loss on progress payment being the maximum and forecasting being the minimum this shows that, there are problems implementers' faces.

On objective three, evaluating the problems associated with controlling cost on construction sites in the Ghanaian construction industry.

To help obtain the problems implementers face, the likert scale rating was used. Averagely, on the mean score, 4.42 was the highest while 2.9 was minimum showing that, almost all the factors mentioned have influence on cost control. Although contractors may understand the cost control tools and techniques, if management policies on cost control are not improved, such as the use of adequate estimating procedures adhering to good budgeting techniques; proper resource allocation, good risk assessment, clear contractual documentation, proper variance check measures and a realistic costing for bidding team, projects are likely to suffer losses.

5.3 CONCLUSION

The research is focused on the identification of the extent of usage of the various cost control tool and techniques in the Ghanaian construction industry, to assess the level of understanding implementers have on cost control tools and techniques and to evaluate the problems associated with controlling cost on construction sites in the Ghanaian construction industry. By contractors in the Sekondi-Takoradi metropolis with the financial capabilities of D1K1/A1B1, D2K2/A2B2/D3K3/A3B3 and D4K4/A4B4.

In the quest of identifying the extent of usage of various cost control tools identified in the literature review, by their mean score ranking, profit and loss on progress payment was ranked highest and with the Forecasting being the least.

On the understanding level, profit and loss on progress payment also scored the highest mean mark with Forecasting scoring the least mark.

With the challenges contractors face during implementation of cost control, the various problems identified in the literature review were made to be ranked through scaling. Averagely, the factors of the mean score ranking were very significant to the causes affecting cost control implementation. With lack of management policy on control practices reading 4.45 as first and improper estimating, inadequate work breakdown structure being second with 4.0 reading the minimum was excessive pressure on the bid team to win the project also scoring 2.9 .

5.4 RECOMMENDATIONS

Project managers' knowledge on cost control tools and techniques should be improved through in-service training for both fresher's and existing ones. The education should be based on control principles such as Earned Value Analysis, Cost Value Reconciliation and Forecasting. Since they minimize cost better than the traditional method, that is profit and loss and profit and loss on progressive payment based and unit cost

- Cost control practices such as the Earn Value Analysis, Cost Value Reconciliation and forecasting should be adopted for all project cost control practices since they check cost control throughout the life cycle of the project under execution.
- In-service training should be organized for exiting project managers and fresher's on policy on control practices. Proper estimating principles should be adopted such as the use of work breakdown structure and the three-point estimating techniques.
- As the say goes failing to plan is planning to fail, so well planning techniques should be included in the management training. With the use of effective standards budgeting, adequate planning measures on resources, proper contractual documentation, effective

risk assessment, proper change request procedures and bidding with the realistic cost estimate, project cost overrun can be overcome.

- When these recommendations are implemented, it is hoped that all clients will receive value for money invested in such projects whilst quality is also assured. Building Contractors and Civil engineers will also be happy having obtained realistic profit margins from works well executed.

5.5 LIMITATION

The readiness's of targeted contractors, in the Sekondi-Takoradi to respond to the questionnaires distributed on and make them ready for collection and analysis within time.

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APPENDIX

Research Topic: Improving contractors' project cost control on construction site of Sekondi-Takoradi Metropolis of western region of Ghana

Questionnaire Survey

Please this questionnaire is for academic purposes and that all the detail of individuals and information provided shall be treated strictly confidential

1. Please fill this questionnaire with duly reference to your latest experience about contractors cost control tools & techniques.
2. Please answer the questions by ticking {such as “✓”}

Section A: Background of respondent

1. Please tick the category of your firm the options from below.....

a. D1K1/AIB1, [] b. D2 K2/A1B1 [] C.D3 K3/A3B3, [] D4 K4/A4K4 [] d. If other type please state it.....

2. How many years have you been working with the company.....

a. ≤ 5 years [] b. 5-10years [] c. 10-15year [] d. ≥ 15 years []

3. Please tick to indicate your educational level from the option below.

a. Msc. [] b. Bsc [] c. HND. [] d. Technician [] e. BTECH [],

e. any other please specify ,.....

4. Please indicate the average number of projects you have worked on in the Sekondi-Takoradi Metropolis.

☐ 1-5 projects ☐ 6-10 projects ☐ 11-15 projects ☐ Over 15 projects

Section B: Contractors cost control practices

Question: what is your level of understanding on construction project cost management tool & techniques?

Please, rate them by your level of understanding of each system with respect to its practices on construction projects

1 = very low level; 2 = low level; 3 = Moderate high level; 4 = high level; 5 = very high.

		Level of understanding
No.	Cost Control management Techniques	
		Low <<<--->>>Extreme
A What is your Level of understanding on the following cost control systems?		
1	Earn value analysis	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
2	Unit cost	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
3	Cost value reconciliation	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
4	Overall profit or loss	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
5	Profit and loss based on progress payment	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
6	Forecasting	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
B What is your level of application on cost control systems?		
1	Earn value analysis	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
2	Unit cost	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
3	Cost value reconciliation	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
4	Overall profit or loss	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
5	Profit and loss based on progress payment	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
6	Forecasting	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5

Section C: problems affecting cost control implementation

Question: The following are factors which influence cost control practices: How significant are the following cost control practices have on construction projects in Ghana? Please, rate the significance of each practices with respect to cost control influencing affecters' under which they are listed.

1 = extremely low significance; 2 = very low significance; 3 = Moderate significance; 4 = Very significance; 5 = extremely significance.

No.	Contractors cost control systems	Level of Significance
		Low <<<--->>>Extreme
Factors influencing cost control		
1	Improper estimates	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
2	poor standards and budgeting techniques	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
3	Unrealistic budgets	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
4	inadequate work break down structure	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
5	lack of management policy on control practices	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
6	Reducing budgets or bid to be competitive	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5
7	escalation of material cost	☐ 1; ☐ 2; ☐ 3; ☐ 4; ☐ 5

- | | | |
|----|--|--------------------|
| 8 | inadequate planning | □1; □2; □3; □4; □5 |
| 9 | unnoticed and uncontrolled increase in the scope of work | □1; □2; □3; □4; □5 |
| 10 | Improper assessment of risks by the bidding team and by executive management | □1; □2; □3; □4; □5 |
| 11 | lack of comparison between actual and planned cost; | □1; □2; □3; □4; □5 |
| 12 | Contractual discrepancies and inconsistencies. | □1; □2; □3; □4; □5 |
| 13 | Excessive pressure on the bid team to WIN the project | □1; □2; □3; □4; □5 |

Please indicate other cost control practices and rate (if any)

- | | | |
|---|--|--------------------|
| 1 | | □1; □2; □3; □4; □5 |
| 2 | | □1; □2; □3; □4; □5 |
| 3 | | □1; □2; □3; □4; □5 |

This is the end Thank you for your assistance

