ANALYTICAL AND APPROXIMATE VARIANCE OF PUBLIC BUILDING TOTAL PROJECT COST, ESTIMATION BY MEAN COMPONENT COSTS METHOD

BY

DEMIDE NASIRU ISAAC
M.SC/ENV-DESIGN/8358/2009-2010

DEPARTMENT OF BUILDING,
AHMADU BELLO UNIVERSITY,
ZARIA NIGERIA

NOVEMBER, 2O15

ANALYTICAL AND APPROXIMATE VARIANCE OF PUBLIC BUILDING TOTAL PROJECT COST, ESTIMATION BY MEAN COMPONENT COSTS METHOD

BY

DEMIDE NASIRU ISAAC B.Sc (BUILDING) ABU, 1985
M.SC/ENV-DESIGN/8358/2009-2010

A THESIS SUBMITTED TO POSTGRADUATE SCHOOL
AHMADU BELLO UNIVERSITY, ZARIA
NIGERIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT

DEPARTMENT OF BUILDING,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA.

NOVEMBER, 2O15

DECLARATION

I declare that the thesis entitled 'Analytical and Approximate Variance of Public Building Total Project Cost; Estimation by Mean Component Costs' has been performed by me in the Department of Building under the supervision of Prof. K. Bala and Prof. A. D. Ibrahim. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

DemideNasiru Isaac	____________________	__________________
Name of Student	Signature	Date

CERTIFICATION

This thesis entitled 'ANALYTICAL AND APPROXIMATE VARIANCE OF PUBLIC BUILDING TOTAL PROJECT COST; ESTIMATION BY MEAN COMPONENT COSTS' by DemideNasiru Isaac meets the regulations governing the award of the degree of Master of Science in Construction Management of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

____________________________ ____________________

Prof. K. Bala Date

Chairman, Supervisory Committee

___________________________ ____________________

Prof. A.D. Ibrahim Date

Member, Supervisory Committee

__________________________ ____________________

Dr. D. Dikko Date Head of Department

________________________ ___________________

Prof. K. Bala Date

Dean of Postgraduate School

DEDICATION

This research work is dedicated to Almighty God who guided and inspired me to write this thesis. I am fully persuaded that the glory of the latter day shall be greater than the former just as the Lord has said. Unto Him alone be all the honour and glory for ever more.

ACKNOWLEDGEMENT

I wish to thank the Almighty God for His infinite mercies, love and guidance throughout my pursuance for more academic knowledge in this new field of studies.

My special gratitude goes to my supervisors Prof. K. Bala and Prof. A.D. Ibrahim for the time spent and their interest in the chosen topic demonstrated in the critical reading of the research work and so ensuring the successful completion of the thesis.

Special thanks go to all academic staff and non-academic staff of Department of building, for their supports and encouragements, Dr. D. Dikko (HOD), Prof. G.O. Okoli, Prof. M.M. Garba , Prof. I. Mbamali, Dr. I. Mshelgaru, Dr. Abdulazeez, Dr.Shehu. A special thanks to QS. Aliu for his immense contributions in the supply of the needed data at the appropriate time. I appreciate the contribution of every member of my family: my dear wife Deaconess Demide C. A. and my loving children. I am very grateful to Dr. S.O. Makanjuola and Mrs. E.O. Makanjuola, the Demides and my co-labourers in the LORD. May God in His, mercies bless them, Amen.

ABSTRACT

Building construction project has become an everyday issue, and this involves the spending of hard earned money by the project owner called the client. The expectation of the owner of any building project is justification of good project delivery. This is enabled by the objectives of the project which definitely includes project cost that envelopes the cost and quality of delivery at the expected time. The major issue, is the project cost which dictates its success. Project cost variance has been affecting the speedy and successful delivery of building construction projects. The key fact in this study method was to collect and analyse public building project cost estimates containing building components, which includes preliminaries, substructure, superstructure, mechanical/electrical, external works and contingency in the bill of quantity (BOQ) from projects handled by Education Trust Fund(ETF) in the tertiary institutions located in Kaduna, Kwara, Kogi and Abuja from 2009 to 2010. The study adopted mean component cost method modeled by Skitmore and Ng (2002) to determine the projected cost variance of the Lecture Theatres and Lecture Rooms handled by the organization in various tertiary institutions in Nigeria. The analysis of the data collected was made by using standard method of analysis which employs SPSS for the project costs.Skitmore and Ng (2002) model was employed to test the variability of the project cost data. The result shows that; the building component cost data 4782.50 had closer link to the mean 4773.92(mean) for preliminaries component column in project ID 4 of Lecture Theatreandanother component data 2797.62 is also close to 2312.91(mean) for Ext.Wkscolumn in project ID 7 for the Lecture Theatre building projects butfor the Lecture Classrooms building the preliminaries column had 1531.41 and 1416.33(mean) in project ID 2 and 1611.22 and 1673..58(mean) for M/E column for project ID 5. This project therefore concludes in addition to the results of the cost variances, that the lecture theatre and classrooms projects are underestimated.Interview was also conducted on the professional estimators in building industry. Moreover significant differences exist among the components in those public buildings.The analytical calculation shows that the correct variance for an average lecture theatre project from this research was found to be 34.73%. The sample analyzed had shown that the correct variance of the class room was found to be 38. 50%. Therefore lecture theatre is observed to be a better building project than the class room building. The study recommends the need to minimize the occurrence of the overrun by thoroughly crosschecking the initial estimate and addressing other technical issues before the contract is awarded. It also recommends the employment of the mean component cost method of analysis and setting of a committee to properly scrutinize the estimate.

TABLEOFCONTENTS

CHAPTER TWO

LITERATURE REVIEW

CHAPTER THREE

RESEARCH METHODOLOGY

CHAPTER FOUR

4.0 PRESENTATION ANALYSIS AND DISCUSSION

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

LIST OF TABLES

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

In the building construction industry, it is a formal procedure to determine the initial cost of a building project before awarding the contract. This is in order to ascertain the financial level of the client whether the project is worth undertaking. The underlyingfact is because of the instability of the market prices of material, labour and equipment which are the major tools involved in the construction.

The wave of project production cost variability in the recent time calls for a concern in the building industry. If a building project cost estimate is presented for tender and the contractor gives his quotations, with all necessary adjustment made and contract is awarded, it is not likely that the agreed contract price will still be the final project cost at completion. The final project cost is often found to be higher at completion.

There are many factors leading to the changes in the final cost. Giwa (1998) had stated that the effect of change between the initial and the final cost incurred constitute a major problem in the building industry, especially between the client and estimator. This cost differential is called cost variance in the building construction industry. Cost variance is significant for general cost planning, and can be a big problem to solve by the managers in the building industry.

Yang (2004) defined cost in building construction as the application of price to the scheduled items of labour and material in order to obtain an approximation of the cost of construction. It therefore means that the cost variation can be caused by the changes in labour prizes, material prizes and plant costs among several other causes.

Total building project costs have been evaluated by several researchers through many methods. They all end up with one or more factors causing the hiking of final cost. Giwa (1998) had revealed that the bigger the project the higher the difference between the initial and final cost of construction. It means therefore that the size of the project, in other wards the cost of the project, can either reduce or be higher at the completion stage.

This differential in building contract sums have impact in building project in Nigeria (Ibrahimand Kano,2004). One of the factors leading to changes in final cost is underestimation of the project. The building construction industry undergoes an unexpected cost, in excess of a budgeted amount due to an underestimation of the cost during budgeting. This incurred cost is also called cost overrun or cost increase/budget overrun (Thiboudeaux, 2012).

Mahmid (2013) said that cost overrun had the potential of decreasing contractors profit. This hinders the attainment of the building project cost objectives (Kasimu, 2012). The implication of cost overrun is that it increases the burden of financial risks to clients (Boukendour, 2005).

It is therefore necessary to continue to analyse the building project cost in order to see how the building project cost may be minimally reduced.

1.2 Statement of the Research Problem

Cost variance is a term which is frequently voiced out in most contracts in building industry. This is because most cost variance often leads to rise in prices of building project cost. Clients often raise alarm on this terminology as if the money that they budgeted for the building structure had been diverted. Cost variance can however be caused by many factors which includes material price escalation, due to sudden shortage in the production of such materials for example, cement. This often leads to the difference between estimated cost and the final cost (cost at completion).This is the basic problem that cuts across boundaries.

Several methods had been used to calculate the projected cost variance in building industry. The main aim had been to secure the method of reducing the cost overrun by subjecting the estimated cost through analysis in order to obtain a projected cost variance from the estimated costs.

These methods include the use of SPSS which is often been employed to analyze the dataobtained. Secondly,several researchers had worked on the analysis of public building project cost usingMonte Carlo simulation method,otherwise known as SIMULATION.One of the basic reasons for employing the simulation method was because of its simplicity while the use of the exact analytical approach for calculating the coefficient of variance was considered difficult. However the project cost variance still persists.

With increase in knowledge however, a more accurate and a more straight forward method of calculating the cost variance was modeled by Skitmore and Ng (2002) in Hong Kong and this model was used on school projects with good results obtained. This project intends to test the Skitmore and Ng model of 2002 on tertiary institution projects handled by education trust fund (ETF) in Nigeria to see its applicability in projecting cost variance in tertiary educational structures.

In Nigeria, the problem of cost variance is phenomenal in the building industry. It is hoped that this study will lead to a result that may drastically minimize the high level of contract overrun in Nigeria.

1.3 Justification of the Study

In order to unveil the benefit of this study, the analysis of public building project costs continues to examine the more practical situation where the mean component costs are computed from the assumed estimated cost to show that the accuracy of the approximate method of estimating for an average project will be considerably improved. It will also show how the exact variance may be calculated for an individual project with this model.

The analysis of public building total project cost will be a useful guide as cost control for the project monitors, contractors, estate owners and property developers in the building industry.

1.4 Aim and Objectives

1.4.1 Aim

The aim of this research is to establish cost variance of public buildings project cost, estimation by mean component cost method with the view to determining ways of minimizing building construction cost.

1.4.2 Objectives

The specific objectives of this research are;

1. To articulate on the methodologies for analyzing project cost variance of public building.
2. To determine project cost variance of lecture theatre building projects using Skitmore and Ng(2002) model
3. To determine project cost variance of classroom building projects using Skitmore and Ng(2002) model

1.5 Scope and Limitation of the Study

The study focused on the Analytical and approximate variance of public building total project cost and it's implication on the construction industry. The data drawn covered publicbuildings. Qualitative secondary data method using unstructured questionnaire was adopted for the collection of the sample sizes used. The data were collected from Education Trust Fund (ETF) files of building projects constructed for tertiary institutions in Kaduna, Kwara, Kogi and Abuja. ETF had been the sole financiers of quite a number of public building projects located in the tertiary institutions within the states sampled among others.

The data did not cover the whole country. The study is also limited to public buildings, within the areas selected. It does not include commercial structures. The total cost of the selected building structures does not include the cost of maintenance but basically production costs only.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Construction Industry in Nigeria

The building construction industry as part of the general construction industry in Nigeria is an important industry which impacts positively on thenational economy. The growth of the construction industry is rising at a steady rate and is predicted along with Indian construction industry to have generated higher growth rate than china between 2009 and 2020 in terms of construction output (GCP, 2009).

Bashir (2014) said that despite the huge capital expenditure and steady growth of the industry, the Nigerian construction industry like other construction industries around the world, is faced with challenges of improvement in terms of product and service delivery necessitated by constant criticism by the industry's customers. The industry is characterized by an alarming rate of the repeated collapse of buildings (Oke and Abiola-Falemu, 2009) and poor health and safety records (Olatunji*et al*., 2007). Olatunji (2006) reported that the industry is struggling to salvage the economic resources wasted in construction projects as a result of cost and time overrun, poor workmanship and professional incompetence which have left the industry's customers disgruntled with the industry. In addition, Ogunsemi andSaka (2006) stressed that the industry is under siege due to poor performance. Similarly, Dantata (2007) identified lack of skilled manpower, finance and incompetent professionals as contributing factors hindering the performance of the industry.

In an effort to address the prevailing issue of corruption in public procurement, the Nigerian government as a major player in the construction industry as revealed by Dantata (2007), initiated policies aimed at controlling public procurement and contract awards. One of such policy was the introduction of Due Process Policy Model (DPPM) to public procurement contracts (Oluwole, 2008).The implementation of the policy was supervised by a Budget Monitoring and Price Intelligence Unit (BMPIU) which had a mandate of ensuring a transparent, competitive and fair procurement system in public procurement at the same time ensuring value for money (Oguonu, 2007). The establishment of BMPIU affected the way public construction projects were procured as projects were awarded based on lowest tender which has invariably led to escalation of project cost at completion due to unrealistic tender prices (Oluwole, 2008). Although over the years review of public procurement framework has been an ongoing concern, enacting of the Public Procurement Act 2007 further cemented the government’s willingness in ensuring transparency in public procurements system.

The present state of the construction industry in Nigeria falls short of meeting domestic and international quality standards and the performance demand expected from the sector (Olatunji, 2006). Construction projects have problems with construction techniques and management as well as limitation of funds and time. The critical problems are liability to complete the projects on schedule, low quality of finished product and significant cost overrun.

2.1.1 Challenges of Building Projects

According to Bashir (2014) the construction industry has been under the search light and has been criticized by reports on the industry's performance. Two notable reports sponsored by the UK government; Latham (1994) and Egan (1998) criticized operations of the construction industry and suggested identified that clients were dissatisfied with the products of the industry and the need for the construction industry needs to re think its approach towards production and delivery of its product and services. The construction industry, in common with most industries, is beset with problems of efficiency and productivity. These problems are perhaps much greater in the construction industry than any other industry due to the complex nature of the industry and the unique characteristics of its end products (Akinsola and Potts, 2003). The productivity and profit level of the industry compared to other industries has been dwindling as a result of inefficiency in the industry. Chapman (2001) reported that the industry is at or near the top in the annual rate of business failures and resulting liabilities compared to other industries. The production and delivery of products and services in the construction industry involves interaction between different parties i.e. (clients, industry professionals, regulators and contractors) within the industry providing a variety of services; all of which directly or indirectly contribute to the overall inefficiency of the industry. The level of services offered by the professionals in the industry, has contributed to the woes of the construction industry as affirmed by Egan, (1998) while reporting that in 1997 the British Property Foundation pointed out that more than a third of major clients are dissatisfied with the performance of contractors and consultants inefficiency. The situation in the UK is echoed across different countries around the world and poor performance of the industry is well documented

(Amehl*et al*., 2010). According to Daniel and Andrew (2003), poor cost performance of construction projects is continually becoming a reoccurring theme and a norm rather than the exception particularly in most developing countries where the problem is more severe. Kasimu(2012) reported that the construction industry in Nigeria is beset with problems ranging from cost overrun, time overrun and poor risk management etc, all of which has contributed to the woos of the industry in terms of satisfying clients expectations. Ali and Kamaruzzaman (2010) reported that despite the growth of the Malaysian construction industry due to rapid development of the country, poor cost performance of project delivery has been a reoccurring phenomenon. The scenario in Palestine is no different as Mahamid and Dmaidi (2013) reported that poor project performance due to several factors has been the bane of the industry in satisfying clients.

A reoccurring factor highlighted by research on the causes of poor project performance in the construction industry has been cost overrun of projects. The occurrence of cost overrun in the industry has the tendency of increasing the cost of investments in the industry (Morris, 1990). Furthermore, Morris *et al.* (1998) while examining records of more than four thousand construction projects reported that projects were rarely finished on time or within the allocated budget. This might be dependent on cost escalation in the course of the construction and many other reasons.

Cost is one of the primary measures of a project’s success (Atkinson, 1999). This is true, especially for public projects in developing countries like Nigeria, because public construction projects in these countries are executed with scarce financially resources (Daniel and Andrew, 2003). Project success is often measured in terms of success using three parameters namely; cost, time and quality (Mahamid, 2013). These measuring criteria are often referred to as Project ‘iron triangle’ (Atkinson, 1999). A project may not be regarded as a successful endeavor until it satisfies the cost, time, and quality limitations applied to it (Mahamid, 2013).

Extensive studies of cost overrun in Nigeria have also been conducted over the years. In a study reviewing public sector construction projects in Nigeria, Dlakwa&Culpin(1990) found that the three main reasons for cost overruns are “fluctuations in material, labour and plant costs”, “construction delays” and “inadequate pre-planning”. In another study, Okpala&Aniekwu (1988) reported that architects, consultants and clients agreed that ‘shortage of materials’, ‘finance and payment of completed works’ and ‘poor contract management’ were the most important causes of cost overruns. Mansfield*et al.*,(1994) studied the performance of transportation infrastructure projects in Nigeria and concluded that ‘material price fluctuations’, ‘inaccurate estimates’, ‘project delays’ and ‘additional work’ contributed most to cost overruns. In a fourth study on construction projects in Nigeria, Elinwa&Buba (1994) found that ‘cost of materials’, ‘fraudulent practices’ and ‘fluctuations in materials had the most significant impact on project costs.

2.2 Variance Analysis

The process by which the total difference between standard and actual results is analyzed is known as variance analysis. When actual results are better than the expected results, we have a favorable variance (f). If, on the other hand, actual results are worse than expected results we have an adverse variation (A). This is observedin building material production and delivery (Thibodeaux, 2012).

In building construction industry project, cost management is very essential. Cost management will ensure the completion of project to schedule and within the budget. Project Cost Management (PCM) is primarily concerned with the cost of the resources needed to complete project activities, so that the products meet the profit (or cost) target (Ansari and Bell, 1996). Predicting costs and schedule completion are of necessity. Therefore for complex projects, estimate to complete (ETC) and the associated costs estimate including estimate at completion (EAC) should be considered as the project progresses.

Estimate to complete (ETC) is quite different from Estimate at Completion (EAC). The ETC is the estimated cost required to complete the remainder of the project. ETC is used to compute the Estimate at the Completion (EAC). The EAC include the sunk cost of the project at the end of the project. This makes EAC the predictor of the sunk cost of the future. Booz (2012) said that EAC=AC + ETC …………. where EAC is estimate at completion, AC is the actual cost of project and ETC is estimate to complete.

This is the means by which a group of certain variables (of elements that are subject to change) is broken down into its constituent parts, and the analysis of these parts are further refined. The goal is to determine the causes of a variance (that is to say the difference between an expected result and an actual result) in a building project. This kind of narrowed-down analysis can be used toidentify the factors that affect each element.

Since the analysis addresses each aspect contributing to a variance, variance analysis is an effective way to discover the sum causes of a result that differs from the result that was anticipated. There is the need however, to additionally focus on the scope, cost, and schedules in the variance analysis.

In probability theory and statistics, the variance is a measure of how far a set of numbers is spread out. It is one of several descriptors of a probability distribution, describing how far the numbers lie from the mean (expected value). In particular, the variance is one of the moments of a distribution. In that context, it forms part of a systematic approach to distinguishing between probability distributions. While other such approaches have been developed, those based on moments are advantageous in terms of mathematical and computational simplicity.

The variance is a parameter describing in part either the actual probability distribution of an observed population of numbers, or the theoretical probability distribution of a sample (a not-fully-observed population) of numbers. In the latter case a sample of data from such a distribution can be used to construct an estimate of its variance: in the simplest cases this estimate can be the sample variance (Wikipedia).

Alin*et al* (2011) stated that in construction project operation, there is a project cost variance which is seen in materials, equipment and man power, subcontractors, over head cost, and general conditions. In all these, material is the main component in a construction project. Therefore if the material management is not properly done, it will create a project cost variance. Project cost can be controlled by taking corrective actions towards the cost variance. A corrective action towards the variance of the material purchasing cost is actually a preventive action (before processing). There is an unexpected cost incurred in the excess of a budgeted amount due to an under-estimation of the actual cost during budgeting. This incurred cost is also called cost overrun or a cost increase or budget overrun (Wikipedia).Cost overrun is however different from cost escalation, which is used to express an anticipated growth in a budget cost due to factors such as inflation. Cost overrun is common in infrastructure, building and technology projects. A comprehensive study of cost overrun published in Journal of America Planning Association in 2002, found that 9 out of 10 construction projects, had had underestimated cost, (Bent, 2002). Many major construction projects have incurred cost overrun. The Suez Canal cost 20 times as much as initially estimated (Bent *et al*, 2002). The Sidney opera house cost 15 times more than was originally projected. When Boston's "Big Dig" tunnel construction project was completed, the project was 275% ($11 billion) over budget (Bent *et al* 2005). The Channel Tunnel between the UK and France had a construction cost overrun of 80% and a 140% financing cost overrun (Flyvbjerg, 2005).

Three explanations were believed to be the causes. Those causes were technical, psychological, and political-economic. Technical indicated imperfect forecasting technique, Psychological was that of optimism bias (with forecasters) & scope creep which required rising political-economic factor. It wasequally termed strategic misrepresentation.

All those three causes can be considered as forms of risk. A project budgeted cost should include contingency funds to cover such risks. That could be seen in engineering researches. Continuous poor risk analysis and contingency estimating practices accounted for many project cost overruns (Hackney and John, 1991).

2.3 Estimating Project Cost

In estimating project cost, Duncan (2011), defined the term estimating-cost as "a decision about how much time and resources are required to carry out a piece of work to acceptable standard of performance". The estimate may be inaccurate due to common mistakes. The common mistakes include;

- lack of understanding of what it involves to complete an item of work,
- starting with an amount of money and making the project cost fit into it,
- assigning resource at more than 80% utilization at completion.
- failing to build in contingency,
- failing to adjust the estimate in accordance with changes in scope,
- dividing the task between more than one resource,
- providing estimates under pressure in project meeting,
- Giving single –data-point estimate rather than range estimates.

The main types of estimating errors are:

- Omissions: These are items accidentally left out of the estimate – either soft costs (permits, fees, etc.) or hard construction costs. Omissions may be due to items missing from the plans and specs that were, therefore, not included in the estimate and bid.
- Wrong assumptions: These are items that you assumed were covered under a contractor's or subcontractor's bid, but aren't.

- Inadequate allowances: You may get an estimate from a contractor or subcontractor with a material allowance that's too low, a very common problem.
- Price changes**:** Material cost or labor costs may rise between the estimate and the project.
- Novel materials/techniques**:** Every new material or building technique has a learning curve. Even allowing a little extra time, you may find that it takes a lot longer than planned.

Other reasons for which actual costs may exceed estimated costs include:

- Unclear or incomplete plans and specifications**:** The absence of clear plans leaves much room for disagreement about what, exactly, was bid on. This can lead to change orders and extra costs for extra work.
- Cost-plus bids: Unless you have a guaranteed maximum, the final cost is unknown, and often more than you estimated.
- Job-site surprises: hidden conditions (insect damage or wood decay in remodeling, underground ledge or water problems, etc.) In some cases, these could and should have been detected by more diligent investigation.
- Construction/design errors: If you build something wrong, have to tear it out and build it again, you
- may be able to get someone else to pay – the architect, a sub, a supplier – but most likely you'll end up paying for it twice.

- Owner changes: You, the owner, may decide to use better windows, roofing, flooring, etc., during the project; or decide to move walls, windows, etc., after installation.

Omissions

It is easy to accidentally leave things out of an estimate, especially soft costs, but construction items are also easy to forget, especially by the inexperienced estimators. The soft costs include permits and fees, which can add up to many thousands of dollars. There are the not-so-obvious costs like temporary power, dumpsters, and site prep. Budgeting for land development are often much higher than expected. Finally, basic construction items like fasteners and hardware, window jamb extensions, or household exhaust fans are easy to overlook.There are also finishing touches like bathroom accessories or topsoil and landscaping. Each mistake can range from a few hundred to thousands of dollars.

Costly Presumption

Knight (2001) had said that this is a broad and potentially costly category that takes vigilance to steer clear of. Thereare saying that “But I thought that was included in the price” this is typical of an assumption at first hand.These problems of assumptions are usually related to unclear communication of expectations througth plans, specifications, and work descriptions (scope of work) in the contract. An experienced contractor knows what to expect from his subcontractors, and which details must be put in writing in the contract.

It is hard to generalize as to what is a standard scope of work for a certain trade, as these things vary from region to region, and to some extent from sub region to sub region. Some foundation contractors will provide excavation, formwork, concrete delivery, damp proofing, drainage, and backfill; others will do just the formwork, and you will need to hire an excavator, order concrete from a ready-mix company, and hire another company to damp-proof or waterproof the foundation. Again, the key is to make sure that every step in the construction process and every material are covered under someone's bid.

An example: Recentlya new homeowner was hit with a surprise of N750, 000 bill for "cut and fill" that the general contractor did not include in his estimate and bid. The contractor had assumed that anything related to rough grading would have been included in the earthwork estimate, but not in this case. This may be another reason how contract may overrun due to an assumption.

Inadequate Allowances

To keep their bids attractive, many contractors put in unrealistically low allowances. Let's say if contract contains a N750, 000 allowances for kitchen cabinets, but the client may end up choosing cabinets that cost N1, 200, 000. He then owes N450, 000 extra, plus taxes, and even more if the contractor charges markup on allowance up charges. He may even charge extra to install the more expensive cabinets.

Price Changes

Prices of some building items, especially commodities like sandcrete blocks and hardwood, can undergo dramatic price swings due to real or perceived upshot of cement and wood scarcity. The prices of building materials tend to rise over time. It is however the best thing to check material prices before committing to an estimate and to negotiate with suppliers to fix in prices for the project.

Unclear Plan and Specifications

There is a very common problem on small jobs where people do not want to take the time to specify every detail. However, it can be a much more expensive problem on large jobs where there is more naira involvement

Ibrahim and Kano (2004) described the following terms in the research titled ‘’ The causes and impacts of differentials in contract sums of building project in Ni

1. Variation Order

The term variation as defined by the standard form of Building contract in Nigeria 1990 (SFBCN 1990) is any alteration or modification of the design, quality or quantity of the works as shown upon the contract drawings and described by or referred to in the contract bills, and includes the addition, omission or substitution of any work, the alteration of the kind or standard of any of the materials or goods to be used in the works, and the removal from the site of any work materials or goods executed or brought thereon by the contractor for the purposes of the works other work materials or goods which are not in accordance with this contract. It also includes the addition, alteration or omission of any obligations or restrictions imposed by the employer in the contract bills in regard to access to the site or use of any specific parts of the site, limitations of work space or completion of the work in any specific order.

The varied works, which should be of a minor nature as compared to the entire project, are communicated to the entire project are communicated to the contractors as written architect's instruction.

The complexity of the construction industry due to different stakeholders'involvement makes it differ from other industry. This complexity gives rise mostly tounwanted situation like variations with their attached effects, and the more variationorders on a project, the greater the likelihood that they become time consuming andcostly in construction projects (Mohamed, 2001). It is almost becoming a rare thingfor a project not to have variation, thus becoming a normal occurrence in allconstruction projects. Most contracts these days must make provisions for possiblevariations given the nature of building construction project (Finsen, 1999; Wainwrightand Wood, 1983). An unfortunate aspect of the variation clause is that it tends toencourage clients to change their minds and embark on building projects withouthaving properly thought through their project requirements (Finsen, 1999). It is the same for the architects; theytend not to crystallize their intentions on paper before the contract is signed becausethey know the variation clause will permit them to finalize their intentions during theterm of the contract (Wainwright and Wood, 1983). Ashworth (2001) added that theadvantage of the variation clause is that it allows the architect or other designers todelay making some decisions almost until the last possible moment.

2 Prime Cost Sum

A prime cost (PC) sum is defined in SFBCN 1990 as a sum provided for work or services to be executed by a nominated sub-contractor, a statutory authority or public undertaking or for materials or goods to be obtained from a materials or goods to be obtained from a nominated supplier. Such sums are usually exclusive of any profit required by the general contractor and provision is usually made thence. It is against this background that all PC items are required to have the following associated items included by the contractor;

a). General attendance (allows for use of main-contractor's site facility).

b). Special attendance (allows for facilities, which the sub-contractor requires the main-contractor to provide).

c). Profits (for the main-contractor on the sub-contract work).

3.Provisional Sums

The term Provisional sum has been defined in SFBCN 1990 as a sum provided for work or for costs which cannot be entirely foreseen, defined or detailed at the time tendering documents are issued. Thus provisional sums are allowed for the works whose extent and/or nature are not precisely known at the time the bills of quantities are prepared. The Architect may either authorize the execution of work involving the provisional sum by the main contractor or the provisional sum may be converted into a PC sum and another firm (subcontractor) nominated to execute the work or supply the materials.

4.Claims and other Adjustments

Although the standard forms of contract do not specifically use the word 'claim', the contractor is required to give notice on the occurrence of certain events, which entail extra cost. The dictionary defines claim as a 'demand for something supposed to be due', i.e. in this context the contractor is claiming something, which he/she believe he/she is entitled to under the terms of the contract. Examples include loss/expenses, liquidated and ascertained damages, compensations, ex-gratia (sympathy), and interest on delayed payments.

Loss and/or expenses claims are claims made by the contractors for expenses or losses which might have been suffered as a result of the disturbance of the regular progress of work by the employer or his/her agents. The non-completion of the works within the stipulated time may also result in the payments made by the contractor to the employer as damages for non-completion at the stipulated time usually expressed as liquidated and ascertained damages. These are an estimate of the actual loss or damage suffered by the employer as a result of the delay in completion of the works. In other words, this is a negative claim in which the contractor is paying some compensatory amount to the employer. While the sum paid to the contractor under the loss/expense clause will cause an increase of the contract sum, the sum paid to the employer under the liquidated damages clause will be deducted from the contract sum. The effect of both sums depends on the amounts actually

5.Fluctuation

The term ‘fluctuation’ refer to any approved changes (decrease or increase) in prices of materials and/or labour wages of materials and/labour wages after the date of tender. The effect of fluctuation on the contract sum depends directly on its magnitude. A large amount of fluctuation may cause a substantial difference in the contract sum and a small amount will expectedly cause little difference in contract sum. The amounted of fluctuation depends on the levels of the new prices relative to the prices contained in the schedule of basic prices. During inflationary times, prices may be high in comparison to their former levels at the time of tender leading to the occurrence of an increase in the contract sum. During deflationary periods however, prices of materials fall and this results in the decrease in the amount of fluctuation and therefore a decrease in the contract sum. Fluctuation also depends on the frequency of changes in price levels. More changes in price level leads to more fluctuation and this can be anticipated more readily in a contract of a long duration than that of short duration especially in unstable economies. Thus, the effect of material price fluctuation on the contract sum depends on the rate of inflation or deflation and the duration of the contract (Ibrahim and Kano, 2004).

2.3.1 Cost Budgeting

Cost budgeting is the process of aggregating the cost of individual activities to produce a time- phased presentation of a project cost estimate. A time-phased presentation of a project cost estimate shows total cost at each period during project development and establishes a structure of spending for each particular period.When accepted, this structure will become a guideline for project financial plan and policy, which must be aligned with other projects within the organization (Abdomerovic, 2006).

According to project management Body of Knowledge (1996), an essential element when entering into any type of project management is cost budgeting. To create an effective cost budgeting plan, a total budget for the entire project must first be established. To achieve this, each area of the project must be analysed and give a particular cost estimate. Once this done, the total sum of cost assessments, whether those costs are in individual projects or in work packages, are combined to establish a certain parameter to provide a working guideline for the budget. These guidelines according to kumaraswamy and Thorpe, (1999) are set in place so that the allotted costs are divvied up amongst the appropriate project needs. This will ensure that the budget goals are being accurately met. The process of cost budgeting is a simple, yet necessary process of any successful type of project management.

2.3.2Cost Control

The standard cost control has, for each line item from the plan, two cost categories; planned (or standard) cost and actual cost. Having two cost categories for each line item, we can make a comparison between planned and actual cost and then determine variance. Comparing actual cost to planned cost shows the cost variance on a given date (Lambert, 2006). This variance between planned and actual cost is caused by either:

1. Resources used to accomplish the work have been paid more than was planned,

2. Resources used to accomplish the work have been consumed in more quantity than was planned. Therefore, cost analysis based on a standard cost control system has been focused on two elements: resources and cost of resources and is given by the following equations:

Planned cost = Planned quantity X Planned Unit Price

Actual Cost = Actual Quantity X Actual Unit Price

Total Variance = Planned Cost – Actual Cost (Abdomerovic, 2006)

In the design and implementation of a project cost control system, the individual according to Ellis (2006), must be considered. However, the following criteria should be considered regardless of the specific situation:

Validity:the information reported must accurately reflect actual versus estimated costs.

Timeliness: The cost data must be reported soon enough so that managerial action can be taken if a problem arises.

Cost effectiveness: collection and reporting of cost data must be done in a way that does not hinder project progress.

The above cost control systems he concludes can work if they are set up with these criteria in mind.

2.4Cost Overrun

Cost overrun as defined by Mahmid and Dmaidi (2013) is the "difference between the final actual cost of a construction project at completion and the contract amount, agreed by and between the client (the project owner) and the contractor during signing of the contract".The problem of cost overun in the construction industry is a reoccurring phenomenon (Mahmid, 2013) that hinders projects progress, as it has the potentials of decreasing contractor's profit (Kasimu, 2012) and hindering attainment of project objectives. Besides, failure to meet project objectives, cost overrun increases the burden of financial risk to clients(Boukendour, 2005).

2.4.1 Causes of Cost Overrun

Bashir(2014) working on modeling of cost overrun building projects in Abujahad said that very many researchers have probed into the factors that cause or lead to cost overrun in construction projects and their findings are very much available in the academic and industrial forum. Since the 1980s various studies were conducted on the causes of project cost overruns on construction projects. Morris (1990) reported that the occurrence of cost overrun and time overrun has been on the increase since the sixties but gathering this information has been difficult due to lack of adequate and accessible information. The causes of cost of overrun vary from project to project (Frimpong et-al, 2003) and most of the factors are difficult to predict and manage (Morris and Hough, 1991). Kaming*et al*. (1997) conducted research on factors influencing delay and cost overrun in Indonesian high-rise construction projects and he identified 7 variables of cost overruns. The first three factors included; materials cost increase due to inflation, inaccurate quantity take-off and labor cost increase due to environment restriction. Thereafter Chang (2002) investigated into the causes of cost and schedule increment in engineering design project he regrouped the factors into three main headings; project owners factors, consultants factors and external factors i.e. factors beyond the control of either the client or consultant. However in another research conducted, Le-Hoai*et al*. (2008) identified factors influencing delay and cost overrun and grouped them into six main headings; mainly client owner related factors, consultants related factors, contractors related factors, project related factors, material and labour related factors and finally external related factors.

1. **Optimism bias**- Is documented through tendency for people to be highly optimistic about the outcome of planned actions. That included over estimating the likelihood of an event and so going ahead to underestimating, the likelihood of the event.

2. **Strategic misrepresentation** - This is the planned systematic distribution or misstatement of fact and thereby employing lying in response to the incentives in the budget process. An example of this is budgeting, which illustrates that it is a contingent strategy, responsive to a system of reward in a highly competitive game of a resource constraints (Jones and Euske, 1991).

The whole discourse tends to revolve around the accuracy of cost estimating.

Larry (2006) posited that cost estimating is the predictive process used to produce quantity cost, and price resources required by the scope of an investment option, activity, or project. When taking into account the uncertainty associated with an estimate, the amount added to the initially developed point value to represent this uncertainty in the final estimated cost is called contingency.

Accuracy is the degree to which a measurement or calculation varies to its actual value. The estimate accuracy is an indication of the degree to which the final cost outcome of a project may vary from the single point value used as the estimated cost of the project. To the estimator, the contingency is an amount used in the estimate to deal with the uncertainties inherent in the estimating process. The estimator regards contingency as the funds added to the originally derived point estimate to achieve a given probability of not overrunning the estimate, giving relative stability of the project scope and the schedule assumptions upon which the estimate is based, (Larry, 2006).

Contingency is required because estimating is not an exact science. The word "estimate" simply means a judgmental probability value; and the one sure thing known is that estimate is not an exact value. Cost estimating as further explained by Yang (2005), is a process of collecting, analyzing, and summarizing data in order to prepare a projection of the anticipated cost of a project. This process begins in the early stages of the project and repeats frequently during the entire life cycle. The prices of all the resources (materials, equipment and labour) are exposed to certain levels of uncertainly (risks) particularly when the project life cycle is lengthy.

Ashworth (1996) said that the estimation of capital cost of new building projects requires, among other factors, a combination of knowledge, skills, experience and judgment. The knowledge component relies on information. In professional practice, this cost information may have been gathered from a quantity surveyor's own record, building price book or other source of information such as Building cost information service (BCIS). It is however to be noted that this secondary sources of information are used only in those circumstances where personal cost information does not exist, or where it is necessary to validate this information.

Williams *et al* (1998) has shown that the completed project cost is a function of the low bid raised to a power multiplied by a constant. Williams *et al* (1998) and Giwa (1998) further explained that, this indicates that very large projects can be expected to have a relatively larger cost overrun than small projects.

The completed costs of complex projects are difficult to predict and subject to variations. These are caused by many different factors. The factors include; mistakes in bidding for a poor design, a design that is not easily buildable, management of the construction, the complexity of the project and many other factors unique to individual projects. The unique factors include; the location of the project, weather condition, labor relation and availability of specified materials.

In their contributions Edward and Bowen (1998) believed that the estimating /costing of project have decision variables that are subject to risk and uncertainly. He therefore defined, risk analysis and risk management as "probability that an adverse event occurs during a started period of time." (Royals' Society,1991).There are categories of human risks relating to construction and these include social, political, economic, financial, legal, health, managerial, technical and cultural risk. These are bound to be met with errors.

The finding of Ayodele [2010] showed that the adjustment of prime cost and provisional sums are some of the causes of cost and time overruns in the construction industry. He cited Giwa [1988] that the allowances made for prime cost in contract bills, cause overruns in contract sum because the actual costs are in most cases, higher. This according to Ogunsemi [2007] was because the Quantity Surveyor usually allowed for arbitrary figures. In fact the amount allowed for has often led to high figures in order to beon the safe side. Ogunsemi [2007] concluded that the way andmanner by which provisional sums are allowed for inthe contract bill and later expended has a greatimpact on the final cost of construction project. The more the provisional sums inserted into contract bills, the less the concrete and realistic will be the initial contract sum and eventually invariably the final cost. Ogunsemi [2007] further said that'' an ideal bill of quantities is that which contain neither prime cost nor provisional sum". In a study carried out in Nigeria on building projects by Akewusola [2007] carried out a study within the period of 1972-1978 and had the following analysis and deductions that, the mean of cost overrun was 46.76% out of which 7.79% was contributed by the adjustment of prime cost sum and 3.23% came from adjustment of provisional sums. During the recession period of 1979-1983; the mean of cost overrun was 65. 83%, out of which were 28. 37% sand 11. 77% came from adjustments of prime cost and provisional sums respectively. During the depression period 1984 until the period of writing, mean of cost overrun was found to be 23.39% out of which 1.97% and 0. 96% were by prime cost and provisional sums respectively.

Cost Caused by Rework

Rework represents a new terminology in construction dictionary and it becomes essential when an element of building works fails to meet customer's requirement or when the completed work does not conform to the contract documentation. Reworks contribute to time and cost overruns in projects. Thus, to enhance efficient project delivery processes, (Oyewobi*et al*, 2011) conducted a research work which evaluated rework cost on elemental basis in some selected building projects in Niger State. The study revealed that Finishes (19.09%)have higher contribution to rework costs than any other elements of building for the projectsconsidered and the rework costs on an average basis for the elements was 4.49%.

Rework may occur in any conceived project at both the design and construction stages and it may be in the form of variation, non-variation or design error or omission. By evaluating rework cost, he envisaged that it would give the construction professionals and clients better understanding or create an early warning on the effect of reworks on project delivery. He said, it is believed that the understanding of this will promote and enable client identify effective prevention strategies that can be implemented to improve project performance in terms of cost, time and quality, (Oyewobi*et al*, 2011).

Kasimu (2012) reported that the construction industry in Nigeria is beset with problems ranging from cost overrun, time overrun and poor risk management etc. all of which has contributed to the woos of the industry in terms of satisfying clients expectations.

2.5 Negative versus Positive Variances

Thibodeaux (2012) in his discuss on the subject stated that cost variances may be either positive or negative figures. Negative figures occur when the expenditure on a project is more than the budgetary provision. Positive figures result if the expenditure is less than the project cost estimate. Negative cost variance figures are almost always bad prediction for a business, as construction companies cannot always guarantee they can come up with the funds to cover the excess cost. However, positive cost variances are not always good for a company, either. For instance, if there comes out in the black on a project budget by sacrificing customer service for quality parts, that may resultin not selling as many of the products. That may end up in the loss of clients. Cost variance figures must be examined for the business in order to determine the true impact those numbers will have.

Regardless of whether the variance is positive or negative, it means one of two things. The first reason is that, due to insufficient or inappropriate data or human error,there could be overestimation or underestimationof expenses. The second possibility is that events or circumstances can arise that may alter the costs, such as a supplier being unable to come through on an order and this can necessitate the expedition of sourcing of the materials from another site butfrom more expensive suppliers. Sometimes these events or circumstances are preventable, in which case, risk management strategies can help, but this is not always the case, particularly because it may be difficult to foresee every possible problem or scenario that could play out. In the construction industry this scenario occurs if the production delivery date is fixed.

2.5.1 Importance of Negative versus Positive Variance

Thibodeaux (2012) was swift in analyzing the importance saying that cost variance allows the monitoring of the financial progression of business undertakings. When cost variances are low, risk control is well managed. Ideally, the actual costs should match what was budgeted and the cost variance should be zero, but in practice this is fairly difficult to achieve he concluded. Cost planning is therefore needed in order to achieve the right objectives. The accuracy of such cost planning is measured by how well the estimated cost can be compared to the actual construction cost, (Oberleder and Trost, 2002).

It has been observed that for most public buildings, like any other construction project the initial contract estimate often differs from the actual cost of construction, (Giwa 1998). An attempt to advance the reason for the perpetual overruns will helpthe clients to direct attention to solving those problem areas and why there are the observed differentials between the initial and final project costs.

2.5.2Controlling and Defining Scope

A lack of scope definition at the onset of a project is one of the main causes of cost overruns duringdesign. A cost overrun occurs whenthe actual cost of the design to the design firm is above the fee paid to the design firm to complete the work, assuminga project fee estimated at the onset of the project. The Construction IndustryInstitute's publication on Scope definition and control (1986) ranks the loss of scope during engineering as having the second highest impact on cost overruns. Dysert (1997) claimsthat "poor scope definition at the estimate stage and loss of control of project scope" are the most frequent contribution to cost overruns. Apoorly defined project is subject to changes initiated by the client that will require extra work and effort by the design team to complete. Minor changes to the scope throughout the design phase can add upand lead to major cost overruns on the project. This is known as creeping scope. Scope creep is the addition, as development proceeds, of new frames to a project that are above andbeyond what the original contract called for. With a poorly defined scope there is no baseline against which changes cm be evaluated and monitored to identify those that are not within the original scope of work. According to Dumont *et al*. (1997) these changes may result in cost overruns and a greater potential for disputes. Dumont also claims these changes may"delay the project schedule, cause rework, disrupt project rhythm, and lower the productivity and morale of the workforce." But increased levels of scope definition will "improve the accuracy of cost and schedule estimates as well as the probability of meeting or exceeding project objectives." A survey done by Bresnen*et al*. (1991) showed that of projects surveyed that wereover budget, 40% of the cost estimate was due to additional work and prior design variations.

Scope creep is a problem that is often easilyidentified by project managers on their projects, but they may have reasons for not pointing out to the owner or architect that extra work is beingdone. Oftenthe amount of extra work is minimal and the project manager may want to avoid confrontation with the owner and so will not askfor extra money as it could affect futurerelations with theowner. Another factor that affects whether a consultant receives extra money for extra work done is the prime consultant.

The prime consultant may be unwilling to approach the owner for extra fees or perhaps it is a contract issue not following them to. Some contracts between the prime consultant and the owner will stipulate that direct labourextra work will be done at a specific rate, which may be much less than what the consultant would normally charge, again causing the consultant to lose money. Al1these minor amounts of extraworks can add up and create a large difference to the bottom line. Apoorly defined scope also may be caused by internal problems within a design firm. If the project manager does not adequately define the project and tasks to be done the designers and quantifiers may do extra work due to lack of direction. A project manager musthave good communication with the design team and provide guidance anddirection to ensure everyone is working towards the same goal. Misunderstandings and misinterpretations between parties working on the project can cause problems such as rework and extrawork and will invariablycause disputes between the parties. Good communication, good organization and control, and proper scope definition are therefore important elements of a successful project.

CHAPTERTHREE

3.0 RESEARCH METHODS

3.1 Research Approach

This project was designed to analyze public building total project costs estimate, using mean component costs method. The research used a qualitative approach in which the data was drawn from completed project files. The choice of this study method is adopted in this research because it involves real life investigation in obtaining a reliable data for cost variance analysis in the use of skitmore and Ng (2002) model. A study of this type had been previously employed with good results by Skitmore and Ng (2002. It is there trusted that the data collected for these case studies will be accepted as being enough for the research results obtained.

3.2 Data Collection

In order to realize the study objectives of this research the work was pursed through literature review, journals, magazines and internet facilities so as to articulate existing knowledge on analysis of public buildings total project cost. There are four data collection techniques that are known. These are through interviews, questionnaires, observation and unobstructive measures. In this research the use of both interview of the professionals and searching of available documents were used for the collection the data. Data for empirical study to determine the variances were collected from project files of completed building projects from reputable consultant Quantity Surveyors practicing in Nigeria. The public buildings were educational structures composed of classroom and lecture theatre drawn fromEducational Trust Fund (ETF) office.

3.3 Sample Size

The sample size determination was achieved through the method of sampling adopted by Guilford and Flurchter (1973) as stated.

$$n = \frac{N}{1 + e^2 N}$$

Where: n, = sample size

N= Population Size

e= 0.10@ d.f=1 for 90% confidence interval

Thus: $n = \frac{42}{1+(0.10)^2\,(42)} = \frac{42}{1+(0.01)42} = \frac{42}{1+0.42} = \frac{42}{1.42} = 29.577 =\hat{=}\ 30$

Therefore 30 was determined as sample size.

Levin (1990) suggested that in carrying out a survey, large samples should be used because the larger the sample the higher the position. The researcher therefore went for a total of 42 project files and based on selection a total of 30 met the following data required based on the following check list:

1) State of location of institution
2) The institutions located within the state selected
3) Institutions having the required data namely:

(a) Ground floor buildings.

(b) The component within the bill of quantities.

3.4 SamplingProcedure

In any research a representation of the population is that sample which has approximately the characteristics of that population relevant to the research under investment (Bello and Ajayi, 2002). This research focused on the analysis of public and private total Project Cost: Using mean component costs method in Nigeria. Therefore a purposed driven sampling procedure which sought data from project with estimated and completed work evidenced in the files was adopted. Direct interview with the consultants and examination of relevant papers were employed to source the needed data. The project samples were building constructed and finished. The construction project estimators were contacted to obtain the files where the data were drawn from.

The data collected for each sample building structure were: Ground floor area, Estimate provisions for the Preliminaries, Substructure, Superstructure, Services (mechanical and electrical), External Works and Contingency. The building construction projects supervised by the consultants cut across some tertiary institutions. The projects covered classroom buildings and lecture theatres.

3.5 Data Analysis Technique.

The analytical method of determining variance derived by Skitmore and Ng (2002) was adopted, using the exact derivation of total project cost variance.

It involved the calculation of the mean, standard deviation and the coefficient of variation. The calculation of the standardized components which was the amount of cost per square area for the following components; preliminaries, substructure, superstructure, mechanical and electrical services, external works and contingencies were made. These derivatives were further subjected to Skitmore and Ng(2002) model of calculations to arrive at the results obtained.

3.6The Exact Derivation of Total Project Cost VarianceDerived and used by Skitmore and Ng (2002) for Calculating the Coefficient of Variance.

Let $c_{ip}$and e_{ip} denote the respective actual and estimated standardized values of cost component i=1, 2….n and p=1,2….m that is $c_{ip}= c'_{ip}/\alpha_p$and $e_{ip}= e'_{ip}/\alpha_p$ where C' and e' are the original (Naira) values of the respective actual and estimated component costs and α is the project gross floor area.

The total standardized actual and estimated costs are therefore given by $\sum c_{ip}$ and $\sum e_{ip}$ respectively. The standardized estimated minus actual component cost difference is

$d_{ip} = e_{ip}-c_{ip}$, so that the total standardized estimated-actual cost difference is $t_p = \sum d_{ip}$.

Now, if D_i and D_j are random variables from which d_{ip} and d_{jp} are values, the variance of

$\sum D_i$, and therefore t_p, is the well known

$$var[\sum D_i]=\sum var[D_i]+2\sum\sum cov[D_i,D_j] \ldots\ldots(1)$$

which in terms of standardized estimated total project cost gives a coefficient of variation of

$$CV_p=100 \sqrt{var} (\sum_i D_i) / \sum_i e_{ip} \ldots\ldots(2)$$

Note: the CV_p value is the same for both standardized and unstandardized data.

$$CV^*_P =100\sqrt{} var(\sum \alpha_p D_i) / \sum_i \alpha_p e_{ip} \ldots\ldots(3)$$

and the α_p (approximate) values cancel

Since the research was focused on evaluating the approximation, assuming independence i.e.

$$Var[\sum_i D_i]^* = \sum_i var[D_i] \ldots\ldots(4)$$

and use the ratio

$$V = CV_P^* / CV_P \ldots\ldots(5)$$

Where,

$CVp^* = 100\sqrt{\ } var[\sum_i D_i] / \sum_i e_{ip}$……………………………………………….(6)

So that V < 1 indicates that the true CV is underestimated and V >1 indicates that the trueCV is overestimated.

CHAPTER FOUR

4.0 PRESENTATION, ANALYSIS AND DISCUSSION

4.1 LECTURE THEATRE

The data obtained from the field study are presented below for both lecture theatre and the classroom. They are further analyzed and the discussion also follows

Table 4.1: Unstandardized Project Component Data of Lecture Theatre

Proj. ID	G/floor Area	Prelim. (N)	Substructure (N)	Superstruct	M& E	Ext. Works (N)	Conting (N)	Total
1	659	2,500,000`	16,112,545	46,408,233	7894,060	5,937,500	1,500,000	80352338
2	504	4,000,000	11,332,590	41,000,213	5,316,835	830,000	1,712,500	64192138
3	285	2,102,693	3,275,290	19,955,213	863,400	481,700	2,000,000	28678296.25
4	285	1,363,014	3,043,890	23,443,486	863,560	481,700	1,143,164	30338813.88
5	483	2,583,100	5630,550	44,506,099	1,666,800	943,400	2,712,252	58042200.88
6	483	3,980,006	6,008,350	44,448,200	1,666,800	943,400	4,000,000	61046756.25
7	1517	6,150,000	33,676,550	75,666,417	11,238,180	4,244,000	2,000,000	132975147
8	1517	13,700,000	32,120,810	68,696,580	10,713,450	3,214,000	2,000,000	130444840
9	1517	4,600,000	3,505,250	76,066,120.00	13,496,790	4,514,000	2,000,000	104182160
10	972	500,000	8,704,390	41,524,892	1,000,000	750,000	250,000	52729282
11	1,180	3,100,000	17,948,250	56,902,845.00	7,342,850	707,2022	500,000	86501147
12	2,129	1,170,000	8,215,226	38,483,203.95	5,411,853	1,168,096	1,000,000	55448378.95

Table 4.2: Standardized Values of Lecture Theatre Data

Proj. ID	G/floor Area	Prelim. (N)	Substructure (N)	Superstruct	M& E	Ext. Works (N)	Conting (N)	Total
1	659	3793.62	24449.99	70422.20	11978.84	9009.86	2276.17	121930.71
2	504	7936.50	22485.29	81349.62	10549.27	1646.82	3397.81	127365.35
3	285	7377.87	11492.24	70018.29	3029.47	1690.17	7017.54	100625.60
4	285	4782.50	10680.31	82257.84	3030.03	1690.17	4011.10	106451.97
5	483	5348.03	11657.45	92145.13	3450.93	1953.20	5615.42	120170.18
6	483	8240.17	12439.64	92025.25	3450.93	1953.20	8281.57	126390.79
7	1517	4054.05	22199.43	49878.98	7408.16	2797.62	1318.39	87656.65
8	1517	9030.98	21173.90	45284.49	7062.26	2118.65	1318.39	85988.68
9	1517	3032.30	2310.64	50142.46	8897.02	2975.60	1318.39	68676.44
10	972	514.40	8955.13	42721.08	1028.80	771.60	257.20	54248.23
11	1,180	2627.11	15210.38	48222.75	6222.75	599.32	423.72	73306.05
12	2,129	549.55	3858.72	18075.71	2541.96	548.65	469.70	26044.33
Total		**57287.13**	**166913.18**	**742543.85**	**68650.47**	**27754.93**	**35705.45**	**1098855..03**

Standardized component cost for public buildings obtained by the Division of component cost of each project identity by the square area occupied by the project structure.

Table 4.3: Analysis of Lecture Theatre Data

Total	57287.13	166913.18	742543.85	68650.47	27754.93	35705.45	1098855..03
Mean	4773.9277	13909.43	61878.65	5720.87	2312.91	2975.45	91571.25
Var.	8396332.5	53766671	526167595.5	12215657.4	5042150.50	7419941.98	1011608708
STDAV	2897.64	7332.57	22938.34	3495.09	2245.47	2723.95	31805.79
Coef. ofVar in Percentage (%)	60.69	52.71	37.06	61.09	97.08	91.54	34.73

The analysis of the lecture theatre above shows that the Coefficient of Variation cutting across the row is below the standard of 100%

4.2 CLASSROOMS

Table 4.4: Unstandardized Project Component Data on Classrooms

Proj. ID	G/floor Area	Prelim. (N)	Substruct. (N)	Superstruct	M& E	Ext. Works (N)	Conting (N)	Total
1	499	800,000	6374,640	14,714,840	1,187,000	804,000	318,515	24198995
2	382	585,000	4,783,960	12,498,080	1,187,000	1,000,000-	1,500,000	36101512
3	845	1,842,853	7,205,480	30,000,408	5,223,550	696,000	2,125,757	47094048
4	613	300,000	6,920,780	17,948,150	8,432,582	1,000,000	1,500,000	36101512
5	339	250,000	3,748,201	20,100,000	1,626,970	571,150	250,000	26546321
6	691	3,100,000	9033,100	30,900,000	3,988,000	1,046,265	500,000	48567365
7	1058	750,000	7,035,830	16,508,513	1,403,740	2,382,800	500,000	28580883
8	274	485,000	1,891,575	12,87,456	6,055,450	217,000	1,448,008	22984489
9	898	550,000	5,206,245	24,565,718.30	2,508,160	1,303,210	500,000	34633333.3
10	1049	250,000	4,508,060	15,771,06	2,841,150	1,433,750	350,000	25154024
11	1,058	750,000	7,035,830	16,508,513..75	1,403,740	2,382,800	500,000	28580883.75
12	337	650,000	2,998,609	10,496,979.75	1,368,690	702,910	900,000	17117188.75

The table above shows the unstandardized project Component Data from the Classrooms cost estimate drawn from the bill of quantities (BOQ) for 12 Lectures Classroom Project handled by ETF for Tertiary Institutions in the selected States.

Table 4.5: Standardized Values of Classroom Data

Proj. ID	Prelim. (N)	Substructure (N)	Superstruct (N)	M& E (N)	Ext. Works (N)	Conting (N)	Total (N)
1	1603.20	12774.83	29488.65	2378.75	1611.22	638.30	48494.97
2	1531.41	12523.45	32717.48	3107.32	2617.80	5094.24	57591.72
3	2180.89	8527.19	35503.44	6181.71	823.66	2515.68	55732.60
4	489.39	11290.01	29279.20	13756.25	1631.32	2446.98	58893.16
5	737.46	11056.64	59292.03	4799.32	1684.80	737.46	78307.73
6	4486.25	13072.50	44717.80	5771.34	1514.13	723.58	70285.62
7	708.88	6650.12	15603.50	1326.78	2252.17	472.58	27014.06
8	1770.07	6903.55	47034.51	22100.18	791.97	5284.70	83884.99
9	612.47	5797.60	27356.03	2793.05	1451.23	556.79	38567.18
10	238.32	4297.48	15034.37	2708.43	1366.77	333.65	23979.05
11	708.88	6650.12	15603.51	1326.78	2252.17	472.58	27014.06
12	1928.78	8897.94	31148.30	4061.39	2085.78	2670.62	50792.84
Total	**16996.04**	**108441.48**	**223282501.7**	**70311.35**	**20083.07**	**21947.21**	**620558.04**

Standardized component cost for public buildings obtained by the Division of component cost of each project identity by the square area occupied by the project structure.

Table 4.6: Analysis of Classroom Project Data

Total	**16996.04**	**108441.48**	**223282501.7**	**70311.35**	**20083.07**	**21947.21**	**620558.04**
Mean	1416.33	9036.78	18606875.14	5859.27	1673.58	1828.93	51713.17
Var.	1345436.08	9158996,.7	182438385.8	37336409.5	309580.16	3230077.41	396617462.5
STDAV	1159.92	3026.38	13506.97	6110.35	556.39	1797.24	19915.25
Coef. ofVar. in Percentage (%)	81.89	33.48	0.072	104.28	33.24	98.26	38.51

4.3 LECTURE THEATRE

4.1.1 Application of Skitmore and Ng (2002) Model

In the absence of any other information, assume an 'average' future project, P.

Here,

From Table 4.3

$\sqrt{var[\sum D_i]} = \sqrt{[\sum C_i]} = S = Sd = 31805.79$

Where C_i is a random variable to which $\acute{C}_i$ belongs and $\sum e_{ip} = \sum C_{ip} = 91571.25$

And so from equation (2)

$CV_p = 100(31805.79)/91571.25 = 34.73\%$

Also $\sqrt{var[D_i]} = \sqrt{var[C_i]} = S = Sd = 2897.64, 7332.57$ etc.

which means,

$Var[D_i] = Var[C_i] = S^2 = 8396332.5, 53766671$ etc

andso, from…equation…………..(6)

$CV_p^* = 100 \sqrt{\{[$

$8396332.5+53766671+526167595.5+12215657.4+5042150.50+7419941.98] / 91571.25\}}$

$= 100 \times 40306.54/91571.25$

$= 44.02\%$

And from equation …………(5)

$V = CV_p^*/CV_p$

$= 44.02 / 34.73$

$= 1.26\%$

4.4 Discussion of Results

4.4.1 Lecture Theatre

Table 4.1, summarizes the estimated data drawn directly from the bill of quantities(BOQ) while Table 4.2 displays the updated standardized component costs: C_{ip}, for the data drawn from the lecture theatre project. The values of the cost components are standardized by dividing the cost with the gross floor area of the building.

The columns contain the C_{ip} values for the components: Gross Floor Area, Preliminaries, Substructure, Superstructure, Mechanical and Electrical Services, External works, Contingencies and Total. The drainage, site development and furniture and equipment are not common to all the constructions. The last column gives the standardized total project costs $[\sum C_{ip}]$. The last four rows give the mean, variance and standard deviations and coefficient of variation respectively for each C_{ip} column, with the final (total) column showing the mean and standard deviation of the standardized total project to be 91571.25 and 31805.79 per m2 respectively, representing a coefficient of variation of 34.73%.

The $CV_p$and CV_p^* values of 34.73% and 44.02 % for both standardized and unstandardized data are identical.

With a V value of 1.26, the approximate project variance overestimated the true value by 0.26%.

The analysis here is approximate for project cost forecasts where the forecast is obtained by summing the means of each $C_i$for the projects in the database. In this case therefore the forecast for a new, non-database, project would be in the absence of any project details, N91571.25 per m^2 floor area with a coefficient of variation of 34.73%

This study has described a method for calculating the variance of total project cost based on standardized component costs for a set data from projects.

For the sample analyzed the correct variance for an ‘average’ project, taking into account intercomponent variability, was found to be CV= 34.73%, the variance of approximation under the assumption of interdependence (CV= 44.02%).

The coefficient of variation in thisproject estimate indicates a generally lower level with reference to the standard. The highest coefficient of variation is from the external works, followed by the contingency and superstructural component has the least coefficient. .

Cost contingency is included within a budget estimate so that the budget represents the total financial commitment for the project sponsor. The coefficient of the variation for this contingency component is second to that of external works in high as shown in the Table 4.3

The variance of the lecture theatre building is more than the true value by 0.26% as it’srepresented in the calculation.

4.4.2 Classrooms

Table 4.4 Summarizes the data taken from the bill of quantities (BOQ) while Table 4.5 shows the updated standardized component costs: C_{ip}, for the Classroom project data. The values of the cost components are standardized by dividing the cost with the gross floor area of the building.

The columns contain the C_{ip} values for the components: Gross Floor Area, Preliminaries, Substructure, Superstructure, Mechanical and Electrical Services, External Works, Contingencies and the Total. The drainage, site development and furniture and equipment are not common to all the constructions. The last column gives the standardized total project costs $[\sum C_{ip}]$.

The calculations follow the same method as analysed in the Lecture Theatre calculated before and the result are shown below.

The last four rows give the mean, variance, standard deviations and coefficient of variation respectively for each C_{ip} column, with the final (total) column showing the mean and standard deviation of the standardized total project to be 51713.17 and 19915.25 per m2 respectively, representing a coefficient of variation of 38.50%.

The CVpand CVp* values are identical for both standardized and unstandardized data.

With a V value of 1.26%, the approximate project variance overestimated the true value by 0.26%.The analysis here is approximate for project cost forecasts where the forecast is obtained by summing the means of each $C_i$for the projects in the database. In this casetherefore the forecast for a new, non-databases project would be in the absence of any project details, N51713.17 per m^2 floor area with a coefficient of variation of 38.50%.

The coefficient of variations of the Classroom buildingfell short of standard value generally across the row shown by the percentages computed on the last row of the table except the cv of mechanical and electrical component that is above the standard value (101.28%).This is closely followed by the cv for the contingency component (98.26%) and the least cv value that of the superstructure (0.072%).For the sample analyzed the correct variance for an ‘average’ project, taking into account intercomponent variability, was found to be much smaller(CV=38 50%), than approximation under the assumption of interdependence (CV=48.55%). With the value the variance being 1.26 indicating that the lectureroom building estimate is more than the true value by 0.26% as its represented in the calculation.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSSION AND RECOMMENDATION

5.1 Summary of Finding

The summary of findings from this research work shows the following:

5.1.1 Lecture Theatre

From table 4.1

1. The coefficient of variations is generally lower than 100%. Next to this standard are the coefficients of Ext. works (97.08) and the Contingency (91.54%).
2. The coefficient of variation of substructure, superstructure and mechanical/electrical are 52.71%, 37.06%, 61.09% while the preliminary has 60.69% respectively.
3. The analytical calculation shows that the correct variance for an average lecture theatre project from this research was found to be 34.73%.
4. There is a significant difference existing among the component in the lecture theatre building cost studied.

5.With a V - value of 1.26% the approximate project variance overestimates the true value by 0 26%

5.1.2 Classrooms

From table 4.6

1. The coefficient of variation of the Lectureroom building components indicated that: preliminaries (81.89%), substructure (33.48%), superstructure (0.072%), mechanical/electrical (104.28%), external works (33.24%) and contingency (98.26%) fell short of the standard value of One Whole number (1) or 100%.
2. The sample analyzed had shown that the correct variance of the class room was found to be 38. 50%.

3 With a V value of 1.26% the approximate project variance overestimates the true value by 0.26%.

5.2 Conclusions

1. Generally, the results of this study reveals and confirm the established facts that cost overrun occurs in building projects.
2. A total of 24 building project was studied, 12 of which were lecture theatre and 12 from lecture rooms, which data were drawn from ETF projects in Kaduna, Kwara, Kogi and Abuja tertiary institutions.
3. The major problem in Nigerian construction industry is that building contracts are completed at sums much higher than estimated cost, hence the need to develop predictive model of factors affecting project cost using estimation by mean component costs that identify at the onset of estimation, the possibility and the extent of variances.

4. The analytical calculation shows that the correct variance for an average lecture theatre project from this research was found to be 34.73%. The sample analyzed had shown that the correct variance of the class room was found to be 38. 50%. Therefore lecture theatre is observed to be a better building project than the class room building.

5.3 Recommendations

1. It is therefore recommended that every project cost estimate, should be cross-checked by calculating the variances in order to know whether the project cost will be underestimated or overestimated.
2. The implication of cost overrun should be a point of consideration before awarding any contract. So necessary steps should be taken to minimize possible project overrun at the completion of the building structure.
3. Cost estimators should be registered professionals in order to limit any personal error that may lead to cost overrun.
4. There should be provision for quick and frequent report of variances by the monitoring or supervision of the project, for quick decisions.
5. The motivated labour should be briefed early in respect of the goal of the construction industry and the need for their cooperation and dedication so as to expedite the action on completion of the project at the scheduled time.
6. Professionalism should be seen in the preparation of the cost of building structure, devoid of political influence, or mistakes arising from estimator's mistakes of omission and miscalculation. Deliberate inclusion of undesirable financial incursions should be avoided.

7. Since acost estimate is the approximation of the cost of a program, project, or operation, the problem with a cost overrun can be avoided with a credible, reliable, and accurate cost estimate.The cost estimate is the product of the cost estimating process.

5.4 Contributions to Knowledge

The study has revealed that project cost variance can be minimized or maintained even though; there are observable variations in material cost, plant and labour. If the amount budgeted for project can be utilized within the stipulated time and judicious management of the estimated contract cost. This model can identify cost variance of a project in prospect.

5.5 Recommendation for Further Study

It is recommended that further research work should be carried out on Estimation by subjectively derived component costs and Estimation by mean component unit costs in Nigeria.

REFERENCES

Abdomerovic, M. (2006) "Project cost management in practice" in- TheAMA Handbook of Project Management, 2nd ED Paul C. Dinsmore, Jeannette Cabanis-Brewin (Eds),Amacom, New York.

Ansari, J. and CAM-1, (1997) Target costing: The next frontier in strategic cost Management-CAM-1 publishing (1997).

Allan, A. (1996) Estimating Life Expectances of Building Components in the Life Cycle Costing Calculations Structural Survey.14(2):4-8

Akewusola, W.A.O., 2007. Effect of economic trade cycle on final cost of construction projectsin Nigeria. The Quantity Surveyor. Nigerian Institute of Quantity Surveyor.Lagos, 55(2): 31-40.

Akinsola, A. &Potts, K.F. (1998) A methodology for evaluation of the variation clause in the standard forms of contract, *Proceeding of COBRA 98, RICS*

Ali, A.S &Kamaruzzaman, S.N. (2010)Cost Performance for Building Construction Projects in Klang Valley. *Journal of Building Performance,1*(1)

Amehl, O. Soyingbe, A.&Odusami, K. (2010) Significant factors causing cost overruns in telecommunication projects in Nigeria.*Journal of Construction in Developing Countries*, 15

Ashworth, A. (1996) Estimating the life expectances of building components in the life-cycle costing calculation; *Structural Survey* 14(2):4-8.

Atkinson, R. (1999) Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management*, 17(6), 337-342.

Bashir, M. (2014) Modelling of Cost overruns in Building Project in Abuja *Unpublished masters project.*

Bello, R. And Ajayi, O.O.S (2000), *Research Method and Statistical Analysis*. Hayfec Press and publishing company Limited, 154 Ibrahim Taiwo Road Ilorin Kwara State, Nigeria.

Boukendour S (2005) A New Approach of Project Cost Overrun and Contingency Management; *OCRI Partnership Conferences Series Process and Project Management.*

Bresnen, Michael J., and Haslam, Cheryl O. 1991. Construction industry clients: A survey of their attributes and project management practices. Construction Management and Economics. 9:327-342.

Edwards, P.J. &Bowen, P.A. (1998) "Risk and risk management in construction: a review and future directions for research", *Engineering, Construction and Architectural Management, 5(4):*339 – 349.

Cowan, G. (2005) Monte Carlo Technique. *Chap 33*

Daniel,B.& Andrew, D. (2003) Modeling global risk factors affecting construction cost performance.*International Journal of Project Management*, 21:261–269

Dantata, S. (2007)General Overview of the Nigerian Construction Industry.*Unpublished Master's Thesis Massachusetts Institute of Technology*, Massachusetts

Dlakwa, M. M. And Culpin, M. F. (1990)Reasons for overrun in public sector construction projects in Nigeria.*International Journal of Project Management*, 8(4):237–240.

Dumont, Peter R., Gibson Jr., Edward, and Fish, John R. 1997. Scope management using project definition rating index. Journal of Management in Engineering. 13(5): 54-60.

Duncan, H. (2011)Introduction to project management. Pg 233-243.

Egan, J. (1998) *Rethinking Construction, The Report of the Construction Industry Task Force*, DETR, London.

Dysert, Larry R. 1997. Scope development problems in estimating. Transactions of AACE International, American Association of Cost Engineer, Morgantown, USA, pp.128-131.

Elinwa, A.U., &Buba, S. A.(1994) Construction cost factors in Nigeria. *Journal of Construction Engineering and Management*, 119(4)698-713

Finsen, E. (1999) The Building Contract – A Commentary on the JBCC Agreements, 1st ed.,Cape Town: Juta and Co, Ltd.

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

Gamu A. (2009) Assessing the process of evaluating variations in building contracts.

Ganiyu B.O. and. Zubairu, I.K, (2010) Project cost prediction model using principal component. Regression for public building projects in Nigeria. *Journal of Building Performance*Vol.1

Ganiyu B.O. and Oyewobi, L.O. (2011). Evaluating Rework Cost; A study of selected building projects in Niger State.

Gaya I.Z. (1999). Survey of Projects with Differing Initial and Final Contract Sums, Sources and Extent of Variation.

Giwa S.L. (1988) Differences Between Initial and Final Contract Sums of Construction Projects in Nigeria- Cause and Solution. *A paper presented at N.I.Q.S Seminar*, *Lagos.*

Ibrahim D. A. and Kano A. H. (2004) Causes and Impacts of Differentials in Contract Sums of Building Projects in Nigeria, NIQS, 49(8).

Jones and Euske, (1991) Strategic Misrepresentation in budgeting .*Journal of public Administration research and theory, issue* 4:437-460.

Kaming, P., Olomolaiye, P., Holt, G.,& Harris, F. (1997)Factors Influencing Construction Time and Cost Overruns on High-Rise Projects in Indonesia. *Construction Management and Economics*, 15 (1):83-94

Kasimu, M.A. (2012) Significant factors that cause cost overrun in building construction in Nigeria.

Knight, K. G. (2001). AFuzzy Logic Mode1 for Predicting Commercial Building Design Cost Overruns:A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillmentof the requirements for the degree of Master of Science inConstruction Engineering and ManagementDepartment of Civil and Environmental EngineeringEdmonton, Alberta.

Larry, R. D. (2006). Is “Estimate accuracy” an oxymoron? *AACE International Transaction*, EST.01.

Lambert, L.R. (2006). “Studies in Cost Management: Earned Value-An Integrated Project Management Approach. In: The AMA Handbook of Project Management, 2^{nd} ED Paul C. Dinsmore, Jeannette Cabanis-Brewin (Eds), Amacom, New York.

Latham, M. (1994).*Constructing the Team, Final Report on Joint Review of Procurement and Contractual Agreements in the UK Construction Industry*, HMSO, London

Le-Hoai L., Dai Lee, Y & Lee, J. (2008). Delay and Cost Overruns in Vietnam Large Construction Projects: A Comparison with Other Selected Countries; *KSCE Journal of Civil Engineering*

Levin, I.R. (1990). *Statistics for Management 4th Edition* Prentice-Hall of India

Mahamid, I. (2013). Effects of project's physical characteristics on cost deviation in road construction: *Journal of King Saud University - Engineering Sciences*, 25(1):81–88

Mahamid I.&Dmaidi N. (2013). Risks Leading to Cost Overrun in Building Construction from Consultants' Perspective. *Organization, Technology& Management in Construction An International Journal* 5 (2).

Mansfield, N.R., Ugwu, O.O., & Doran, T., (1994). Causes of delay and cost overruns in Nigeria Construction Projects, *International Journal of Project Management*. 12(4):254–60.

McGeorge, John F., (1988).Design productivity: a quality problem. *Journal of Management in Engineering. 4(4): 350-362.*

Metropolis, N. and Ulam, S. (1949) The Monte Carlo Method.*Journal of American Statistical Association, 44(247):335-341.*

Michel L, (1977). "Probability Theory", *Graduate Texts in Mathematics*, Volume 45,4th edition, Springer-Verlag, 1977:12.

Mohamed, A.A. 2001. Analysis and Management of Change Orders for combined Sewer overflow construction projects, Dissertation, Wayne State University.

Monte Carlo Method (2005). Available from www.http//www.risk *glossary.com/link/ Monte Carlo method. Htm.*

Morris, P. W. G., Caupin, G., Knöpfel, H., Motzel, E., &Pannenbäcker, O. (1998). ICB IPMA Competence Baseline, International Project Management Association, Zurich.

Morris, P. W. G (1990). The Strategic Management of Projects.*Technology in Society*, 12(2):197-215.

Oberlender G.D, (2000). Project management for engineering and construction, second edition, McGrawhill, Boston.

Oguonu , C.N. (2007). Hollerafrica.com

Ogunsemi, D.R., 2007. Predicting the final cost of Construction Projects in Nigeria. The Quantity Surveyors, 54(4):3-6.

Ogunsemi, D. R., &Saka, N. (2006) TheNepad Initiative and The Challenge of Efficient Cost Management of Infastructure Development in Nigeria. *NIQS 22nd Bienniel Conference*, 67-86

Oke, A., &Abiola-Falemu, J. (2009). Relationship Between Building Collapse and Poor Quality of Materials and Workmanship in Nigeria. *RICS COBRA Research Conference*, 873-884. Cape Town.

Okpala, D. C., &Aniekwu, A. N. (1988). Causes of high costs of construction in Nigeria.*Journal of Construction Engineering and Management*, 114(2):233-244.

Olatunji, O. A. (2006). Assessing Client's Confidence and Satisfaction in Construction Professionals in Nigeria.*NLCIB* , 436-445.

Oluwole, A. O. (2008). Due Process and Contractor Selection for Public Works in Nigeria. *Building Abroad:Procurement of construction and reconstruction projects in the international context*. Montreal, 385-396

Oyewobi L.O., Ibironke O. T, Ganiyu B. O and Ola-Awo A.W (2011).Evaluating rework cost- A study of selected building projects in Niger State, Nigeria *Journal of Geography and Regional Planning Vol. 4(3):147-151, March 2011*

PMI [Project Management Institute] (2004). A guide to the project management body of knowledge. 3rd Edition, Newtown Square: PMI.

Seeley, I.H. (1984). Quantity Surveying Practice, Macmillan: England.

Skitmore, M. and Thomas, S. (2002). Analytical and approximate variance of total project cost. *Journal of construction engineering and management 128(5):456-460.*

Thibodeaux, W. (2012). What is cost variance? *Demand media.*

Thomas, R. (2001). *Construction Contract Claims*, 2nd ed. Hampshire: Palgrave Publisher.

Umar, A. (2004). Relationship between variation and final cost of building projects in Nigeria

Wainwright, W.H. and Wood A.A.B. 1983. Variation and Final Account Procedure, 4th ed.Hutchinson: Nelson Thornes ltd.

Williams, T. and More, C.J. (1998). Modeling Cost Increases in competitively bid construction projects. *Royal Institute of Chartered Surveyors (RICS); Cobra*

Yang, I. (2004). Simulation based estimation for correlated cost elements. *International Journal of project Management* 23(2005): 275-282.

Appendix 1: Research Interview Questions

As an attempt to contribute to knowledge under the MSc research in building titled "Analysis of public and private building total project cost estimate by mean component data method is being carried out. The questions asked here will be treated utmost confidentiality that it may deserves. The questionnaire was administered directly to the Quantity Surveyors (Consultants).

1. What is your profession?
2. What role does the organization play in educational sector?
3. Are you practically involved in the building project supervision?
4. How many projects did your organization handled since 1995-2010 on tertiary institution?
5. Have you observed any difference between the initial and final building project costs?
6. If yes, how have you handled the difference in the cost?
7. Have you always had your projects completed to scheduled time?
8. How long does it take to complete any building project by your policy?

   Pleaseanswer as appropriate: 3-6 months [ ] 7-12 months [ ] and above 1year [ ]
9. How many of your projects were completed with cost saving?
10. Are the contractors motivated to take on contract with your organization?