EVALUATION OF PROJECT RISK AND THE DETERMINATION OF CONTINGENCY SUM FOR BUILDING DEVELOPMENTS IN NIGERIA

BY

GOGNAJE YUSUF BARDE
MSC/ENV-DESIGN/5124/2009-2010

**A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA
IN PARTIAL FULFILLMENT OF THE AWARD OF A MASTER OF SCIENCE DEGREE IN CONSTRUCTION MANAGEMENT**

**DEPARTMENT OF BUILDING,
FACULTY OF ENVIRONMENTAL DESIGN
AHMADU BELLO UNIVERSITY ZARIA-NIGERIA**

NOVEMBER, 2015

DECLARATION

I hereby declare that the work in this project titled "Evaluation of Project Risk and the determination of Contingency Sum for Building Developments in Nigeria" has been performe by me in the Department of Building under the supervision of Prof. K. Bala. The information derived from the literature has been duly acknowledged in the text and a list of reference provided. No part of this was previously presented for another degree or diploma

....	....	....
Name of Student	Signature	Date

CERTIFICATION

This project thesis **entitled "Evaluation of Project Risk and the determination of Contingency Sum for Building Developments in Nigeria"** by Gognaje Yusuf Barde meets the regulations governing the award of Master 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	
....	....
Dr. I.H Mshelgaru	Date
Member, Supervisory Committee	
....	....
Dr. D. Kado	Date
Head of Department	
....	....
Prof. K. Bala	Date
Dean, School of Postgraduate Studies	

DEDICATION

I hereby dedicate this work to my parents, Late Mr.GognajeBarajeBarde and Mrs Gognaje and also to my wife and Children

ACKNOWLEDGEMENT

My profound gratitude goes to the Almighty God for his mercy, love, guidance and for giving me the opportunity to complete this work successfully.

I also wish to express my sincere appreciation to my project supervisors, Prof. K.Bala and Dr.I.H Mshelgaru for their encouragement, assistance, comments and contribution and to the entire staffs of Building Department of ABU Zaria.

Finally, I wish to appreciate my beloved wife and children, Jerusha, Jessica, Joyceand my brothers, sisters,course mates and my friends for their support and contribution in various ways towards the successful completion of this program

ABSTRACT

The construction industry is characterised with inherent risk and uncertainties as a result of its fragmented and competitive nature. This therefore makes it difficult to accurately estimate the cost of construction project. To achieve the objective of having work completed most especially within cost and quality, contingency sum is apportioned to cater for unforeseen items of work that may likely evolve. Therefore, this current study aims at evaluating project risks with a view to determining adequate contingency funds to improve project performance. A quantitative approach was used in obtaining data through structured questionnaires administered to the construction professionals practicing in the F.C.T. Abuja as well as survey pro forma to gather archival data on completed building projects. 402 questionnaires were returned (44.4% response rate) and found useful for further analysis and 47 projects were also considered suitable for the study. The data were analysed using Relative important index (RII), Severity Index (SI), correlation and regression analysis. The study revealed that deterministic method (percentage addition to base estimates) was the most commonly used method, contingency sum usually allocated to construction projects are inadequate and that other risk factors are not being considered in its allocation. The study concludes that contingency sum determination was insignificantly related to the perceived level of inherent risk (R^2= 7%) in construction project; and also has a weak relationship with the cost overrun. Based on this, more scientific approach to estimating contingency sum should be employed instead of the experiential approach that often results into under or over estimation of construction cost and estimating professionals should pay greater attention to the effects of economic and environmental risk factors in allocating contingency sum

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Construction by its nature involves certain unavoidable risks. There are many variables affecting the outcome of a building project especially its final cost. Contractors are required to accept a certain level of risk due to unforeseen costs that are incurred during construction. Risk is also a thing of concern for clients (Mak and Picken, 2000). To account for the various risk that lead to cost increase, many owners and contractors allocate a contingency amount to each project.

Project owners allocate contingency fund to the budgets for proposed projects, while contractors attach a contingency amount to all their submitted bids. Ford (2002) postulates that, project budgets are one of the most important and widely used project management tools. Project complexity and the inherent uncertainty of the financial performance of constructed facilities, development funding, and the control of costs and schedule makes exact budget needs impossible to forecast accurately. These characteristics also cause projects to deviate from plans. In the same vein, Akintoye and Fitzgerald (2000) identified the causes of inaccuracy in cost estimation, as lack of practical knowledge of construction process by those responsible for estimating function, insufficient time to prepare cost estimates, poor tender documentation, wide variability of sub-contractors price, change in owners requirements, poor communication between the estimating team and construction team. Cost estimation is particularly difficult in the construction industry, often leading to considerable cost overruns that are explained by large uncertainties and uniqueness of projects (Buker*et al,* 1995). When an inaccurate original estimate is prepared for a project and is used to compare the actual cost of that project, then there can be a noticeable difference, referred to as a cost change (Flyvbejerg, Holm and Buhl,2002). It is often expected that cost overrun has the same probability as completing the project below the cost estimate. However, observations clearly indicate an over-representation of cost overrun (Emhjellen, 2003). Project cost overrun can be caused by rising cost from inflation and inadequate analysis of information (Kayode, 1979) and by costing methods (Akpan and Igwe, 2001). Design and project specific factors such as vagueness in scope, design, complexity and project size affect the cost estimate of a project (Akinci and Fischer, 1998). Therefore, contingency sums are included in development budgets to address uncertainties and deviations that threaten achieving set objectives.

Contingency Sum is an integral part of the total estimated costs of projects. It has been defined as additional funds to cater for unforeseeable elements of cost within the defined project scope (Ford, 2002), Contingency Sum may be derived either through statistical analysis of past project costs or by applying experience gained on similar projects. This usually does not include changes in scope or scheduled events such as Industrial Action and Force Majeure (Parsons, 1999). The purpose of Contingency Sum therefore is to provide a reserve fund, sufficient to manage the inherent risk within the project completion time and within the project total budget. Its establishment eliminates the adverse impact of unforeseen events.

Risk is inherent in all human activities including construction work(s) and risk elements are diverse and varied (Odeyinka, 2000). Risk and uncertainties are some of the inherent difficulties which arise during the construction process. The degree of risk in a project may result from a combination of factors and these factors differ from one project to another.

According to Kwakye (1997), there is no construction project that can be undertaken without an element of risk. In the construction industry, risk is defined as an exposure to economic loss or gain arising from involvement in the construction process. Some of the major risks in construction at project level include physical risk, environmental risk, logistic risk, legal risk, political risk and financial risk, among others (Odeyinka, 2000).

In recent times, risk in construction has received a lot of attention because of time and cost overruns. Unforeseen conditions could exist but other considerations that can affect and influence risk factors include construction restraints due to continuity of operation, security, environmental complexity and other unique factors of a project. Regardless of the complexity of factors, the degree of detailed design to produce an accurate estimate is an important factor (AACE, 2000). Projects which cannot be defined adequately require high contingency sum. As the project progresses, the amount of contingency decreases. The cost performance of building construction projects is a key success criterion for clients. Projects require that budgets are set for the client's financial commitment to provide the basis for cost control and measurement of performance

A key component of a project budget is Contingency Sum. Project cost contingency has been part of projects and project management for at least fifty years, therefore the accuracy of an estimated price has a major impact on the cost of a project (Baccarini, 2005).

In Nigeria, it is characteristic to undertake construction works without any risk appraisal. High contingency sums which often do not occur are rather included in the mark –ups, to address future problems (Badu, 2004).

According to Owusu (1999), the construction industry in Nigeria is bedevilled with time overrun. This may be associated with many factors which include the following; lack of access to finance; weak cash flow; lack of collateral and high bank interest rates. These factors have their associate risk thereby influencing the determination of project cost contingency sum. It is against the background that the evaluation of project risk with a view to determining adequate contingency fund to help project performance is important

1.2 Statement of the Research Problem

In construction contract, the chief objective of all the parties is to have the construction project realised within cost and time without compromising the quality of the work.

However, construction projects are often typified with various and inherent uncertainties due to the fragmented and competitive nature of the industry, where a contractor is selected based on competitive tendering (Harris and McCaffer, 2007). In executing construction projects, some unforeseen items of work are unavoidable and this constitutes risks in construction (Jimoh and Adama, 2014). Management of these inherent risks is the ability required of all the construction parties throughout the process of the construction, this is very key and essential to avoid undesirable consequences (Buertey, 2014).

This is because the success of any construction project is evaluated based on three major elements of schedule, cost and quality performance that constitute the inherent risks (Jimoh and Adama, 2014; Addo, 2015). Smith (1999) regarded these parameters (time, cost and quality performance) as the three types of contingencies. In most cases, these risks are frequently being ignored or superficially dealt with through an addition of certain percentage in a form of contingency sum onto the estimated cost of construction project (Buertey, 2014). This addition are provided to take into account the likely changes that may be experienced or occurred during course of executing the work without considering the distinctive nature of the project variables (Thompson and Perry, 1992). Musa, Zubairu and Bala (2011) posited that contingency sums are monies added to a development budgets to address uncertainties and deviation that may hinder achievement of set objectives. Such approach is referred to as deterministic method which is considered unscientific by Hartman and Chen (2000).

As a result of this, several approaches of calculating and allocating contingency sum has been the subject of various researches (Addo, 2015). For example, Contingency Sum could be determined or calculated using either statistical analysis method or budgeting involving previously executed project cost or by using past experience gained on similar projects (Thompson and Perry, 1992; Addo, 2015). In spite of the popularity of this approach, which considers a certain percent of estimated cost as contingency sum based on previous experience of similar projects; the method has been criticised not to be appropriate as it gives an arbitrary value based on only project cost which often results into many projects being over or under-budgeted for (Hartman and Chen, 2000; Lee, Park and Shin, 2009).

In support of these assertions, a recent research has shown that circa 40 percent of all major construction projects with contingency sums estimated through the deterministic method run longer than planned and incur significant cost overrun (Protiviti, 2008). Little research appears to exist that examine the risk impact of contingency sum in building construction and their correlation to the actual completed cost of a project. There also appears to be little research that identifies risk factors in specific building types and their relationships to budget cost overrun (Williams, 2003). It is against this background that it has become necessary to evaluate project risks to determine their contingency sums which will help projects performance and quality as well as lead to more realistic project budget estimate.

1.3 Justification of the Study

At different stages of project development, there are different types of risk exposure. To address these risks, contingency fund is often provided, which have been across-board a percentage addition to base estimate. This method is as a result of past experiences, intuition and sometimes historical data without much scientific bases. Though the method is simple, it has resulted into some problems as the fund is more often than not inappropriately estimated. In many projects, the actual cost exceeds the estimated cost; that is, the fund is inadequate to meet unforeseen cost and by extension, leads to cost overrun, (Hogg, 2003), delay in completion of project, loss of capital and litigation as well as abandonment of projects which have bedevilled the industry in Nigeria. On the other hand, contingency fund may be inflated. That is it is over estimated, in an attempt to avoid the need to seek additional funds if budgets become over spent which may lead to misallocation of resources, (Maks and Picken 2000). Therefore, determining appropriate contingency sums is very important for the smooth delivery of projects. It is against this background that the study to evaluate project risks exposures to determining adequate contingency provision in building project in Nigeria is significant.

1.4 Aim and Objectives

The aim of this research is to evaluate project risks with a view to determining adequate contingency funds to improve project performance. This aim is hoped to be achieved through the following objectives

1. To evaluate the risk factors associated with construction projects in Nigeria.
2. To determine the relationship between the risk factors and contingency sum
3. To determine the relationship between contingency sum and cost overrun in public procured projects.

1.5 Statement of Hypotheses

Based on the objectives stated in section 1.4 of this thesis, the study hypothesised that:

Null Hypothesis H_{01}: There is no significant difference between the project risk factors and contingency sum

Alternate Hypothesis $H_{1:}$ There is significant difference between the project risk factors and contingency sum.

Null Hypothesis H_{02}: There is no significant difference between contingency sum and cost overrun in projects procured by traditional contract method

Alternate Hypothesis H_2: There is significant difference between contingency sum and cost overrun in projects procured by traditional contract method

1.6 Scope and Limitation of the Study

The scope of this study covers projects executed within Abuja and the municipal area council for which data were available for this research. The research only addressedpublic building construction projectsexecuted between 2000 and 2013, which is the period the researcher believed the construction industry experienced most construction developments. The study also sampledthe opinion of building professionals such as Architects, Builders, Civil/Structural Engineers, Electrical Engineers and most preferably Quantity Surveyors in FCT Abuja.

However, the study is limited to the period stated and those projects executed within the time frame of which the data available. Also, the quality of the data is hinged on the level of honest opinions provided by the respondents to thiswork because some respondent may not want to disclose information that may reflect badly on their organizational risk management preparedness.

1.7 Definition of Operational Terms

The Project Management Institute (Project Management Institute, 2000) defines a project as*:* a temporary endeavour undertaken to create a unique product or service: ‘Temporary meaning that every project has a definite beginning and a definite and unique meaning that the product or service is different in some distinguishing way from all similar products or services.

Much earlier, Steiner (1969) defines a project as*:* an organization of people dedicated to a specific purpose or objective.Projects generally involve large, expensive, unique or high-risk undertakings that have to be completed at a certain date, for a certain amount of money, and deliver some expected or anticipated level of performance.

The Project Management Institute (2000) defines project management as the: application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project.

The Project Management Institute (2000) defines ‘stakeholder’ as individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion. The original meaning of risk is associated with gambling. Risk as defined by Chapman and Ward (1997) as being: the exposure to the possibility of an economic and financial loss or gain, physical damage or injury, or delay as a consequence of uncertainty.

By comparison, Young (1996), considers risk in the project management environment as being any event that could prevent the project realizing the expectations of the stakeholders as stated in the agreed project brief or agreed definition. Adameitz (2003) describes various aspects of risk as follows: “Risk can be viewed as a four-letter word. There can be economic boundaries from the addition of extra ‘overhead’ activities, and political/cultural boundaries from an unwillingness to acknowledge that a risk exists and must be mitigated. To prevent this budget pressure, risk management and mitigation activities need to be factored into the project plans from the very beginning of a project. Construction projects involve numerous unpredictable and complex processes”.

Dias and Ioannou (1995), concludes that, there are two types of risk:-

1. Pure risk that exist when there is the possibility of financial loss but no possibility of financial gain (e.g physical damages)
2. Speculative risk that involves the possibility of both gains and losses (i.e financialand production risk)

Royer (2000) describes risk management as:Deciding what is acceptable risk, how the level of the risk can be brought down to a level that is acceptable and monitoring the reduction in risk after exposure control actions has been taken.

Contingency Sum is an integral part of the total estimated cost of a project. It has been defined by the American Association of Cost Engineers (AACE, 2000) as specific Provision for Unforeseeable element of cost within the defined project scope. It is particularly important where previous experiences relating to actual cost have shown that unforeseeable events such as industrial action, fire outbreak, incremental weather, etc. will increase costs.

The Department of Energy of Los Angeles in the United States of America also defines Contingency Sum as provision which covers cost that may result from incomplete design, unforeseen and uncertainties within the defined project scope (Parsons, 1999).

CHAPTER TWO

LITERATURE REVIEW

2.1. The Concept of Project Cost Estimation

Cost estimating is the technical process of predicting costs of construction (CIOB, 1997). Generally, cost estimating is carried out in the process of pricing Bill of Quantities that is prepared in accordance with the Standard Method of Measurement

The construction industry in most countries is one of highly competiveness, with high risks and low margins of profit when compared with other key industries. Consequently, pricing is one of the most important aspects of marketing in construction (Mochtar and Arditi, 2001). According to Enshassi*et al* (2005), the success or failure of a project is dependent on the accuracy of several estimates throughout the course of the project. Therefore, cost estimation for building projects is extremely important to both clients and contractors. It allows the parties to know their respective commitment at the early stage of a project. It is used predominantly by contractors for construction planning during the execution stage and assessing project success (Akintoye and Fitzgerald, 2000).

Before an estimator begins, the actual process of pricing each individual bill item, a great deal of information needs to be gathered to enable him price the work accurately. According to Akintoye (1998), the cost estimator, in the course of preparing a cost estimate is expected to carry out tasks such as thorough examination of tender documents, a site visit, the preparation of methods statement and tender program, a visit to the project consultants, and make inquiries and receive quotations for materials, plant and sub-contractors. The estimator, having completed these preliminary tasks, and collected all the necessary information, can then start preparation of the estimate.

The traditional techniques for cost estimation entail pricing of direct and indirect costs for site facilities, labour, materials, plant and sub-contractors that will be used in the projects.

A percentage of estimated cost is then added to cover overheads cost contingency and profit. (Akintoye and Fitzgerald 2000).

2.2 The Concept of Risk in Construction Industry

The performance of cost contingency in a project depends on the method used in its estimation combined with the management process applied. Since the fund is provided to address risks and uncertainties in a project, the understanding of the concept of risk and uncertainties in construction industry is necessary. Virtually all authors and researchers acknowledge the fact that construction contract delivery is a complex undertaking, which is characterised with uncertainties and risk.

According to Odeyinka (1987), risk is inherent in any construction project right from inception through its completion. Ashworth (1999) posited that risk can be mathematically predicted, whereas uncertainty cannot. Different authors and researchers including Odeyinka (1987); Yeo (1990); Ramus and Birchall (1998); Mak, Wong and Picken (1998); Ashworth (1999); Smith (1999); Harris and McCaffer (2001); Picken and Stephen (2001) and Andi (2004) have written on construction risks and its management. Thus, changes and risks are inevitable in construction contract and these are the major cause of disruption, delay and dispute on construction contracts. Nworuh and Nwachukwu (2004), asserted that experience on many projects indicate poor performance in terms of achieving time and cost targets, thus many cost and time overruns are attributable to unforeseen events for which uncertainties was not appropriately estimated. An amount of money used to provide for uncertainties associated with a construction project is referred to as contingency allowance (Mak and Picken, 2000)

2.2.1 The Nature of risk

While risk is fairly well documented in the literature, the terminology is not consistently applied across construction, project management, engineering, health and safety, environment, business and other industries (del Cano and de la Cruz, 2002). Risk can be classified as voluntary or involuntary, depending on whether or not the events leading to the risk are under the control of the persons at risk or not (del Cano and de la Cruz, 2002). In the theoretical sense, Cvethovich and Earle (1992) view risk not as an inherent quality of the physical world but as a representation of the interaction between physical and psychosocial characteristics with the assessment of risk involving judgements about what is valued.

Kumamoto and Henley (1996) identify five attributes of risk. These are: likelihood, outcome, significance, causal scenario and population.

Uher (1994) identifies 34 individual risks and categorizes them into a single model, referring to some as activityrisks that may affect individual activities, while others were globalrisks that were common to all activities. The majority of risks Uher (1994) identifies are global risks. Rutgers and Haley (1997) developed a model that identifies phases of risks in a project:

1. Developmental risks– technical, commercial/financial feasibility
2. Project economics**,** permits/authorization, third-party intervention and political change
3. Construction risks– schedule, cost, performance, design changes, interest rate escalation, consequential damage, force majeure/country risk, currency changes
4. Operational risks – market changes, statutory changes, unrest/strikes, acts of God, third-party liability etc.

2.2.2 Risk and uncertainty

Decisions are concerned with variables which are normally classified as risks or uncertainties. Risks are unknowns, the probability of the occurrence of which can be assessed. Risks are usually insurable. Uncertainties are uninsurable (Chapman and Ward, 1997). It is possible, however, for a decision-maker to assign a subjective probability to an uncertainty. As knowledge increases in conjunction with the amount and detail of statistical data, areas of uncertainty are progressively converted to areas of risk (del Cano and de la Cruz, 2002).

Risk links strongly with the uncertainty of the probability and consequence of a risk event, Ayyub and McCuen (1997) point out that, uncertainty has two types of origins namely: non-cognitive and cognitive. Non-cognitive uncertainty results from physical randomness. This type of uncertainty is normally dealt with by employing current statistical and probabilistic science (Chapman and Ward, 1997). Cognitive types of uncertainty result from humans expressing subjective judgements. Blair (1999) uses a fuzzy set theory approach for the development of costs and schedules for complex engineering systems. Uncertainty always exists in the modeling and project management of complex construction projects and this uncertainty is due to the model representing real systems and is also attributed to humans who express risk in subjective terms.

Rafter (1994) points out that, risk and uncertainty characterize situations where the actual outcome for a particular event or activity is likely to deviate from the estimate or forecast value. As well, risks exist in projects because of their uniqueness and temporary nature and can impact on the project contractor and sub-contractors, stakeholders and project owner in a variety of ways. Leu*et al.* (2001) point out that during project implementation, many uncertain variables dynamically affect the project duration and the costs can thus change accordingly (del Cano and de la Cruz, 2002).

Edwards (1995), Smith and Bohn (1999), and Kim and Bajaja (2000) list potential construction risks.

-

Table 2.1: Some of the Most Common Risk Sources in Construction Projects

Risk source	Description of risk source
Cost	Estimate is uncertain because it is based on past and project costs
Schedule	Schedule is uncertain because it is based on past and predicted performance
Labour	Labour strength and productivity uncertainties
Project management	Uncertain experience levels, team cohesiveness and composition
Safety	Potential for accidents and consequences of injuries or higher costs
Change orders	Potential increased cost, schedule delay, and poor technical performance
Unforeseen conditions	Undefined underground or hidden site conditions that can cause cost and schedule growth
Environmental concerns	Regulatory approvals and mitigation of environmental concerns may cause time delay or cost escalation
Inflation	Potential for material and labour price increases
Weather	Delay causing costs and technical non-performance from adverse weather
Construction complexity	Level of difficulty increases the potential for cost and schedule growth
Fire	Probability of fire hazard from work operations, vandalism or lightning
Suppliers	Non-performance from vendors, sub-contractors or suppliers that can cause impacts to cost and schedule
Property loss	Potential for loss due to flood, fire, theft, sabotage or vandalism
Design	Incomplete or lack of design elements that considers construction aspects
Quality	Potential for consequence of poor quality and technical non-performance
Political	Potential loss of support leading to less opportunity to acquire new projects

Source: Edwards (1995), Smith and Bohn (1999), and Kim and Bajaja (2000)

2.2.3 Work breakdown structure

This technique makes it possible for risk to be identified that can contribute primarily to cost overrun of the project. We do not have a definition of the work that has to be done to complete the project. Without knowing the work that has to be done we cannot possibly determine the cost of the project or determine the schedule of the project. Without knowing the cost or schedule of the project how will it be possible to control the project or determine how much should be spent to complete it? The amount of resources that must be used on the project and when they must be made available cannot be determined without knowing the schedule. Funding to do the project cannot be scheduled to be in place when the project needs it without a time-phased budget for the project. Without knowing the work to be performed on the project, risk management cannot be done in a satisfactory way. These things cannot be done without the work breakdown structure. According to the *Guide to the PMBOK*, the definition of a work breakdown structure is: A deliverable oriented grouping of project components that organizes and defines the total scope of the project. Each descending level represents an increasing detailed definition of the project work.

The WBS is decomposed into work packages. The deliverable orientation of the hierarchy includes both internal and external deliverables. Work outside the WBS is outside the scope of the project. In this definition of the WBS, we are striving for a method to identify the work that is required to produce all of the deliverables of the project. As we will see, with many projects it will be possible to identify close to 95 percent of the work that must be done in the project. To create a WBS is a simple task: The project is first broken down into a group of subprojects. Each of these subprojects can be broken down to sub-subprojects. The sub-subprojects can be broken down again and again until the desired level of detail is reached. The level of detail is termed the work package level. The work package is the lowest level of management that the project manager needs to manage. Below the work package other project team members may break down their parts of the project into additional levels. The reason this technique is so effective is that it follows the principle of ‘‘divide and conquer.’’ If we were to hold a meeting and write down a list of all the things that had to be done to complete the project, the meeting would not produce a very good list. meeting of this type where there is little focus, attention will drift into one area and do a pretty good job of listing the work needed in that area and ignore other areas of the project. A better way to do this is to break the project into smaller projects or products of the project. When we do this we can think of each one of these subprojects as producing one or more of the deliverables of the whole project. In this way we can also think of the WBS as a product-oriented breakdown as well. This allows project management to become a methodology that will work well on the largest of projects or programs as well as the smallest. At the top levels of the project, particularly large projects, think of these early levels of breakdown as product breakdowns. This is because on larger projects there can be a grouping of deliverables into large deliverables that might be called products so, initially the project is broken up into a group of subprojects. These subprojects are further broken down into sub-subprojects, and so on. In this way the largest project we can imagine could be broken down into subprojects. Since each of these subprojects could be considered to be a project in its own right, any large project can be thought of as a family of smaller projects that are interrelated.

2.2.4 Risk breakdown structure

Much like the work breakdown structure that is the basis for so much of good project management, the Risk Breakdown Structure (RBS) can be considered in much the same way. Starting at the highest level we have the project risks. From there we have a hierarchical Structure organized by risk causes. As we move down this structure the description of the risk causes and the risks themselves becomes more and more detailed. For example, a project’s risks might first be divided into technical risks, business risks, project management risks, customer risks, and environmental risks. The RBS should continue until all of the detailed risks have been detailed enough that they can be acted on and have one and only one person responsible for them.

2.2.5 Types of risks in construction contracts

A construction project by its nature involves certain unavoidable risk. These have been classified in various ways. Murdorch and Hughes (2002) identify seven types of risk in the construction industry as follows:

1. Physical works:- Physical conditions of the ground; artificial conditions causing obstruction; site preparation; inadequacy of staff, labour, plant, materials, time or finance; weather; defective materials or workmanship; costs of tests and samples.
2. Delay and disputes:- possession of site; lateness in the supply of information inefficient execution of work; delay outside both parties' control; control; layout disputes
3. Direction and Supervision:- Greed; incompetence; inefficiency; unreasonableness; partiality; lack of communication; mistakes in the documentation; defective designs; ensuring compliance with requirements; lack of clarity in specifying requirements; inappropriate choice of consultances or contractors; changes in requirements.
4. Damage and Injury to persons and property:- Negligence or breach of warranty; uninsurable matters outside the parties control; accidents; uninsurable risks such as war, usurped power, consequential losses arising from the above; exclusions, gaps and time limits in insurance cover.
5. External Factors:- Government policy on taxes, labour, safety or other laws; delay or refusal of planning approval; financial constraints; energy and pay restraints; cost of war or civil commotion; malicious damage; intimidation; labour demands and unrest; strikes; lockouts; pickets.

6. Payment:- Devaluation; delay in certifying and settling claims; delay in honouring (payment) of valuation certificates; legal limits in recovery of interest; insolvency of contractor, subcontractor or employer; funding constraints; shortcomings in the measure and value process; exchange rate fluctuations; inflation; anything not covered by fluctuation clause; replacement cost of plant and equipment.
7. Law and Arbitration:- Delay in resolving disputes; injustice; uncertainty due to lack of records or ambiguity of contract; cost of obtaining decision; enforcing decisions; changes in statutes; new interpretations of common law.

In considering this list of items, it is important to think about the extent to which they can be priced for at tender stage and indeed the extent to which they can be predicted at all.

2.2.6 Risk management

Risk management is the process by which clients and their project managers make decisions based on data generated in risk assessments. Risk management involves making educated decisions about different configurations, construction scenarios and operational parameters, Garry (2007). The management of risks concerns dealing with events, the likelihoods of the occurrence of which are variable, either of quantifiable (known) variability, or probability risk, or of unquantifiable variability only through subjective estimation at best i.e uncertainties. Often risks and uncertainties are associated with negative (undesirable) outcomes exclusively which is a biased view and is termed “down side risk”. (Fellows *et al,* 2002). Perry and Hayes (1985), classified the process of dealing with risks into three main stages. These are:

a. Risk Identification
b. Risk analysis
c. Risk Response

2.2.6.1 Risk Identification

This is the process of defining a risk event. The information to be sought includes the type of risk and effects on the project. The primary basis for identifying risks is historical data, experience and insight (Oduro, 2008). The identification of risks is very important. Each must be described in detail so that it will not be confused with any other risk or project task that must be done. Each risk should be given an identification number. During the course of the project, as more information is gathered about the risk, all of this information can be consolidated about the particular risk.

Risks which are due to variables outside the control of the project should be separated from those which lie within the boundaries of the project. Those outside must be accepted and dealt with as part of the project environment, while those within the project and subject to the control (influence) of the project management may be employed as performance incentives. (Fellows *et al*, 2002).

2.2.6.2 Risk Analysis

The second step in the process is to analyse each of the risks in terms of the likely frequency of occurrence, the likely severity when they do occur and the range of possible values in terms of minima, maxima and medians for each of these aspects (Murdoch and Hughes 2002). Some risks may be deemed to be so critical that they need detailed quantitative analysis, but most risks will be dealt with more subjectively because they are lower in priority. According to Fellows *et al* (2002), quantification can only be applied to risks. However, subjective assessment can be applied to uncertainties.

Risk assessment is the stage in our risk management process where the importance of each risk is evaluated. This evaluation will also serve as the guideline for determining the risk strategy. Here we use the list of identified risks that were made as inputs. The list of risks will constantly change as well, since the time of the risk and the progress toward completion of the project will affect the risks that will be on the list of identified risks. It is critical that the risks be evaluated, since, because of risk tolerance of the stakeholders, some risks will be ignored while others will have rather elaborate monitoring and mitigation plans associated with them. The evaluation or assessment process is necessary to itemize these risks into a ranking that will place them in the order of importance. In the evaluation process we will be concerned with determining the impact and probability of the risk

2.2.6.3 Risk Response

The next task that must be done in our risk management system is risk response planning. At this stage we have discovered all of the risks known to date and have an iterative process for discovering new risks as the project progresses. We have evaluated the risks and assessed their impact and probability of occurrence. We have prioritized the risks in their order of importance. We now must decide what to do about them. This is risk response planning. Risk response planning is the process of developing the procedures and techniques to enhance opportunities and reduce threats to the project's objectives. In this process it will be necessary to assign individuals who will be responsible for each risk and generate a response that can be used for each risk. It is important to consider the extent to which the risk can be controlled by certain parties. e.g risks connected with the design of the project are best controlled by the designers, hence it makes sense to leave liability for defective design to them. Risks connected with the management of sub-contractors are best controlled by the contractor.

Fryer (2004), presented a model suggesting that response may take the form of: Risk Removal, Risk Reduction, Risk Avoidance, Risk Transfer and Risk Acceptance

i. Removal or Reduction of risk is likely to involve redesign and/or significant changes to the project e.g. relocation to a different site with better ground condition.
ii. Avoidance: Risk avoidance means just what it says. The strategy is to avoid the risk completely. The project plan or the nature of the project is actually changed to make it

impossible for the risk to occur. Some risks, such as the risk of not having a clearly defined set of user requirements, can be avoided by expending the effort to more clearly define the requirements. This may increase the time and effort previously allowed for this activity, but it will have the result of eliminating the risk. For example, suppose our project is to design a bicycle. Let's say that during the design phase someone identified a risk of corrosion in the frame of the bicycle. If this corrosion were severe enough, it could cause a failure in the bicycle frame. This failure could cause serious injury to the person riding the bicycle at the time of failure. The strategy exercised by the project team on this project is to redesign the components that are corrosion problems and use a corrosion resistant material such as stainless steel. This avoids the problem of corrosion in the bicycle frame identified as risky. The avoidance strategy cannot completely eliminate the risk. In this example, even though the bicycle is redesigned in stainless steel, if the bicycle were left outdoors by the ocean for nineteen years, it might stillcorrode enough to fail, but the probability becomes so small that the risk is, for all practical purposes, eliminated.

iii. Transfer: Transferring a risk also eliminates the risk from impacting the project. When we transfer a risk, we move the impact of the risk to some other party. When risks are transferred to another party, there is usually some sort of payment involved to induce the third party to take on the risk.

Insurance is a method for transferring risk. In terms of risk management, what we are doing is hiring some third party to take over the impact of the risk. In return for this we pay a premium. For example, in 1995, PMI held its annual meeting in the city of New Orleans. Six months prior to this meeting, the PMI Board of Directors held their quarterly board meeting in New Orleans. The chapter hosted the board for a chapter meeting, and for the program they invited a panel of disaster and emergency management people to discuss hurricane effects on the city. The discussion at the meeting concerned itself with the possible results of a hurricane hitting New Orleans. The PMI board became somewhat nervous about their meeting, since it would be held in prime hurricane season. PMI recognized that the revenue from their annual meeting was a significant part of their operating budget, and they could not afford to take this loss. The result of this nervousness was that PMI purchased event insurance for the first time, paying a premium to an insurance company to take the risk. The insurance company agreed to pay PMI in the event of some disaster occurring that would force PMI to cancel their meeting. This was indeed a real risk. Just three years later, a hurricane caused the last-minute cancellation of a similar meeting by the Petroleum Engineers Association, after food and other supplies had already been ordered.

iv. Acceptance: The acceptance of a risk means that the project team has decided not to change the project in any way to compensate for the risk. The risk will be dealt with if and when it occurs. One way to think of acceptance is to visualize the list of risks that was made. The risks were about the risk. If the risk actually occurs, the project team will develop a way to work gotten rid of the risk entirely, transferred it to someone else, or accepted the risk, either passively or actively. Risk mitigations an effort to reduce the probability or impact of the risk to a point where the risk can be accepted. Adding additional tests, hiring duplicate suppliers, adding more expert personnel, designing prototypes, or in other ways changing the conditions under which the risk can occur are ways of mitigating risk. The important difference in risk mitigation is that it reduces the risk to a level where we can accept it and its consequences. Adding specific work to the project plan employs the mitigation strategy. This work will always be done regardless of whether the risk occurs. The mitigation tasks are specific project tasks that are added to the project plan to reduce the impact or probability of the risk. It should be clear that an overall risk strategy should be designed to deal with risks by accepting them as they are, avoiding them by eliminating them from being possible, transferring them to another’s responsibility, or reducing their impact and/or probability to a level where they can be accepted.

2.2.7 Risk monitoring and control

Risk monitoring and control is the process of keeping track of all the identified risks and identifying new risks as their presence becomes known and residual risks that occur when the risk management plans are implemented on individual risks. The effectiveness of the risk management plan is evaluated on an on-going basis throughout the project. When a risk is apparently going to take place, the contingency plan is put into place. If there is no contingency plan, then the risk is dealt with on an ad hoc basis using what is termed a ‘‘workaround.’’ A workaroundis an unplanned response to a negative risk event. A corrective actions the act of performing the workaround or the contingency plan. The concern of the project manager and the project team is that risk responses have been brought to bear on the risk as planned and that the risk response has been effective. After they have observed the effectiveness of the risk response, additional risks may develop or additional responses may be necessary. Risk management is a continuous process that takes place during the entire project from beginning to end. As the project progresses, the risks that have been identified are monitored and reassessed as the time that they can take place approaches. Early warning indicators are monitored to reassess the probability and impact of the risk. As the risk approaches the risk strategies are reviewed for appropriateness, and additional responses are planned. Risk assessments, reviews, and audits may be performed periodically to review the probability and potential impact of risks that have been identified and are nearer to their possible occurrence. Risks that have already taken place can be reviewed and audited to assess the effectiveness of the risk response. As each risk occurs and is dealt with or is avoided, these changes must be documented. Good documentation ensures that risks of this type will be dealt with in a more effective way than before, and that the next project manager will benefit from ‘‘lessons learned.’’

2.3 Concept of Cost Contingency

The cost performance of construction projects is a key criterion for project owners. Construction and development is fraught with difficulty and the basic principle of risk analysis is that an attempt should be made to at least identify these risky project items and attach some financial value to them. These amounts can then be added to a project budget as items of possible expenditure. The intention of this notion is that the project budget becomes a more realistic representation of the client's likely outlay. Some of the project uncertainties will be eliminated or clarified as the planning of the project matures, however some uncertainties will be carried forward to project tender stage. The use of risk premium money is regarded as standard practice in construction. Despite the fact that most project construction owners transfer most risks to other parties in different forms, in many construction projects the owner adds a contingency allowance to the estimated cost in order to avoid project overrun arising from unexpected events.

In terms of managing risk on a project, contingency can take many forms. It may be a time allowance in the program of work for delay such as wet weather, a cost allowance in the project cost estimate to account for the resident risk accepted by the project manager or a contingency process in case an event happens. Cost contingency is included within a budget to represent the total financial commitment for a project client and the quantum of such contingency is of critical importance to projects. There appears to be no standard definition of contingency. Patrasou (1988) observes that Contingency is probably the most misunderstood misinterpreted and misapplied word in project execution. Contingency can and does mean different things to different people.

More recently, the Association for the Advancement of Cost Engineers (AACE 2000:28) defines contingency as: An amount of money or time (or other resources) added to the base estimated amount to achieve a specific confidence level, or to allow for changes that experience shows will likely be required.

Musa (2008), summarized that, Contingency is an amount of money added to an estimate to cater for events within the defined project scope that are unforeseen or undefined.

The key attributes of the concept of project cost contingency are:

1. Reserve – cost contingency is a reserve of money (AACE, 2000)
2. Risk – the need and amount for contingency reflects the existence of risk in projects (Thompson and Perry, 1992).

Contingency can be divided into two categories of risk – known unknowns and unknown unknowns (Hillson, 1999; Project Management Institute, 2000) and can be invoked for events within the defined project scope that are: unforeseen (Moselhi, 1997; Yeo, 1990), unexpected (Mak*et al.*, 1998), unidentified (Levine, 1995), Undefined (Clark and Lorenzoni, 1985; Thompson and Perry, 1992).

2.3.1 Estimating methods for cost contingency

The practice of presenting project cost estimates as a determining figure comprising a base estimate and the addition of a single contingency amount (usually as a percentage addition) has been adopted in the construction industry for a long time for budgeting purposes. Usual practice is for this amount to be a single lump sum with no attempt made to identify, describe, and value various categories and possible areas of uncertainty and risk. Cost contingency is included within a budget to represent the total financial commitment for the project owner. Therefore the estimation of cost contingency and its ultimate adequacy is of critical importance to project owners.

Baccarini (2004) details numerous estimating methods available for project cost contingency as shown below:

1. Traditional percentages
2. Method of moments
3. Monte Carlo Simulation
4. Factor rating
5. Individual risks – expected value
6. Range estimating
7. Regression
8. Artificial neural networks
9. Fuzzy sets
10. Controlled interval memory
11. Influence diagrams
12. Analytical hierarchy process.

When estimating, the most common method of allowing for uncertainty is the addition of a percentage contingency figure to the most likely estimate of the final cost of the known works. Although this contingency can be calculated in various ways as detailed previously, the most common way is to consider around 10% of the estimated project cost (Burger, 2003). Hartman (2000) argues that this is an unscientific approach and thus a reason why so many projects finish over budget.

As Yeo (1990) also points out, the most common method of contingency allocation could be regarded as overly simplistic and heavily dependent on an estimator's faith in their own experience. Quantification of contingency allowances for cost estimating items can also be achieved by applying the risk management processes detailed in AS/NZS 4360 (Standards, 1999). Historical events may be used as a guide; however estimators and project managers need to use their experience and professional judgement to weigh the competing factors to arrive at the most likely value. Where risks are significant and complex, a statistical evaluation such as the Monte Carlo method can be used. The objective of contingency allocation is to ensure that the estimated project cost is realistic and sufficient to contain any cost incurred by risks and uncertainties.

This contingency is often calculated as an across-the-board percentage addition on the base estimate, typically derived from intuition, past experience and historical data. This approach is considered arbitrary, as Thompson and Perry (1992) observe: All too often risk is either ignored or dealt with in an arbitrary way: simply adding a 10% contingency onto the estimated cost of a project is typical.

However, Thompson and Perry (1992) outline several weaknesses of using a contingency amount as follows:

1. The percentage figure is most likely arbitrarily arrived at and not appropriate for the specific project
2. There is a tendency to double count risk because some estimators are inclined to include contingencies in their best estimate
3. A percentage addition still results in a single-figure prediction of estimated cost, implying a degree of certainty that is simply not justified
4. The percentage added indicates the potential for detrimental or downside risk; it does not indicate any potential for cost reduction and may therefore hide poor management of the execution of the project
5. Because the percentage allows for all risk in terms of a cost contingency, it tends to direct attention away from time, performance and quality risks
6. It does not encourage creativity in estimating practice, allowing it to become routine and mundane, which can propagate oversights.

Eden *et al*. (2005) point out that it may be important to require different contingencies for different elements of a project. However, the establishment of a range of contingencies can require a considerable amount of work by estimators, so they simply add on a 10% contingency across the board for example in order to acknowledge the difficulty of pinning down project uncertainty.

When Euro Tunnel (the private company that owns the tunnel under the English Channel) went public in 1987 to raise funds for the project, investors were told that building the tunnel would be relatively straightforward. Under waterCooper *et al.* (1989) reported that, in respect to cost escalation, the prospectus read: Whilst the undertaking of a tunnelling project of this nature necessarily involves certain construction risks, the techniques to be used are well proven

The Directors, having consulted the Mitred'Oeuvre, believe that 10% would be a reasonable allowance for the possible impact of unforeseen circumstances on construction costs.

Cooper *et al.* (1985) points out that, in estimating the cost of a large hydroelectric development, the cost variability and uncertainty was acknowledged by incorporating a contingency allowance in the estimate of 10%. This was calculated as a proportion of the total construction cost after subtracting engineering, management and owner's costs. In this case, the contingency proportion reflects past experience industry practice and the feel of the cost estimating team.

Touran (2003) proposed a probabilistic model for the calculation of project cost contingency to counter initial project cost estimates by considering the expected number of changes and the average cost of change. The model assumed a Poisson arrival pattern for change orders and independent random variables for various change orders. From these elements, Touran (2003) calculates the probability of cost overrun for a given contingency level. Touran (2003) also asserts that project owners, such as transportation agencies, who are usually engaged in specific types of construction projects can, by reviewing historical data of a specific transit agency, calculate rates of change, size and distribution of changes and prepare risk profiles or cumulative probability curves for various values of contingency. Touran (2003) also suggests that such outcomes can be used at the budgeting phase of new projects to ensure consideration is given to potential cost overrun after projects commence.

In some areas of the public sector, there is a tendency to remove contingency provisions in budget submission, as contingencies are often seen asfats(Yeo, 1990). Consequently there is no allowance to express the anticipation of risk or for the lack of confidence in project estimates. As well, the engineering and construction complexities of projects are often overshadowed by economic, societal and political challenges. In addition to these challenges, a number of observers suggest that project estimates are purposely misrepresented in quantum in an effort to secure project approval (Flyvbjer *et al.*, 2002).

Contingency can have a major impact on project outcome for a project owner. If contingency is too high it might encourage poor cost management, cause the project to be uneconomical and so aborted. It may also lock up funds not available for other projects or activities (Flyvbjerg *et al.*, 2002). On the other hand, if the contingency allocation is too low, then it may be too rigid and set an unrealistic financial environment, resulting in unsatisfactory performance outcomes (Dey *et al.* 1996).

Under many companies risk management strategies, risks are reviewed at intervals throughout the life cycle of the project and assessments updated to reflect the current level of uncertainty surrounding the project (Flyvbjerg *et al.*, 2002). Risks for which contingencies are provided early in a project may some later time be overcome by further investigation or design modifications. For example, a contingency allowance for rock in cuttings early in the project may be replaced by specific quantities and costs following geotechnical investigations to minimize the specific risk exposure. The amount of contingency is reassessed at project review points to reflect current knowledge and level of uncertainty of the project with a view to forecasting the most likely outcome (Dey *et al.*, 1996).

HM Treasury (1993) identifies two major categories of contingency that can be incorporated into construction projects:

1. Design contingency – this allows for change during the design process for such factors as incomplete scope definition and inaccuracy of estimating methods and data (Clark and Lorenzoni, 1985).
2. Construction contingency – this is for changes during the construction process. Under a traditional procurement arrangement, the project owner engages others to produce the design before competitively selecting the construction contractor. Subsequently a contract is signed between the project owner and the contractor, which typically contains a *variations* clause to allow for changes and provide a mechanism for determining and valuing variations. Construction contingency exists to cater for these variations allowable under the contract between the project owner and contractor (Staugas, 1995).

Mak and Picken (2000) state that contingency can be compared with the total approved value of contract variations to assess the accuracy of the contingency. Baccarini (2004) analysed project cost data of 48 road construction projects from an Australian government road authority for the estimation of construction contingency. He reports that the organization uses a traditional percentage approach for estimating contingency. The main findings of his analysis include:

1. Construction contingency is on average 5% of award contract value, whilst variations were 10% of award contract value. This shows a shortfall in contingency of 4.6%.
2. The amount of estimated contingency is significantly inadequate to cater for the total value of contact variations, by an average shortfall of 47%.

3. There are no significant correlations between project variables and cost contingency that might be used to predict cost contingency.

2.3.2 Limitation of cost contingency

Project cost contingency should not be expected to cater for all events that cause the cost of a project to increase, for example, there is strong consensus that contingency should not cater for scope changes i.e what is expected is materially different from what was previously reasonably expected (Querns 1989, AACE 1992, Baccarini 2005). But, it can cover for scope development i.e scope remains constant even as the product characteristics are progressively elaborated (PMI 2004).

According to Stevenson (1984), Contingency should not be used to cater for the following events; schedule changes, scope expansion and acts of God.

Samid (1994) suggest that, contingency should not cater for human errors in estimating, due to negligence, unjustified conclusions from data, or miscalculations. The rational is that poor estimating processes might be promoted if estimators know that their errors will be compensated by the use of contingency.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

This research was pursued through field survey. However, an intensive literature review was carried out from textbooks, magazine, professional and academic journals, published and unpublished articles and the internet to obtain an in depth knowledge in the subject area. The data for this study was obtained from primary source. The primary data constitutes data obtained from professionals in the building construction industry and Quantity Surveying Firms, Government Ministries and Parastatals.

3.2 Population of the Study

The study population are building projects executed by public sector clients. The project types are commercial and institutional buildings and only projects procured by traditional contract method were considered which were executed between 2000 and 2013

3.3 Sampling Techniques and Size

Due to the inability of the researcher to identify the exact number of projects executed within the period under considerations in Abuja, a combination of sampling techniques were used; non-bias sampling and snowballing techniques were adopted. A snowball sample is a non-probability sampling technique that is often being used in research when the elements of a population are difficult to locate. In this case, the actual number of construction projects in these areas could not be ascertained, then a snowball sample is adopted which assists the researcher to obtain data from the few organisations which the researcher can locate, then make a request from those identified to provide information needed to locate other members of that population whom they know.

Babbie (1990) asserted that sampling is necessary in research due to the challenges imposed by time and cost. In this study, the target population are the practicing construction professionals in the Nigerian construction industry and that are based and working in Abuja. A total of 9050 professionals were identified through the registration bodies of their different professional organisations. However, because it was impossible to obtain data from all 9050 professionals in the population, sampling was necessary to make the survey possible.

Following the examples of Ankrah (2007) the sampling frame that was adopted for the selection of the sample in this current research was the list of professionals registered with their respective registration bodies in the study area. In order to determine a suitable size for the sample, the table presented by Salant and Dillman (1994) as shown in Table was adopted.

Table 3.1: Sample Size for the 95% Confidence Level

Population	**Size Sample Size**
100	49
250	70
500	81
750	85
1,000	88
2,500	93
5,000	94
10,000	95
25,000	96
50,000	96
100,000	96
1,000,000	96
100,000,000	96

Source: Salant and Dillman (1994**)**

From the table, the sample size for this research will be 366 professionals. However, Takim, Akintoye and Kelly (2004) suggested that response rate in the range of between 20 – 30% is believed to be the norm for studies in the construction industry. Hence, to cater for the expected low responses rate most especially when questionnaire survey is employed, this research take into cognizance the likelihood of non-response level see (Ankrah, 2007) by taken 40% as the boundary to adjust for the survey sample size.

Thus, the new sample size for the study will be:

New Sample size = 366/0.4 = 916 professionals approximately

Table 3.2: Study population, Sample and Response Rates

	Architects	**Builders**	**Engineers**	**Quantity Surveyors**	**All sampled professional**
Number of professionals in Abuja	3000	1125	4250	675	9050
Required population sample	94	93	94	85	366
Sampled population	235	233	235	213	916
Usable responses received	138	44	188	32	402
Response rate (%)	46.0	39.1	44.2	47.4	44.4

Source: Professionals registration bodies (2013).

3.4 Research Instruments and Data Collection Procedure

This study used dual sources of primary data in order to achieve the aim of this study. Scheurich (2007) opined that collection of data is the most vital process in a research most especially in when the study seeks to obtain two types of data set: structured questionnaires and pro forma data.

3.4.1 Primary data

3.4.1.1 Structured questionnaires

Primary data is any type of data which a researcher has collected 'first-hand' from its original source as components of the 'applied' aspect of the study. This exclude any previously collected data previously by anyone else. Therefore, primary data sources used in this study includes a well-structured questionnaires distributed to the identified professionals s in the study area. The questionnaire (see Appendix I)wasprepared to have three sections; the first section of the questionnaire dwells on the background information, which is to collect data on the general characteristics of the respondents in order to check the quality of the data to be used for analysis. It includes such things as the profession and years of working experience of the respondents. The second section dwells mainly on methods of determining contingency sums in construction, while the third section centers on the risk factors to be taken into account in determining and allocating contingency sum for construction projects. These section were structured in such a way that relates to the objectives of the study and questions were asked on a 5-point Likert scale with 4 being the highest of the rating very significance = 4, significance = 3, not significance=2, very insignificance = 1 and neither significance nor insignificance = 0. Summarily, the questionnaire designed for this study are mainly designed for the professional that are involved in construction projects in the study area of which they are to provide opinions about the projects that have been executed by them amongst other questions.

3.4.1.2 Research pro forma/record form

In pursuant of the objectives of this research, a combination of methods were used to obtain data; a research pro forma (see appendix II) was designed which is a document prepared to obtain specific information about different projects identified for inclusion in this research and as well as a survey approach. The research pro forma was designed to obtain data that are project specifics such as estimated project cost, Actual Project cost and Contingency Allowance on 47 completed projects in Abuja municipal local council areas. Data from these 47 completed projects were obtained from 16 Organisations including Consulting firms, Government Ministries and Parastatals. The original contract sum ranged from N8.00million to N19.00 Billion.

3.5 Data Analysis

The data obtained from the questionnaire and research pro forma were analysed with the aid of simple mathematical/statistical tools such as; percentages, T-test, Regression, correlation and Relative Importance/Severity Index.

3.5.1. Percentage method

Percentage helps in rating a number of variables. Percentage is used to show the size of the respondents who had the same opinions and those that had conflicting opinions. It involves obtaining the proportion of response to a particular option by a respondent to the total number of respondents. These were being expressed as percentages. The option having the largest number of responses was considered as representing the majority upon which the final conclusion to the question was based. The percentage was used in analysing demographic characteristic of the respondent.

3.5.2 Relative Importance/ Severity Index (RII)

Relative Importance Index (RII) was employed for two purpose; that is ranking and determination of significance of different factors of the data to be collected. The premise of decision for the ranking was that the factor with the highest Relative Importance Index (RII)is ranked 1st and others in subsequent descending order (Nurudeen, 2002). Also a 5-point Likert scale wasemployed for the collection of data. The formula for relative importance index is:

$$RII = \frac{4n_4 + 3n_3 + 2n_2 + 1n_1 + 0no}{4(n_4 + n_3 + n_2 + n_1 + no)} \text{ --- (1)}$$

$$RII = \frac{\sum fx}{N\sum x} \text{ --- (2)}$$

Where n_0= number of respondents who answered “neither significance nor insignificance”

n_1 = number of respondents who answered “Not Significant”

n_2 = number of respondents who answered “Less Significant”

n_3 = number of respondents who answered “Significant”

n_4= number of respondents who answered “Very Significant”

x = number of respondents (n_0, $n_{1,}$ n_2, $n_3$and n_4)

f = rating factor (4, 3, 2,1 and 0)

fx= $4n_{4,}$ $3n_{3,}$ $2n_2$, $1n_{1\ and}$ $0n_0$.

N = total sample size.

CHAPTER FOUR

ANALYSIS OF DATA AND DISCUSSION OF RESULTS

4.1 The Research Data

Data for the research was collected from surveys conducted. The variables provided through the questionnaires and record form as well as their measurement scales are presented below:

4.2 Demographic Data of Respondent

Section A of the research instrument employed were subjected to demographic analysis in order to reveal salient characteristics of the research data that might have bearing on the behavior of the data and thus on the inferences that will be drawn from the analysis of the data.

Table 4.1 shows that the research sample was dominated by Architects. Other members of the design and construction team were also represented as well. The preponderance of Architects could be explained by the fact that the study sampled the professionals based on the approximate numbers of such professionals working in Abuja. This is why the number of Quantity Surveyors appears low in the sample, even though estimates of costs of construction work are normally prepared by them, which places Quantity Surveyors in a better position to providethe information sought in the questionnaire.

Table 4.1 shows that the analysis of the level of education attained by the respondents buttressed the assertion that the respondents were trained professionals in the construction industry. Almost one-half of the sample possessed university Bachelor degrees. The lowest education certification held by respondents was the Higher National Diploma, conferred by polytechnics upon successful conclusion of a four-year course of study.

Table 4.1 show that almost two-thirds of the sample was registered with the various professional associations that exist in the construction industry. This shows that the research sample was representative of the professional aspect of the industry, where a sizeable proportion ofprofessionals belong to one professional body or the other.

In Table 4.1, More than a quarter of the research sample had worked for between 11 and 15 years. About 15% had worked for at least five years. This is indicative of the ability of the respondents to be knowledgeable about the research problem, since it is likely that they would have encountered it in the course of their work. Contingency allowances occur in almost all types of projects, and this increases the likelihood of the research sample elements' exposure to situations involving the determination of contingency allowances.

Table 4.1: Summary of Characteristics of Respondents

Category	**Classification**	**Frequency**	**Percent**
Profession of respondents	Quantity Surveying	32	8
	Architecture	138	34
	Building	44	11
	Engineering	188	47
	Total	**402**	**100**
Year of working experience	0-5	64	16
	6-10	120	30
	11-15	116	29
	16-20	59	15
	21 and above	43	11
	Mean	**80,4**	**100**
Educational qualification	OND/HND	52	13
	BSc/BTech	177	44
	PGD/MSc	141	35
	PhD	32	8
	Total	**402**	**100**
Professional	Graduate /Probationer	253	63
Membership	Associate/Fellow	149	37
Type	Total	402	100

4.3 Methods of Determining Contingency Sums

Analysis of the methods adopted in deriving contingency sums was assessed using the relative importance index in table 4.2 and it revealed that deterministic methods which is the most simpler methods were preferred to more complex and scientific (and often more accurate) methods. Probabilistic and Estimating using Risk Analysis (ERA) were also used to a muchlesser extent. However, Range estimating was the least used method of estimating.

Table 4.3 shows the range of percentage additions being used by the respondents to this research. Out of the 402 respondents to the survey, 89% of them apportion between 5-10% as contigency sum without any rationale for its allocation other than previous experience as indicated by Buertey (2014). This coroborrated the assertion of earlier researchers that many estimators often used deterministic approach in allocating contingency sums for construction projects. (Thompson and Perry, 1992; Hartman *et al*., 2000).

Table 4.2: Methods of Determining Contingency Sums According to Frequency of use by Respondents

Methods of Determining Contingency Sums	RII	RANK
Deterministic Methods	0.88	1
Probabilistic Estimating	0.55	2
Range Estimating	0.49	5
Estimating using Risk Analysis	0.50	3
Monte Carlo Simulation	0.50	3

Table 4.3: Percentage Addition as Contingency

Contingency Percent	Frequency	Percent
0-5%	177	44.0
6-10%	181	45.0
11-15%	36	9.0
16-20%	5	1.2
Above 20%	3	0.7

4.4 Identification of Risk Factors Associated With ConstructionProjects

Respondents were presented with a list of ten risk factors grouped into three categories as developed by American Assocation of Cost Engineers (AACE, 2008) and were asked to rank them in terms of the perceived significance in the determination of contingency sum for construction projects. A Five-point Likert scale was employed (0 to 4, representing a range from 'neither insignificance nor significance' to 'very significance').

The 'Form of Procurement/Contract' was the most significant factor, with a relative importance index (RII) of 0.81. It was followed by 'Unexpected ground conditions' (0.80) and 'Contract period' (0.79). The three least significant factors were 'Global economic pressure' (0.61), 'Force majeure' (0.58) and 'Increase in demand for extractive materials such as steel' (0.56).

Table 4.4: Ranking of Risk Factors Considered During Determination of Contingency Sums for Construction Projects.

S/N	RISK FACTOR	SI	RANK	GROUP MEAN	RANK
A	**Technical factors**			**0,77**	**1**
1	Form of Procurement/Contract	0,81	1		
2	Unexpected Ground Conditions	0,80	2		
3	Contract Period	0,79	3		
4	Project Specification	0,75	4		
5	Project Management	0,73	5		
6	Design Consideration	0,73	5		
B	**Economic factors**			**0,67**	**2**
7	Inflation	0,73	5		
8	Global economic pressure (increase in demand for fuel)	0,61	8		
C	**Environmental factors**			**0,57**	**3**
9	Force Majeure	0,58	9		
10	Increase in demand for extractive materials (Timber, Steel etc.)	0,56	10		

According to Table 4.4, 'Inflation', 'Project Management' and 'Design consideration' (0.73) were ranked 5th out of ten factors, below 'Project Specification' (0.75) but above 'Global economic pressure' (0.61).

Technical factors (mean rank = 0.77) were considered more significant than economic (0.67) or environmental factors (0.57). These results represent an important view of the mindset of the professionals that determine the amounts of contingency sums. The results also underscore the need for more research into the relative contributions of the three groups of factors to the costs of construction projects in Nigeria, in order to determine if adequateattention is being paid to the risk groups by construction professionals.

4.5 Test of Hypotheses

As earlier stated in chapter one, two main hypothesized statements were given in this study.Before testing for the hypotheses, correlations among the variables was undertaken results of which are shown in Tables 4.5. There are significant correlations among some of the variables especially the initial and final contract sum as well as cost overrun variables. However, a quick check of the variance inflation factors (VIF) indicated that the maximum was 1.00, which is far less than the threshold of 10 given by Neter, Kutner, Nachtsheim and Wasserman (1996). Hence, the problem of multicollinearity is minimized in this analysis.

In testing the hypotheses, the study followed the approached used by Aje (2008) whereby the variable were also subjected to t-test using paired t-test. The statistical level of significance for the acceptance of each hypothesis where appropriate was set at 0.05.

The decision rule therefore depends on whether the calculated values of t are greater than or less than the critical values of t for (n-1) degree of freedom. Thus the null hypothesis H_0 is rejected if $t_{cal}> t_{tab}$ or if $t_{cal}<$ -ve value of t_{tab}. at a level of significance of 5% (Chan and kummraswamy 1996).

4.5.1 Hypotheses

Null Hypothesis H_{01}: There is no significant difference between the project risk factors and contingency sum

Alternate Hypothesis $H_{1:}$ There is significant difference between the project risk factors and contingency sum.

Null Hypothesis H_{02}: There is no significant difference between contingency sum and cost overrun in projects procured by traditional contract method

Alternate Hypothesis H_1:There is significant difference between contingency sum and cost overrunin projects procured by traditional contract method

Table 4.5 and 4.6 summarizes the result of the analysis of the test of hypotheses.

From the result in Table 4.5, it can be observed that for contingency sum and risk factors that the null hypothesis of no significant difference between the significance of project risk factors and contingency sum is rejected at the 5% level of significance (r = 0.222 and t-value = -4.678). However, for contingency sum and cost overrun, the null hypothesis is accepted while the alternate hypothesis that there is significant difference contingency sum and cost overrun in projects procured by traditional contract method is rejected (Rs = 0.265 and t-value = .112). This further reinforces the reason whyHartman *et al.* (2000) and Lee *et al*. (2009) argued that deterministic approach to allocation of contingency sum is inappropriate.

Table 4.5: Correlation Matrix of Variables.

S/No	VARIABLES	t	Sig.	1	2	3	4	5
1	Risk factors	17.676	.000	1				
2	Contingency sum	4.410	.000	.222	1			
3	Cost overrun	1.222	.228	.498	.265	1		
4	Final contract sum	3.117	.003	.324	.647**	.882**	1	
5	Initial contract sum	3.246	.002	.319	.672**	.866**	.999**	1

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 4.6: Test of Relationship between Contingency Sum, Risk Factors and Cost Overrun

	Paired Differences						
Variables	Rs	Mean	Std. Deviation	Std. Error	t	sig
RISKFAC - CONTINSUM	0.222	-180694697.31300	122158890.35964	38630032.99753	-4.678	.001
OVERRUN - CONTINSUM	0.265	6117256.83196	369088537.64654	54419135.98496	.112	.911

4.6 Relationship Between Contigency Sum and Cost Overrun

As a result of this research, a model for examining the adequacy of allocated contingency sums for building construction projects was developed. The model would assist clients' and professionals' involved in the building construction process in adopting better ways of determining and allocating contingency sum to cater for the occurrence of unforeseen items of works; and also reduce if not total elimination of tendencies for corrupt practices often linked to how the allocated contingency sums are been dispensed during contract while also benefiting contractors by helping to reduce estimating errors which will invariably curb the persistent cost overruns in public projects.

The study, used Linear Regression Analysis (LRA) in establishing the relationship between Contingency sums and cost overruns in the selected projects considered for this current study. In designing the model, the basic work undertaking was to identify the relevant dependent and independent variables to be included in the model. This was made easy by the use of a survey of construction professionals who possesses reasonable experience in construction process. These professionals consist of mainly Builders, Architects, Engineers, Quantity Surveyors and Construction Clients such as ministries and parastatals who have also executed a number of building projects in recent years. The independent variable used is also in tandem with the approach used by Jimoh and Adama (2014) where contingency sum is the predictor.

Hence, the model was based on archival data obtain on 47 completed building projects which were executed in Abuja. The final regression model is given thus:

Y = 2812918.902 + 1.053 CONTINSUM ……. ………….4.1

(R =26.5%, R2 = 7%, Adjusted R2 = 5%)

Where Y = Cost overrun, and CONTINSUM = Contingency sum allocated to the projects.

From equation 4.1, the coefficient of correlation (R) which, according to Xiano and Proverbs (2003), measures the strength of a linear association is 0.27. This shows that there is approximately 27% relationship between cost overrun and the allocated contingency sum. The coefficient of determination (R^2) is 7% while the adjusted R^2 is 5% indicating a very low degree of fitness of the linear regression model (LRM). The R^2 value of 7% also indicates that only 7% in the variation of contract sum as a result of cost overrun can only be captured by the allocated contingency sum for the projects considered, hence 93% of the residual variation in the cost overrun is not included in the model. The result of the regression analysis is summarized in Tables 4.7 and 4.8

Table 4.7: Result of the Multiple Regression Analysis of the Contingency Sum

R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
.265a	.070	.049	373223898.33670	3.31	0.075

a Predictors: (Constant), CONTINSUM

Table 4.8: Coefficients in the Contingency Sum Model

Variables in Equation	β	Std. Error	Beta	t-stat.	Sig.
(Constant)	2812918.902	65888591.749		.043	.966
CONTINSUM	1.053	.577	.265	1.825	.075

a Dependent Variable: OVERRUN

4.7 Impact of Risk Factors on Contigency Sum

According to Odeyinka, Oladapo and Akindele (2006), risk is inherent in all facets of human activities including construction work(s); and this risk elements form the inherent difficulties which often arise during construction process. In fact, Kwakye (1997) asserted that it is almost impossible to have a construction project executed without an element of risk.The extent of the risk in a project varies from project to the other as there are no two projects that are entirely similar, thus the uncertainties evolve may be a combination of factors. In order to cater for these uncertainties often associated with a construction project, certain amount of money are provided or allocated in form of contingency (Mak and Picken, 2000). Therefore an accurate allocation or determination of contingency sum for construction projects is very important during estimation and construction process. Such correct allocation enables ease the construction process as it provides for unforeseen items of work that might evolved.

This study therefore attempted to predict the performance of construction works in terms of cost based on the adequacy of contingency sum allocated, the tender figure submitted as well as the influence on final contract sum. Furthermore, the complexity of the project in terms of cost was also taken into consideration in developing this model. Linear Regression Analysis (LRA) was employed in mapping the relationship between risk factors and the allowed contingency sum used in developing model in this study. The model was developed in order to predict the effect of the risk factors on final contract sum based on the allocated contingency sum.

The resulting linear regression equation is thus written as:

CONTINSUM=28804142.987+56255761.86RISKFAC……… ……………………………. 4.2

$(R = 0.22, R^2 = 5\%, Adjusted\ R^2 = -7\%)$

Where CONTINSUM is the Contingency sum and RISKFAC = Risk factors.

From equation 4.2, the strength of linear association as determined by the coefficient of correlation (R) is 0.22, signifying 22% relationship between the dependent variable and the independent variable and hence the association can be termed to be weak and imperfect. The coefficient of determination as defined by the R^2 value is also 5% while the adjusted R^2 value is also -7% indicating a very low degree of fitness of the linear regression model (LRM). The R^2 value of 5% also showed that risks are not been factored into the determination and calculation of contingency sum that which implies 95% of the residual variation in the dependent variable is not included in the regression model. Tables 4.9 and 4.10 show the result of the regression analysis

Table 4.9: Result of the Multiple Regression analysis of the contingency sum

R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig
.222a	.049	-.069	.49951	0.416	0.537

a Predictors: (Constant), RISKFAC

Table 4.10: Coefficients in the contingency sum Model

Variables in Equation	β	Std. Error	Beta	t-stat.	Sig.
(Constant)	28804142.987	238727334.491		.121	.907
RISKFAC	56255761.861	87170897.462	.222	.645	.537

a Dependent Variable: CONTINSUM

4.8 Discussion of Results

The results obtained from analysis of data revealed that Quantity Surveyors formed less than 10% of the sample; other members of the design and construction team were better represented. This was as a result of the stratify random sampling method adopted vis-à-vis the population of the professionals within the study area. All of the respondents were trained professionals in the construction industry, with almost 50% having university bachelor's degree. About two-thirds of the sample was registered with the various professional associations that exist in the construction industry. Over 74% of the research sample had worked for between 1 and 15 years. The perceptions of the respondents about contingency sums in line with the research objectives were discussed in details below.

The study also revealed that deterministic methods with 44% were preferred to more complex (and often more accurate) methods in the derivation of contingency sums. Deterministic methods were often used by majority of the respondents. Probabilistic and Estimating using Risk Analysis (ERA) representing 17% and 16% were also used to a much lesser extent. Range estimating with 10% was the least used method of estimating. This situation could be most conveniently explained using the competency levels of professionals involved in the derivation of contingency sums (Akintoye and Fitzgerald 2000). In-house traditions within construction firms are also another important influence, as is the perceived level of risk contained in a job (Badu, 2004). Attempt to examine the most often applied methods of allocating and determining contingency sum, percentage method was found to be the mostprevalent system as almost 90% of the respondents were found to be using the method.

This compares well wih the findings of Asamoah, Danku and Assimiah (2013) who found that 77% of the building professionals surveyed in Ghana have been using the Percentage Approach and 23% have been using the Probabilistic Estimation Method.

All of the ten risk factors tested for significance of influence on construction projects were perceived by respondents to be significant. This was because the relative importance index of all ten factors was higher than 0.50, which was the cut-off point for a 5 – point Likert scale. The most significant factors were 'Form of Procurement/Contract' (RII = 0.81), 'Unexpected ground conditions' (0.80) and 'Contract period' (0.79). The three least significant factors were 'Global economic pressure' (0.61), 'Force majeure' (0.58) and 'Increase in demand for extractive materials' (0.56).These results are in line with what other researchers have established; the ranking of scale of significance is however an addition to existing knowledge (Akinci and Fischer, 1998; Ahmed.,*et al*, 1999).

Technical factors (mean RII = 0.77) were considered more significant than economic (0.67) or environmental factors (0.57). this finding is not totally in consonance with Asamoah et al. (2013), where economic factor was rated higher than the technical factor. This represents an important view of the mindset of the professionals that determine the amounts of contingency sums and could be indicative of inadequate awareness of the influence of economic and environmental factors (Akintoye and Fitzgerald 2000).

Testing of the hypothesised statements stated earlier in this study revealed that cost overrun are always in excess of the contigency sum. In other words, contingency sums are often inadequate in catering for possible overruns that often characterised with construction project but can reduce its impact on construction cost. This is established by study conducted by Musa *et al*. (2011) which revealed that an inclusion of contingency allowance is capable ofreducing the incidence of project cost overrun on construction projects.The results of the regression analysis emplyed to establish the relationship between cost overrun and contigency sum showed a very weak relationship which implies the allocated sum for contingency is inadequate. This was identified as a challenge by Otali and Odesola (2014) due to lack of basis for the determining and allocating adequate contingency results to reduce the occurrence of cost overruns in the project.

Lasty, in assessing the impact of risk factors in allocating and determining contigency sums, the null hypothesis that states there is no significant difference in risk factors and contigency sums was rejected. The regression results also showed that risks are not being factored into the estimation of contingency sums. This is supported by Buertey, Abeere-Inga and Adjei Kumi(2012) who argued that the level of knowledge and application of risk in professional work is limited, which is likely responsible for major risk factors affecting cost contingencydetermination and provision in construction projects (Buertey, 2014).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS AND AREAS FOR FURTHER STUDIES

5.1 Summary of Findings

The findings of this study obtained from analysis of data collected from fieldwork are summarized below.

1. The study revealed that deterministic methods (F= 44%) were preferred to more complex (and often more accurate) methods in the derivation of contingency sums.
2. It was also found that percentage method was the most prevalent system as almost 90% of the respondents were found to be using the method.
3. Contingency sums allocated to the entire project considered on average were found to be inadequate in catering for possible overruns that often characterised construction works but reduce its impact on construction cost.
4. The results of the regression analysis to establish the relationship between cost overrun and contingency sum showed a very weak relationship which implies the allocated sum for contingency is inadequate.
5. The regression results also showed that risks are not being factored into the estimation of contingency sums.
6. The study revealed that a better method of estimating contingencies should be adopted as opposed to instinctive system of estimating at 5% or 10% as practiced in the study area. The model gives 7% as the coefficient of determination (R2) for construction projects to cater for variations and scope changes at 95% confidence level.
7. All of the ten risk factors tested for significance of influence on construction projects were perceived by respondents to be significant with RII higher than 0.50
8. The factors with the most significant influence/impact on construction projects were

‘Form of Procurement/Contract’ (RII = 0.81), ‘Unexpected ground conditions’ (0.80) and ‘Contract period’ (0.79).

9. The three least significant factors were ‘Global economic pressure’ (0.61), ‘Force majeure’ (0.58) and ‘Increase in demand for extractive materials’ (0.55).
10. Technical factors (mean RII = 0.77) were considered more significant than economic (0.67) and environmental factors (0.57).
11. Seven factors had significant impact on the adoption of contingency sums while Three factors were not significant
12. Project Specification and Project Management have significant impact on adoption of contingency sums range of 0 - 5% of project cost.
13. Form of Procurement/Contract, Contract Period, Design Consideration, and Inflation have significant impact on contingency sums range of 6 - 10% of project cost.

5.2 Conclusions

The following constitute the conclusions reached in this study after testing of the research objectives set earlier, using data derived from fieldwork.

1. Deterministic (percentage addition to base estimates) methods (F=44%) were the most frequently employed for the derivation of contingency sums. Probabilistic and Estimating using Risk Analysis (ERA) representing 17% and 16% respectively were also used, but to a much lesser extent. Range estimating with 10% was the least used method of estimating. This showed that deterministic (simpler) methods were preferred to more complex (and often more accurate) methods in the derivation of contingency sums. This situation calls to question the competency levels of professionals involved in the derivation of contingency sums; this was however beyond the scope of this study.

2. The study shows that although all ten risk factors were perceived to have significant influence on construction projects, the most significant factors were (1)'Form of Procurement/Contract' [RII = 0.81], (2) 'Unexpected ground conditions' [0.80] and (3) 'Contract period' [0.79]. Some factors that were ranked least in terms of significance of influence on construction projects were (i) 'Global economic pressure' (0.61), (ii) 'Force majeure' (0.58) and (iii) 'Increase in demand for extractive materials' (0.56). This study has introduced the ranking of scale of significance of risk factors' influence on construction projects into existing knowledge.
3. Technical factors (mean RII = 0.77) have more significant influence on construction projects than economic (0.67) or environmental factors (0.57). Why this is so and whether it is indicative of inadequate awareness of the influence of economic and environmental factors was not examined, being beyond the scope of this study.
4. The study established that Contingency sum determination was significantly influenced by seven risk factors. These include Project Specification, Project Management and Unexpected Ground Conditions which were significantly linked to adoption of contingency sums range of 0 - 5% of project cost. The adoption of higher proportions (6.0% - 10%) of project costs as contingency allowance was discovered to be significantly linked to the Form of Procurement/Contract, Contract Period, Design Consideration, and Inflation. These findings align directly with those of earlier researchers who postulated that design and project specific factors such as vagueness in scope, design, complexity and project size affect the cost estimate of construction projects.

5.3 Recommendations

1. Based on the result of the study, it was recommended that a more scientific approach to estimating contingency sum should be employed instead of experiential approach that often results into under or over estimation of construction cost.
2. In recognition of expanding globalization of construction, it was recommended that estimating professionals pay greater attention to the effects of economic and environmental risk factors. This is in line with best practices aimed at reducing waste in construction, and the carbon footprint of buildings.
3. It was recommended that in the absence of other extenuating circumstances, between 6% - 10% of project costs could be set aside as contingency sum. This is for projects where the Form of Procurement/Contract, Contract Period, Design Consideration,Unexpected Ground Conditions and Inflation are evaluated present in the project.
4. It was also recommended that cognizance should be taken on the level of risk that projects are exposed to in estimating contingency sum and should be adjusted in proportion to the level of risk.

5.4 Areas For Further Studies

1. The effect of risk evaluation on differences in cost derailment between public and private client should be considered in future studies.
2. The effects of risk apportionment and cost management between traditional procurement and other procurement methods should be studied in future researches.
3. The impact of professional backgrounds on risk perception amongst Architects, Civil or Structural Engineers, Electrical Engineers Builders and Quantity Surveyors should be studied.
4. The probability of project risk occurrences in the determination of project cost should be studied in future studies

REFERENCES

Addo J. N. T.(2015) Determination of Contingency Sum for Building Projects in Ghana. In: Mojekwu, J.N., Ogunsumi, L.O., Ojigi, L. M. Atepor, L., Thwala, D.W., Sackey, S. Awere E., and Bamfo-Agyei, E. (Eds) *African Journal of Applied Research .(AJAR) Journal*, 1(1), 248- 261.

Ahmed, S.M., R. Ahmed and D.E. Saram. (1999). Risk management trends in the Hong Kong construction industry: a comparison of contractor and owners perceptions. *Journal of Engineering Construction and Architectural Management*

Aje, I. O. (2008). The impact of contractors' prequalification and criteria of award on construction project performance in Lagos and Abuja, Nigeria. An unpublished Ph.D thesis submitted to Department of Quantity Surveying, Federal University of Technology, Akure, Nigeria.

Akinci, B and M. Fischer.(1998). Factors affecting contractors; Risk of cost overburden. *Journal of Management Engineering,* 14 (1): 67-76

Akintoye, A. and Fitzgerald, E. (2000). A survey of Current Cost Estimating Practice *U.K. Construction Management and Economics*, 18, 161-172

Akpan, E.O.P .and O. Igwe. (2001). Methodology for determining price variation in project execution.*Journal of Construction Engineering and Management,* 116 (3): 533-546

American Association Cost Engineers (AACE). (2000). International Risk Management Dictionary.*Journal of Cost Engineering,* 42 (4) 28-31

Anderson, S.D. and R.L. Tucker. (1994). Improving project management of design. *Journal of Management Engineering*, 10 (10): 35-44

Ankrah, N. A. (2007). An investigation into the impact of culture on construction project performance. Unpublished PhD thesis submitted to School of Engineering and the Built Environment, University of Wolverhampton, UK.

Ashworth, A. (1994). Cost Studies of Building. London: Longman Scientific and Technical

Ashworth, A. and M. Skitmore.(1983). Accuracy in estimating.*Chartered Institute of Building* (Occasional paper no. 27)

Association of America Cost Engineers International.(2008). Risk Analysis and Contingency Using Range Estimation.

Ayyub, B.M. and R. Wilcox.(2000). A Risk-Based Compliance Approval Process for Personal flotation Devices. Potomac, MD: BMA Engineering.

Babbie, E. (1990). Survey Research Methods. Belmont, CA: Wadsworth Publishing.

Baccarini, D. (2004). Accuracy in estimating project cost construction contingencies – A statistical analysis. *In COBRA 2004.* Leeds Metropolitan University: RICS

Baccarini,D. (2005). Understanding Project Cost Contingency – Conference. *Proceedings, Construction Research of the Royal Institute of Chartered Surveyors*- 4-8th July 2005 at Queensland University of Technology Brisbane, Australia

Bajaj, D. (2001). Risk response and contingency strategies among contractors in Sydney, Australia. 2001 AACE International Transactions.Risk.01.1- Risk.01.6

Buertey, J. I. T. (2014**).** Project Cost Risk and Uncertainties: Towards a Conceptual Cost Contingency Estimation Model. *International Journal of Construction Engineering and Management*, 3(5): 144-155

Buertey, J. T.I, Abeere-Inga, E. &AdjeiKumi, T. (2012).Practical Application of Risk Management Techniques.In Infrastructural Delivery.In *Proceedings of 1st International Conference on Infrastructure Development in Africa at KNUST*, Kumasi, 22nd – 24th March 2012.

Chan, D.W.M and Kummaraswamy, M. M. (1996).An Evaluation of Construction Time Performance in the Building Industry.*Building and Environment*, 31 (6), 569-578.

Emhjellen, M., K. Emhjellen, and P. Osmundsen., (2003). Cost estimation overruns in the North Sea. *Project Management Journal*, March: 23-31

Fellows, R. F. and liu, A. (1997). Research Methodology for Construction. *Blackwell Science*

Flyvbjerg, B., Holm, S.M. and Buhl, S., (2002). Under estimating Cost in Public Works Projects.*Journal of the American planning Association*. 68, 279 – 295

Ford, D.N. (2002). "Achieving multiple project objectives through contingency management", *Journal of Construction Engineering and Management, 128 (1), 30-37*

Gray I. Larson. (2008). Project Management. (The Management process 4e)

Harold Kerzner, (2006). Applied Project Management (Best Practices on implementation)

Harris F. and McCaffer R. (2007).*Modern Construction Management,* UK: Blackwell Publishing Company.

Hartman, F. T, & Chen, D, (2000).A neural network approach to risk assessment and contingency allocation.*ACCE Transactions*, Risk. 07.01-6.

Jimoh, R. A. &Adama, S. M. (2014). Assessment of Contingency Sum in Relation to the Total Cost of Renovation Work in Public Schools in Abuja, Nigeria. *International Journal of Managerial Studies and Research* (IJMSR), 2(10), 55-63.

Kendall, M.G. (1970). Rank correlation methods. Griffin, London. (4th Edition).

Kish, L. (1965). Survey Sampling.John Wiley and Sons Inc. New York.

Kwakye.A.A (1997). Construction Project Administration in practice, *Longman Ltd. London.*

Lee, E., Park, Y. & Shin, J., (2009).Large engineering project risk management using a Bayesian belief network, Expert Systems with Applications.*An International Journal*, 36 (3), 5880-5887.*Ltd. Oxford.*

Mak, S., Picken, D. (2000)."Using risk analysis to determine construction project cost contingencies", *Journal of Construction Engineering and Management,* Vol. 126 130-6.

Musa, M. M., Zubairu I. K., &Bala, K. (2011). Appraisal of the Performance of Contingency Cost Provision for Building Projects in Nigeria.*ATBU Journal of Environmental Technology*, 4, (1), 41-48.

Musa, M. Muktar. (2008). Evaluation of contribution of cost contingency towards successful execution of building projects in Nigeria.*Unpublished Msc. Thesis, Department of Building, A.B.U Zaria*

Neter, J., Kutner, M. A., Nachtsheim, C. J., & Wasserman, W. (1996).Applied linear statisticalmodels. 4th ed. Chicago, IL: Irwin.

Nurudeen J. B. (2002). Statistical Theory and Analysis. Lagos Planet Press Publishers Ltd,

Odeyinka, H.A. Oladapo and Akindele, O. (2006). Assessing Risk Impacts on Construction CostOnitsha, Nigeria, pp 105 – 117.

Oduro, A.Richard. (2008). Determining and Monitoring of Project Contingency Sum for Building Development in Ghana.*Unpublished Msc. Thesis, Department of Building Technology, K.N.U.S.T-Kumasi*

Osuala, E. C. (1987). Introduction to Research Methodology. *Africana-FEP Publishers Ltd.*

Otali, M. &Odesola, I. A. (2014). Effectiveness evaluation of contingency sum as a risk management tool for construction projects in Niger Delta, Nigeria. *Ethiopian Journal of Environmental Studies & Management,* 7(6), 588 – 598.

Otali, M., Odesola, I.A. (2014). Effectiveness Evalaution of Contingency Sum as a risk mana gement tool for Construction of projects in Niger Delta, Nigeria. *Ethopia Journal of Environmental studies and management* 7(6): 588-598

Owusu Tawiah. (1999). Factors Affecting the Performance of Ghanaian Owned Construction Firms. *Unpublished Msc. Thesis, Department of Building Technology, K.N.U.S.T-Kumasi*

Parsons Jr. E.L. (1999).”Waste Management Project Contingency Analysis”. Centre for Acquisition and Business Excellence of United State Department of Energy

Perry, J.G. and Hayes, R.W. (1985).Risk and its Management in Construction Projects.*In proceedings of the ICE,* part 1, 78, June, pp. 499 – 521

Protiviti. (2010). Risk and Business Consulting, (Capital and construction building: in risk management and project control)

Salant, P. And Dillman, D. (1994).*How to Conduct Your Own Survey.* New York: John Wiley.

Smith, N.J. (1999). *Management Risk in Construction Projects*. Blackwell Science Ltd, Editorial Offices.

Smyth, H., Gustafson, M., Ganskau, E. (2010).The value of trust in project business. *International Journal Project Management* 28(2): 117-129

Stevenson, Jr. J.J. (1984). Determining Meaningful Estimate Contingency. Cost Engineering, 26(1), 35-41.

Takim, R., Akintoye, A. and Kelly, J. (2004) Analysis Of Performance Measurement In The Malaysian Construction Industry, In Ogunlana, S. O., Chareonngam, C., Herabet, P. and Hadikusumo, B. H. W. (Eds.) *Globalization And Construction*, Ait Conference Centre, Bangkok, Thailand, 533–546.

Thompson, P.A. and Perry J.G., (1992).*Engineering Construction Risk: a guide to project risk analysis and risk management*, Thompson Telford, London.

Touran, A.(2003). Probabilistic Model for cost Contingency. Journal *of Construction Engineering and Management.* 129 (3), 280-284

Wasiu, A.B. and Koleola, T.O. (2009). Project variables influencing Contingency on Construction Contract in Nigeria. In *RICS COBRA 2009. University of Lagos Researh Conference*

Williams, T.P (2003). Predicting final Cost for competitively bid construction project using Regression model.*International Journal of project management.* 21, 593-599

Xiano, H. and Proverbs, D. (2005) Factors Influencing Contractors Performance: An International Investigation. *Engineering*, *Construction and Architectural Management* 10(5), 322-332.

APPENDIX I

DEPARTMENT OF BUILDING,
FACULTY OF ENVIRONMENTAL DESIGN,
AHMADU BELLO UNIVERSITY, ZARIA

Questionnaire:

Date of Completion: ………………

Dear interviewee,

EVALUATION OF PROJECT RISK AND THE DETERMINATION OF CONTINGENCY SUM FOR BUILDING PROJECT DEVELOPMENTS IN NIGERIA

This questionnaire is part of a post graduate research work, with the aim of eliciting information on the process of determining contingency sum for building projects in Nigeria.

For the purpose of this questionnaire and research, contingency is defined as “an allowance reserved for unpredictable/ unforeseeable elements of cost not known at the time of the estimate”

The questionnaire is in three Section:- Section A, B,and C. Section A seeks general information about the respondent. Section B seeks respondents’ opinion on the methods of calculating contingency fund, and Section C seeks respondents’ opinion on Risk analysis method of determining contingency fund which will correlate contingency budget with the inherent risk of the project

The information supplied in this completed questionnaire will be used for broad research purposes only. All information provided will be treated with utmost confidentiality and no personal information about the interviewee will be disclosed in the final report. Only generalized analysis of the information contained within this completed questionnaire will be utilized in the research process.

Thank you.

Gognaje Yusuf Barde
MSc/Env-Des/5124/2009-2010
December, 2012

SECTION A
(GENERAL INFORMATION)

1. Which of the following categories of construction profession do you belong to?

(A) Quantity Surveying

(B) Architecture

(C) Civil Engineering

(D) Structural Engineering

(E) Builders

(F) Mechanical & Electrical Engineering

2. What is your highest academic qualification?

HND	B.Sc	M.Sc	P.hd	Others (please specify)

3. What is your professional status?

4. How long have you been in the construction industry?

0-5years 5- 10years 11-15years

16 – 20 years 25 years and above

SECTION B
(METHODS OF DETERMINING CONTINGENCY SUM)

5. Do you prepare building cost estimates? Yes /No

6. If yes, do you consider project contingency sum in your estimates?

Yes No

7. Table 1.is a list of methods of determining contingency sum. Please rank the Methods according to their scale of 1-4 (where 0 = Neither insignificance or significance, 1= Not frequent, 2= Less frequent, 3= Frequent and 4= Most frequent

Table 1. Methods of Determining of Contingency Sums

Item	Methods	Ranking				
		0	1	2	3	4
1	**Deterministic Methods** - The traditional method of estimating cost contingency sum which involves the computation of base estimate and the addition of a single contingency amount usually in percentage of the base estimate					
2	**Probabilistic Estimating** – It is a computation of cost based on probabilities and ranges of possibilities of the outcome of a project.					
3	**Range Estimating** - A technique in which the uncertainty of each line item of an estimate is determined by specifying the lowest and highest values that each element could assume based on an assessment of the related risks					
4	**Estimating using Risk Analysis (ERA)-**The ERA process is to identify risks by the project team. These risk items are then categorised into either fixed or variable. For each risk event, an average risk allowance and a maximum risk allowance are calculated.					
5	**Monte Carlo Simulation** - The risk analysis methodology for providing a means to quantify project risks, managing uncertainties, and determining project contingency using cost and schedule range estimating data inputs.					

8. Please tick the advantage(s) of the most frequent used method from Q7.

Table 2. Indicates the advantages of the most frequent used method

Item	Advantages	Tick
1	Quick and easy to determine	
2	Serves as financial control	
3	Eliminates the tendency of double – count of risk	
4	Monitors project performance and quality of risk	
5	Mechanism for accounting for public money	
6	Encourages creativity in estimating practices	

9. Please tick the disadvantage(s) of the most frequent used method from Q7.

Table 3. Indicates the disadvantages of the most frequent used method

Item	Disadvantages	Tick
1	Inflating of cost contingency to cover for over spending and avoid the need to request for additional fund	
2	Arbitrarily determined contingency is appropriate for specific project	
3	The tendency of double – count of risk	
4	No proper monitoring of project performance and quality of risk	
5	Does not indicate any source of cost reduction	
6	Does not encourage creativity in estimating practices	

10. What percentage addition do you always allow in contingency provision?

0-5% ☐ 6- 10% ☐ 11 – 15% ☐

16 – 20% ☐ More than 20 % ☐

SECTION C
(RISK ANALYSIS METHOD OF DETERMINING CONTINGENCY SUM)

11. Table 4.is a list of factors associated with the determination of Contingency Sum. Please rank the factors on a scale of 0-4 (where 0= Neither insignificance or significance, 1= Not Significance, 2 = less significance, 3= Significance and 4 =Very Significance)

Table 4. Factors that can be considered during determination of project contingency sum

Item	Factors	Relative Significance				
		0	1	2	3	4
	Technical Factors					
1	Form of Procurement/Contract					
2	Project Specification					
3	Contract Period					
4	Project Management					
5	Design Consideration					
6	Unexpected Ground Conditions					
	Economic Factors					
7	Inflation					
8	Global economic pressure (increase in demand for fuel)					
	Environmental Factors					
9	Increase in demand for extractive materials (Timber, Steel etc)					
10	Force Majeure					

Please return the completed questionnaire to:

GOGNAJE YUSUF BARDE
DEPARTMENT OF BUILDING,
AHMADU BELLO UNIVERSITY ZARIA

E-mail: gognaje2000@yahoo.com
Yb5124gognaje@gmail.com
Phone: 08036211878, 08072265003

APPENDIX II

RESEARCH PRO FORMA/RECORD FORM

Table 1.1: Survey data on completed construction projects

SN	Procurement method	Client Type	Initial Proj Cost	Cont in Percent	Contin Amt	Final Proj_Cost	Cost Overrun Percent	CostOverrun Amt
1	Traditional contract method	Public	4,200,000,000.00	5.00	210,000,000	4,320,000,000.00	2.86	120,000,000.00
2	Traditional contract method	Public	5,200,000,000.00	5.00	260,000,000	5,350,000,000.00	2.88	150,000,000.00
3	Traditional contract method	Public	5,600,000,000.00	5.00	280,000,000	5,760,000,000.00	2.86	160,000,000.00
4	Traditional contract method	Public	1,100,000,000.00	6.00	66,000,000	1,234,200,000.00	12.2	134,200,000.00
5	Traditional contract method	Public	500,000,000.00	5.80	29,000,000	500,000,000.00	0	0
6	Traditional contract method	Public	6,000,000,000.00	6.30	378,000,000	6,564,000,000.00	9.4	564,000,000
7	Traditional contract method	Public	3,200,000,000.00	5.00	160,000,000	3,270,000,000.00	2.19	70,000,000.00
8	Traditional contract method	Public	23,675,003.40	4.00	947,000.13	26,347,000.00	11.30	2,671,996.60
9	Traditional contract method	Public	3,900,000,000.00	7.00	273,000,000	3,900,000,000.00	0	0

SN	Procurement method	Client Type	Initial Proj Cost	Cont in Perc ent	Contin Amt	Final Proj_Cost	Cost Overrun Percent	CostOverrun Amt
10	Traditional contract method	Public	2,907,336,743.45	5.16	150,000,000	3,139,923,682.92	8	232,586,939.48
11	Traditional contract method	Public	4,600,000,000.00	3.00	138,000,000	4,940,400,000.00	7.4	340,400,000.00
12	Traditional contract method	Public	4,100,000,000.00	3.50	143,500,000	4,346,000,000.00	6	246,000,000.00
13	Traditional contract method	Public	300,000,000.00	6.00	18,000,000	300,000,000.00	0	0
14	Traditional contract method	Public	420,000,000.00	5.00	210,000,000	420,000,000.00	0	0
15	Traditional contract method	Public	1,751,637,305.25	3.99	70,000,000	1,839,219,170.51	5	87,581,865.26
16	Traditional contract method	Public	269,205,955.90	1.85	5,000,000	282,127,841.78	4.8	12,921,885.88
17	Traditional contract method	Public	98,438,760.00	5.00	5,000,000	98,438,760.00	0	0
18	Traditional contract method	Public	18,652,975.74	4.00	746,119.02	18,652,975.74	0	0
19	Traditional contract method	Public	563,689,505.14	1.77	10,000,000	608,281,161.82	7.90	44,591,656.68

SN	Procurement method	Client Type	Initial Proj Cost	Cont in Perc ent	Contin Amt	Final Proj_Cost	Cost Overrun Percent	CostOverrun Amt
20	Traditional contract method	public	396,235,961.00	3.78	15,000,000	421,198,826.54	6.3	24,962,865.54
21	Traditional contract method	Public	19,231,357,516.38	1.03	200,000,000	21,827,894,726.12	13.50	2,596,537,209.80
22	Traditional contract method	Public	287,823,608.89	3.47	10,000,000	307,971,261.51	7	20,147,652.62
23	Traditional contract method	Public	16,300,382.04	2.28	372,333.88	17,196,903.05	5.5	896,521.01
24	Traditional contract method	Public	8,454,555.00	2.23	188,575.40	8,877,282.75	5	422,727.75
25	Traditional contract method	Public	23,401,339.60	2.50	5,850,334	24,992,630.69	6.8	1,591,291.09
26	Traditional contract method	Public	47,861,901.00	12.54	6,000,816	47,861,901.00	0	0
27	Traditional contract method	Public	591,771,479.00	8.40	50,000,000	591,771,479.00	0	0
28	Traditional contract method	Public	108,285,035.55	5.00	5,414,251	108,285,035.55		
29	Traditional contract method	Public	1,036,480,429.68	5.78	60,000,000	1,036,480,429.68	0	0

SN	Procurement method	Client Type	Initial Proj Cost	Cont in Perc ent	Contin Amt	Final Proj_Cost	Cost Overrun Percent	CostOverrun Amt
30	Traditional contract method	Public	48,905,878.20	10.2 2	5,000,000	48,905,878.20	0	0
31	Traditional contract method	Public	148,275,121.00	3.37	5,000,000	154,947,501.45	4.5	6,672,380.45
32	Traditional contract method	Public	284,503,097.00	2.46	7,000,000	289,421,087.00	1.70	4,917,990.00
33	Traditional contract method	Public	50,475,595.00	3.96	2,000,000	50,475,595.00	0	0
34	Traditional contract method	Public	161,823,320.00	2.47	4,000,000	168,296,252	4	6,472,932.80
35	Traditional contract method	Public	68,534,814.00	2.91	2,000,026	72,783,972.47	6.2	4,249,158.47
36	Traditional contract method	Public	580,035,296.00	4.00	23,201,411	594,536,178.4	2.5	14,500,882.4
37	Traditional contract method	Public	450,603,407.84	5.00	20,435,528	450,603,407.84	0	0
38	Traditional contract method	Public	22,643,145.00	5.00	1,026,900	22,643,145.00	0	0
39	Traditional contract method	Public	22,643,145.00	5.00	1,026,900	22,643,145.00	0	0

SN	Procurement method	Client Type	Initial Proj Cost	Cont in Percent	Contin Amt	Final Proj_Cost	Cost Overrun Percent	CostOverrun Amt
40	Traditional contract method	Public	22,643,145.00	5.00	1,026,900	22,643,145.00	0	0
41	Traditional contract method	Public	36,386,470.00	5.00	1,819,323.50	36,386,470.00	0	0
42	Traditional contract method	Public	36,386,470.00	5.00	1,819,323.50	36,386,470.00	0	0
43	Traditional contract method	Public	1,750,597,060.00	3.00	53,417,911.80	1,811,867,957.10	3.5	61,270,897.10
44	Traditional contract method	Public	9,199,020.00	5.00	459,951	9,199,020.00	0	0
45	Traditional contract method	Public	52,058,410.00	5.00	2,602,920.50	62,056,410.00	19.20	9,998,000.00
46	Traditional contract method	Public	53,032,031.00	6.00	3,181,921.86	53,032,031.00	0	0
47	Traditional contract method	Public	13,687,076.66	4.50	620,729.10	13,687,076.66	0	0

Source: Authors fieldwork (2013)