AN EVALUATION OF CONTRIBUTION OF COST CONTINGENCY TOWARDS SUCCESSFUL EXECUTION OF BUILDING PROJECTS IN NIGERIA

BY

MUSA MOHAMMED MUKHTAR

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DEPARTMENT OF BUILDING
FACULTY OF ENGINEERING
AHMADU BELLO UNIVERSITY
ZARIA
NIGERIA.

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DECLARATION

I declare that the work in this thesis entitled “An Evaluation Of Contribution of Cost Contingency Towards successful Execution of Building Projects in Nigeria” has been prepared by me in the Department of Building under the supervision of Dr. K. Bala and Dr. I. K Zubairu.

The information derived from literature has been dully acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any University.

Musa Mohammed. Mukhtar	……	……
Name	signature	Date

CERTIFICATION

This thesis entitled "AN EVALUATION OF CONTRIBUTION OF COST CONTINGENCY TOWARDS SUCCESSFUL EXECUTION OF BUILDING PROJECTS IN NIGERIA" by Musa Muhammed Mukhtar meets the regulation governing the award of the degree of Master of Science (Construction Management) of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

……..	……
Dr. Kabir Bala Chairman Supervisory Committee	Date
……..	……
Dr. I. K Zubairu Member, Supervisory Committee	Date
……..	……
Dr. M.M Garba Head of Department	Date
…….	……
Dean, Postgraduate School	Date

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ABSTRACT

Contingency funds are included in project estimates to manage risk and uncertainties associated with a construction project. The fund is calculated in various ways. In most cases it is either underestimated or inflated. The aim of this research work was to evaluate the contribution of Cost Contingency toward successful execution of building projects in Nigeria. To achieve this aim the impact of contingency provision in some selected building projects had been evaluated. Data for this study was obtained from 40 project files of completed buildings obtained from 10 organizations.. Furthermore 100 comprehensive survey questionnaires on project Cost Contingencies were randomly distributed to Quantity Surveyors and Project Managers with 67% response obtained. The data were analyzed with the aid of simple statistical tools using SPSS package. The study found that although the inclusion of contingency allowance reduces the incidence of project cost overrun, 55% of the projects considered were in excess. It was also found that projects exceed their initial cost estimate by an average value of 5.07% where contingency is applied and by an average value of 9.52% where no contingency is applied. Based on the results it was concluded that, there is a lack of application of quantitative risks analysis in the determination of contingency fund. Therefore to improve the accuracy of Cost Contingency allowance an application of quantitative risk analysis techniques in its estimation has been recommended.

TABLE OF CONTENTS **Page**

LIST OF TABLES **Page**

LIST OF APPENDCES **Page**

Chapter 1

INTRODUCTION

1.1 Background

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 concern of clients (Mak and Picken, 2000). To account for the various risks that lead to cost increase, many owners and contractors allocate a contingency amount to each project. Owners allocate contingency amount to the budget for upcoming 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 schedules make exact budget needs impossible to forecast accurately. These same characteristics also cause project to deviate from plans. Therefore, contingency funds are included in development budgets to address uncertainties and deviation that threaten achieving set objectives. Similarly, Hogg (2003) posits that there has been high level of concern with regard to the performance of construction industry in terms of its ability to deliver projects on budget, on time and to satisfactory quality.

It has been reported that “under achievement can also be found in growing dissatisfaction with construction among both private and public sector clients. Projects are widely seen as unpredictable in terms of delivery on time, within budget and to

standard of quality expected" (Construction Task Force 1998). In the same publication, reference was also made to the British Property Federation's 1997 survey, which revealed that: "more than a third of the major clients are dissatisfied with contractors' performance in keeping to the quoted price and to time and with consultant performance in providing a speedy and reliable service and in providing value for money ". (Construction Task Force 1998).

Therefore, it is only wise and prudent to plan for unexpected events that may affect project cost, and to ensure the success of projects by allowing for appropriate contingency sum in the base estimate. Mak and Picken (2000) defined contingency as an amount of money used to provide for uncertainties associated with a construction project. According to Okafor (2003), contingency is an allowance reserved for unpredictable items of cost not known at the time of preparing the estimate. It provides for possible cost escalations, currency fluctuations, local conditions within the country where the project is to be sited, inaccuracy of cost estimation etc. Seeley (1984), added that contingency sum is included in a contract to cover the cost of work or expenses not contemplated or implied in the contract sum. These monies are to be expended at the discretion of the project manager, and where such circumstances do not arise, this figure constitutes a saving to the employer. This provides an opportunity for the employer to secure the execution of essential additional work within the contract sum.

Contingency sum is determined in various ways, depending on the organization. The most common and simple method is a percentage addition to the top of base estimate. The objective of contingency allocation is to ensure that, the estimated project cost is realistic and sufficient to contain any cost incurred by risk and uncertainties.

Actual costs are defined as real, accounted construction cost determined at the time of project completion. On the other hand estimated costs are defined as budgeted or forecasted construction costs at the time of tendering (Flyvbjerg et al. 2002). Accuracy of estimation refers to the magnitude of the deviation between the estimated cost of a project and its actual cost. This research work evaluates the contribution of contingency allowance in addressing project cost risk.

1.2 Need for the Study

At different stages of project development, there are different types of risk. To address these risks, contingency fund is often provided, which is usually expressed as a percentage of the base estimate. Because the fund is more often than not inappropriately determined, 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). On the other hand, contingency fund may be inflated in an attempt to avoid the need to seek additional funds if budgets become over spent. That is it is over estimated, which may lead to misallocation of resources, (Maks and Picken, 2000). Therefore, determining appropriate contingency amount is very important for the smooth delivery of projects. It is against this background that the study to determine the adequacy of contingency provision in building project is significant.

1.3 Aim and Objectives

The aim of this research is to evaluate the contribution of cost contingency allowance in building projects with a view to promoting project implementation, on time, within budget and to a satisfactory quality. This was achieved through the following objectives:-

i) Identification of the methods used in contingency allowance assessment selected by companies engaged.

ii) Study of cost contingency management practice in selected organizations.

iii) Determination of initial and final provision of contingency in some selected building projects.

iv) Evaluation of the impact of cost contingency in accommodating project cost risk.

1.4 Statement of Hypotheses

Two Hypotheses were developed concerning how contingency allowance improve the accuracy of construction cost estimates. Accuracy of cost estimation is measured by the magnitude of deviation between estimated cost of a project and its actual cost. If appropriate contingency fund is allowed, it will address most of the risks associated with the project. Hence the relative percentage variance between estimated project cost and actual project cost is expected to be closer to exactness when contingency is included in the base estimate than when it is not. Based on this, the following Hypotheses were developed.

Ho: There is no significant difference between projects with and without contingency with respect to the accuracy of cost estimates. i e $\mu 1 = \mu 2$.

H1: There is significant difference between projects with and without contingency with respect to the accuracy of cost estimates. i e $\mu 1 = \mu 2$.

Where $\mu 1$ = Mean of percentage difference between actual and estimated cost with contingency.

$\mu 2$ = Mean of percentage difference between actual and estimated cost without contingency.

1.5 Scope and Limitation

Scope

The three types of contingency in building projects are; tolerance in the specification; float in the schedule and money in the budget (CIRIA 1996). It is the latter-money in the budget (project cost contingency) that is the focus of this research work. Cost contingency is defined as "an amount of money used to provide for uncertainties associated with a construction project. (Mak and Picken 2000). Because management practice can vary across project types, the research focused on one project type-institutional building. To reduce the impact caused by the differences between public and private client, only public projects have been considered.

The risk apportionment and cost management relating to traditional procurement differ from that of other procurement methods. For example, with design and build, the risks relating to design belong to the contractor whereas with traditional procurement they remain with the client. In the light of this, only projects based on traditional procurement and executed between 2000 and 2007 have been selected.

Limitations

Because of the longer time that is needed and the difficulty in obtaining reliable data on project costs, this research work covers a small sample size of projects. Another limitation was that, it has not been possible to fully examine adequately the reasons for cost variations in these projects.

Furthermore, there is likelihood of an element of bias being introduced because responding organizations could have provided data that present their projects in favourable light; that is selected projects that will not disclose information that may reflect badly on their organizations. These limitations were considered in interpreting the results from statistical analysis of the sample. The sample is not assured to be perfect by any means, but it is large enough for appropriate analyses.

Chapter 2

LITERATURE REVIEW

2.1 The Concept of Project Cost Estimation

2.1.1 Preparation of Cost Estimates

Cost estimating is the technical process of predicting costs of construction (CIOB, 1997). Generally, cost estimating is carried out in the process of pricing of bills of quantities that are prepared in accordance with a standard method of measurement.

The construction industry in most countries is one of extreme competitiveness, 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, contingencies and profit. (Akintoye and Fitzgerald 2000).

2.1.2 Factors Affecting the Accuracy of Cost Estimation of Building Projects

Construction project performance is frequently measured in terms of cost, time and the value of the constructed facility (Ford, 2002). It has been found that, there is a great concern by the clients with regard to the performance of the construction industry in terms of its ability to deliver projects, on budget on time and to satisfactory quality. (Hogg 2003). Generally, it has been established that, the actual cost of building projects are more often higher than estimated cost. (Flyvbjerg et al. 2002,) This problem appears to be a disappointment to the clients, with the industry's failure to deliver products that fulfill the promises made at the tendering stage.

Ford (2002), suggested that "project complexity and the inherent uncertainty of the financial performance of constructed facilities, development funding, and the control of cost and schedules make exact budget needs impossible to forecast accurately" thereby causing projects to deviate from plans. In the same vain, Akintoye and Fitzgerald (2000), identified the causes of inaccuracy in cost estimation, as lack of practical knowledge of construction process by those responsible for the estimating function, insufficient time to prepare cost estimates, poor tender documentation, wide variability of sub-contractors'

price, change in owners requirement, poor communication between the estimating team and construction team etc.

Enshassi et al. (2005,) pointed out that, the main factors affecting the accuracy of cost estimate are: location of the project, financial status of the owner, increase in unit cost of construction materials, experience of consultant engineer, clarity of project drawings, clarity of information before execution and tender currency. Additional factors that have some influence on the accuracy of estimating the cost of construction work have been identified as; availability of design information, type and quality of cost data, type of project, project size, number of bidders on competitive projects, stability of market conditions, personal factors, proficiency in estimating and experience. Enshassi et al. (2005).

Shash and Al-khaldi (1992) have identified and classified factors affecting the accuracy of cost estimating as financial issues, bidding situations, project characteristics and the estimating process itself.

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.

2.2.1 Risk and Uncertainty

Decisions are concerned with variables which are normally classified as risk or uncertainties. Risks are unknowns, the probability of the occurrence of which can be assessed by statistical means (risks are usually insurable). Uncertainties are unknowns,

the probability of the occurrence of which cannot be assessed (uncertainties are uninsurable). It is possible, however, for a decision maker to assign a subjective probability to an uncertainty.

According to Mak and Picken (2000), risks can arise from planning decision, where the outcome cannot be adequately costed. The majority of risks, however, arise from matters yet to be decided (e.g incomplete brief or lack of site investigation). Risk assessment of the cost of certain features will be present at all stages of a project. The number of risks will normally decrease as a project progresses through the various planning stages of the work program. Obviously, other risks can arise until planning is complete and during the construction phase.

2.2.2 Types of Risk in Construction Contracts

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

i) 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.

ii) Delay and Disputes: Possession of site; lateness in the supply of information; inefficient execution of work; delay outside both parties' control; layout disputes.

iii) 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 consultants or contractors; changes in requirements.

iv) 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.

v) 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.

vi) 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 a fluctuation clause; replacement cost of plant and equipment.

vii) 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.

2.2.3 Risk Management

The management of risks concerns dealing with events, the likelihoods of the occurrence of which are variable, either of quantifiable (known) variability, or probability risks, or of quantifiable 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. Risk identification, analysis and responses.

A) Risk Identification

Risk identification concerns determination of what risks (and uncertainties) apply to the project. A systematic approach is essential. 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).

B) 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 may be quantified by measuring variability of outcome variance, standard deviation and coefficient of variations; Monte-Carlo and Delphi techniques may also be employed. Sensitivity analysis to determine the effect on the project outcome in terms of important performance criteria may be used to detect those risk variables which are likely to have greatest impact on the project, and to which management must devote attention.

Fryer (2004), provide a useful classification of risk analysis techniques, as decision tree, sensitivity analysis and probabilistic analysis.

C) Risk Response

The result of the previous steps will be an insight into both the priorities of the client and the major risks involved. The final step is to decide who is best placed to manage risk. According to Murdoch and Hughes (2002), the choices lie between employer, consultants, contractor or insurers.

The client and consultants determine the contract terms (standard form or amended standard form). Any decision about laying off risks on to others must involve weighing up the frequency of occurrence against the level of premium being paid for the transfer.

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 avoidance, transfer, reduction or retention.

Fellows et al (2004) grouped risk response into five main ways; removal, reduction, avoidance, transfer and acceptance.

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.

Avoidance"- may occur similarly or in extreme cases, may mean a constructor declining to undertake the project.

Transfer of risk means transferring the impact of a risk to a third party, so that if it occurs the project will not be affected adversely. This may be done by passing the work to a sub-contractor.

Acceptance of risk:- many of the risks identified will be either too improbable or too low in their impact to worry about. These risks should not be completely ignored since they can grow in probability and impact as time goes on, but it is normal that such risks should be logged and reviewed periodically.

Another way of handling risk is through the provision of contingency fund in project cost estimate; accordingly it is important to plan and have resources ready in case a certain risk does occur, so that no time will be lost in dealing with it. Of course, if the risk does not arise, the contingency is not spent and the money saved can be used elsewhere.

2.2.4 Risk Management Workshop

Fellows et al (2002), stated that risk management rely principally on workshops, which draw together key project stakeholders and encourage participants to reflect on issues that impact upon organizational project success. The meeting should aim at producing a ranked list of all the identifiable risks for the project. Each identified risk should be recorded and ranked for its severity. Severity is the product of the likelihood of occurrence of the risk and the impact if it occurs. There are many possible ways to do this, but for most projects it is sufficient to rank each of the risk probabilities and impact as high, medium or low. A five or even a ten point scale may be used to score probability and impact. It is during the session or afterwards, that a decision would be taken on whether management actions other than acceptance of the risk are necessary, and the appropriate action would be identified. The most efficient way to do this is to sort the list of risks according to severity as shown in Table 2.1. High impact, high probability risks almost certainly need some management action. Low probability, low impact risks almost certainly deserve nothing more than active acceptance of the risk.

Table 2.1: Risk Management

S/NO	Description of Risk	Probability	Impact	Severity	Management Action
1					
2					
3					

2.3 Concept of Cost Contingency

CIRIA (1996) described three types of contingencies ***as*** tolerance in the specification, float in the schedule and money in the budget. Project cost contingency has been defined as an amount of money included in the project budget to manage risk and uncertainty to achieve project goals PMI 2004; Ford 2002; Mak and Picken, 2000; Diekmann et al 1988). On the other hand cost contingency is defined as a sum of money included in an estimate to cover for cost of undefined work which cannot be foreseen before construction begins and which may not arise at all. (Seeley, 1984; AACE 1992). Similarly CIOB (1997) and Ramus and Birchall, (1996) defined contingency as form of undefined provisional work which can not be identified at tender stage.

Generally Cost contingency caters for two categories or types of unknown. Known unknowns and unknown unknowns (Carr 1989, Hillson 1999). Known unknowns are risks that have been identified, analyzed and it may be possible to plan for them while unknown unknowns cannot be managed, so project mangers may address them by applying a general contingency (PMI 2004). So it is important to identify contingency associated with all significant individual risks (known unknown), plus a residual allowance for other unidentified risks.

In a nutshell, project cost contingency is an amount of money added to an estimate to cater for events within the defined project scope that are unforeseen or undefined. Furthermore, the realization that contingency is fundamentally provided to deal with many risks and uncertainties means that, the application of quantitative risk analysis techniques such as simulation in its estimation is necessary.

2.3.1 Method of Contingency Allowance Assessment.

Contingency is calculated in various ways, depending on the organization and level of sophistication of the estimator (Hogg 2003; Touran 2003). These are as follow:-

i) Advice from the Architect.

ii) Addition of standard percentage of estimated cost, such as 10% based on previous experience with similar projects.

iii) Addition of a sum reflecting intuitive perception of risk. In this method, the consultant quantity surveyor allows a single figure for risk that reflects the overall perception of the project. The assessment may be carried out by one person or with the benefit of advice from other consultants. For instance, project workshop may be organized to identify and evaluate the project risk.

iv) Addition of a sum based on formal risk analysis. The techniques used in this method for analysis include probability scores and tables, sensitivity analysis and simulation.

The most common method for determining contingency fund, according to Mak and Picken (2000) is addition of standard percentage of estimated cost of the project. However, Thompson and Perry (1992) pointed out several weaknesses of using the method of percentage addition, as follows:-

(i) The percentage figure is, most likely, arbitrarily arrived at and not appropriate for the specific project

(ii) There is tendency to double count risk because some estimators are inclined to include contingencies in their best estimate.

(iii) A percentage addition still results in a single figure prediction of estimated cost, implying a degree of certainty that is simply not justified.

(iv) 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.

(v) Because the percentage allows for all risk in terms of cost contingency, it tends to direct attention away from time, performance, and quality risks.

(vi) It does not encourage creativity in estimating practice, allowing it to become routine and mundane, which can propagate over site.

To improve the accuracy of estimating contingency allowance; the application of quantitative risk analysis techniques for its determination has been recommended. (Baccarini 2005; Hogg 2003, Mak and Picken 2000).

2.3.2 Cost Contingency Management

Cost contingency management may be defined as the process of planning, allocating and controlling contingency fund toward the achievement of pre-determined project objectives

2.3.3 Objectives of Cost Contingency Management

Ford (2002), stated the four contingency management objectives as;

i) Resolve emergencies:- protect against spending more than the budget by providing funds for future required unforeseen expenses, referred to as emergencies.

ii) Control the schedule: ensure completion by the project deadline by accelerating progress.

iii) Improve the facility:- add value to the constructed facility, typically by design and scope changes beyond minimum project requirement.

iv) Return excess contingency:- return contingency that remains after the project is completed to the developer

The first two objectives (resolve emergencies and control schedule) include many of the risks that contingencies are used to manage. Successfully managing these is considered critical to project success, whereas the third and fourth objectives (improvements and excess contingency) are desirable but optional, (Ford 2002). Objectives one through three reflect the traditional project management performance measures of cost, time and value

2.3.4 Contingency Management Strategies

Contingency management strategies are categorized into two; aggressive or passive (Ford 2002). Aggressive strategy reallocates funds quickly, uses contingency to correct schedule before many emergencies are discovered, resolves and applies fund early to improve the facility.

In contrast, a passive strategy reallocates fund slowly, postpones using contingency until it must be used to meet critical objectives, and uses little funds for improvement until emergency and schedule objectives are met. Project managers can make their contingency management strategy selection based on the level of uncertainty and variability in their project. A passive strategy was found to perform better than an aggressive strategy under most conditions identified as critical (emergencies and schedule

control). But an aggressive strategy is more robust in the same condition and therefore is better able to absorb changes in project conditions (Ford 2002). Therefore, project with little risk of changes that degrade performance can take advantage of the better performance available by applying a passive strategy, whereas more variable project conditions should have an aggressive strategy. Thus, project managers can improve their contingency management strategy selection by identifying and qualifying project risk and the variability it may generate.

2.3.5 Expenditure of Cost Contingency Fund.

Cost contingency is defined as a special kind of provisional sum (Ramus and Birchall, 1996). Clause 13 of JCT (80) form provide that, Architect shall issue instructions with regard to the expenditure of provisional sum included in the contract bill and in a sub-contract. Therefore, cost contingency being a special kind of provisional shall only be expended at the discretion of project manager. In such situations the quantity surveyor should be asked to estimate the amount required for the project manager to approve.

2.3.6 Adequacy of Contingency Fund

Adequacy here means, the effectiveness of the contingency provision in accounting down side cost risk, so that the actual cost of the project will not exceed the estimated cost. For the purpose of this work 5% level of significance is taken. Therefore, any contingency estimate that falls outside $\pm$ 5% was considered inadequate. However, this can only be achieved when an appropriate method of determining

contingency is used combined with good management of the funds. Hence, application of quantitative risk analysis technique to its estimation has been recommended. Hogg (2003), pointed out that, contingency allowance is not appropriately determined in many Projects and as such, its inclusion in the estimates has little benefit. He found in his study that although the inclusion of the sum reduces the incidence of cost overrun, a large number of projects proved to be in excess.

2.3.7 Limitations of Contingency Management Practice

The followings are some of the limitations of contingency management practice.

i) There is no evidence of formal or standardized models, methods or tools in practice for contingency management. (Ruskini 1981, Diekmann et al. 1988). This means that contingency management is a function performed primarily in the minds of managers; that is decision is made based on experience and judgment.

ii) Contingency management practices are not organized by clearly defined procedure, compared to other managerial tasks, such as estimating and scheduling (Ford 2002).

2.3.8 Areas of Application of Contingency Fund

The primary objective of contingency fund is to counter balance the risk of spending beyond the projects monetary resources due to deviations from project plans, or in other words, it is meant to cater for cost overrun. This is widely recognized in the literature in various ways, such as Mak and Picken's (2000) who assert that contingency

should cater for contract variations, site conditions, market condition, additional client requirements, contract period etc.

Okafor (2003) states that contingency should be used to cater for fluctuations, cost escalations, accuracy of cost estimation etc.

According to Ramus and Birchall (1996), contingency fund can be used to cater or offset costs of undefined work which cannot be foreseen before construction begins. In summary, contingency fund should cater for contract variations, change in client requirements, market conditions e.g increase in the cost of labour and materials; undefined work e.g site conditions, provisional quantities/provisional sum, project complexity, underestimation due to incomplete scope definition at the time of estimating.

Some of the areas of application of contingency fund have been explained below:-

A. Variation

According to the JCT Form (80), variations may arise in any of the following situations:-

i) Alteration or modification of the design, quality or quantity of works as shown upon the contract drawings and described by or referred to in the contract bill.

ii) When a discrepancy is discovered between any statutory requirement and any of the contract document.

iii) When a discrepancy is discovered between any two or more of the contract documents.

iv) When an error in or omission from the contract bill is discovered.

B. Fluctuation.

In a fluctuating price contracts, contingency fund should cater for the net increase in the cost of labour and /or materials after the date of tender. JCT Form contains three different provisions, any one of which may be incorporated in a contract by deleting the other two clause references in the Appendix to the conditions of the contracts.

These provisions are:-

i) Adjustment of the contract sum limited to fluctuations in statutory contributions, levies and taxes as specified in clause 38.

ii) Adjustment of the contract sum in respect of fluctuations in labour and material costs and in statutory contributions, levies and taxes as specified in clause 39.

iii) Adjustment of the contract sum in respect of fluctuations as in (ii) above by the use of price adjustment formulae as specified in clause 40.

C. Project Complexity

Project complexity can be viewed in terms of type of structure, scope of construction, complexity of design, site constraints etc. Complex projects are generally more difficult to manage, cost more and take longer time. Contingency fund can be used to cater for project complexity.

D. Expenditure of Provisional Sum

A provisional sum is defined in S.M.M. 6 as “a sum provided for work or for

costs which cannot be entirely foreseen, defined or detailed at the time the tendering documents are issued".

Sometimes, the actual value of the work which is the subject of a provisional sum exceeds the amount of the sum. In such a situation contingency fund should be used to cater for the additional cost.

2.3.9 Limitations 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 (Baccarini 2005 AACE 1992, Querns 1989). 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 3

RESEARCH METHODOLOGY

This Chapter describes the methods adopted in data collection and analysis. The study was conducted mainly by means of a questionnaire and a check list designed to collect data from 40 completed projects. Oral interviews and discussion were also held with professionals in the construction industry on ways of preventing the wide variance between the original and final contract sum.

3.1 Population

The research population includes building projects executed by public sector clients. The project types are institutional buildings and only projects based on traditional procurement system were considered. For ease of data collection 40 projects executed between 2000-2007 were used for the study. The population also include Quantity Surveyors working in consulting firms, government ministries and parastatals.

3.2 Sampling Procedure and Sample Size

The sample for this study was selected on the basis of data availability. All projects for which data on project cost were obtainable were considered for inclusion in the sample. Project cost here refers to estimated project cost, actual project cost and contingency allowance. Sample size of 40 projects from checklist and 67 questionnaire responses were used.

3.3 Data Collection.

In order to realize the objectives of this study data collection was carried out by means of questionnaire survey and check list, as described below.

3.3.1 Questionnaire Survey

The questionnaire survey (Appendix III) was undertaken to determine the opinion of clients quantity surveyors and project managers regarding methods used in calculating and managing contingency fund in their organizations. The questionnaires were sent randomly to 100 Quantity Surveyors working in consulting firms, Government Ministries and Parastatals. Respondents were required to either write the requested information in the space provided or by using a tick ( ) to indicate the option that best represented their opinion. A total of 67 completed questionnaires were returned in a usable format, representing a 67% response rate.

3.3.2 Checklist

A checklist (Appendix IV) was also prepared and completed through personal study of project files to provide data on Estimated project cost, Actual project cost and Contingency allowance. Data from 40 completed projects were received from 10 organizations including consulting Quantity Surveying firms, Government Ministries and Parastatals. The original contract sums ranged from ₦3.00 M to N187.19 Million.

3.4 Data Analysis

The data obtained from the questionnaire survey and checklist were analysed with the aid of simple mathematical/statistical tools, that include; percentages, means, variance and standard deviation using the **SPSS** statistical package

3.4.1. T - test

T - test was used to test the hypothesis formulated so as to clarify whether the means of the two sets of data are significantly different.

Chapter Four

DATA PRESENTATION, RESULTS AND DISCUSSION.

This Chapter presents and explains the results obtained in the study and interprets the analyses of the data collected.

4.1 Data Presentation of Questionnaire Survey

This section presents and explains the results obtained from a questionnaire survey. A total of 100 questionnaires were administered and 67 of them were returned completed.

Demographic Distribution of Respondents

Tables 4.1 and 4.2 show the demographic distribution of respondents. It can be noted that majority of the respondents (71%) have work experience ranging from 5 to 20 years in the building industry and have basic academic qualification such as Higher National Diploma, Bachelor of Science degree and Masters Degree. Based on work experience and educational background, it is reasonable to say that, respondents have adequate knowledge and experience relating to construction cost estimating and management within the building industry.

Table 4. 1: Qualification of Respondents

	Qualification	**Frequency**	**%**
a)	HND	28	42
b)	BSc Degree	30	45
c)	MSC Degree	9	13
	Total	67	100

Table 4. 2: Experience of Respondents

Experience	Frequency	%
a) Less than 5 years	13	20
b) 5 – 10 years	21	31
c) 11 – 15 years	15	22
d) 16 – 20 years	12	18
e) 21 – 25 years	6	9
Total	67	100

4.1.1 Methods of Calculation of Contingency Fund.

The study investigated the methods adopted in the calculation of contingency funds for building projects, its adequacy and the range of percentages often allowed. The results of the responses are presented in Tables 4.3 –4. 6.

Table 4. 3: Use of Percentage Addition in Estimating Contingency Funds

	Response	Frequency	Percentage
a)	Yes	41	61
b)	No	26	39
c)	Don't Know	0	0
	Total	67	100

The result in Table 4.3 indicated that,, one of the most common methods of calculating cost contingency is to consider a percentage of estimated cost based on previous experience with similar projects. It can be seen from Table 4. 3 that the percentage approach is used by 61% of the respondents. This is of concern because the percentage figure is most likely arbitrarily arrived at and not appropriate for the specific project.

Table 4.4: Percentage Distribution on Methods of Assessment Used by Estimators for Contingency Allowance.

	Methods of Contingency Allowance	**No. of Project**	**Percentage**
a)	Advice from the Architect	6	2
b)	Addition of standard percentage	225	67
c)	Addition of sum reflecting intuitive Perception of risk	94	28
d)	Addition of sum based upon formal risk analysis	10	3
	Total	335	100

Table 4. 4 reveals that percentage addition is the most frequently adopted method of contingency allowance representing 67% of cases, followed by addition of sum reflecting intuitive perception of risk which represent 28% of the projects. Seeking advise from the Architect and the use of risk analysis in calculating contingency allowance is very rare, representing only 2% and 3% respectively.

Table 4.5: Percentage Addition Allowed in Contingency Provision by Estimators

Percentage Allowance		Number	Percentage
a)	0 – 5 %	34	59
b)	6 – 10 %	22	38
c)	11 – 15 %	2	3
d)	16 – 20 %	0	0
e)	More than 20 %	0	0
Total		58	100

The results in Table 4. 5 indicate that, a high percentage (59%) of those respondents who calculate contingency based on standard percentage allow between 0 – 5% of the estimated cost, while 38% of the respondents allow 6 – 10%, and only 3% of

the respondents allow 11 – 15%. However, none of the respondents indicated that they allow anything over 15% of the base cost estimate.

Table 4. 6: Adequacy of the Methods used in Estimating Contingency Allowance.

Method of Contingency Allowance		**No. of Project**	**Adequate**		**Not Adequate**	
			No.	**%**	**No.**	**%**
a)	Advice from the Architect	6	2	33	4	67
b)	Addition of standard percentage	225	108	48	117	52
c)	Addition of sum reflecting intuitive Perception of risk	94	59	63	35	37
d)	Addition of sum based upon formal Risk analysis	10	9	90	1	10
Total		335	178		157	

From Table 4. 6, it is obvious that, advice from the Architect alone was rarely relied upon in determining the provision of contingency fund. The study found that the addition of standard percentage is adequate in 108 projects out of 225 representing 48%. This implies that this method is fairly adequate for estimating contingency, while method of contingency allowance that reflects intuitive perception of risk is found to be 63% adequate in most projects in which they were applied. By the result in Table 4. 6 the contingency fund is adequate in 90% of the projects where formal risk analysis was used.

Table 4.7: Use of Risk Analysis Tools and Techniques.

Variables		Mean score	S.D	Rank
a)	Internal Workshop	2.45	1.31	1
b)	Project team workshop	2.19	0.99	2
c)	Qualitative assessment of risk	1.54	0.86	3
d)	Sensitivity analysis	1.28	0.62	4

It is apparent from Table 4. 7 that the levels of use of risk analysis tools and techniques within Quantity Surveying organization is low; more particularly the use of sensitivity analysis approach in assessing contingency fund.

4.1.2 Management of Contingency Fund

This section presents results of study of the management process of cost contingency, its areas of application and problems encountered in the administration of the fund. The results are presented in tables 4.9 to 4.14.

Table 4.8: Objectives of Contingency Fund.

	Variables	Mean score	S.D	Rank
a)	Resolve emergency	4.61	0.82	1
b)	Control schedule	3.09	1.22	2
c)	Improve facility	2.30	1.34	3

Table 4. 8 presents the ranking of the 3 objectives of contingency fund according to their importance. The result shows that, the most important objective is to resolve

emergency situations by providing funds for unforeseen expenses. This is followed by controlling the schedule to assure completion by the project deadline. Improving the facility was considered least important objectives by the respondents.

Table 4. 9: Choice of Cost Contingency Management Strategy by Project Managers

	Strategy	Number of Project	Percentage
a)	Aggressive strategy	64	19
b)	Passive strategy	271	81
Total		335	100

From the result of Table 4. 9 it can be noted that, passive strategy (reallocate fund slowly, i.e using contingency only to meet critical objectives) is the most frequently (81%) adopted strategy in contingency management, while the application of aggressive strategy (reallocate fund quickly at the early stage of project) is minimal, used in only 19% of the projects studied.

Table 4.10: Adequacy of Cost Contingency Management Strategy.

Assessment of Strategy		**Type of Strategy**			
		Aggressive		**Passive**	
		No.	**%**	**Nr.**	**%**
a)	Adequate	45	70	234	86
b)	inadequate	19	30	37	14
Total		64	100	271	100

From Table 4. 10 it can be seen that, the contingency fund was inadequate in 30% of projects where aggressive strategy was applied, while it was inadequate in 14%

of projects were passive strategy was used. This means, the percentages of emergencies resolved using an aggressive strategy was less than the percentages using a passive strategy.

Table 4. 11: Availability of Formal Policy for Project Cost Contingency

	Response	Frequency	Percentage
a)	Yes	44	66
b)	No	20	30
c)	Don't know	3	4
	Total	67	100

Table 4.11 shows that, when the respondents were asked whether their organizations have formal policy for the project cost contingency, that is guideline for estimation and management of the contingency fund. Thirty percent (30%) of the respondents stated that their organizations do not have. This suggests that there is room for improvement in the whole approach to project cost contingency.

Table 4. 12: Monitoring Project Cost Contingency Throughout a Project

	Response	Frequency	Percentage
a)	Yes	56	84
b)	No	8	12
c)	Don't know	3	4
	Total	67	100

The result of Table 4. 12 indicates that, twelve percent (12%) of the respondents said that they do not formally monitor contingency fund throughout a project,. This implies an area of poor management practice. More importantly, for good management, cost contingency should be used for the intended purpose and not incorrectly used for other

issues. The responses suggest significant room for improvement in the management of project cost contingency.

Table 4. 13: Persons Responsible for Authorizing Expenditure in Respect of Contingency Fund

	Response	Frequency	Percentage
a)	Architect	30	45
b)	Quantity Surveyor	6	9
c)	Project Manager	24	36
d)	Clients	4	6
e)	Engineer	3	4
Total		67	100

It can be observed from Table 4. 13 that 45% of the respondents opine that, the Architects have the authority of issuing instructions with regard to the expenditure of contingency fund, while 36%indicated that the project manager is the person with such authority. This can be explained as a situation whereby the Architect is the prime consultant then he has the authority of issuing the instructions, but if the Architect is not , then the project manager will be the one who will issue the instructions irrespective of his profession.

Table 4. 14: Procedure for the Expenditure of Contingency Fund

	Response	Frequency	Percentage
a)	By claim from the contractor to project manager	14	21
b)	By instruction from project manger to Q.S to quantify variation/claim of contractor	13	19
c)	Both	40	60
	Total	67	100

From the result in Table 4.14 Sixty percent (60%) of the respondents indicated that, the procedure for the expenditure of contingency fund is by Claim from the Contractor to the Project Manager followed by an instruction from the Project Manager asking Quantity Surveyor to quantify any variation or contractor's claim therein. This procedure suggest that, the contractor in the first instance has to make claim to the Architect/project manager explaining any additional cost he incurred. If the claim is justified, the project manager will instruct the Quantity Surveyor to verify the contractors claim. But in the case of variation, the project manager may in the first instance ask the Quantity Surveyor to assess the variation and in the event of any additional cost to the contractor, the project manager may address this using contingency fund. This explanation was made by the respondents during a discussion with them.

Table 4. 15: Availability of Excess Contingency at Completion of a Project

	Type of Project	**Frequency**	**Percentage**
a)	Public	14	21
b)	Private	13	20
c)	Both	9	13
d)	None	31	46
Total		67	100

When the respondents were asked whether they had excess contingency in any of the recently completed projects within their organizations, 54 % stated that they had in some of their projects, 21% of the respondents had in public projects, only 20% had in

private projects while 13% had excess contingency in both public and private projects, as shown in Table 4.15. This result is of concern for it means the contingency allowance was over estimated in those projects.

Table 4. 16: Assessment of Presence of Post Contract Review of Accuracy of Cost Contingency in Building Projects

	Response	Frequency	Percentage
a)	Yes	40	60
b)	No	25	37
c)	Don't know	2	3
	Total	67	100

The result of Table 4.16 indicates that, 37% of the respondents said they do not undertake post contract review to assess the accuracy of project cost contingency at completion of a project,. This is of concern because as part of quality management, organizations need to review their activities in order to improve. Without a review it is difficult for management to know the areas that need improvement. In order to improve the accuracy of the process of calculating project cost contingency there is need to undertake a post contract review.

Table 4. 17: Frequency Distribution of Major Areas of Application of Contingency Fund

	Response	Frequency	Percentage
a)	Variation	55	82.09
b)	Change of client requirement	33	49.25
c)	Fluctuation	21	31.34
d)	Unforeseen work	23	34.33
e)	Underestimation of provisional Quantities/undefined work	18	26.87

Table 4.17 shows that, the major areas of application of contingency fund are in variation representing 82% while change of client's requirements is 49%. Twenty seven percent (27%) of the respondents applied cost contingency to cater for underestimation of provisional quantities due to the incomplete/undefined scope at the time of preparing cost estimate.

Table 4. 18: Items not expected to be covered by contingency fund.

	Response	Frequency	Percentage
a)	Scope change	38	57
b)	Estimating errors	31	46
c)	Insured risks	25	37
d)	Force majeure (act of God)	19	28
e)	Losses on site due to negligence	17	25
f)	Claim due to delay in payment	14	21
g)	Unknown	13	19

From Table 4.18, it can be observed that 57% of the respondents hold the opinion that, contingency should not be applied to cater for scope changes. This suggests that any scope changes should be accommodated by client reserve. So contingency does not cater for scope changes but can cover for scope development. Forty six percent (46%) of respondents stated that, contingency should not be applied to cater for human error in estimating. The rationale is that poor estimating processes might be promoted if estimators know that their errors will be compensated for by the use of contingency. Nineteen percent (19%) of the respondents were indifferent on items that contingency

should not cater for . This implies that a significant number of project participants exhibit limited understanding of the important concept of project cost contingency, or have never been required in their projects to reflect upon what contingency should include and exclude. This could lead to the inappropriate use of contingency, because any vagueness of what contingency is meant to cater for may tempt many to use it for other purpose than it is originally intended.

When the respondents were asked to state the problems encountered in managing contingency fund, the following are the main problems they highlighted.

1) According to some respondents, at times contingency fund is not adequate to cater for its intended use. This is because the fund is more often than not inappropriately calculated.
2) Variations as a result of Architect's instructions are usually so many during implementation of projects, while contingency fund is limited and fixed.
3) Contractors see contingency fund as free money, thus unnecessary claims are usually made in order to exhaust the fund to fullest.
4) Poor understanding of what should be funded with contingency and what should not, is another problem highlighted

4.2 Presentation and Analysis of Historical Data.

This section presents and interprets the analyses of the data obtained from 40 project files on completed buildings.

Table 4. 19: Contingency Performance by Project Value

% change	Categories by Value (₦ 'm) <20		20-50		50-100		>100		Total	
	N	%	N	%	N	%	N	%	N	%
a) (<5)	10	43.4	4	57.1	-	-	1	14.3	15	37..5
b) 0	2	8.7	1	14.3	-	-	-	-	3	7..5
c) <5	4	17.4	1	14.3	-	-	3	42.8	8	20.0
d) 5-10	3	13.0	1	14.3	3	100	1	14.3	8	20.0
e) 11-20	2	8.7	-	-	-	-	2	28.6	4	10.0
f) >20	2	8.7	-	-	-	-	-	-	2	5.0
Total	23	100	7	100	3	100	7	100	40	100

Note: Category shown in parenthesis reflects final costs that were less that estimated cost.

Table 4.19 shows the contingency performance by project value. The results indicate that the largest range of variation >20% between actual and estimated cost, including contingency allowance, is with the project value of less than N20.00 m having 8.7% variation. The possible explanation of this result is that estimators more often do not use any means to identify and evaluate risk associated with small projects as compared with large projects, thus contingency fund is arbitrarily arrived at in those projects. The results also show that, the most frequently occurring variation is (<5%) involving 37.5% of the total projects, while the least occurring variation is >20% involving 5% of the projects.

It was also found that, 65.0% of the projects considered have their estimated cost within the limit of ± 5% of the actual cost.

Table 4.20: Impact of Cost Contingency in Addressing Project Cost Overrun.

% difference between actual & estimated cost	**No. of projects without contingency**	**No. of Projects with contingency**	**Change**
a) (<5%)	2	15	13
b) 0	0	3	3
c) <5%	15	8	-7
d) 5 – 10%	12	8	-4
e) 11 -20%	7	4	-3
f) >20%	4	2	-2
Total	40	40	0

Note: Category shown in parenthesis reflects final costs that were less that estimated cost.

Table 4.20 shows the impact of the contingency on the sample, without the consideration of the contingency allowance 38 projects would have been over budget. With the inclusion of contingency allowance, 22 projects resulted in cost overrun. Thus, in aggregate, the contingency allowance has been effective in avoiding cost over run in 16 projects.

Table 4.21: Descriptive Statistic of Ratio Between Actual Cost and Estimated Cost.

Actual vs estimated cost ratio	No of cases	Mean	Standard deviation
a) Including contingency	40	1.0507	0.1136
b) Excluding contingency	40	1.0952	0.1195

Table 4.21 shows that, the relative mean of the ratio between the actual cost and the estimated cost of the projects are 1.0507 and 1.0952 with and without contingency respectively. The result suggests that, where contingency is applied, the projects' cost overrun their initial estimate by an average of 5.07% while, in a situation where no contingency is included the initial estimated cost is exceeded by an average of 9.52%. This implies that, greater accuracy is obtained where contingency is applied.

Table 4.21 also shows that, the standard deviations was smaller with contingency provision, and hence was more consistent.

Table 4.22: Using Risk Analysis to Determine Contingency Allowance.

Actual vs estimated cost ratio	No of cases	Mean	Standard deviation
a) Including contingency	10	1.0146	0.0312
b) Excluding contingency	40	1.0952	0.1195

Table 4.22 shows that when risk analysis was applied in the determination of project cost contingency, actual cost are higher than estimated cost by an average value of 1.46%. This suggests that the use of risk analysis approach has improved the accuracy of estimating contingency allowance.

4.3 T - test

T - test was used to test the hypothesis formulated so as to clarify whether the means of the percentage difference between actual and estimated cost with and without contingency are significantly different and establish whether to accept or reject the hypothesis. The result is as shown in table 4.23.

Table 4.23: *T* - test Result for Percentage Difference Between Actual and Estimated Cost with and without Contingency.

Differences.							
		standard					
mean	SD.	Error mean	lower	upper	df	t	sig
3.007	3.2915	0.5204	1.9543	4.0597	39	5.778	0.00

A two tail t – test was used to determine whether the means of the percentage difference between actual and estimated cost with and without contingency are the same or different. The result of the t – test is presented in table 4.23. It shows that the resultant *t* – value is 5.778 with 39 degree of freedom. This is larger than the critical value for t (2.02) at the 5% significance level (P = 0.00). Thus, the null hypothesis that, the means of the two groups are equal is rejected. It is therefore concluded that, there is significant difference between the means of the two groups.

Chapter Five

CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusions drawn from the study and the recommendations given as possible ways of solving the problems identified.

5.1 Conclusion

The following are the conclusion drawn from the study.

(i) It has been found that, although the inclusion of contingency allowance reduces the incidence of project cost overrun, 55% of the projects considered have actual cost exceeding estimated cost.

(ii) The study also shows that, project cost exceeds their initial estimate by an average of 5.07% where contingency is applied and by an average of 9.52% where no contingency is applied. This means, greater accuracy is obtained where contingency is applied.

(iii) The study established that, when risk analysis was applied in the determination of project cost contingency, actual costs are higher than estimated costs by an average value of 1.46% as against 5.07% when non risk analysis was used. This suggests that, the use of risk analysis approach has improved the accuracy of estimating contingency allowance.

(iv) Majority of practitioners (61%) use a percentage addition approach for estimating project cost contingency. This means that there is a lack of application of risk analysis in its determination. Thus in many situations, the

contingency fund which is intended to address project cost risk is not well considered.

(v) The research also found that 30% of the organizations studied lack formal policy for the determination and management of project cost contingency. Also 37% of the respondents do not review the accuracy of contingency allowance at the completion of projects. It is very clear that, without a review, it is difficult for an organization to know the area that needs improvement.

(vi) The major areas of application of contingency fund were found to be in variation (82%), change of client's requirement (49%), fluctuation (31%), unforeseen work (34%) and in under estimation of provisional quantities (27%). On the other hand, there is strong consensus that, contingency should not cater for scope changes but can cater for scope development (57%). Forty six percent (46%) of respondents have the opinion that, contingency should not cater for estimating errors due to negligence of the estimator.

(vii) Finally, the study also found that, the major problem encountered in the management of contingency fund is that, the fund more often is inadequate to cater for all the risks and uncertainties associated with projects.

5.2 Recommendations.

(i) To improve the accuracy of the cost contingency allowance, a quantitative risk analysis technique should be applied in its estimation. This is because, cost contingency is a sum allowed to address project cost risk, hence a non-risk perspective in its estimation may result in an inadequate contingency reserve.

(ii) To improve project cost contingency management, organizations should establish a guideline to define and control the scope, estimation and management of contingency fund.

(iii) For good management practice, contingency fund should be constantly monitored, controlled and reassessed throughout the project life cycle. Furthermore, at project completion, the accuracy of contingency calculation should be reviewed, to establish whether there is need for improvement.

(iv) To improve the effectiveness of the contingency allowance, organizations should keep historical data of completed projects for better estimates of uncertainties. This information should be organized in a computerized system for easy accessibility.

(v) The Architects should ensure that the design decision and other bid documents are complete and adequate as much as practicable. This will minimize the extent of variation orders issued by the architect during the progress of work, and that any additional work should be due to unforeseen circumstances only.

(vi)To employ risk analysis techniques in the calculation of cost contingency, project team should utilize project workshop to identify risks associated with a project and to evaluate the likelihood of their occurrence.

Reference.

AACE (American Association of Cost Engineers) (1992). Skills and Knowledge of Cost Engineering. AACE, Morgantown, W. Virginia

Akintoye, A. (1998) Analysis of Factors Influencing Project Cost Estimating Practice. *Construction Management and Economics, 18, 77-89.*

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

Baccarini, D. (2005, Understanding Project Cost Contingency; A Survey. *Conference Proceedings of the Queensland University of Technology 4-8 July.*

Carr, R.I (1989) Cost Estimating Principles. *Journal of Construction Engineering and Management. 115 (4), 545 – 551)*

C.I.O.B (Chartered Institute of Building) (1997), Code of Estimating Practice, 5th Edition. *The Charted Institute of Building, Ascot,UK* .

C.I.R.I.A (Construction Industry Research and Information Association) (1996). Control of Risk: *A Guide to the Systematic Management of Risk from construction,* C.I.R.I.A, London.

Construction Taskforce (1998). "Rethinking Construction" *(The Egan Report) Department of the Environment, transport* and the Regions. U.K

Diekmann, J.E., Sewester, E.E., and Taher K. (1988). Risk Management in Capital Projects. *Construction Industry Institute*, *Source Document 41.* Austin Texas

.

Enshassi, A., Mohammed, S. and Madi, I. (2005), Factors Affecting Accuracy of cost Estimation of Building Contracts in the Gaza strip. *Journal of Financial Management of Property and Construction* 10, 115 – 124.

Fellows,R. Langford. D., Newcombe, R. and Urry, S. (2002). *Construction Management in Practice*. Blackwell Science Limited, London. PP. 230 – 287.

Flyvbjerg, B., Holm, S.M. and Buhl, S., (2002), Underestimating 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. *Construction Engineering and Management.* 128, 30 – 39.

Fryer, B. (2004). *The Practice of Construction Management*. Blackwell Publishing Limited, Oxford. PP 196 – 206.

Hillson, D. (1999) Developing Effective Risk Responses. *PMI Annual Seminars and Symposium,* Philadelphia, 10 – 16th October.

Hogg, K. (2003). The Role of Quantity Surveying Profession in Accommodating Client Risk. *Journal of Financial Management of Property and Construction*. 8, 49 -56.

JCT (1980), Standard *form of Building Contract with Quantities*. RIBA Publication Limited

Mak, S. and Picken, D. (2000). Using Risk Analysis to Determine Construction Project Contingencies. *Journal of Construction Engineering and Management,* 126, (2), 130 -136

Mochtar, K., and Arditi, D. (2001) Pricing Strategy in the U.S Construction Industry. *Construction Management and Economics, 19, 405 -415.*

Murdoch, J. and Hughes W. (2002), *Construction Contracts, Law and Management., 3rd Edition,* Spon Press, New York. PP 82 - 107

Okafor, O .P. (2003). Cost Estimating and Control of Industrial Engineering Project. *The Quantity Surveyor.* 43 (2), PP. 8 -13.

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.

PMI (Project Management Institute) (2004). *A Guide to the Project Management Body of knowledge* 3rd Edition, PMI, Newtown square.

Querns, W.R. (1989). What is Contingency, Any way? *AACE Transactions*, San Diego.

Ramus, J. and Birchall, S. (1996). *Contract Practice for Surveyors.* Laxton's, Oxford.

Ruskin, A.M. (1981). Monitoring and Contingency allowances: Complimentary aspect of project control. *Project Management Quarterly, 12 (4), 49 -50.*

Samid, G. (1994). Contingency Revisited. *Cost Engineering. 36 (2), 23 -26.*

Seeley, I.H. (1984). *Quantity Surveying Practice*. Macmillan Press Limited. London.

Shash,A.A and Al-Khaldi (1992).The Production of Accurate Construction Cost Estimates in Saudi Arabia, *Cost Engineering, 34 (8), 15 -24*

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

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

The Royal institute of Chartered Surveyors (1979), *Standard Method of Measurement of Building Works,* sixth edition RICS, London.

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

Appendix I

Comparison of Estimated Projects' Cost (with Contingency) and Final Projects' cost

S/N	Estimated Cost (with Contingency) ₦	Actual Cost ₦	Net Difference ₦	Difference (%)	Cost Ratio
1.	24,110, 264.00	23,127,878.00	(982,326.00)	(4.07)	0.9593
2.	99,721,864.00	107,441,886.00	7,720,022.00	7.74	1.0774
3.	137,684,4994.00	142,844,865.00	5,160,366.00	3.75	1.0375
4.	43, 360, 460.00	46, 105, 141.00	2,744,681.00	6.33	1.0633
5.	27, 461, 148.00	27, 862, 420.00	401, 272.00	1.46	1.0146
6.	16, 960,350.00	16, 422, 415.00	(537, 35.00)	(3.17)	0.9683
7.	116, 920, 415.00	115,812,920.00	(1,107,495.00)	(0.95)	0.9905
8.	6, 911, 000.00	7, 462, 880.00	551, 880.00	(7.99)	1.0799
9.	7, 256, 493.00	7, 191, 493.00	(65, 000.00)	(0.90)	0.9910
10	12, 256, 493.00	12, 001, 437.00	(254, 42.00)	(2.08)	0.9792
11.	7, 963, 434.00	7, 733, 434.00	(230, 00.00)	(2.89)	0.9711
12.	14, 700, 502.00	15, 699, 222.00	998, 720.00	6.79	1.0679
13.	28, 538, 853.00	28, 538, 853.00	00.00	0.00	1.0000
14.	181, 000, 000.00	181,441,378.00	441, 378.00	0.24	1.0024
15.	71, 335, 277.00	75, 091, 066.00	3,755,789.00	5.26	1.0526
16.	10, 591, 546.00	10, 591, 546.00	00.00	0.00	1.0000
17.	24, 750, 000.00	24, 550, 000.00	(200, 000.00)	(0.81)	0.9919
18.	13, 140, 000.00	12, 940, 000.00	(200, 000.00)	(1.52)	0.9848
19.	25, 440, 000.00	25, 050, 000.00	(390, 000.00)	(1.53)	0.9847

Appendix I (Continued)

20.	11, 580, 000.00	16,257,890.00	4, 677, 890.00	40.40	1.4040
21.	17, 336, 393.00	17,305,500.00	(30, 893.00)	(0.18)	0.9982
22	30, 397, 500.00	29,698,450.00	(699, 050.00)	(2.30)	0.9770
23.	9, 188, 025.00	9, 072, 050.00	(115, 975.00)	(1.26)	0.9874
24.	93, 105, 788.00	101,695,915.00	8,590, 127.00	9.23	1.0923
25.	17, 973, 127.00	17,453,347, 00.	(519, 780.00)	(2.890	0.9711
26.	6, 600,000.00	7, 855, 000.00	1,255,000.00	19.02	1.1902
27.	187, 190, 513.00	217,781,825.00	30, 591, 312.00	20.19	1.1634
28.	5, 898, 945.00	8, 966, 249.00	3, 067, 304.00	52.00	1.5200
29.	3, 141, 915.00	3, 018, 705.00	(123, 210.00)	(3.92)	0.9608
30.	2, 995, 048.00	2,934, 609.00	(60, 439.00)	(2.02)	0.9798
31.	122, 500, 000.00	126,000,000.00	3, 500, 000.00	2.86	1.0286
32.	3, 000, 000.00	3, 150,000.00	150, 000.00	5.000	1.0500
33.	124, 425, 000.00	134,665,178.00	10, 240, 178.00	8.251	1.0823
34.	6, 900, 000.00	7, 051, 800.00	151, 800.00	2.20	1.0220
35.	13, 229, 750.00	13, 007, 550.00	222, 200.00	1.68	1.0168
36.	4, 345, 923.00	4, 345, 923.00	00.00	0.00	1.0000
37.	17, 877, 155.00	17, 497, 000.00	380, 155.00	2.13	1.0213
38.	7, 956, 387.00	7, 863, 478.00	92, 909.00	1.17	1.0117
39.	108, 714, 300.00	126,313,450.00	17, 599, 150.00	16.19	1.1619
40.	10,512, 125.00	12, 316, 120.00	1, 803, 995.00	17.16	1.1716

Appendix II
Comparison of Estimated Projects' Cost (without Contingency) and Final Projects' cost

S/N	Estimated Cost (without Contingency) ₦	Actual Cost ₦	Net Difference ₦	Difference %	Cost Ratio
1.	23, 005, 948.00	23, 127, 878.00	121, 930.00	0.53	1.0053
2.	95, 221, 864.00	107,441,886.00	12, 220, 022.00	12.83	1.1283
3.	133, 284, 499.00	142, 44,865.00	9, 560, 366.00	7.17	1.0717
4.	40, 860, 460.00	46, 105, 141.00	5, 244, 681.00	12.84	1.1284
5.	26, 461, 148.00	27, 862, 420.00	1,401, 272.00	5.23	1.0523
6.	15, 460, 350.00	16, 422, 415.00	962, 065.00	6.22	1.0622
7.	114, 920, 415.00	115,812,920.00	892, 505.00	0.78	1.0078
8.	6, 581, 905.00	7, 462, 880.00	880, 975.00	13.38	1.1338
9.	6, 916, 493.00	7, 191, 493.00	275, 000.00	3.98	1.0398
10.	12, 006, 379.00	12, 001, 437.00	(4, 942.00)	(0.04)	0.9996
11.	7, 354, 233.00	7, 733, 434.00	379, 201.00	5.16	1.0516
12.	13, 700, 503.00	15, 699, 222.00	1, 998, 719.00	14.59	1.1459
13.	26, 538, 852.00	28, 538, 853.00	2, 000,000.00	9.76	1.0754
14.	176, 000, 000.00	181,441,378.00	5,441, 378.00	3.09	1.0309
15.	70, 335, 276.00	75, 091, 066.00	4, 755, 790.00	6.76	1.0676
16.	10, 091, 546.00	10, 591, 546.00	500, 000.00	4.95	1.0495
17.	24, 250, 000.00	24, 550, 000.00	300, 000.00	1.24	1.0124
18.	12, 890, 000.00	12, 940, 000.00	50, 000.00	0.39	1.0039
19.	24, 940, 000.00	25, 050,000.00	110, 000.00	0.44	1.0044

Appendix II (Continued)

20.	10, 780, 000.00	16,257,890.00	5,477, 890.00	50.82	1.5082
21.	16, 510, 850.00	17,305,500.00	794, 650.00	4.81	1.0481
22.	28, 950, 000.00	29,698,450.00	748, 450.00	2.59	1.0259
23.	8, 750, 500.00	9, 072, 050.00	321, 550.00	3.67	1.0367
24.	86, 605, 788.00	101,695,915.00	15, 090, 127.00	17.42	1.1742
25.	17, 873, 127.00	17, 453, 347.00	(419, 780.00)	(2.35)	0.9765
26.	6, 200, 000.00	7, 855, 000.00	1, 655,000.00	26.69	1.2669
27.	182, 842, 302.00	217,781,825.00	34, 939,523.00	19.11	1.1911
28.	5, 798, 945.00	8, 966, 249.00	3, 167, 304.00	54.62	1.5462
29.	2, 868, 705.00	3, 018, 705. 00	150, 00.00	5.23	1.0523
30.	2,734, 609.00	2, 934, 609.00	200, 000.00	7.31	1.0731
31.	115,000,000.00	126,000,000.00	11, 000,000.00	9.57	1.0957
32.	2, 950, 000.00	3, 150, 000.00	200,000.00	6.78	1.0678
33.	123, 425, 000.00	134,665,178.00	11, 240, 178.00	9.11	1.0911
34.	6,571, 429.00	7, 051, 800.00	480, 371.00	7.31	1.0731
35.	12, 729, 750.00	13, 007, 550.00	277, 800.00	2.18	1.0218
36.	4, 145, 923.00	4, 345, 923.00	200, 000.00	4.82	1.0482
37.	17,377, 155.00	17, 497,000.00	119, 845.00	0.69	1.0069
38.	7, 577, 511.00	7, 863, 478.00	285, 967.00	3.77	1.0377
39.	105, 714, 300.00	126,313,450.00	20,599, 150.00	19.49	1.1949
40.	10, 255,732.00	12, 316, 120.00	2, 060, 388.00	20.09	1.2009

Appendix III

SAMPLE OF QUESTIONNAIRE

An Evaluation of Contribution of Cost Contingency Towards Successful Execution Of Building Projects In Nigeria

This questionnaire is part of research work, for a study on cost contingency for building projects, for MSc programme. For this study, cost contingency is defined as "an allowance reserved for unpredictable items of cost not know at the time of the estimate"

The questionnaire is in section A, B, and C Section A seeks general information about respondents. Section B seeks respondents' opinions on the methods of calculation of contingency fund. Section C seeks respondents' opinions regarding to the management of contingency fund.

Your participation in the survey is very important to the success of this research. All information provided will be treated with utmost confidentiality and for the purpose of this research only. No personal information about you or your organization will be disclosed in the final report.

SECTION A
GENERAL INFORMATION

For each of the following questions, you are required to either write the requested information in the space provided or indicate, using a tick ( ), the option that best represent your opinion.

1. What is your highest academic qualification?

HND	B.Sc	M.S.c	P.HD	Others (please state)

2. How many years have you been involved in the construction sector?

Less than 5 years	6-10 years	11-15 years	16-20 years	21-25 years	More than 25 years

3. What is your rank/position in your organization?

Senior management level	Middle management level	Low management level

4. Type of your organization in the construction industry

Public sector	Private sector

5. Size of your organization, in terms of work force and annual turnover, relative to others in the same sector.

Very large	Large	Medium	Small	Very small

SECTION B
METHODS OF CALCULATION OF CONTINGENCY FUND

The following are method of calculation of contingency fund. For each question, you are required to either tick the option that best represent your opinion or write the requested information in the space provided.

1. Is contingency typically calculated on percentage basis in your organization?

Yes	No	Don't know

2. With reference to five most recently completed project within your organization, indicate the frequency of use of the following methods of calculation contingency fund.

Methods of Contingency Allowance	No of projects
Advice from the Architect	
Addition of standard percentage	
Addition of sum reflecting intuitive perception of risk	
Addition of sum based upon formal risk analysis	

3. If the method of contingency calculation based on standard percentage is used, indicate the percentage allowance.

0-5%	6-10%	11-15%	16-20%	More than 20%

4. With reference to the projects in 2 above indicate the accuracy/adequacy of the following methods of contingency allowance in providing your client with protection against cost risk.

Method of contingency allowance	No. of project	
Advice from the Architect	Adequate	Not adequate
Addition of standard percentage		
Addition of sum reflecting intuitive perception of risk		
Addition of sum based upon formal risk analysis.		

5. Indicate the frequency of use of the following risk analysis/techniques in your organization. Using a scale of 1-5, where 1 represent never, and 5 very high.

a) Internal workshop to identify and evaluate project risk.

b) Project workshop to identify and evaluate project risk.

c) Qualitative assessment of risk via probability impact score.

d) Sensitivity analysis

SECTION C
METHODS OF COST CONTINGENCY MANAGEMENT

The following are methods of management of contingency fund. Fo each question, you are required to either tick the option that best represent your opinion or write the requested information in the space provided.

1. Indicate your preference on the objectives you seek to achieve with contingency fund. Using a scale of 1 – 5, where 1 represents "not important" and 5 represents "very important".

a) Resolve emergency (by providing funds for future unforeseen expenses)

b) Control the schedule (assure completion by the project deadline)

c) Improve facility (add value to the constructed facility)

2. With reference to five most recently completed projects within your organization, indicate the frequency of use the following cost contingency management strategy;

a) Aggressive strategy (reallocate fund quickly at the early stage of project)

b) Passive strategy (reallocate fund slowly, i.e. using contingency only to meet critical objectives)

Strategy	No of project
Aggressive strategy	
Passive strategy	

3. With reference to five most recently completed projects within your organization, indicate the adequacy of each strategy in achieving your set objectives.

Strategy	No. of project	
	Adequate	Not adequate
Active strategy		
Passive strategy		

4. Does your organization have formal policy for the project cost contingency?

(i.e guideline for estimation and management of contingency)

Yes	No	Don't know

5. Is project cost contingency formally managed throughout the project e.g. formally reported?

Yes	No	Don't know

6. Who has the authority of issuing instructions with regard to the expenditure of contingency fund in a building project?

Architecture	Quantity Surveyor	Project manager	Client	Engineer

7. What is the procedure for the expenditure of the fund?

a) By claim of the contractor to the Architect/ project manager

b) By instruction of the project manager to Quantity Surveyor

(i.e to quantify variation/claim of contractor)

c) Both

d) Others (please state) _____

8. Did you have excess contingency in any of the recently completed projects within your organization?

Yes	No	Don't know

9. If yes, state the type of client in that/those projects (s)

Public	Private	Both public and private

10. At project completion, is nay review undertaken of the accuracy of project cost contingency

Yes	No	Don't know

11. What were major areas of application of contingency fund in the recently completed projects within your organization? (e.g. in Variation, fluctuation etc).

a. _____ b. _____

c. _____ d. _____

e. _____ f. _____

12. List any items that contingency should not be used to fund.

a. b.

c. _____ d. _____

e. _____ f. _____

13. What were the main problems you encountered in managing contingency fund?

_____

_____

_____

_____

14. Any remarks of comments: _____

_____

_____

Date: _____

Appendix IV

CHECKLIST (PROJECT INFORMATION DATA)

Project S/No.	Contract Type	Project Type	Type of Client	Estimated cost of the project (without contingency)

Appendix IV (continued)

Contingency sum Allowed	Total estimated cost (contingency) inclusive	Actual project cost	Area of Contingency application