Appraisal of the Performance of Contingency Cost Provision for Building Projects in Nigeria

Musa, M. M.[1]; Zubairu I. K.[2] and Bala K.[3].
[1]Quantity Surveying Programme, Abubakar Tafawa Balewa University, ATBU, Bauchi.
[2, 3]Department of Building, Ahmadu Bello University, ABU, Zaria.

Abstract

The paper appraised performance of contingency allowance in addressing projects' cost risk. To achieve this aim, impact of contingency provision in some selected building projects were evaluated. Data for the study was collected by means of checklist from 40 completed projects' files. Furthermore, 100 questionnaires on project cost contingency were randomly distributed to quantity Surveyors out of whom 67 completed responses were returned. The results showed that there is significant difference between projects with and without contingency with respect to the accuracy of cost estimates. The study revealed that although the inclusion of contingency allowance reduces the incidence of project cost overrun, majority of the projects under study (55%) had cost overrun. It was also found that the projects exceeded their initial estimate by an average value of 5.07% where contingency was included and by an average value of 9.52% where contingency was not included. The study showed 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, application of quantitative risks analysis in its determination has been recommended.

Keywords: Contingency, Risks, performance, Building.

Introduction

There is no doubt that construction by its nature involves certain unavoidable risks that threaten achieving set objectives. To address this problem, contingency funds are included in projects base estimate. A contingency fund is an amount of money used to manage risks and uncertainties associated with a construction project. The fund is often either underestimated or overestimated.

Risks have long been recognized in construction projects. 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, 2002). 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) postulated that project budgets some 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 projects to deviate from plans. Similarly Hogg (2003) observed 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. Therefore, contingency funds are included in development budgets to address uncertainties and deviation that threaten achievement of set objectives.

Contingency is calculated in various ways, depending on the organization and level of project sophistication. Some of the methods used, according to Hogg (2003), are;

i) Advice from the Architect
ii) Addition of standard percentage of estimated cost, based on previous experience with similar projects
iii) Addition of a sum reflecting intuitive perception of risk
iv) Addition of a sum based on formal risk analysis

The most common and simple method of contingency calculation according to Touran (2003) is to consider a percent of estimated cost based on previous experience with similar projects.

Patrascu (1988) observed that contingency, which could mean different things to different people, is probably the most misunderstood, misinterpreted and misapplied word in project execution. Mak and Picken (2002) defined contingency as an amount of money used to provide for uncertainties associated with a construction project. Seeley (1984) stated that contingency sum is included in a contract to cover the cost of work or expenses not contemplated or implied in the contract sum. Contingency has also been defined as an amount of money added to the estimate to allow for changes that experience shows will likely be required (AACE 1992).

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, that is what is expected is materially different from what was previously reasonably expected (Baccarini 2005, AACE 1992, Querns 1989). 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) suggests that contingency should not cater for human errors in estimating, due to negligence, unjustified conclusions from data or miscalculations. Baccarini (2005) stated that many organizations do not have a policy or guidelines for the estimation and management of project cost contingency.

The aim of this paper was to appraise the performance of cost contingency in addressing project cost risk. The performance of cost contingency here refers to how well the provision of contingency allowance addresses project cost risks and uncertainties. The aim of this study was achieved through the following objectives:

i) Identification of the methods used in contingency allowance assessment selected by organisations.
ii) Determination of initial and final provision of contingency in selected building projects.
iii) Evaluation of the impact of cost contingency in accommodating project cost risk.

Materials and Method

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 a project. Hence the relative percentage variance between estimated project cost and actual project cost is expected to be less when contingency is included in the base estimate than when it is not.

To realize the aim of this study, two Hypotheses were developed concerning how contingency allowance improves the accuracy of construction cost estimates.

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. $\mu 1 \neq \mu 2$.

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.

Data collection was carried out by means of questionnaire and checklist. A questionnaire survey was undertaken to determine the opinion of clients' quantity surveyors regarding methods used in calculating contingency fund in their organizations. The questionnaires were sent randomly to 100 quantity surveyors working in public and private organizations in Kaduna, Kano and Abuja. Respondents were required to either write the requested information in the space provided or thick the option that best represented their opinion. A total of 67 completed questionnaires were returned in a usable format, representing a 67% response rate. A checklist was also prepared and completed through personal study of completed projects' files from ten public and private organizations. The research population included building projects executed by public sector clients. The project types were institutional buildings and only projects based on traditional procurement system which were executed between 2000 and 2007 had been considered for the study. The original contract sums ranged from ₦3.00 Million to ₦187.19 Million. The parameters of interest were:-

i Estimated project cost
ii Actual project cost.
iii Contingency allowance.

The data obtained from the questionnaire survey and checklist were analysed with the aid of simple statistical tools that included simple percentages, means, and standard deviation. T-test was also used to test the hypothesis formulated.

Results and Discussion

This section analyses and discusses the results obtained from the questionnaire survey as presented in Tables 1 to 5.

Table 1: Use of Percentage Method in Estimating Contingency Sums

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

When the respondents were asked whether contingency sum is typically calculated on percentage basis in their organization. Table1 indicate the results. It can be seen that the percentage approach is used by 61% of the respondents. This is of concern because the method has several weaknesses. For instance the percentage figure is most likely arbitrarily arrived at and not appropriate for the specific project as pointed out by Thompson and Perry (1992).

Table 2: Distributions of Methods of Assessment for Contingency Allowance.

Methods of Contingency Allowance	Frequency	Percentage
a) Advice from the Architect	2	3
b) Addition of standard percentage	41	61
c) Addition of sum reflecting intuitive Perception of risk	21	31
d) Addition of sum based upon formal risk analysis	3	5
Total	67	100

When the respondents were asked to indicate the methods used for determining contingency allowance. The results of the analysis in Table 2 reveal that the percentage method is the most frequently adopted method of contingency allowance (61%) followed by addition of sum reflecting intuitive perception of risk (31%). Seeking advice from the Architect and the use of risk analysis in calculating contingency allowance is very rare, representing only 3% and 5% respectively.

Table 3: Percentage Allowed in Contingency Estimation

Percentage	AllowanceNumber	Percentage
0 – 5 %	23	56
6 – 10 %	16	39
11 – 15 %	2	5
16 – 20 %	0	0
More than 20 %	0	0
Total	41	100

The results in Table 3 indicate that a high percentage (56%) of those respondents who calculate contingency based on standard percentage allow between 0 –5% of the estimated cost, while 39% of the respondents allow 6 – 10%, and only 5% of the respondents allow 11 – 15%. However, none of the respondents indicated that they allow anything over 15% of the base Estimate.

Table :4 Adequacy of the Methods of Contingency Allowance

Method of Contingency Allowance	**Mean**	**Rank**
a) Addition of sum based upon formal Risk analysis	4.50	1
b) Addition of sum reflecting intuitive Perception of risk	3.15	2
c) Addition of standard percent	2.40	3
d) Advice from the Architect	1.65	4

When the respondents were asked to rate the adequacy of the various methods of contingency allowance in accommodating projects cost risk on a five point Likert scale ranging from 1– 5,

where 1 represents not adequate and 5 represents highly adequate. Table 1 presents the results.

The results show that addition of sum based upon formal risk analysis was rated high by the respondents, this implies that, the method is regarded as very much adequate in accommodating projects cost risk, it is followed by addition of sum reflecting intuitive perception of risk while advice from the Architect alone was rarely relied upon in determining the provision of contingency fund as it was rated least.

Table 5: Use of Risk Analysis Tools and Techniques.

Variables N =67	Mean score	S.D	Rank
Internal Workshop	2.45	1.31	1
Project team workshop	2.19	0.99	2
Qualitative assessment of risk	1.54	0.86	3
Sensitivity analysis	1.28	0.62	4

When the respondents were asked to rate the frequency of use of the listed risk analysis techniques in their organizations on a five point Likert scale ranging from 1– 5, where 1 represents 'Never' and 5 'Very Frequent', it is apparent from the results as presented in Table 5 that the level of use of risk analysis tools and techniques within the respondents' organizations is low; more particularly the use of sophisticated techniques and approach to risk analysis in assessing contingency fund.

Presentation and Analysis of Historical Data.

This section presents and interprets the analyses of the data obtained from 40 completed projects' files.

Table 6: Contingency Performance by Project Value

Categories of projects by value (in million naira)										
% variation	<₦20		₦20 - ₦50		₦50 - ₦100		>₦100		Total	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
(<5)	10	43.7	4	57.1	-	-	1	14.3	15	37..5
0	2	8.7	1	14.3	-	-	-	-	3	7..5
<5	4	17.4	1	14.3	-	-	3	42.8	8	20.0
5-10	3	13.0	1	14.3	3	100	1	14.3	8	20.0
11-20	2	8.7	-	-	-	-	2	28.6	4	10.0
>20	2	8.7	-	-	-	-	-	-	2	5.0
Total	23	100	7	100	3	100	7	100	40	100

Note: 1- Column 1 shows categories of the % change between estimated projects cost (including contingency) and final cost.

2- Category shown in parenthesis reflects final costs that were less than estimated cost.

3- No. = Number of projects.

Table 6 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 ranged (<N20,000,000) . 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 total projects. It was also found that, 65% of the projects considered have their estimated cost within the limit of ± 5% of the actual cost.

Table 7: 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 in No. of Projects
(<5%)	2	15	13
0	0	3	3
<5%	15	8	-7
5 – 10%	12	8	-4
11 -20%	7	4	-3
>20%	4	2	-2
Total	40	40	0

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

Table 8: Ratio Between Actual Cost and Estimated Cost

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

Table 7 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 overrun in16 projects, out of forty projects considered. Table 8 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 actual projects' cost exceed initial estimate by an average value 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 8 also shows that, the standard deviations was smaller with contingency, and hence was more consistent.

Test of Hypothesis

T - test was used to measure the variability of the two sets of mean of the percentage difference between actual and estimated cost with and without contingency and establish whether to accept or reject the hypothesis. The result is as shown in Table 9.

Table 9: *T* - test Result for percentage difference between actual and estimated cost

with and without contingency.

Differences.							
			95% confidence interval of the difference				
mean	SD.	standard 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 9. It shows that the resultant *t* – value is 5.778 with 39 degrees 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. This implies that there is significant difference between projects with and without contingency with respect to the accuracy of cost estimates.

Conclusion

Accurate cost estimates is an important ingredient for successful project delivery. A key component of a project estimate is cost contingency, which is allowed to address risks and uncertainties associated with a construction project.

The results of this study show that there is significant difference between projects with and without contingency with respect to the accuracy of cost estimates. The results also reveal that although the inclusion of contingency allowance often reduces the incidence of project cost overrun, majority of the projects considered (55%) had cost overrun.

Furthermore, it was found that project cost exceeds their initial 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. This means there is a need for contingency allowance to ensure accurate project cost estimates.

It has been observed that majority of practitioners, 61% of the respondents, use a percentage approach for estimating project cost contingency and that, there is a lack of application of risk analysis in determination of contingency allowance.

The study identified methods used in the determination of cost contingency allowance as an area that needs improvement. Thus, it is essential that estimators use a quantitative risk analysis technique in their estimation.

Limitations of the Study/ Suggestion for Further Study

The study did not fully examine the reason for the inadequate contingency provision, which was however traceable to non-application of the appropriate method for calculation of contingency cost provision in construction projects.

Suggestion for further study

Area of further study is suggested to determine the effect of application of risk analysis in the calculation of contingency allowance. This would enable a comparison of the variability and consistency of contingency estimates, between risk analysis and non-risk analyses.

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