Project Cost Contingency in the Nigerian Construction Industry

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Abstract—The object of this study was to identify the various methods of carrying out project cost contingency, the use of contingency as well as the percentage most appropriate for allocation to cost contingency in construction projects which have created obvious problems of project overruns and subsequent abandonment. The study sampled the opinion of fifty-three selected project professionals from the built environment who had worked on related construction outfits in Owerri, Imo State. The study adopted the survey and non-probability convenience sampling methods. Questionnaires as well as interviews with some of the professionals in the industry were deployed to elicit opinions on the research questions posed at the beginning of the study. A total of Sixty (60) questionnaires were distributed to the respondents via emails and personal contacts with the respondents (professionals) and at the end a total of fifty seven (57) were retrieved, while fifty three (53) were found to be usable for the analysis. Results from the survey were analyzed using descriptive statistics, charts, relative importance index and mean score with the aid of SPSS and Microsoft Excel respectively. The findings from the study indicate that the respondents carry out their project contingency estimates for construction projects using the traditional percentage and estimate quality methods which are usually arrived at on the basis of an arbitrary method of calculation. The study further found out that most of the professionals see contingency allowance as a means of providing for risk and uncertainty in their construction projects and finally, they also allot less than ten percent (10%) of the total cost of construction projects to cost contingency during their estimating activities.

Keywords— Project cost contingency, PERT, artificial neural networks, relative importance index, mean score value.

I. INTRODUCTION

The performance of construction projects via the cost, is a key success factor for project funding. Projects, the world over requires budget to set the client’s financial commitment and create an avenue for the control of cost and measurement of cost performance during the design process as well as during construction (Baccarini, 2005).

The completion of construction projects within the initial estimate have been challenging for the construction industry. It should be noted that achieving the objectives of a construction project is very crucial to the parties involved, mostly the client. Construction work plans and budget estimates are usually prepared with a view to achieving the desired quality within scheduled completion time and cost (budget) efficiency.

According to Baccarini (2005), another important component of a project budget is called cost contingency. Project cost contingency according to Baccarini, (2005) has been part and parcel of project management from time immemorial. Baccarini, (2005) further opined that in as much as the ubiquity associated with project cost contingency in the project management parlance, there has been the dearth if not possible, low research findings towards the understanding of the concept of contingency by practitioners in achieving cost estimating objectives.

According to Hart, (2007), contingency is a preconceived sum of money or percentage of contract sum withheld for purposes of unforeseen challenges in a project. Musa, et al. (2011) defined contingency, as part of funds or amount of money that is used to manage risks and uncertainties associated with a construction project. Contingency as stated by Patrascu (1988) is the most misunderstood, misinterpreted and misapplied concept used in construction project execution. It can and usually means different things to different people. This is the reason why contingency needs to be investigated to see how it can help solve the problems associated with project cost estimation.

Cioffi and Khamooshi (2007) opined that contingency allocation process is subjective in nature, judgmental and arbitrary. They further stated that contingency being expressed as a percentage of total cost of project is usually insufficient except it is being
linked with some elements of probability whereby the level of cost overrun will not exceed the allotted contingency allowance. The approach of adding a percentage of project cost as contingency have been adduced to be unscientific and inadequate (Buertey et al., 2012). The lack of a consistent and reliable method of determining cost contingency devoid of the application of stochastic approach often leads to cost and schedule overruns, which often leads to delay in construction projects. The use of project cost contingency in construction projects gives a clear and vivid acknowledgement of impending perennial problems of cost overruns in the delivery of construction projects.

The incidence of cost overrun in construction projects and in the construction industry is a common phenomenon the world over. Such incidences of overruns are usually a source of conflict between clients, consultants and contractors on the issue of price or budget variation in the built environment. In as much as the root cause of project cost overrun is well known, the way and manner used in handling its assessment with regards to contingency allowance on projects is at best described as insufficient. Project cost overruns can be seen to be the symptoms of inadequate planning and budgeting of projects that in turn is a consequence of accuracy of costing data employed for estimating project budgets. In a bid to understand the nature and factors that precipitate cost overruns, efforts should be tailored towards establishing more accurate project costs contingency in appreciation of the relationship between project budget estimates and final budget for completed projects, this would provide insights on the general profile of budget contingency to adopted for different types of projects. Aibinu and Jagboro (2002) opined that when projects are delayed, they are either expedited or have their duration extended beyond the scheduled completion date and that these extension are not without some cost implications. A better way of handling the issue of extra cost is to include a percentage of the project cost as contingency in the pre-contract budget. Aibinu and Jagboro (2002) further stated that the conventional approach to the allocation of contingency is usually based on judgmental factors. The uniqueness of construction projects makes the allocation of contingency allowance dependent on assumption and intuition and this seems to be inadequate and unrealistic in most cases. Inadequate contingency gives rise to additional financial commitment, which in most cases are beyond the reach of the client and the client may not be prepared to pay for such extra cost and this leads to seeking of funds the inform of loans to take care of the unexpected cost implications.

Furthermore, an investigation by Aibinu and Jagboro (2002) revealed that in Nigeria between 5–10% of pre-contract estimate is in most cases set aside as contingency and this provision in most cases may or may not be found to be unrealistic and inadequate. Creedy et al. (2010) opined that the level of project risk contingency in estimates has a severe impact on financial outcomes of the client. A situation where contingency sum is too high, it tends to encourage poor cost management, leading to a situation where the project becomes uneconomic and subsequently aborted, or tie up funds that would not be available for other projects to use. On the other hand, if the contingency allocation is too low, it would be too rigid and at the tail end set an unrealistic financial environment thus resulting in unsatisfactory performance outcomes.

In Nigeria, the entire environment is a washed with evidence of failed and abandoned construction projects stemming from cost related issues ranging from poorly articulated cost estimating principles, poor risk management practices which is often hinged on clear cut knowledge of contingency provisions and management. Baccarini and Collins (2003) opined that realistic time and cost estimates should be made available as part of measures for achieving a successful project. Buertey et al., (2012) finally capped it up by saying; project cost contingency is an integral component of project cost estimating which invariably is the keystone of cost engineering and total cost management which is a thorough and integrated platform for risk management and cost estimating and contingency processes.

Attempts have been made by scholars to address issues of project cost contingency as indicated in most literatures. In Nigeria, specifically, little has been done in this area, while in Owerri, Imo State, there hasn’t been any work tailored towards addressing the issue of cost contingency in construction projects. This work is going to address some of the issues raised in the research questions, thereby creating an avenue to address the core issues related to cost contingency in the study area.

In a bid to acquire the necessary information for purposes of achieving the stated objectives of this study, the under listed research questions were sought;

1. What are the methods of project cost contingency in use by professionals in the construction industry?
2. What are the uses of contingency allowance/provision in a construction project of the area of study?
3. What percentage of total project cost is allotted to contingency provision?

The main object of this work is to:
1. To identify and evaluate the various contingency allowance methods most applicable to the construction industry.
2. To identify and evaluate the use of contingency allowance in project cost estimation within the construction industry.
3. To identify the percentage allotted to contingency and the manner in which the allocation is done.

II. RELATED WORK
A. Project Cost Contingency

A contingency, according to Hart, (2007), is a predetermined sum or percentage of a contract set aside for purposes of taking care of unpredictable changes in a project. Hart, (2007), further opined that a contingency functions as a risk management tool that primes the client towards addressing risks inherent in a project. Most contracts make provision for contingencies for paying for unknown situations like price escalation, design changes in scope or as a result of errors and omissions or most appropriately necessary construction changes that are realized on site during construction process. Baccarini, (2004), defined contingency as any amount of money or time (variable resource) added to a base estimate of a construction project to achieve a specified level of confidence and allow for likely changes as per specifications. Furthermore, Baccarini, (2004), citing PMI (2000), defined contingency as the amount of money or time required above an already estimated cost to reduce the risk of cost and schedule overruns to an acceptable level.

The main attributes of the concept of project cost contingency as opined by Baccarini, (2004) are; reserve, risk, risk management, total commitment and project outcomes.

- Reserve-It implies that contingency is a reserved fund.
- Risk-The overall concept of contingency lies around risks in projects. Thus, it covers two categories of risks that is, the known and unknown risks. There are risk events defined within the context of construction projects.
- Risk Management-This is usually attributed to strategies for handling risk events. These strategies include; risk transference, risk reduction, and contingency provisions.
- Total Commitment-It tends to include contingencies within a budget estimate as a means of representing the total financial commitment in a project. It thus, should, avoid the need to appropriate more funds and minimizes the impact of defeating the cost objectives. Baccarini, (2006)

- Project Outcomes/Behaviours-The impact of contingency can be devastating to the client in such a way that a higher contingency provision might lead to a sloppy cost management, thereby leading the project outcome to be uneconomic by tying up funds restricting other activities from using funds, if it is lower, on the other side it may lead to rigidity creating a room for unrealistic and unsatisfactory project outcomes. Baccarini, (2006).

In construction, according to Hobbs, (2010) there exists two main categories of generally accepted contingency reserves that are commonly employed in a construction project. They are; Designer Contingency and Contractor Contingency

Designer Contingency -is usually included in the pre-construction stage and allows for potential cost increases that occur through the detail design phase of a construction project. For instance, such a contingency may be used to account for uncertainties in the design of the mechanical systems for a building. Typically, as the design phase progresses, these unknowns become known and the designer contingency can therefore by systematically ‘absorbed’ into the individual budget line items for the project.

Contractor Contingency-is included in the construction budget to cover unexpected events that may occur during actual construction work, such as weather-related delays and surprises with soil conditions. One of the typical ways to control these risks is to enter into a stipulated-price contract in which the contractor absorbs responsibility for construction risks in return for an expected price premium.

In addition, owners may also elect to include another project contingency to cover uncertainties in project-related “soft costs” such as furniture and equipment, consultant’s fees, permits and other line items outside the construction contract itself. It is expected that clients should endeavour to provide a healthy contingency in their construction projects to address risk related issues. If this is managed properly, it can provide a safeguard for the designer, contractor and client towards meeting the project budget objectives.

Most specifically, project cost contingency serves three core purposes. Hart, (2007);
1. To account for errors and omissions in the construction contract document.
2. To modify or change the scope of the project.
3. To pay for an unknown conditions.

Each project as a matter of concern should include a client’s, contractors and designers contingency. Applying a specific sum to each project could lead to cost overruns, accusations and litigations. As a matter of
fact, it is recommended that client’s develop an internal mechanism to evaluate project cost contingency needs. Hart, (2007). It is also adequately important to set aside an allowance of the right sum, neither too low nor too high. It is also not possible to produce a perfect set of construction documents, leaving room for errors and omissions. It is amazing to find few errors and omissions in any given set of documents. Hart, (2007), further opined that in his observation, most errors and omissions amount to less than 5 percent of a project’s budget. A client’s program of work inevitably changes if only slightly during the construction process and changes or modifies the scope of work in response to internal program changes. The project cost contingency is one sure way to prepare for such changes in scope or errors and omissions. Furthermore, another key aspect that is important to the client’s contingency is to account for risks. Risk is thus created when some aspects of a construction project are known or when certain key project elements are likely to cause concern.

Another aspect of cost contingency for construction project termed construction contingency, according to Baccarini, (2004a) is for changes during the construction process in traditional (design bid build) setting. In this type of arrangement, the client procures professionals to produce design after a competitive selection, a contract is consummated making provisions for a variation clause to allow for changes and the determination of variations as specified in the contract document.

B. Different Forms of Project Cost Contingency

Various forms of project cost contingency exist in the literature as illustrated by various authors. The methods used for contingency estimation are generally divided into Deterministic and Probabilistic classes (Hobbs, 2010), in which deterministic methods - most traditionally employed and involve the assignment of a percentage contingency based upon the estimate of project cost or based upon subcomponents of project cost. The probabilistic methods involves assigning probability distribution functions to project cost components and then, through a summative process, developing a probability distribution function for the overall project cost. According to Hobbs, (2010), it has been a testament to the extent that probabilistic methods have gained entrance into cost engineering practices to the extent that the American Association of Civil Engineers (AACE) has included risk analysis and probabilistic approach to contingency estimating among its recommended practices, but although the methods have been slow in terms of its adoption as a result of its perceived complexity. They include; traditional percentage, range estimating, factor rating, regression, Monte Carlo Simulation, artificial neural network, methods of moment, fuzzy sets, influence diagram, controlled interval memory, analytical hierarchy process, individual risks. (Aibinu and Jagboro, 2002; Orberlander and Trost, 2001; Ahmad, 1992; and Baccarini, 2004, 2005 and 2006). As stated, let us have a look at some of the listed project cost contingency methods.

Traditional Percentage—This method of project cost contingency usually makes use of the application of an across the board addition on a base estimate by mere intuition, previous experience and from historical data. The method is subject to arbitrariness and unjustifiable, lacking scientific backing and sometimes leads to cost overruns in most construction projects. The method can be applied to smaller construction projects.

Regression—This method of cost contingency has been in existence since the 1970s. According to Baccarini, (2004a) and Sonmez, (2004), the regression method uses the principle of parsimony; this implies that the method should be simple but fit for purposes of achieving accurate results. The main aim of this method is to predict the nature and relationship between the independent and dependent variables.

Monte Carlo Simulation—Is a quantitative method of quantifying risk by making provision for a structured way of setting up contingency value in a project cost estimate. The output of this method is in the form of a probability distribution for the total cost of the project. The method, according to Baccarini, (2005), often gives a recommended contingency value of less than 5 percent or even zero for a properly defined project. Although, for a large project, an 80 to 90 percent probability level is chosen for contingency and at the preliminary stage 95 percent may be required.

Artificial Neural Networks—Is a cost contingency method that uses an information processing method to stimulate the brain. It mimics the nervous system by sending signals through a network of elements by means of interconnections and connectivities. The method employs the mechanism of problem-solving capabilities by way of detecting hidden relationships with data thereby providing solutions to problems. The method is specifically suitable for non-linear modeling of data that is in contrast with linear approaches using regression. Its use has grown considerably as it can be used for predicting cost overruns in projects by assisting management in developing a perfect contingency plan. Baccarini, (2006) and Cook, (2006)

Programme Evaluation and Review Technique (PERT): Is a method that calls for some judgment about the probability density function, which describes each cost item as a random variable taking on values between its estimated lowest and highest
costs. It uses formulae similar to PERT according to a 5-95th percentile. Three estimates of cost are needed for each item being considered: lowest cost (optimistic), highest cost (pessimistic) and the most likely cost (modal value). The three estimates of cost can be made based on judgment and experience or based on data collected from previous project. Ssemwogerere, (2011)

Estimate Quality- According to Baccarini, (2006), a qualitative model was developed to predict the amount of cost contingency based on the quality of the project cost estimate and historical cost data. The quality of most estimates is dependent on four critical determinants viz; the person involved in the estimate, the mode of estimate preparation, details of the project, and other factors. The four determinants were decomposed into forty five (45) elements for purposes of measuring the quality of an estimate. The prediction model is usually \( y=mx+b \), where \( y \) represents the percentage contingency and \( x \) the estimate score, \( m \) the slope and \( b \) the intercept. The score then predicts the accuracy of the estimate, the higher the score, the greater the inaccuracy and therefore the need for more contingency for a chosen confidence level.

Methods of Moment- In this method, the cost item in the estimate is usually expressed by a probability distribution indicating the risk in the cost item. The individual cost item distributed has its expected value and variance. The expected values and variances for the cost items are added at the expected value and standard deviation for the overall project cost. The total cost of the project can be assumed to follow a normal distribution based on the central limit theorem, but only if the cost items are independent. Using probability tables for normal distribution, a contingency can be derived from the probability distribution based on a desired confidence level.

Individual Risks- Expected Value- In this method, the amount of contingency reserve can be based on the expected value for the risk events. Expected value is the mean of a probability distribution of a risk. In this method, a risk-free estimate of a known scope is produced and the risk events identified and costed in terms of an average and maximum risk allowance computed into two forms, namely fixed risk and variable risk.

Fixed Risks- Are risk events that will occur in total or not at all for instance, if an additional access road is necessary. If this occurs, the maximum cost will be incurred, if it is not, then no risk will be incurred. Hence, the maximum risk allowance will be the cost if the risk ensues, while the average cost is the product of the maximum cost and probability of occurrence.

Variable Risks- These are risk events that will occur without a defined extent. Its maximum risk of allowance that is assumed to have a 10 percent chance of being exceeded is usually estimated by a project team on the basis for worst case scenario for the risk that may not ensue.

Cost Item Allocation- In this method, a contingency percentage is allocated to each item of cost in the work breakdown structure or several other work packages where the final contingency is estimated as a weighted average with each work package treated separately as a risk centre with different contingency amount allotted. Ssemwogerere (2011).

C. Research Gap Analysis

Although extensive research has been carried out on factors involving project cost estimation and cost contingency issues in construction projects, very little of this research contains information appropriate to the factors within our immediate environment. A cursory look at some previous author’s contributions in this area will help create an enabling environment to treat our case.

Mughari, (2013) developed a mathematical model based on multiple linear regression to be used by contractors as a guideline for estimating cost contingency of building projects in the Gaza Strip during bid submission phase. The study adopted a literature review and semi-structured interview methods to identify 6 main risk factors associated with 74 sub-factors affecting cost contingency estimation using a questionnaire as a research tool to obtain the opinions of 87 contractors on the most important factors affecting cost contingency. Factor analysis technique, regressing analysis and Fully Modified Least Squares (FM-OLS) multiple regression analysis were applied as tools. The results yielded 36 independent variables categorized into 6 main risk factors affecting cost contingency estimation, they include; project characteristics related risks, financial issues related risks, design and supervision related risks, productivity issues related risks, etc.

Bello and Odusami, (2009), carried out a study to assess the influence of project variables in determining the contingency sum applied to the construction cost estimate in Nigeria construction industry. The study identified correlation between contingency and project characteristics and variables. Information on past projects were collected from 21 organisations and included project variables of 99 projects of varying sizes.
and contract types. Correlation analysis was used to establish the strength and direction of linear relationship between the project variables with special attention on variation to determining future contingency. Analysis of variance (ANOVA) was also used for the analyses of data in exploring relationships among variables and compare groups respectively. There was a strong, positive correlation between variation and five of the variables: consultant estimate, contingency sum, planned duration, gross floor area, and lowest bid and also there was a strong positive correlation between contingency and five of the variables with high value of the variables associated with high value of contingency. The result of the ANOVA indicated that there is no statistical significant difference in the contingency applied on project based on nature of project, type of project and type of client. Therefore, contingency by cost expert is not really dependent on these three variables.

Richard, (2008) did a study on identifying existing methods and factors influencing the determination, and monitoring of contingency sum as well as proposing guidelines for determining and monitoring of contingency sum. Random sampling technique (stratified) was used in determining sample size for the selected building professionals, using the Kish formula. About 250 questionnaires were administered to professionals in the building industry. The data collected were analysed using relative important index, while Kendall’s coefficient of concordance was used to measure the degree of agreement among the selected professionals. The study identified the deterministic approach (percentage method) as the most widely used method. Unexpected ground conditions (sub structure works), design consideration and inflation were identified as the most influencing factors.

Musa, et al. (2011) in a study appraised the performance of contingency allowance in addressing projects’ cost risk in Nigeria by evaluating the impact of contingency provision in some selected building projects. The data for the study was collated via checklist from 40 completed projects’ files. Another 100 questionnaires on project cost contingency were randomly distributed to quantity Surveyors. The results showed that there is significant difference between projects with and without contingency with respect to the accuracy of cost estimates. The study further revealed that although the inclusion of contingency allowance reduces the incidence of project cost overrun, majority of the projects under study 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 further showed that there is a lack of application of quantitative risks analysis in the determination of contingency fund.

Baccarini and Love (2013) did a study on analyzing the statistical characteristics of cost contingency and cost growth experienced in 228 Australian water infrastructure projects that were procured by using traditional lump contracts. It was revealed that mean project final costs exceeded the approved budgets that contained contingency. The mean contingency percentage addition was 8.46%, yet the mean contingency required for the final cost was 13.58% for the sampled projects. Thus, the deterministic percentage addition, used by the sponsor to accommodate for cost growth beyond their baseline budget, was found to be inaccurate. To improve the accuracy of a contingency estimate, the empirical distributions of cost contingency and cost performance were examined to determine their best-fit probability distribution. The study further concluded that in determining the best fit probability distribution provides a more robust and defensible basis for selecting a cost contingency than the traditional deterministic percentage approach.

Bello and Odusami, (2013) carried out a study to assess the practice of professionals in the management of contingency and determine the percentage contingency that is predictable on construction projects in Nigeria. A sample selected quantity surveyors in government, institutions and consulting organizations were used for the study. Data from previous projects were collected from 21 organizations and information on 99 projects of varying sizes and contract type. Analysis of variance, correlation and multiple regression were used to compare groups and for exploring relationships among variables in proposing a model. The proposed model using standard multiple regression predicted 10.10% contingency allowance on consultant’s estimate. The study revealed that about 60% of the respondents do not formally manage and report contingency in their organizations alluding to the fact that an intuitive 5% allowance contingency is not only inadequate but also weakens the purpose of the contingency allowance.

Baccarini, (2005) in his study reports the results of a survey of 78 project practitioners’ comprehension of issues pertaining to project cost contingency. Whilst there is consensus that cost contingency is a reserve of money which should be used for scope changes, a key finding is that there is a lack of appreciation that project cost contingency is a risk management notion. Consequently, the majority of practitioners (77%) continue to use a deterministic percentage approach for estimating project cost contingency. Furthermore, 46% of respondents work in organizations that do not have a
policy on contingency and 36% do not manage the use of contingency.

Baccarini, (2004b) in his study on accuracy in estimating project cost construction contingency-a statistical analysis. Cost data for 48 road construction projects completed by an Australian government were statistically analyzed to investigate the accuracy of contingency. The study showed that the average construction contingency was 5.24% of the award contract value, but the average value of contract varied was 9.92%. The organization used a traditional percentage approach for estimating construction contingency. This suggests that the organization has room to improve the accuracy of its construction contingency estimates by seeking alternative estimating methods. An investigation on an alternate estimating approach derived from the analysis of the data found out that there were no significant correlations between project variables and construction contingency that might be used to create a prediction model for construction contingency.

Buertey, et al. (2012) in their paper project cost contingency estimation in Ghana discussed cost contingency estimating processes and proposes a framework on improving upon the practice. The study adopted a mixed approach while distributing 204 questionnaires to construction clients, professionals and experts in the built industry. Findings from the study shows that at least 95% of the engineering design actors primarily used traditional methods. The research revealed that the reasons why these actors predominantly used the deterministic method were the ease of its application, unavailability of any other tested and approved framework and finally because most of the actors lacked the requisite knowledge for applying complex risk analysis processes.

III. RESEARCH METHODOLOGY

The research work was carried out using the survey method. The non-probability convenience sampling method to be specific was utilized. The study was to identify the various methods of carrying out project cost contingency, the use of contingency and percentage most appropriate for allocation to cost contingency in construction projects in Owerri, by professionals in the built industry. Previous researches on the topic were thoroughly and adequately consulted from the literature for a better understanding of the topic. Questionnaire distribution as well as interviews with some of the professionals in the industry was deployed to elicit opinions on the objectives of the study. All the professionals that were administered the questionnaires were from the construction industry in Owerri, Imo State, Nigeria, they include; Architects, Builders, Quantity Surveyors, Engineers, Project Managers, public agencies, private property developers, project consultants and main contractors whom have gained ample experience on project cost contingency related issues. Sixty (60) questionnaires were distributed via emails and personal contacts to the respondents (professionals) and a total number of fifty seven (57) were retrieved, while fifty three (53) were found to be useable for the analysis. The professional background of the respondents was of importance as this was used to determine their level of experience in project cost contingency issues. The Likert four point scale, was used in eliciting response from the professionals in the scale of 1 to 4 (1=not frequently used, 2=less frequently used, 3=frequently used, 4=most frequently used). In addition, the data collected were also used to compare the opinions between clients, organizations, project consultants and main contractors on the project cost contingency related issues. Results from the questionnaire survey were analyzed using different statistical techniques with the aid of Statistical Package for Social Science. Firstly, a descriptive statistics of the demographic concerns about the respondents in terms of their frequency as regards the type of organization, designation of respondents, organization’s years of experience, number of projects executed, as well as the value of projects executed were presented using charts. Secondly, the respondents were asked to provide answers to the possible uses of contingency sums, as well as the percentage and manner of allotting contingency sums to construction projects and the various methods for determining contingency sum by way of ranking using the likert four point scale.

The outcome of these response were analyzed using relative importance index, mean score value respectively. The relative importance index method was adopted to analyze the data collected from the questionnaire survey with the aid of Microsoft Excel. Mean score is a measure chosen such that the sum of deviation from it would be zero, thus it is determined by assigning numerical values to respondents’ score. This was carried out with the aid of SPSS 17.0 software.

The four-point scale 1–4 stated initially was transformed to relative importance indices for each of the nine methods of determining project cost contingency. The indices were later used in determining the rankings of each of the nine methods identified in the study. The rankings created a platform for comparing the relative importance of the nine methods as perceived by the professionals from the built industry. The relative importance for each of the methods as perceived by the professionals was determined and
ranked based on the perceptions of the professionals. The relative importance index (RII) was calculated for each method using the formula below as used by Aibinu, and Jagboro, (2002), Babalola and Adesanya (2007), Kazaz, et al. (2008):

\[
\text{RII} = \frac{1n4 + 2n3 + 3n2 + 4n1}{4N}
\]

Where, (n4=most frequently used, n3=frequently used, n2=less frequently used, n1=not frequently used) N=Total number of respondents.

Data Analysis

Demographic Statistics of the Respondents

![Figure 1: RESPONDENTS TYPE OF ORGANISATION](image1)

Source: Field Survey (2014)

From the figure above, (34.0%) 18 respondents are from the building/civil contracting firm. This is closely followed by Project Management firm (30.2%) 16, Consultancy and Other Consultancy based firms (28.3%) 15 and (7.5%) 4 respectively. This is an indication that the respondents are based in the core area of the built environment, thus it can be deduced that the respondents were sufficiently experienced in responding to the issues of cost contingency.

![Figure 2: DESIGNATION OF RESPONDENTS](image2)

Source: Field Survey (2014)
From the figure above, (30.2%) 16 respondents are Engineers, (24.5%) 13 are Project Managers, (26.4%) 14 are Quantity Surveyors, while Architects are made up of (18.9%) 10. This is an indication that the key professionals in the construction industry are adequately prepared as professionals in their fields and thus the responses from them could be deemed reliable for purposes of this study.

**Figure 3: EXPERIENCE OF ORGANISATION IN CONSTRUCTION BUSINESS**

Source: Field Survey (2014)

From the figure above, majority of the construction firms have put in more than 10 years in the business (58.5%) 31 respondents. While 15 (28.3%) have spent from 6 to 10 years, 2 (3.8%) from 3 to 5 years and 5 (9.4%) less than 3 years. This is also an indication that the professionals were familiar with issues bordering on project cost contingency given their years of experience and this will enable them contribute meaningfully to the survey.

**Figure 4: NUMBER OF PROJECTS EXECUTED IN THE LAST FIVE YEARS**

Source: Field Survey (2014)

From the figure above, majority of the construction firms 32 (60.4%) have executed from 11 to 20 projects in the last 5 years. While 13 (24.5%) have executed less than 10 projects, and 8 (15.1%) executed between 21 to 30 projects. It is an indication that the professionals in the built industry had ample time working on related projects thus making them fit to make meaningful contributions to the survey.

**TABLE 1: METHODS OF DETERMINING CONTINGENCY SUM AS PERCEIVED BY THE RESPONDENTS.**

<table>
<thead>
<tr>
<th>SUM</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 1, depicts the methods used by the construction firms for determining contingency sum/allowance as perceived by the respondents in the study area. The analysis revealed that the most frequently utilized method for determining contingency sum is the traditional percentage method and estimate quality method with a RII score of 0.13 and both ranked first. This is followed by the regression method with a RII score of 0.12 and was ranked third and the cost item allocation method fourth, with a RII score of 0.11. Monte Carlo and artificial neural network methods were both ranked eighth with a RII score of 0.04 respectively.

**Table 2: The use of contingency allowance in cost estimation as perceived by the respondents**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Standard Deviation</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve Fund or Allowance</td>
<td>.47811</td>
<td>3.6604</td>
<td>2nd</td>
</tr>
<tr>
<td>Risk &amp; Uncertainty</td>
<td>.46347</td>
<td>3.6981</td>
<td>1st</td>
</tr>
<tr>
<td>Underestimation</td>
<td>.56955</td>
<td>2.5849</td>
<td>3rd</td>
</tr>
<tr>
<td>Cost Overrun</td>
<td>.63177</td>
<td>2.2830</td>
<td>4th</td>
</tr>
<tr>
<td>Total Commitment</td>
<td>.50398</td>
<td>1.5283</td>
<td>5th</td>
</tr>
</tbody>
</table>

**Source: Field Survey (2014)**

Table 2, shows the use of contingency allowance by the construction firms as perceived by the respondents in the study area. The findings revealed that the majority of the professionals see contingency allowance as a means of providing for risk and uncertainty with a mean score of 3.698 and ranked first. This is followed by reserve fund with mean score of 3.660 and ranked second. While underestimation, cost overrun and total commitment with mean scores of 2.585, 2.283 and 1.528 were ranked third, fourth and fifth.

**Table 3: Percentage allotted to cost contingency**

<table>
<thead>
<tr>
<th>ACCURATE PERCENTAGE ALLOCATED TO COST CONTINGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
</tr>
<tr>
<td>LESS THAN 10%</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>38</td>
</tr>
<tr>
<td>10% TO 20%</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>53</td>
</tr>
</tbody>
</table>

**Source: Field Survey (2014)**
Table 3 shows the percentage allotted to cost contingency by the construction firms as perceived by the respondents in the study area. The analysis revealed that the construction firms 38 (71.7%) allot less than 10% as cost contingency in their estimates, while 15 (28.3%) allot between 10 to 20% of contingency in their estimates.

Figure 5 shows the technique for estimating cost contingency by the construction firms as perceived by the respondents in the study area. The findings reveal that the construction firms 36 (67.9%) use arbitrary calculations in arriving at their contingency sums, while 17 (32.1%) make use of data from previous similar projects in arriving at their contingency sum allowance.

IV. RESULTS AND DISCUSSIONS

Some of the findings from this study were discussed alongside the research questions set ab initio.

A. Demographic and Sundry Issues on the Respondents

The responses from the questionnaires were drawn from professionals in the built industry comprising mainly building/civil contracting firm making 34.0% of the respondents; this was seconded by the project management firms with 30.2%. Majority of the response came from the engineers with 30.2%, while quantity surveyors made up 26.4% of the respondents. The experience garnered by the firms shows that 58.5% have spent above 10 years in the construction business, while 28.3% equally spent between 6 to 10 years doing construction business. A handful of the construction firms (60.4%) have executed about 11 to 20 projects in the last 5 years. While (24.5%) have done less than 10 projects, and (15.1%) between 21 to 30 projects in the past five years. The results from the demographic and other related issues indicate that the contractors were duly involved in project cost contingency and estimation related issues and they have had an appreciable level of understanding of it based on the number of construction projects they have executed as well as the wealth of experience attained which is hinged on years they have spent practicing.

B. Understanding the concept of cost contingency

Research Question 1. What are the methods of project cost contingency in use by professionals in the construction industry?

The analysis in Table 1 revealed that the most frequently utilized methods for determining contingency sums are the traditional percentage method and estimate
quality method with a RII score value of 0.13 and where both ranked first. This is followed by the regression method ranked third, with a RII score of 0.12. Monte Carlo and artificial neural network methods were ranked eighth with a RII score of 0.04 respectively. This implies that the deterministic methods (traditional percentage method) are widely applied (Baccarini, 2005, Richard, 2008) compared to the probabilistic or stochastic approaches (Monte Carlo and artificial neural network methods) as seen from their RII of 0.04 as well as their rankings. The stochastic methods have been adjudged by some authors (Baccarini, 2005, 2006, 2004a, 2004b, Musa, et al. (2011), Buertey, et al. (2012), as the best way to handle cost contingency related matters in construction projects than the deterministic approaches that relies mostly on intuition and lacking sound scientific justification.

**Research Question 2. What are the uses of contingency allowance/provision in a construction project of the area of study?**

In table 2, the response from the practitioners indicate that majority of the respondents see contingency allowance as a medium to provide for risk and uncertainty with a mean score of 3.698 and ranked first. This was followed by reserve fund with mean score of 3.660 and ranked second. While underestimation, cost overrun and total commitment with mean scores of 2.585, 2.283 and 1.528 were ranked third, fourth and fifth by the respondents. This implies that the need and amount for contingency as opined by Baccarini, (2004b) reflects the main existence of risk and uncertainty in projects, and as such contingency takes care of unforeseen risk factors defined within project scope that are undefined, unidentified, unforeseen or unexpected.

**Research Question 3. What percentage of total project cost is allotted to contingency provision?**

On the percentage allotted to cost contingency by the construction firms. The findings in table 3 revealed that the construction firms (71.7%) allot less than 10% as cost contingency in their estimates, while (28.3%) allot between 10 to 20% of contingency in their estimates. This fact is also in consonance with some of the bill of quantities examined by the researcher where a handful of the bills of quantities fall within this category. This also collaborates with Bello and Odusami, (2013), Baccarini and Love (2013) decisions on the issue of allotting contingency sum.

On the issue of the technique for estimating cost contingency by the construction firms as perceived by the respondents in the study area. The findings in figure 5 revealed that the construction firms 36 (67.9%) use arbitrary calculations in arriving at their contingency sums, while 17 (32.1%) make use of data from previous similar projects in arriving at their contingency sum allowance. This also implies that giving the arbitrariness in arriving at cost contingency by most of the respondents, both in the study area and from literatures consulted (Baccarini , 2006, Buertey, et al. 2012) shows that a more proactive method needs to be adopted by way of inculcating the probabilistic approaches to solving this problem thus getting it right once and for all. The tendency to use the arbitrary approach undermines the real objective of both the client and the contractor in most cases.

**CONCLUSION**

Based on the results of the analysis, the following conclusions were arrived at;

From the obtained results, it can be concluded that professionals from the built environment in Owerri specifically, carry out their project contingency estimates for construction projects using the traditional percentage and estimate quality methods which are usually arrived on the basis of an arbitrary mode of calculation. The study further concludes that the majority of the professionals adduce contingency allowance to mean providing for risk and uncertainty, they also allot less than ten percent (10%) of the total cost of construction projects to cost contingency during their estimating activities.

Based on the conclusions arrived at from this study, it is imperative to state that a comprehensive project budget with an accurate contingency sum is pertinent for a project to be considered successful on completion. The contingency allowance should be designed as part of a project risk assessment and should adequately address project risks, while not overly restricting the use of capital funds that can be assigned to other projects. Managing the contingency fund proactively allows the client’s project management team to analyze trends and respond to cost pressures relative to the overall budget. Professionals in the built industry in Imo State specifically can borrow a leap from this study as a way of creating the platform for the realization of their project cost contingency objectives in a bid to meeting up their estimation challenges. Other climes are keying into the use of probabilistic approaches to developing their cost estimates which is lacking in Sub Saharan Africa and Nigeria in particular, a lot needs to be done in this direction to set the records straight.

**REFERENCES**
