



**CHOOSING AN APPROPRIATE CONTINGENCY SUM ESTIMATING
METHODS FOR HIGHWAY CONSTRUCTION PROJECTS IN
NIGERIA: A LITERATURE REVIEW**

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Abstract

In order to establish a gap to be filled in a particular field, there is a need to gather information that allows the researcher to identify and analyse the current state of researches on the topic. Contingency sum estimation for projects plays an important role for inclusion for risk taken by the contractor on the bid amount. This is good in order to meet project objectives (cost, time, quality, health and safety, and environment). The main function of contingency sum is to cater for variations that arise during the construction phase of projects. The aim of the study is to identifying and examine the various methods for estimating contingency sum for projects with a view to propose an appropriate method which will be suitable for a specific project in order to increase accuracy and reduce cost overrun. A literature review of selected papers (journals, conference proceedings and theses) on contingency estimation was carried out. The major findings from this study is that most studies were carried out on building projects while few were carried out on highway projects. From the analysis carried out, no single method of estimating has been effective for all types of projects. These methods of estimating contingency sums have developed over the years as a result of shortcomings of one method after the other. It is therefore recommended that peculiarity of each project, ease of using each of the methods and accuracy of the estimates needed should be the basis of choosing method of estimating contingency sum.

Keywords: Construction projects, contingency sum, estimating, highway

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INTRODUCTION

Cost performance of construction projects is a critical success criterion always watched out for by project sponsors. El-Sayegh and Mansour (2015) state that several studies establish that highway construction projects have higher risks than other construction projects. This is due to the fact that highway projects are capital intensive, take longer time to complete, spread over a wider geographic area and are threatened by underground conditions. Reeley and Brown (2004) posit that infrastructure and underground projects (of which highway projects) are complex and most of the time, span through several terrains, including sandy and rocky areas. Thomas, Kalindidi and Ganesh (2006) cited in El-Sayegh and Mansour (2015) posits that highway projects involve very high risks due to long project duration, low market value of security packages and complex contract mechanisms and involvement of many participants with diverging interest and challenges. The required huge investment and difficult as well as complicated site conditions, according to Zayed, Amer and Pan (2008), make it imperative to have a robust contingency sum which can take care of this imminent risks inherent in highway projects. Cost contingency is included within a budget estimate so that the budget represents the total financial commitment for the project sponsor (Baccarini, 2006). Therefore, choosing an appropriate method of estimating cost contingency and its ultimate adequacy is of great importance to success of projects.

Definition and Attribute of Contingency

Different researchers such as PMI (2000) have at different times offer varying definitions of contingency. AACE (2010) defines contingency as “an amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effects is uncertain and that experience shows will likely result, in aggregate, in additional costs”. Bakshi and Touran (2014) offer a definition of cost contingency which is very relevant for this study, as a reserved budget for coping with monetary impacts of risks and uncertainties associated with a project. However, AACE (2010) states that contingency does not cover the following: (i) major scope changes (ii) extraordinary events such as major strike and catastrophes (iii) escalation and currency effect and (iv) management reserves.

Besides, many researchers applied the extension rule to the model counting problem (Touran, 2003), and many amended it so as to apply it into the TP of modal logic¹⁹. Still some researchers improved the extension rule, and put forward series of algorithms such as NER, RIER, etc (Yeo, 1990; Zayed, Amer & Pan, 2008).

Extension-rule based TP method has commended considerable respect from many related researchers. For example, Murray (PMI, 2000; Thomas, Kalindidi & Ganesh, 2006) has applied the extension rule into the generation of the target language based on the knowledge compilation, and

achieved good results. Besides, many researchers applied the extension rule to the model counting problem (Touran, 2003), and many amended it so as to apply it into the TP of modal logic (Touran & Liu, 2015). Still some researchers improved the extension rule, and put forward series of algorithms such as NER, RIER, etc (Yeo, 1990; Zayed, Amer & Pan, 2008).

RESEARCH METHODOLOGY

This study is a theoretical research based on review of literature on the methods of estimating cost contingency for construction projects. Academic journals, conference proceedings, textbooks, monographs and other valuable materials that are relevant to the study were selected and referenced. The study carried out a comprehensive survey of literature to highlight the findings of previous researchers with the view to examine the characteristics of different contingency estimation methods, in order to choose an appropriate method when the need arises so as to provide an adequate and reliable contingency sum for construction projects.

CRITICAL ANALYSIS ON VARIOUS METHODS OF ESTIMATING COST CONTINGENCY

S/N	Methods	Researchers	Advantages of the Methods	Disadvantages of the Methods	Projects used for
1.	Traditional method	Ahmed, 1992; Melsehi, 1997; Baccarini, 2004; Mohammed, 2009; Adama & Jimoh, 2014; Amade et al., 2014.	It is easy to use. It does not require long time or budget.	Risk is either ignored or dealt with in arbitrary way. Not suitable for big projects. Fail to take risk drivers in to consideration. No justification for the percentage used.	All form of construction projects. Developing countries still adopt it for highway projects, especially Nigeria.
2.	Individual risk – Expected Value	Mak, Wong & Picken, 2000.	It can model uncertainty as contingencies with specific probabilities which can be analysed for better result.	Identifying fixed and variable factors of the projects is difficult. It still adopts traditional approach.	Construction projects generally.
3.	Method of Moment	Diekmann, 1983; Yeo,	This method is good in situation	Due to its mathematical background, it is	Rarely used in practice.

		1990; Molsehi, 1997.	where simulation is inefficient. No need to invest in any software.	very difficult to use. Not suitable for complex and large infrastructure.	
4.	Monte Carlo Simulation	Lorance & Wendling, 1999; Clark, 2001; Barazza & Bueno, 2007.	It captures outcome of risk identification and impact which can be used to estimate contingency.	The method is hard and cumbersome. It is rarely used in the industry. Only good when there linear relationship between project parameters.	Heavy capital projects
5.	Regression Analysis	Merrow & Yarossi, 1990; Aibinu & Jagboro, 2002; Sonmez, 2004; Thai, Cook & White, 2010; Kim et al., 2004; Bello & Odusami, 2013; Abednego et al. 2014.	It addresses the factors that drive project risk. It is more accurate than traditional method.	It relies on historical cost data which sometimes may not be available. Time consuming to gather historical cost data.	All construction projects, but majorly on building projects.
6	Range Estimating	Curran, 1989.	It takes care of optimistic and pessimistic ends of estimation. It is safer than the traditional method.	It also adopts deterministic approach which makes it less accurate compare to regression models.	Roads in WISDOT
7.	Artificial Neural Networks	Chen & Hartman, 2000; Williams, 2003; Cook, 2006; Polat, 2012.	Prediction accuracy of ANNs gives better results than traditional method	ANN is suitable for non-linear modelling of data.	Roads, Oil and gas projects
8	Factor Rating	Hackney, 1985;	This method can be used	Choosing the four	Capital project in the

	/Estimate Quality	Oberlander & Trost, 2001.	to check the amount of contingency determined by other methods of estimating contingency sum, apart from being a method of estimating contingency.	determinants of the accuracy of the estimate is severely inadequate. It may lead to high contingency if the estimate is inaccurate.	Process industry.
9	Influence Diagram	Diekmann & Featherman, 1998; Park et al., 1998; Oppong, 2013.	It reduces large volumes of data crucial for making decision. Good in sensitivity analysis.	Like other probability models,	Complex construction projects.
10.	Theory of Constraints	Leach, 2003.	It makes use of three point estimates and with the use of probability function makes it more accurate than the traditional method.	This method assumes cost items are independent of each other which is not true in real in real life.	All form of construction projects
11.	Fuzzy Sets	Paek, Lee & Ock, 1993; Shayen, Fayek & Aburizk, 2007; Rezakhani, 2012.	It allows analysis with small samples. It reveals relationship between outcome and explanatory variables.	It is hard to develop a fuzzy model. It requires more fine-tuning which has made it difficult in real practice.	Majorly on building projects but in few occasions for highway projects.
12.	Analytical Hierarchy Process	Dey, Tabucanon & Ogunlana, 1994; El-Touny,	AHP is good in solving complex estimating and decision	It cannot be used to find a true solution to a problem or	Complex construction like civil and heavy

		Ibrahim & Amer, 2014.	making problems which characterizes construction projects.	deriving a final answer.	engineering projects.
13.	Bayesian Belief Network.	Khallafah, Taha & El-Said, 2002.	This method uses probability method which is more accurate than the traditional method.	It is difficult to use by layman	Residential buildings.

Source: Literature review.

With the extant review of literature, the major findings in the analysis of different contingency sum estimation methods are:

- 1) Traditional percentage method has been widely used across all projects despite criticisms that it is based on intuition and no rationale for arriving at the percentage. Regression and Theory of constraints have also been used in estimating contingency sum for construction projects
- 2) Monte Carlo Simulation, ANN, Influence Diagram and AHP have been used for complex projects such as heavy engineering, roads, oil and gas. These methods give high degree of accuracy.
- 3) While Bayesian Belief method has been widely used for residential buildings, method of moment is rarely used in practice.
- 4) Range estimating has been used in estimating contingency sum in WISDOT.
- 5) Factor rating/ Estimate quality has been used to estimate contingency sum for capital projects in the process industry.

CONCLUSION

This study reviews the concept of contingency estimation for construction projects with a special emphasis on highway projects. While so many researchers have focused on building projects, little attention has been paid to estimating contingency sum for highway projects which have higher risks than other construction projects. From the analysis carried out, no single method of estimating has been effective for all types of projects. These methods of estimating contingency sums have developed over the years as a result of shortcomings of one method after the other. Also, this study will guide practitioners in the industry on which method to use, having considered the

advantages, disadvantages and type of projects different methods have been used. It is therefore recommended that peculiarity of each project, ease of using each of the methods and accuracy of the estimates needed should be the basis of choosing method of estimating contingency sum

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A THEORETICAL ASSESSMENT ON SUSTAINABLE WELLBEING INDICATORS FOR PEOPLE INTERRELATIONSHIPS

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Abstract

Sustainable well-being is the well-being attained without compromising others' opportunities to pursue their happiness. The concept of well-being is not merely personal, relational, organizational or communal issues, but rather the synergy of all four dimensions. The four dimensions of well-being are distinguishable, but they are inseparable entities. While focusing on subjective measure of well-being some research fail to interrogate the influence of contextual dynamics on respondents who report high levels of well-being despite living in deprived community conditions. This study argues that there could not be well-being without the combination of personal, relational, organizational and communal wellness.

Keyword: sustainable well-being, human interrelationships with other humans.

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