Improving the efficacy of cost contingency plans for construction projects in South Africa

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Abstract. The use of cost contingency in construction projects provides a lucid and lively recognition of upcoming/impending challenges of cost overrun in delivering the construction project thereby giving room for project delivery to cost. The aim of this study is to evaluate how the efficacy of cost contingency plans for construction projects can be improved. This study adopted the use of a quantitative research approach with the use of questionnaire structured to capture the perceived measures of improving the efficacy of cost contingency plans for construction projects. The study harnessed information from Construction Managers/Project Managers, Contract Managers and Quantity Surveyors in Gauteng Province, South Africa. Data retrieved was analysed using mean item score, standard deviation and Kruskal-Wallis H-test. This study was limited to Gauteng province in South Africa due to time and cost constraint. The findings showed that the three most effective measures of the efficacy of cost contingencies in construction projects are assessing risk possibilities, assessing risk impact, and identifying project risk and uncertainties. The study concluded that cost contingency plan can be improved when risks are adequately assessed together with their impact on the construction project. By recommendation, identification; definition; and evaluation of risks is a paramount activity which project professionals must embark upon before a construction project can commence.

Keywords: Contingency, Cost, Project planning, Risks, Uncertainties

1. Introduction

Cost contingency plan in a construction project allows for flexibility and effective responses to change orders and unforeseen risks during the construction phase of a project. In a construction project, cost contingency planning begins with the size of the project before looking at other factors. This helps the project to be able to establish a baseline for uncertainties within the project. It also helps in defining both external and internal risks and putting appropriate measures in place [1]. Fry [2] added that cost contingency planning provides good structure to identify, quantify and put risks first thereby setting the programme for the project and allocating resources. A poor cost contingency allowance can result in cost overrun on a project as well as time overrun. However, a good cost contingency plan can be tailored based on the previous similar projects while taking into consideration the individuality of that particular project [3]. By definition, cost contingency is a quantity of money that is enclosed during a budget to represent uncertainty [4]. Bello and Odusami [5] added further that contingencies are added to development budget as an estimated fund which gives client and project team the required flexibility to cover for uncertainties and risks that may pose to affect the completion of set project objectives. To the project owner, it serves as the extra budget that caters for uncertainties which can lead to cost overrun.
Most projects and operational functions usually run into unexpected costs, therefore it is common that unexpected costs can be expected. As such, having a cost contingency in a budget may be a normal application in several projects [3].

2. Related Works
In the construction industry, planning is a key activity to be embarked upon in order to achieve unaltering quality in the project. Cost contingency planning reveals to a property developer what amount of money is to be set aside for risks associated with a project. Likewise, Cost contingency planning reveals when the typical expense shall more likely than not happen. The data is fundamental for achieving the project’s monetary information and for choosing if an enterprise can bring money to the project. Without cost contingency planning, the clients’ obligation will become unpredictable which can result in project cost overruns [1]. Amade [6] submitted that most construction projects fail due to unforeseen costs and budget overruns, which are not considered or adequately allowed for at the planning phase.

In estimating the cost of contingency for construction projects, there are two approaches. According to [7], these methods are Deterministic and Probabilistic methods. The deterministic method is a traditional method is mostly employed for estimating cost contingency for construction projects. The deterministic method usually express cost contingency in terms of a certain percentage of the contract sum or subcomponent of the project. The percentage of the contingency for a construction project is fairly high at the initial phase of the projects where there is a higher number of potential risks. However, the percentage decreases as more project particulars regarding the scope of work are made available by the project team [7–9]. The allowed percentage is dependent on the potential risks attached to the project at hand. For projects in which an allowance is made for cost contingency, it was observed that there is an average of 5.07% cost overrun compared to 9.52% cost overrun on projects without cost contingency allowance [10]. Usually, deterministic method uses a percentage between 5 and 10% of the project cost for contingency. This is always unjustified as the degree of certainty cannot be established and therefore puts contractor at the risk of overcompensation and most times underpayment for uncertainties.

Probabilistic method of estimating cost contingency deals with project cost components being assigned probability distribution functions (PDF) thereby generating a PDF for the overall project cost through the summative process. This process is achieved by breaking down the project overall cost down into element components. The PDF assigned to each component describes the actual values of the component if the same project is to be executed more than once. This, therefore, gives a cumulative value for the overall project cost indicating a possible decrease or increase in the construction cost based on the changes to the cost components [7].

Risks are part of construction projects which cannot be overlooked. These risks are encountered at different phases of construction projects and proper measures need to be put in place to cater for these risks which come in the form of cost contingency. Cost contingency, therefore, covers for schedule delays, unexpected change orders and/or uncontrollable factors attached to the construction project. Risk identification is a major process which enhances risk management ability and determination of Cost contingency allowance [11]. Adafin [12] highlighted the identified key elements of risks to be evaluated and apportioned the right cost for incorporation into the construction cost as laid out in RICS New Rules of Measurement 1. The costing of these risks depends largely on the phase at which the estimate for the construction project is prepared and are therefore subjected to review upon accomplishment of each phase of the construction project. Some researchers identified measures to improving the efficacy of cost contingency which is discussed as follows.

2.1. Prepare Risk Register
Eldosouky [7] submitted that a risk register is an instrument used for giving project risks a discourse and report risk all through the execution phase of the project. Risk register records the greater part of the known risks together with any arranged reactions. Extra data including risks classes and subjective
and quantitative examination information ought to be incorporated as well. Subjective information covers the likelihood and effect of each risk.

2.2. Assessing Risk Probabilities
Hillson [13] uncovered that the appraisal of risks likelihood enhances the comprehension of each hazard, permitting suitable prioritization, better reaction determination, upgraded chance administration viability, and solid accomplishment of task goals.

2.3. Assessing Risk Impact
An impact of risks during project completion is generally easy to assess, compared to the likelihood of the risk happening. This involves a straightforward exercise on envisioning the circumstance where the risks are to occur. The straightforward procedure is stated by the project team in order to determine the risks impact range [14].

2.4. Use of the Risk Factors Perspective for Modelling Project Risk
Arizaga [15] introduces the factors of risks modelling for the utilization and influencing activities on a project. Activities are sorted out by using a “Work Breakdown Structure”. The factors of the risk are then determined for each activity with how it can influence the project work.

2.5. Acquire Project Cost Estimates and Schedules
An initial phase during a project risks administration and cost contingencies appraisal, [16] confirmed that the cost should be expressed showing the total project value and presented together with the programme of work mostly done using “CPM” plan. This is then arranged by an estimator or project manager while the project team determines the value of cost contingency to be added to the project cost.

2.6. Prioritize Risks and Choose Risk Mitigation Actions
Hulett [17] and [7] asserted that the procedures of prioritization involve recognition of the common critical risks and carefully distinguishing the risk that has the highest effect. At that point, the investigator looks into the rest of the risks to see which of those is next most-vital, etc. However, [17] added that eliminating one essential risk may uncover different risks that at that point become critical which were not critical when the main risk still exists. In light of restricted duration of the time accessible for risks appraisal in the tendering procedure, the contract administrator shall analyse risks based on their level of severity, think about alternative risk mitigating actions, and choose which mitigation moves to make.

3. Research Methodology
To achieve the aim of this study, the use of a quantitative research approach with the use of questionnaire structured to capture the perceived measures of improving the efficacy of cost contingency plans for construction projects was adopted. Teddlie and Tashakkori [18] are of the opinion that quantitative research uses the techniques of describing the development of interest within a given numerical data while revealing the differences existing among them. It gathers numerical form data which can be placed in rank order, classified into categories or evaluated using units of measurements. The questionnaire was structured into two sections and section one retrieved background information of respondents while section two treated the objective of the study. The study harnessed information from Quantity Surveyors, Construction Managers and Project Managers in Gauteng Province, South Africa with a total of 50 responses received out of the expected 58. In reaching out to the respondents, a purposive sampling technique was chosen as suitable for the research work while the questionnaire was designed using Google form and distributed through the use of emails. Data retrieved was analysed using mean item score, standard deviation and Kruskal-Wallis H-test.
4. Findings and Discussions
Respondent background information shows that 50.0% of the respondents are Quantity Surveyors, 26.0% of the respondents are Construction Managers, 24.0% of the respondents are Project Managers. 58.0% of the respondents have between 1-5 years of experience, 24.0% between 6-10 years of experience, 11.0% between 11-15 years of experience, 2.0% have experience of more than 20 years and none of the respondents has between 16-20 years. Respondent’s highest educational qualification revealed that 62.0% of the respondents had Honours certificate, 18.0% of the respondents have bachelor’s degree and 20.0% have National Diploma. None of the respondents has both master’s degree or doctoral degree. Based on the demographic information of the respondents, it can be concluded that they have the required experience to give reliable advice on the impediments of cost contingency plans for construction projects in the South African construction industry. 56.0% of the respondents use deterministic method (cost-based estimate), 16.0% uses probabilistic method, while 28.0% used both methods in preparing cost contingency plans.

From Table 1, it was revealed that the most effective measures of the efficacy of cost contingencies in construction projects include: assessing risk possibilities (MIS=4.60; Asymp=0.27; R=1), assessing risk impact (MIS=4.50; Asymp=0.36; R=2), identification of project risk and uncertainties (MIS=4.48; Asymp=0.09; R=3), prioritize risk and choose risk mitigation action (MIS=4.36; Asymp=0.32; R=4), describe project schedule and cost uncertainty (MIS=4.34; Asymp=0.65; R=5). The lowest ranked variables are sharing of the trade-offs discussion and transparency (MIS=3.88; Asymp=0.73; R=11), acquire the project cost estimate and schedule (MIS=3.90; Asymp=0.91; R=12), and let the workers contribute valuable concepts and insights (MIS=3.86; Asymp=0.04; R=13). The least ranked variable has a mean item score of 3.86 which is very much higher than the average 3.0 value for a five-point Likert scale which shows that all the measures can help in improving the efficacy of cost contingency plans for construction projects. From the results in Table 1 also, Kruskal-Wallis H-test reveals that all the variables except one have asymptotic value above 0.05 which interprets that there is no statistically significant difference between the opinion of the respondent groups.

Table 1. Measures for Improving the Efficacy of Cost Contingency Plans

| Measures for Improving Efficacy of Cost Contingency Plans | MIS | Chi-Square Value | Asymp. Sig. | Rank |
|-----------------------------------------------------------|-----|-----------------|-------------|------|
| Assessing risk probabilities                             | 4.60| 2.60            | 0.27        | 1    |
| Assessing risk impact                                    | 4.50| 2.02            | 0.36        | 2    |
| Identification of project risks and uncertainties        | 4.48| 6.52            | 0.09        | 3    |
| Prioritize risks and choose risk mitigation actions      | 4.36| 2.29            | 0.32        | 4    |
| Describe project schedule and cost uncertainty          | 4.34| 0.85            | 0.65        | 5    |
| Prepare risk register                                   | 4.12| 1.62            | 0.45        | 6    |
| Using the risk factor approach to model project risks    | 4.12| 0.36            | 0.84        | 6    |
| Communicate the construction plan with the project team  | 4.06| 0.77            | 0.68        | 8    |
| Determine cost contingency reserve                       | 4.02| 1.30            | 0.52        | 9    |
| Get preliminary values of contingencies                  | 4.00| 5.66            | 0.06        | 10   |
| Sharing of the trade-off discussion and transparency     | 3.98| 1.59            | 0.45        | 11   |
| Acquire project cost estimate and schedule               | 3.90| 0.19            | 0.91        | 12   |
| Let the workers contribute valuable concepts and insights| 3.86| 6.31            | 0.04        | 13   |

The findings are in agreement with [7,13–15], who opined that assessing the risk probabilities, assessing the impact of the risks identified, preparation of a risk register, as well as the use of the risk factors perspective for modelling project risk, will ensure the efficacy of cost contingency plans on a construction project. This implies that risk is the major determinant factor for the addition of cost contingency to the project cost. The findings are also in tandem with the submissions of [7,16,17,19].
that describing project schedules and cost uncertainties, acquiring project cost estimates and schedules, and getting preliminary values of contingencies helps in improving the efficacy of cost contingency for construction projects. When accurate project schedule is prepared and the cost estimates are made available before the award of such project to the contractor for execution, this informs the provisions for cost contingency to be included in the contract sum. This will allow the project team to make necessary considerations before the final decision is made as regards the cost contingency. Prioritising risk and choosing the right risk mitigation actions is another effective measure for improving the efficacy of cost contingency plans as indicated from the findings of this study which agrees with the research work of [14,17] also, when the construction plan is communicated adequately with all the project team and there is sharing of the trade-off discussion and transparency, uncertainties can be reduced to the barest minimum on such construction project which will improve the efficacy of cost contingency plans for construction projects.

5. Conclusion and Recommendation
From the findings of the study, conclusion is drawn that cost contingency plan can be improved when risks are adequately assessed together with their impact on the construction project. This will make provision for risk register which will result in modelling project risks for proper cost contingency calculation. Furthermore, before a construction project is awarded, project cost estimate and project schedule must be acquired and vetted to incorporate uncertainties that may arise at the execution stage of the project into the cost contingency. By recommendation, identification; definition; and evaluation of risks are paramount activities which project professionals must embark upon before a construction project can commence. Also, adequate risk action must be clearly defined in the conditions of contract to cater for uncertainties that can be encountered on the construction project. For further studies, similar research work can be carried out in other provinces of South Africa for a general knowledge on cost contingency efficacy to be achieved.

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