RISK ASSESSMENT AND ALLOCATION IN BUDGETING

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ABSTRACT

The construction industry plays a central and significant role in the economy of any nation. One of the major reasons for ineffective project delivery in the Nigerian construction industry is the improper assessment of risk factors in construction budgeting. As a result, the industry continues to suffer poor performance with many projects failing to meet time and cost targets. A primary measure of success in preparing budget estimates is predicting the project outturn capital cost and the whole life cost accurately at project inception. In this paper, an overview of the concept of risk, its assessment and allocation in construction budget estimates is presented. Specifically, tools for risk identification, qualitative and quantitative risk assessment are discussed using practical and easy to follow examples. Finally, the issue of risk prioritization, risk allocation and risk response strategies are discussed.

Keywords: budget estimate, construction project, risk assessment, risk management

INTRODUCTION

Most building contracts are not meeting set budgets as a result of improper assessment of risk factors. Risk is inherent in all human endeavours, including construction activities, and the risk elements involved are diverse and varied (Odeyinka, 2000). Risk has been defined in different ways depending on the domain of human activity. In project context which is the domain of this paper, the UK-based Association for Project Management (APM) (2012, p. 178) defines risk as 'an uncertain event or set of circumstances that, should it occur, will have an effect on the achievement of one or more project objectives'. The US-based Project Management Institute (PMI) (2012, p. 275) defines risk as 'an uncertain event or condition that, if it occurs will have either a positive or negative effect on one or more of the project's objectives', which are usually cost, time, scope and quality. These definitions take into account the fact that the effect of risk on project objectives could be either negative or positive. Some of the major causes of risk in construction include design error, estimating error, competitive tendering risk, financial risk and changes in political and economic climate among others. Size can also be one of the major causes of risk, so can changes in political or commercial planning. Other risk factors include the complexity of the project, location, speed of construction and familiarity with the type of procurement system. While these risk factors are not unknown to the Nigerian construction practitioners, the relative likelihood of occurrence and impacts in case of occurrence remain a critical issue of concern, hence the concept of risk assessment and management should be taken seriously most especially during budgeting proposal.

Professionals (Quantity Surveyors in particular) in Nigeria often add a contingency sum in bills of quantities without any basis to cater for risk items. This practice has no objective, rational or scientific basis; rather it is based on mere guess work. Perry and Hayes (1985) have faulted this conventional way of adopting a contingency sum to cover or take care of risk and uncertainties. This practice should be redefined in order to make it rational and reasonable. Chapman (1990) cautioned against the arbitrary use of contingency allowance for risk, noting that unspecified contingency sum simply tempt people to use these for other purposes. He therefore called for research into how pre-construction project risk contingency sums can be arrived at and subsequently used in terms of financial administration of contracts. From the foregoing, there is therefore a dire need for proper assessment of the impact of risk on project cost so that adequate provision can be made to deal with risk at the conceptual phase of budget estimate.

THE CONCEPT OF BUDGETING IN CONSTRUCTION

Construction budget is an approximation of project cost target which is refined throughout the construction cycle. It is a formal statement of the financial resources set aside for carrying out specific activities in a given period of time. The Association for Project Management (APM) (2012) defined budgeting as the process of estimating the cost of a proposed project and setting an agreed target. A primary measure of success in preparing budget estimates is predicting the project outturn capital cost and the whole life cost accurately at project inception. Without the ability to predict the outcome of a project with some degree of accuracy, it is not possible to determine which solution offers the best value for money. Anigbogu *et al.* (2007) contended that the first step toward ensuring that problems are avoided in construction process is the production of accurate cost estimates. The consequence of bad estimate at the early stage of a construction project according to Ashworth (2010), Ibrahim (2003) and Lowe *et al.* (2006) includes embarking on an infeasible project and rejecting hitherto feasible project. It has been suggested by Ogunsemi (2006) that a difference of 10% between tender sum and final account is considered an excellent performance. Unfortunately this contention cannot be said to be realistic going by the various studies carried out on the subject matter especially in the developing countries where construction project budgets have increased astronomically.

Escalation of Construction Budgets

In the execution of any construction project, cost of the project is an important factor in term of the success of the project. Even though contract sums are based on estimates, this does not represent what the final cost would be. It has been shown in recent times that these figures differ considerably and in some cases very high (Le-Hoai *et al*., 2008; Flyvbjerg *et al*., 2009; Nkado, 2010). The incessant increase in the cost of construction projects over and above what is budgeted for in the contract has been a major concern to the construction industry as a whole. Delay and cost increase are common phenomena in construction projects worldwide. Major projects, around the world, have consistently presented immense challenges, particularly on cost overruns (Nkado, 2010). Flyvbjerg *et al.* (2009) in their study of major projects in 20 countries showed that nine out of ten projects had significant cost overruns of up to 70% of initial estimate. Famous examples include the Sydney Opera House which was completed ten years later than scheduled at 1,400% higher than initially budgeted (AUS$7 million – AUS$102 million), a world record. In South Africa, the Gautrain project commenced at an initial estimate of R7 billion and is projected to be completed at R25.4 billion (US$3.3 billion).

Construction cost escalation is especially severe in developing countries (Le-Hoai *et al*., 2008). In Nigeria, it has almost become a norm that a project cannot be completed at the agreed contract sum going by the myriad of major and notable projects with more than 50% cost overruns. Omorogie (2006) concluded that the minimum average percentage of escalation cost of projects in Nigeria was 14%. Ayodele and Alabi (2014)'s study of the effects of cost control on public and private developer's cost performance revealed that 89% and 100% of the eighty nine (89) assessed projects for public and private project respectively in Nigeria experienced cost overrun. The Federal Executive Council of Nigeria put the cost of construction and procurement of contracts in Nigeria at between 20 to 30 per cent higher than what is obtainable in other parts of the world (Nigeria Exchange News, 2010). Take for example; the Escravos Gas-to-Liquids Project in Niger Delta had escalated to $5.9bn from the initial $1.7bn (Global hydrocarbon Industry, 2012). The way billions of naira are mentioned in construction project values in Nigeria has become so banal that very soon, experts believe, they are likely to escalate to trillions of naira, even though the values do not appear realistic in relation to the contracts in question. Though the problem, which is rooted in multifaceted factors, may well be beyond the industry but it can also be traceable to improper risk assessment and cost management.

AN OVERVIEW OF CONSTRUCTION RISK MANAGEMENT PROCESS

Risk management (RM) is a concept which is used in all industries, from IT related business, automobile or pharmaceutical industry, to the construction sector. Each industry has developed their own RM standards, but the general ideas of the concept usually remain the same regardless of the sector. While RM has been described as the most difficult area within construction management, its application is promoted in all projects in order to avoid negative consequences. The general attitude towards risk is its identification, evaluation, control and management. Tah et al. (1994), in a survey of estimating practice of seven contractors, found that all of them classified risk as either quantifiable or un-quantifiable, and either included the costing in the estimate or added a lump sum in the preliminary cost estimate. None of the respondents used statistical techniques to analyze risk. Similarly, Pasquire's (1996) survey interviews produced broadly the same findings, as did the questionnaire surveys of Akintoye and Macleod (1997), Bajaj *et al*. (1997), Mok *et al.* (1997), Amos and Dent (1997) and Jackson *et al.* (1997). It seems that very few participants in the building procurement process use formal techniques of risk analysis or systematic approaches to risk management. Fig. 1 below illustrates a structured approach to risk management. As shown in the Fig., risk management commences from risk identification after which risk quantification/ risk assessment is carried out and this can be qualitative or quantitative risk assessment or a combination of both. Risk quantification allows risk to be categorized and prioritized in order

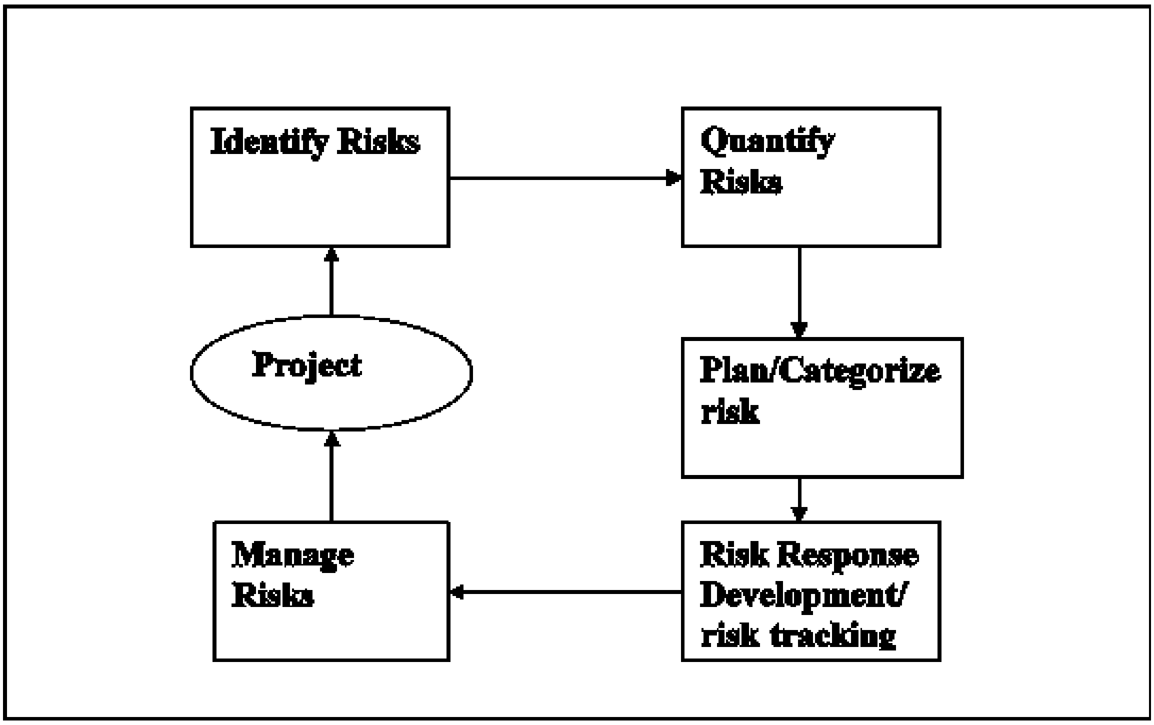

Fig. 1: Risk Management Framework

To determine the appropriate risk response strategies.

Various techniques have been developed for risk identification. These include brainstorming among project stakeholders, interviews, Delphi method the use of checklist and risk register. Qualitative risk analysis sometimes involves considering each risk in a purely descriptive way to imagine various characteristics and the effect that it might have on the project. It could also involve assigning probability to risk occurrence and risk impact using subjective probabilities. Qualitative risk assessment is done using probability/ impact table, iso-risk curves or risk register. Quantitative risk assessment goes a step further by considering risk impact on numeric terms as opposed to probability measures. This could be in terms of additional cost incurred or additional time to be spent on a project. Various techniques are available for quantitative risk assessment including priority table, risk register, probability analysis, sensitivity analysis and Monte Carlo simulation. When risk has been properly analyzed, it could then be prioritized using the traffic light signal into' red risk' (risk with high degree of severity),' amber risk' (risk with moderate degree of severity) and 'green risk' (risk with low degree of severity). Red risk cannot be ignored and appropriate risk response strategies have to be devised which could be risk avoidance, acceptance, mitigation or risk transfer.

Confronted with so many risk identification and risk assessment techniques, many of which are very sophisticated, a Quantity Surveyor or Project Manager may be at a loss regarding which one to use at a particular point in time. However, the use of the risk register has been found very popular among construction practitioner because it is simple and easy to use. Besides, it helps to traverse all the stages in the risk management process from risk identification to risk response. As a result, the next section presents a practical illustration of the use of risk register for risk assessment and allocation in capital project budgeting.

USE OF RISK REGISTER FOR RISK ASSESSMENT AND ALLOCATION IN CAPITAL PROJECT BUDGETING

A risk register, also referred to as a risk log, is a tool that plays an important part in project risk management. It is created during the early stages of a project and used to record and track likely risks and address them as they arise. A risk register will normally be shared between project stakeholders as it allows project participants to be kept informed of risk issues and it provides a means of tracking risk responses. It is also used to flag new risk factors and to make suggestions on the course of action to take to resolve them.

A risk register is a document that is usually presented in a spreadsheet form and can be used not only for risk identification but also for risk assessment/ analysis. It contains information about identified project risks, an assessment of likelihood of risk occurrence and impact/ severity. These pieces of information help in determining the level of risk exposure or degree of risk and the possible solutions to be applied. If effectively used, a risk register proves that a risk need not be a threat to a project, it is simply an issue that can arise during the project and if effectively managed, it shouldn't prevent the project from attaining its objectives of timely completion, within budget and to the right quality.

Table 1 below shows an example of a risk register using a spreadsheet for risk identification and qualitative risk assessment. Each identified risk has a unique identification number with each risk measured on a two-dimensional scale of probability of risk occurrence and impact/ severity. These are assessed on a Likert-type scale of 1 to 5 where:

1= very low likelihood of risk occurrence and very low impact,
2 = low likelihood of risk occurrence and low impact,
3 = moderate likelihood of risk occurrence and moderate
4 = high likelihood of risk occurrence and high impact
5 = very high likelihood of risk occurrence and very high impact.

The degree of risk/ Risk Exposure is given in Eqn. 1 as follows:

$$R = P * I \quad \text{(Eqn. 1)}$$

Where:
R = Degree of Risk/ Risk Exposure
P = Probability of risk occurrence
I = Risk impact/ Severity

Practically, it is impossible for a Project Manager to focus attention on managing all identified risk factors and that is why it is important to prioritise them. The degree of risk/ risk exposure allows each risk factor to be ranked and prioritised. Risk factors can be prioritised using the traffic light symbols of red risks (risks with high degree of exposure), amber risks (risks with moderate degree of exposure) and green risks (risks with low degree of exposure. Categorising risks this way is a qualitative risk assessment and it enables a Project Manager to know that red risks cannot be ignored, informed judgment could be

Table 1: Using Risk Register for Risk Identification and Prioritisation

Risk ID	**Task**	**Risk**	**Probability of risk occurring P = 1-5**	**Impact/ Severity I = 1-5**	**Degree of Risk/ Risk Exposure R = P*I**	**Risk Ranking**

made on amber risks to re-categorise them into either red or green risks. Table 2 shows an example of a risk register using a spreadsheet for risk identification, qualitative risk assessment and risk response. It takes another step further to include the name of the person responsible to take action should the risk occur. This allows for a proactive approach to risk management and avoids ‘fire-fighting’ action in case of risk eventuating.

Table 2: Using Risk Register for Risk Allocation

Risk ID	**Task**	**Risk**	**Probability of risk occurring P = 1-5**	**Impact/ Severity I = 1-5**	**Degree of Risk/ Risk Exposure R = P*I**	**Risk Ranking**	**Mitigating/ Avoiding Action**	**Action by:**

Apart from using qualitative risk assessment to determine priorities, risk analysis goes a step further using quantitative risk assessment. This is because in practical terms, risk impact/ severity is measured in numeric terms such as additional cost or additional time on a project. Table 3 shows an example of using a spreadsheet as a risk register for risk identification, qualitative risk assessment and quantitative risk assessment. Quantitative risk assessment goes a step further from qualitative risk assessment by assigning risk cost and determining Expected Monetary Value (EMV). Actuarial cost or EMV is determined by Eqn 2 as follows:

$$EMV = P * O \qquad \text{(Eqn. 2)}$$

Where EMV = Expected monetary Value
P = Probability of risk occurring (in %)
O = Risk cost

Table 3: Using Risk Register for Risk Costing

Risk ID	Task	Risk	Probability of risk occurring P = 1-5	Impact/ Severity I = 1-5	Degree of Risk/ Risk Exposure R = P*I	Risk Cost	Actuarial Cost/ Expected Monetary Value (EMV)

Example 1

A project is estimated to cost ₦100, 000,000 and a risk of 'problem with foundation' with a probability of occurring assessed at 50% and a cost should the risk happen of ₦ 2,000,000. What is the likely cost of the project?

EMV = P * O

Where P = 50%, O = 2,000,000

The likely total cost of the project = ₦ 100,000,000 + 50% of ₦ 2,000,000

= ₦ 101, 000,000

In many cases, it is difficult to estimate the risk cost using a single estimate. In such a situation, a three- point estimate is used, assuming a triangular probability distribution of minimum, most likely cost and maximum cost. Then, the conditional expected monetary value (CEMV) is given by (minimum + most likely + maximum)/3.

Table 4 illustrates quantitative risk assessment using a three-point estimate. Three risk factors A, B and C have been identified with assessed probability of occurrence and probable cost of impact (in ₦ '000, 000) using a three-point estimate. Using the formula for CEMV, the conditional expected monetary value is given as shown in Table 4. The unconditional expected monetary value (UEMV) is given in Eqn 3 as follows:

UEMV = P * CEMV (Eqn. 3)

Where, P = probability of risk occurring and CEMV = Conditional Expected Monetary Value

The unconditional expected monetary value can then be used to set the risk budget which will be an addition to the original project cost.

Risk ID	Risk	Probability of risk occurring	Probable cost of impact			Conditional Expected Monetary Value	Unconditional Expected Monetary
			Minimum	Most likely	Maximum		
A	Changes to design	1	10	20	30	20	20
B	Payment delays	0.4	10	20	30	20	8
C	Problem with foundation	0.8	20	40	90	50	40

Risk Categorisation

Using the risk register for qualitative risk assessment, risk can then be classified as follows:

Red risks
These are risks that have a high exposure value. We cannot accept red risks in the project; they must be addressed and so we can justify adding some money to the original project budget in developing a response to deal with red risks

Green risks
These are risks that have a relatively low exposure value. We can accept these risks and so we cannot justify adding more money to the original project budget in developing a response. We can however justify adding a contingency sum to cover green risks.

Amber risks
These risks have to be reviewed and a decision taken regarding whether to deal with it as red or green risk. Ignoring any risk is not an option

Risk Response Strategies

Depending on risk category, risk response can take the following forms:

- Avoidance: Do something else or take a different route
- Acceptance: Do Nothing
- Mitigation: Do something to reduce probability or impact
- Transference (Sharing): Pass the risk on to someone else (at a cost), e.g. insurance.

CONCLUSION

Most building contracts do not meet set budget targets as a result of improper assessment of risk factors inherent. The problem of budget escalation is particularly profound in developing countries like Nigeria. As such this paper carried out a review of cost escalation in construction due to inherent risks in construction. It also underscored the need for a proactive approach to risk management in order to avoid fire-fighting during the course of delivering a project. Structured approach to risk management was discussed and practical example given on using the risk register for risk assessment and allocation in capital project budgeting. This approach is simple enough and easy to use for any construction practitioner and it is the hope of the authors that it will stimulate active risk assessment in capital project budgeting among Nigerian construction practitioners.

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