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Evaluating the impact of risk factors on construction projects cost in Nigeria

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ABSTRACT

One of the challenges facing the construction in Nigeria is how to assess the risk of cost overruns and deliver projects within budget. These risks can cause losses that lead to increase in costs, time delays and lack of quality of projects. The purpose of the paper is to identify and assessed the likelihood of occurrence and degree of impact of the risk factors on construction projects within the Nigerian construction industry. In view of the foregoing, the objectives are to establish a relative significance index score for the most important risk factors affecting the performance of the projects. A self administered questionnaire was employed to the construction industry professional for their responses on the likelihood of occurrence of risk factors and the impact of these risk factors on project performance. A total seventy Eight questionnaires were sent to construction industry professionals which comprises of Contractors, Architects, Quantity Surveyors and Engineers but Fifty Eight was return which was later analyzed using descriptive statistic and analyses of variance ,(ANOVA) and subsequently exposure rating levels were determined which enable the categorization of the probability- impact score in Low, medium and high levels. Results of the study indicate a disparity of the ranking of the degree of occurrence and impact among the group. Based on the composite of risk factors, the cost related risk and time related risk was found to be the most likely to occur and have the most impact on project, whereas environmental risk factor was found to be low weighted risk, as it had the least likelihood to occur and the least impact score.

KEYWORDS: *Risk factors, Risk management, Construction industry, Construction project cost, Nigeria*

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I. INTRODUCTION

The pace of change in the construction industry has imposed additional demands on construction project management. Risk management is a vital project management planning and control tool for reducing uncertainty and improving decision-making. Risk cannot be avoided but must be recognized, assessed and managed.

The research reported upon in this research is focused upon assessing key risk factors affecting g construction project cost in Nigeria. The research is to assess the risk factors affecting construction project performance from stakeholder perspective and at a project level. The study is concerned with financial risk rather than hazard. It is argued that if contractors are equipped with an effective decision support system they can improve the quality of their decisions with regard to the most significant risk factors affecting project performance (Odenyinka, 2000)

Construction organization's efficiency and effectiveness largely depends on how managers scan the external project environment, identify the critical factors and adapt their organizations accordingly (Baloi 2002).

Risk is an uncertain event or set of circumstances that could occur, have an effect on the achievement of the project objectives. Risk factors is inherent in every construction project from small to larger project running millions to billions of naira and it is impossible for all risk to be avoided (Abba, 2008).

A risk is the probability of incurring misfortune or loss while, a risk factor is a factor such as a habit or an environmental condition that pre disposes an individual to develop a particular diseases (Collins English Dictionary and Thesaurus, 2006).

It has also been stressed that construction is a risk-prone industry, with a poor track record of coping with risks, as a result of which clients have been enduring the agonizing outcomes of failure in the form of unnecessary delays in project completion, cost overrun and sometimes failing to meet quality standards and operational requirements (Wakjira, 2011).

Traditionally, during the pre- contract stage of project, most of these risks are not properly identified, assess the likelihood of its occurrence, asses it impact on project performance. Rather a 10% contingency is added to the total project cost in order to accommodate the effect of unforeseen circumstances. In most cases the 10% contingency is bases on intuitive guesswork and this explains the attendant high cost overrun (Odenyinka 2000). Thus, a need to assess the risk impact on construction project is still desirable. Proper risk analysis and cost control will ensure certainty of project price i.e project will achieve its cost and will be within budgets, timely delivery of project, project will also receive the best quality and the expenditure must give value for the money spent (Awodele 2012).

II. STATEMENT OF THE PROBLEM

One of the challenges facing the construction industry is to manage the risk of cost overruns and deliver projects within budget. At the beginning of the last decade, Brandon (1990) stated that in construction the new orthodoxy is to accept risk and uncertainty. Latham (1994) put forward that no construction project is risk free, and risk can only be managed, minimized, shared, transferred, or accepted: it cannot be ignored. The risks can cause losses that lead to increase in costs, time, delays and lack quality of project (simu, 2006); while project's objectives are most often related to time, cost, and quality. Shehu and Sommmerville(2006) has also stressed that construction is risk-prone industry, with poor track record of coping with risks, as a result of which client have been enduring the standard and operational requirements.

Contemporary project management practice is characterized by late delivery, exceeded budgets, reduced functionality and questionable quality (Williams, 1999) and while risk management is a recognized practice that helps clients deliver projects on schedule and within budget (project management institute, 2000). The risk management performed in the construction industry has traditionally been that of gut feel or series of rules-of thumb (Al- Bahar and Crandall, 1990). Consequently, project risks are often not adequately dealt with (Thompson and Perry, 1992) and the complexities of projects, locations and types of contracts are significantly contributors to risk in construction projects (Ahmed et al. 1999).

III. RESEARCH METHODOLOGY

This research covers project participants in construction project, primarily Contractors, Architects, Quantity Surveyors, engineers in Northern Part of Nigeria. The study specifically collected data from Kaduna, Kano and Abuja. These places were selected because of frequent construction activities that are carried out in these regions. Data collection was done through a questionnaire survey self- administered on 78 randomly selected construction professionals involved in a nearly completed or recently completed construction projects. The questionnaire was based on a rank scale of 1-5 to be ranked among the various effects of risk factors that can occur to construction project cost. A total of seventy five (78) questionnaires were distributed but fifty eight (58) (74.36%) of the data were retrieved. The data provided by the questionnaire were analyzed using descriptive statistic and analyses of variance (ANOVA). The survey feedback includes two groups of data, the likelihood of occurrence of each risk and its level of impact on project objective in terms of cost, time, quality performance. Thus according to Shen (2001), risk significance, denoted by RS, can be described as the function of these two attributes as follows:

RS= $f(\alpha, \beta)$ ----------(1)

A survey questionnaire will be design to collect a required data about these two attributes. In other to assess the importance of each factor, a risk significance index will be established by calculating a significance score for each factor. An alternative for calculating a significance score is to multiply the probability of occurrence by the degree of impact (Shen 2002). Thus the significance score for each risk assessed by each responded can be calculated through Eq.2

$S_j^i = \alpha_j^i \beta_j^i$ ----------(2)

Where

S_j^i is the significance score for risk i, as acknowledge by respondent j

α_j^i is the probability of occurrence for risk i, as acknowledge by respondent j

β_j^i is the level of degree of impact for risk i as acknowledge by respondent j

(Shen, 2001)

Thus the RSIS can be calculated through the following model:

$$RSIS^i = \left(\frac{\sum_{j=1}^{N} S_j^i}{N}\right) \text{ ----------(3)}$$

Where

$RSIS^i$ is the relative significance index score for risk i

S_j^i is the significance score for risk i, as acknowledge by respondent j

N is the number of the respondent

For the purpose of calculatingS_j^i the following numerical conversion for the rating, as previously use by Shen (2001), was adopted for the conversion of the rating attributes.

Table I. Corresponding numerical conversion for the rating attributes

β	
Rating Attributes	Numerical Conversion
1	0.00
2	0.20
3	0.40
4	0.60
5	1.00

α	
Rating Attributes	Numerical Conversion
Low	0.1
Medium	0.5
High	1.0

The point scales for α (low, medium and high) and β (neglected impact, very small impact, small impact, medium impact, heavy impact, and very heavy impact) need to be converted into numerical scales. According to Shen *et al*. (2001) and Wang and Liu (2004), "high" or "highly" takes a value of 1, "medium" takes a value of 0.5, and "less" or "low" takes a value of 0.1.The index score was used to rank risks factors indentified.

IV. RESULTS AND DISCUSSION:

Table II: Types of organization surveyed

Type of organization	Distributed	Returned	Percentage	Cumulative percentage
Contracting Firms	15	10	17.24	17.24
Architectural Firms	15	10	17.24	34.48
Quantity Surveying Firms	20	18	31.03	65.51
Engineering Firms	15	12	20.69	86.20
Institution	8	5	8.63	94.83
Others	5	3	5.17	100
Total	78	58 (74.36%)	100	

Table I shows the frequency of questionnaires retrieved from different organization. 17.24% of the questionnaires were retrieved from contracting firms, 17.24% from Architectural firms, 31.03% from Quantity Surveying firms, 20.69% from Engineering firms, 8.63% from higher institution of learning, and 5.17% from other professional that are associated with construction activities.

Table III: Respondent's destination

Respondent destination	Distributed	Returned	Percentage	Cumulative Percentage
Contractors	10	6	10.34	10.34
Architects	15	12	20.69	31.03
Quantity Surveyors	25	20	34.48	65.61
Engineers	13	10	17.24	82.75
Project Mangers	10	7	12.08	94.83
Others	5	3	5.17	100
Total	78	58 (74.36%)	100	

Table II shows the frequencies and percentages of the respondents who were involved in the study with their respective professionals. The study was conducted with fifty eight (58) respondents who were construction professionals, 10.34% of the questionnaires were returned by the contractors, 20.69% by the Architects, 34.48% by the Quantity Surveyors, 17.24% by the Engineers, 12.08% by the Project managers while 5.17% were returned by other professionals who were related to construction activities.

Table IV. Relative significance Index Score (RSIS) for the different risk (Cost Related Risk)

Risk factors	RSIS	Std. Dev.	Co. of Var.	Rank
Design Variation	0.9154	0.1040	0.5324	1
Variation by the client	0.2343	0.0986	0.4211	2
Price Inflation	0.2126	0.0997	0.4688	3
Incomplete or inaccurate cost Estimate	0.1480	0.0758	0.5122	4
Inadequate program scheduling	0.1320	0.0953	0.7222	5

The result in Table IV show that Design Variation (RSIS=0.9154, ST.Dev.=0.1040), Variation by client (RSIS=0.2343 , ST.Dev.=0.0986), Price Inflation (RSIS=0.2126, ST.Dev.=0.0997), Incomplete or inaccurate cost estimate (RSIS=0.1480, ST.Dev.=0.0758), Inadequate program scheduling (RSIS= 0.1320, ST. Dev.=0.0953). These RSIS represent the relative importance of these factors in the construction in Nigeria. The relative importance between one factor and the other is express through their relative score. Under cost related factor, design variation has the highest significant factor followed by variation by client etc.

Table V. Relative significance Index Score (RSIS) for the different risk (Time Related Risk)

Risk factors	RSIS	Std. Dev.	Co. of Var.	Rank
Bureaucracy of Government	0.3154	0.1280	0.4057	1
Design variation	0.1257	0.0657	0.5228	2
Quality performance	0.1240	0.0754	0.6083	3
Tight project schedule	0.1206	0.0664	0.5509	4
Variation of construction program	0.1006	0.0503	0.5000	5

The result in Table V show that Bureaucracy of Government (RSIS=0.3154, ST.Dev.=0.1280), Design Variation (RSIS=0.1257 , ST.Dev.=0.0657), Quality performance (RSIS=0.1240, ST.Dev.=0.0754), Tight project schedule (RSIS=0.1206, ST.Dev.=0.0664), Variation of construction program (RSIS= 0.1006, ST. Dev.=0.0503). These RSIS represent the relative importance of these factors in the construction in Nigeria. The relative importance between one factor and the other is express through their relative score. Time related factor, bureaucracy of Government has the highest significant factor followed by design variation by client etc.

Table VI. Relative significance Index Score (RSIS) for the different risk (Quality Related Risk)

Risk factors	RSIS	Std. Dev.	Co. of Var.	Rank
Tight project schedule	0.3114	0.1051	0.3374	1
Design Variation	0.2486	0.0887	0.3568	2
Lack of coordination between Project participants	0.1840	0.0898	0.4881	3
Unsuitable construction Program planning	0.1811	0.0643	0.3552	4
Lack of skilled labor	0.0223	0.0204	0.9176	5

The result in Table VI show that Tight schedule (RSIS=0.3114, ST.Dev.=0.1051), Design Variation (RSIS=0.2486 , ST.Dev.=0.0887), Lack of coordination between project paricipants (RSIS=0.1840, ST.Dev.=0.0898), Unsuitable construction program planning (RSIS=0.1811, ST.Dev.=0.0643), Lack of skilled labor (RSIS= 0.0223, ST. Dev.=0.0204). These RSIS represent the relative importance of these factors in the construction in Nigeria. The relative importance between one factor and the other is express through their relative score. Quality related factor, Tight schedule has the highest significant factor followed by design variation by client etc.

Table VII. Average Level of Impact for the different risk factors for the different risk (Cost Related Risk)

Risk factors	AV. IMP.	Std. Dev.	Co. of Var.	Rank
Incomplete or Inaccurate cost Estimate	0.5886	0.2948	0.5009	1
Inadequate program planning	0.5257	0.1821	0.3463	2
Variation by the client	0.4914	0.2077	0.4227	3
Design Variation	0.4743	0.2063	0.4349	4
Price Inflation	0.4514	0.2241	0.4964	5

The result in Table VII show that Incomplete or inaccurate cost estimate (AV. Impact =0.5886, ST.Dev.=0.2948), Inadequate program planning (AV. Impact=0.5257 , ST.Dev.=0.1821), Variation by client (AV.Impact=0.4914, ST.Dev.=0.2077), Design variation (AV. Impact=(0.4743, ST.Dev.=0.2063), Price inflation (AV. Impact= 0.4514, ST. Dev.=0.2241). These average impacts represent the degree of potential loss on construction project cost in the construction industry. The average impact of the risk factors is express as their relative score on construction projects.

Table VIII. Average level of Impact for the different risk Factors (Time Related Risks)

Risk factors	AV. IMP.	Std. Dev.	Co. of Var.	Rank
Quality program	0.7086	0.2020	0.2851	1
Tight program schedule	0.6057	0.2400	0.3963	2
Bureaucracy of Government	0.4914	0.2884	0.5868	3
Design variation	0.4343	0.2589	0.6268	4
Variation of construction program	0.4057	0.2543	0.2851	5

The result in Table VIII show that Quality program (AV. Impact =0.7086, ST.Dev.=0.2020), Tight program schedule (AV. Impact=0.6057 , ST.Dev.=0.2400), Bureaucracy of Government (AV.Impact=0.4914, ST.Dev.=0.2884), Design variation (AV. Impact=(0.4743, ST.Dev.=0.2063), Variation of construction program (AV. Impact= 0.4057, ST. Dev.=0.2851). These average impacts represent the degree of potential loss on construction project cost in the construction industry. The average impact of the risk factors is express as their relative score on construction projects.

Table IX. Average Level of Impact for the different risk Factors (Quality Related Risks)

Risk factors	AV. IMP.	Std. Dev.	Co. of Var.	Rank
Tight project schedule	0.7314	0.2166	0.2962	1
Design Variation	0.7086	0.2672	0.3771	2
Unsuitable construction Program planning	0.5543	0.2914	0.5257	3
Lack of coordination between Project participants	0.4057	0.2141	0.5278	4
Lack of skilled labor	0.3600	0.2265	0.6291	5

The result in Table VIII show that Tight project schedule (AV. Impact =0.7314, ST.Dev.=0.2166), Design varition (AV. Impact=0.7086 , ST.Dev.=0.2672), Unsuitable construction program planning (AV.Impact=0.5543, ST.Dev.=0.2914), Lack of coordination between project participants (AV. Impact=(0.4057, ST.Dev.=0.2141), Lack of skilled labor (AV. Impact= 0.3600, ST. Dev.=0.2265). These average impacts represent the degree of potential loss on construction project cost in the construction industry. The average impact of the risk factors is express as their relative score on construction projects.

V. CONCLUSION

This paper attempted to investigate the likelihood of occurrence and the impact in case of occurrence of some identified risk factors at pre and post contract stage of the construction projects. The paper concludes that the likelihood of occurrence of risk factor was found to be in cost related risk with RSIS of 0.9154, time related risk with RSIS of 0.3154 and quality related risk of 0.3114. The perceived impact of risk factors in case occurrence was found to be in time related risk with highest average impact (AV. IMP.) of 0.7086, quality related risk with highest average impact of 0.7314 and cost related risk with the highest average impact of 0.5886. Whilst this order is not a surprise in traditionally procured projects, which form the basis of the majority of the responses to the study survey, it provides an invaluable piece of information to the construction stakeholders as regards to the risk factors to concentrates on in the risk management process. The research also found out the level awareness of stake holders in construction industry about risk factors that affect the construction cost to be average.

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