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ABSTRACT

Objectives: This work evaluated the mitigation measures against the risks of cost overrun in Nigerian construction industry. This would control the excess spending and thereby improves the contribution of the industry to the country's gross domestic products (GDP).

Methods/Statistical analysis: Descriptive cross-sectional survey design was adopted while stratified random sampling was adopted to select stakeholders. Structured questionnaire and telephone interviews were adopted for data collection. Reliability of the instrument was established by applying split-half method after duly validation by experts in the field. Cross tabulation and chi-square was adopted to test the data, while the test to find out the strength of association between the variables was carried out using Phi and Cramer's V.

Findings: The study identified delay in payment of claims and honouring of certificates as first with P-value of 0.102 which was followed by inaccurate estimation with P-value of 0.933 respectively as the commonest internal risk factors causing cost overrun. Fluctuations/price escalations of materials, labour and equipment ranked first among the identified external risk factors causing cost overrun with a MIS of 3.90 and RII of 0.780, meaning that the respondents believed that it was a major external factor that affects the overall cost of a project. Ranked next is the shortage of skilled labour for the execution of the project, with the MIS of (3.58). The P-value test carried out shows that all the listed factors in Table 1-2 affect project cost overrun.

Keywords: construction industry, cost overrun, mitigation, project, risk.

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Furthermore, thorough planning before the project begins ranked first among the mitigating measures of cost overrun with MIS of 4.06. This was keenly followed by effective communication with MIS of 4.04.

Application/Improvements: The study reveals further the damage cost overrun done to the economy and the measures to adopt in curbing its effect in order to improve the economic growth of the country.

Keywords: construction industry, cost overrun, mitigation, project, risk.

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I. INTRODUCTION

1.1 Background to the Study

Construction industry is a highly dynamic sector as well as an important player in the development of any nation (Memon, Rahaman and Azis, 2012). This industry is important and plays a vital role in the socio-economic growth of a country. It also improves the quality of life for the people by providing the necessary infrastructure such as hospitals, schools, roads and other basic facilities. The construction industry contributes to the Gross Domestic Product (GDP) and employment rate of the nation, and it procures products and materials from the business in other sectors (Arcila, 2012). The Nigerian construction industry has recorded some impressive growth over the last few years (Isa, Jimoh and Achuenu, 2013). The Nigerian

building and construction industry has contributed between 2.08% and 3.01% to the Nigerian GDP between 2008 and 2013 (African Economic Outlook, 2014). It is therefore fundamentally important to make construction projects completed successfully with time, budget and expected quality (Rahman, Memon and Karim, 2013).

Risk comes in as obstacles to the realization of project objectives which is in square form. These are estimated sum, quality of work done, and time of delivery and project sustainability. It is difficult to rate any of these objectives over the other because without the realization of the mentioned factors, it would be impossible for clients to get values for their money. Cost overruns, time overrun, poor quality and sustainability have significant economic, social, environmental and political implications.

1.2 Statement of Research Problem

Most developing countries including Nigeria have been unable to curb the risk pose by cost and time overrun including project standard. Cost overrun is significant because it has almost become normal norms in nearly all projects in Nigeria. Consultants prepare for the list of claims from the contractors while the clients become restless because of unpredictable extra financial commitment to his project. The effect of cost overrun is more prevailing, in public projects. The government who is the major client of the industry is made to pay an avoidable extra money; thereby doing disservice to her people. Wrong spending has a multiplier effect on the industry, the economy and the people. This has led to risk output such as: job insecurity, unemployment, and poor capital base, lack of expansion, poor image creation, weak growth and total collapse of the system. Several works has been carried out by different authors on cost overrun; but none evaluate it as a key risk issue that needed to be mitigated. There is need therefore to assess and recommend risk management tools to curb effect of cost overrun on the overall construction project cost through this work. This work would guide the

managers of the public coffers on the strategies to adopt in preserving the people's wealth. It would assist the relevant stakeholders in the industry on method to adopt to meet the expected contributors towards building a virile society. The work would also caution and guide the financial of the industry, the clients on their decision rules as it determines the direction of the industry.

1.3 Aim and Objectives

This research is aimed at evaluating the mitigation measures towards risks of projects cost overrun in Nigerian construction industry. The work assessed the causes of cost overrun in the construction industry and identified the core element where cost overrun exist and analysed cost overrun risk measures in the Nigerian construction industry.

II. LITERATURE REVIEW

2.1 Construction Industry and costing

The construction industry is a generic term for a service industry that forms part of the nation's economy, carrying out the planning, design, construction, alteration, refurbishment, maintenance, repair and demolition of structures (Towey, 2012). The industry produces a variety of structures to create the built environment. The construction industry is very crucial in any nation's social and economic development. The industry is considered as a driver of economic development in a country. This is basically due to the fact that almost all other sectors of the economy in one way or the other depend solely on the products and services of the construction industry in order to carry out their operations. The construction industry is often utilized by governments not only to stimulate growth but also to assist economic recoveries from recessions. Cost is a fundamental component for any construction project in the industry. Hence, cost performance is a critical issue to be considered in the success or failure of such projects Subramani, Sruthi and Kavitha (2014). Chitkara, (2011) explained cost as the budgeted expenditure which the client has agreed to commit for creating/acquiring the desired construction facility. The

cost of a work unit is comprised of many cost elements. These cost elements include labour costs, material costs, plant and machinery costs, administration costs and other expenses. In order to identify costs associated with an activity, construction costs are categorized into “Direct costs”, “Indirect costs” or “Overhead costs” and Profit.

Direct costs are costs that can be correlated to a specific activity or a work item, which is being done or produced. Direct cost of permanent work item = Direct material cost + Direct labour cost and Direct plant cost. Direct material costs cover all costs connected with materials, which are incorporated into permanent works of the project. Direct labour costs cover net expenses for procurement, maintenance, and wages of all categories of workers employed at the work site for the execution of an item of project. Other direct expenses include all other expenses on account of services rendered, which can be directly attributed to and clearly identified with the execution of an activity or work item.

2.2 Risk of Cost Overrun in the Construction Industry

Cost overrun is the amount by which actual costs exceed the baseline or approved costs (Danso and

$$\% \text{ Cost overrun} = \frac{\text{Final Contract Amount} - \text{Original Contract Award Amount} \times 100}{\text{Original Contract Award Amount}}$$

Cost escalation refers to the increase in the amount of money required to execute a project over and above the original budgeted amount (Kaliba, Muya, and Mumba. (2009). It occurs when actual costs exceed previously estimated values. Boukendour (2005) argued that several cost estimates are usually produced during the project life cycle, but there is no standard rule to determine which one must be considered for computing the cost overrun. However, according to Mahamid and Amund (2012), cost overrun is referred to as cost deviation which is simply a difference between the final cost of a project and the contract amount without any changes to the original contract. Jain and Singh (2012) also

Antwi, 2012). Cost overrun is defined as the excess of actual cost over budget and is sometimes referred to as cost escalation, budget overrun or cost increase (Bukendour, 2005; Nyamoki, 2012). Cost overrun is also defined as the difference between the actual construction cost on completion of work and original estimated costs, with all costs calculated in constant prices (Nyamoki, 2012; Subramani *et al.*, 2014). Actual costs are defined as the accounted costs actually spent, as determined at the time of project completion while estimated costs are defined as the budgeted or forecasted costs at the time of project approval, which are typically similar to costs presented in the business case for a project (Lee, 2008). Percentage cost overrun can also be defined as the change in contract amount divided by the original contract award amount. This calculation can be expressed as a percentage for ease of comparison.

defined cost overrun as the difference between the actual cost and the initially projected (i.e. expected) cost of the project. According to them, the actual cost of the project is the cost at the time of completion of the project (which can be referred to as the Final Account Sum).

Hence for the purpose of this research work, Cost Overrun = Final Account Sum (the agreed value of the construction work, certified at the final account) – Initial Contract Sum (the award tender sum).

2.3 Causes of Cost Overruns

The history of the construction industry worldwide is full of projects that were completed with significant time and cost overruns (Ameh, Soyngbe, and Odusami, 2010). A large number of studies and surveys evidenced the fact that cost overrun affects all kinds of projects in all industries, and in all countries either in the public or in the private sector (Boukendour, 2005).

2.4 Factors causing cost overrun

A lot of researchers have discovered the reasons for the disparity between the tender sum and the final cost of the construction projects. The following were identified as the factors that influence cost overruns. Reasons given were ranked as issues related to design and documentation, financial resources management, project management and contract administration, contractors site management information and communication technology, material and machinery resource, labour (or human) resource and external factors Memon *et al.* (2012).

The work of Subramani *et al.* (2014) showed that slow decision making, poor schedule management, increase in material/machine prices, poor contract management, poor design/delay in providing design, rework due to wrong work, problem in land acquisition, wrong estimation/estimation method and long period between design and time of bidding/tendering are the major causes of cost overrun in public construction projects in India.

III. RESEARCH METHODOLOGY

The overall purpose of this research is to identify and rank the leading cause of construction project cost overrun in the construction industry and their possible remedies. The process will facilitate learning about construction cost and getting value for money. The resulting remedies are intended for the application in planning for a better cost performance of a project.

3.1 Research Design

The research is a practical problem developed to investigate mitigation measures to risk of cost overrun to the Nigerian construction industry. The study employed the use of case study and survey approach of descriptive research design which involved collection of data from the target population using the survey data collection technique. The data sourced from respondents provided a basis for drawing scientific and logical inferences and conclusion after a thorough statistical analysis.

3.2 Methods of Data Collection

The questionnaire was designed to seek respondents' opinion on level of importance of the listed factors causing cost overruns on a 1-5 Likert-type scale using 1 for not important, 2 for slightly important, 3 for moderately important, 4 for very important, and 5 for extremely important. Similarly, possible remedies for cost overrun were sought from the respondents on a 1-5 likert-scale from 1 for not important to 5 for extremely important. Majority of the questionnaires were administered and collected by direct contact. However to save the time and cost of second visits to collect the questionnaires, some were completed and forwarded electronically through e-mail address of the researcher.

3.3 Methods of Data Analysis

The data collected were analyzed through Statistical Package for Social Sciences (SPSS, Version 20) computer statistical programme. On the basis of the data obtained from the respondents, the causes were assessed for their relative significance index using the mean item score (MIS) method. A five-point scale was used to calculate the MIS for each factor, which was then used to determine the relative ranking of different factors by assigning ranks to the mean scores, with high mean scores assigned high ranks and vice versa. These ranking made it possible to compare the relative significance of the causes as perceived by the various professionals. The mean Item Score (MIS) for each factor was computed by the

following formula (Chan & Kumaraswamy, 1996; Odeh & Battaineh, 2002):

$$MIS = \frac{\sum_{i=1}^5 (s_i \times f_i)}{N}$$

where, i = response category (scaling) index = 1, 2, 3, 4, and 5 for not-, slightly-, moderately-, very- and extremely significant respectively; s_i = score assigned to each factor by the respondents and ranges from 1 to 5; f_i = frequency of responses to each rating (1 - 5) for each factor; and N = total number of responses concerning that factor.

In order to determine the most important causes, the “weighted average” of the mean item scores for each of the causes from each group was evaluated. The analysis of variance was carried out to

determine the significant difference among the various professions for each remedy of cost overrun.

IV. RESULTS, ANALYSIS AND DISCUSSION

4.1 Causes of Cost Overrun in the Construction Industry

The main objective of this section is to identify the causes of cost overrun in the construction industry. The cost overrun in the industry could be classified into internal and external related factors. On internal causes; factors such as the poor management of the project by the contractor; honouring of the certificate raised which affects the cash flow of the contractor and the involvement of quacks in contract administration and management are among the factors identified under the internal factors as shown in table1.

Table 1: Internal-related factors responsible for cost overrun

	INTERNAL RELATED FACTORS	Civil Engr. (N=12)		Qty. Surveyor (N=11)		Architect (N=10)		Builder (N=6)		Mech./Elec. Engr. (N=6)		Others (N=5)		P-value	Level of Sig.
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank		
1	Poor project management and contract administration	3.68	3	3.36	6	3.70	3	3.34	3	3.33	6	3.21	5	0.612	NS
2	Project complexity	3.75	2	3.56	4	3.80	2	3.67	1	4.00	3	3.60	3	0.867	NS
3	Delay in payment to claims/ honouring of certificates	3.50	5	3.64	3	3.40	4	3.17	6	4.17	2	4.00	1	0.102	NS
4	Inaccurate or poor estimation	3.66	4	3.67	2	3.82	1	3.32	5	3.50	5	3.80	2	0.933	NS
5	Lack of contractors' experience in relevant projects	3.25	7	3.09	7	3.00	7	3.36	2	3.54	4	3.20	6	0.896	NS
6	Poor designs and documentation	3.42	6	3.55	5	3.20	6	2.83	7	3.00	7	2.80	7	0.191	NS
7	Poor assessment and management of risk	3.92	1	3.73	1	3.22	5	3.33	4	4.33	1	3.40	4	0.090	NS

Source: Researcher field work, 2018

The analysis of variance (ANOVA) was carried out on the internal-related factors to determine if there is significant difference in the opinions of various professionals concerning these factors that

cause cost overrun. From Table 1, the p-values for all the seven factors are greater than 0.05, implying that there are no significant differences in the mean values of the identified factors that

cause cost overrun at 0.05 α level. Therefore, there is significant degree of agreement between the various respondents in building construction concerning the internal-related causes of cost overrun.

Furthermore, delay in payment of claims and honouring of certificates was ranked first with P-value of 0.102 which was followed by inaccurate estimation with P-value of 0.933. The identified factors in table 1 concurred with previous work by Nnadi, Ugwu and Nwoji, 2015 which stated that

the poor capital base of contractors have weakened the effective performance of the industry in contributing to economic growth of the country.

Mansfield, Ugwu and Doran, 1994 also noted that for a long time, the industry has been plagued with the intertwined perennial problems of quality, cost, and time overruns). Part of the reasons cited are poor project management and poor designs as identified in this work.

Table 2: External-related factors that cause cost overrun

	External-Related Factors	NI	SI	MI	VI	EI	Mean	Remark	RII	Rank	P-value	Level of Sig.
1	Fluctuation/ Price escalations of materials, men and machine	0	0	45	100	50	3.90	VI	0.780	1	0.697	NS
2	Rise in foreign exchange rate (for imported materials)	1	10	66	48	50	3.50	VI	0.700	3	0.446	NS
3	Unavailability of local materials/equipment	0	6	87	40	40	3.46	MI	0.692	4	0.306	NS
4	Shortage of skilled labour	1	6	45	112	15	3.58	VI	0.716	2	0.964	NS
5	Project materials monopoly by suppliers	0	6	105	40	10	3.22	MI	0.644	5	0.997	NS
6	Bad or inclement weather	2	10	78	68	0	3.16	MI	0.632	6	0.170	NS
7	Political situation	3	32	57	44	5	2.82	MI	0.564	7	0.355	NS

Source: Researcher's Field work 2018

Table 2 that fluctuations/ price escalations of materials, labour and equipment ranked first with a MIS of 3.90 and RII of 0.780, indicating that the respondents believed that it was a major external factor that affects the overall cost of a project. This is in agreement with the opinion of Memon *et al.* (2011) that the rise in the price of materials, labour and equipment due to instability of the economy can hamper production because the initial amount set out for the project will be exceeded and the project could automatically stop or be delayed. The second ranked cause is the shortage of skilled labour for the execution of the project, with the MIS of (3.58). This shortage leads to the use of unskilled workers. The factor that ranked third is the rise in foreign exchange rate (for imported materials) with an MIS of (3.50) which is close to the second ranked. Most of our building materials are imported and with the rise in foreign exchange, the prices of these materials will automatically increase thereby

affecting the initial budget of building construction works. Bad or inclement weather and political situation ranked sixth and seventh respectively and with a MIS of 3.16 and 2.82 respectively. Bad weather which is an example of nature-related factor is the act of nature according to Hoe (2013), Niazi *et al.* (2017) and Abusafiya *et al.* (2017) which may cause the construction work to be stopped immediately causing schedule delay and cost overrun. Political situation on the other hand is the least important on the list. The respondents believed that although it's an important factor, it is not always a determining factor of cost overrun.

The analysis of variance (ANOVA) was also carried out on the external-related factors to determine if there is significant difference in the opinions of various professionals concerning these factors that cause cost overrun. From Table 2, the p-values for all the seven factors are greater than 0.05,

implying that there are no significant differences in the mean values of the seven consultant-related factors that cause cost overrun at 0.05 α level. Therefore, there is significant degree of agreement between the various professionals in building construction concerning the external-related causes of cost overrun.

for better delivery of a successful project. There are therefore ways of project management that prevents projects from having cost overrun. Remedies were suggested and the respondents stated their order of importance. Table 3 shows the remedies and their order of importance in checking cost overrun.

4.2 The Remedies for Construction Cost Overrun In the Construction Industry

Cost overrun is a common occurrence in the construction industry. It is necessary to curtail it

Table 3: Remedies for construction cost overrun in the construction industry

E	Remedies	NI	SI	MI	VI	EI	Mean	Remark	RII	Rank	P-value	Level of Sig.
1	Thorough planning before the project begins	0	0	33	100	70	4.06	VI	0.812	1	0.490	NS
2	Engagement of capable contractors; subcontractors and consultants	0	8	36	96	50	3.8	VI	0.760	3	0.160	NS
3	Stay within the project scope	1	10	69	60	30	3.4	MI	0.680	5	0.133	NS
4	Use of good scheduling tools and charts	1	14	51	88	15	3.38	MI	0.676	6	0.485	NS
5	Ensure effective communication	2	8	12	80	100	4.04	VI	0.808	2	0.212	NS
6	Constantly tracking and measuring the progress of the project	0	10	48	92	30	3.6	VI	0.720	4	0.126	NS
7	Early delivery of materials and equipment	3	4	78	68	10	3.26	MI	0.652	7	0.595	NS
8	Have efficient risk management system	5	10	90	32	10	2.94	MI	0.588	8	0.295	NS
9	Determine who pays for errors	12	24	54	24	10	2.48	SI	0.496	9	0.494	NS

Source: Researcher's Field work 2018

Thorough planning before the project begins ranked first in the table with MIS of 4.06. Planning is the most essential component of project management and the biggest weapon against cost overruns and delays. Proper planning reveals loop holes, creates the scope of the work to be done and gives proper direction to all parties involved in the contract. Effective communication ranked second with MIS of 4.04. Proper communication amongst all the parties to the contract is important. It is also important to communicate effectively with the workers to get

maximum co-operation and efficiency of work. The analysis of variance was carried out to determine the significant difference among the various professions for each remedy of cost overrun. From Table 3, all the p-values are greater than 0.05 which indicates that there are no significant differences in the mean values of all the nine remedies of cost overrun at 95% significant level. This implies the acceptance of the null hypothesis (H_0) and rejection of the alternative hypothesis (H_1); therefore, there is a significant degree of agreement between the various

professionals concerning the possible remedies of cost overrun.

V. SUMMARY OF FINDINGS

This project work addressed the mitigating measures of risks of construction projects cost overrun in the Nigerian construction industry. From the overall ranking of all the factors that cause cost overrun, it was revealed that fluctuations/ price escalations of materials, labour and equipment is the strongest factor that cause cost overrun as it ranked first. It was also discovered that some cost overrun factors are more prevalent than others as their level of importance vary according to the response of various professionals. Nevertheless, the result of ANOVA test carried out on all the factors individually revealed that irrespective of their mean differences, there was no significant difference among their weighted mean values.

In the end, the objectives and hypotheses postulated for this research work was met. All factors identified as the causes of construction cost overrun in the industry were categorized as internal and external related factors as shown in table 1 & 2. Cost overrun is a severe problem encountered by all in the industry. Most factors ranked higher than others although without significant difference in their weighted mean values. This indicates that all the sampled factors are important and lead to cost overruns.

Some researchers have suggested the inclusion of appropriate contingency allowance as one of measures against cost overrun. This is evident in the recent work of Abednego, Githae and Masu (2014) stating that the Joint Building Council Conditions of Contract in Kenya allowed a contingency of 15% to cater for cost overrun. Meanwhile, this research does not acknowledge contingency as a reliable risk measure. This makes the improvement of the management of financial resources inevitable. Cost overrun, for whatever reason, will lead to additional financial burden on the clients in form of claims by the contractor. This can lead to delayed payment by clients and

cash flow difficulties on the part of contractors and reduction in his work force. These effects, if allowed to continue unabated, could hinder the growth of the construction industry. This is why the professionals believed that all the suggested remedies if duly implemented would reduce cost overrun in the long run.

VI. RECOMMENDATIONS

In the light of aforementioned research findings and conclusion, the recommendations are simply the implementation of the remedies. This study hereby recommends that for any project, there must be well defined scope from inception to completion. More time should be invested in the early briefing stages of design, including feasibility. It should be borne in mind that contractors tend to overprice variations so as to cover up for any shortfalls in their initial bids. This implies that the variations that result from scope enlargements are costlier resulting in compound cost overrun. Effective scope definitions and reasonable surveys that would bring to light the scope of works to be undertaken must always be conducted towards satisfactory project delivery. This will reduce, to a minimum, the issue of additional work to project.

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