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Performance Evaluation of Construction Projects Delivery in Insurgency Affected Locations in Maiduguri, North East, Nigeria

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Abstract: The study carried out a performance evaluation of insurgency risk factors in Borno. The insurgency risk factors were analysed in terms of three keys that enhance the success of project delivery i.e. Cost, Time and Quality. The data for the study were collected through a questionnaire survey and administered to the professionals involved in the construction projects i.e. the Civil Engineers, Architects, Quantity Surveyors, Builders and Project Managers on construction projects in Maiduguri. The obtained information from the above-mentioned professionals relating to their years of experience and the number of projects they have handled during the insurgency period. A sample size of two hundred and twenty (220) from the total list of the aforementioned respondents Civil Engineers, (52), Builders, (40), Architects, (49), Quantity Surveyors, (43), and Project Managers, (36) i.e. two hundred and forty-eight (248). The sample size was collected using the purposive sampling technique as the targeted sample. The data were analysed using the Relative Importance Index (RII) in order to achieve a concrete and accurate analysis. The results were evaluated and ranked based on the high potential risks prevalent within the construction projects executed during the insurgency period.

Keywords: Borno, Construction Professionals Construction Projects, Risk Factors

I. Introduction

Risk factors are present in every construction project procedure and sometimes is impossible for these risks to be avoided [1]. Furthermore, during the project development, most of these risk factors are not properly identified and assessed [2]. [3] has also advocated that no procurement or construction project system is risk-free. Therefore, it becomes imperative to identify and assess risk factors related to construction project procedures for improving the overall project performance.

Borno State government has witnessed insurgency problems for over a decade. This insur

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gency has negatively affected the development of the state especially in terms of infrastructure. Performances of construction project delivery were faced with insurgency risk factors and led to project abandonment.

Therefore, it becomes imperative to identify and assess insurgency risk factors related to construction project delivery for improving the overall project performance.

It is a well-established fact that every stage of the construction process, from initial investment appraisal through to construction and use of the built facility, is subject to risk for all the parties involved. Indeed, the Nigerian construction firms compared to other industries have a particularly poor record in this regard with the high number of construction-related risks occurring each year [4].

To manage, identify, assess and monitor insurgency risks that arise within a construction project, there exists the process

of risk management, which has its origin in the U.S. in the '30s and in the 70's [5]. Risk management accepted the fact that risk is inherent in any project and [6] one of the greatest difficulties is to determine the risks and how they should be prioritized [7]. This is a key process and that is why project managers recognize that risk management is essential to carry out good project management [8].

II. Materials and Methods

The target population for this research covers primarily, the construction project professionals i.e. the Civil Engineers, Builders, Quantity Surveyors, Architects and Project Managers who were involved in the delivery of the project during the insurgency period in Borno. The study gathered information from the mentioned professionals within the Maiduguri Local Government in the Metropolitan Council (MC) relating to the number of projects they have handled during the insurgency period.

Table 1: Population Breakdown of Construction Projects Professionals in Borno

S/N	Construction Project Professionals	Population Size of the Respondents
1	Civil Engineers	Sixty (60)
2	Architects	Fifty-six (56)
3	Quantity Surveyors	Forty-eight (48)
4	Builders	Forty-four (44)
5	Project Managers	Forty (40)

Source (Researcher's Field Work)

A total population of 248 respondents were drawn from the study area Civil Engineers (60), Architects (56), Quantity Surveyors (48), Builders (44) and Project Managers (40) as shown in table 1 above.

A. Sampling Size and Technique

A sample size of two hundred and twenty (220) from the total list of two hundred and forty-eight (248) professionals obtained from the study area i.e. the Civil Engineers, Builders, Architects, Quantity Surveyors, and Project Managers were collected using purposive sampling technique as the targeted sample because it is a non-probability sample that is selected based on particular characteristics of a population. The sample size was calculated using the Yamane approach with a confidence interval of 95% and it is given by;

$$ny = \frac{N}{(1+Ne^2)} \quad (1)$$

where;
ny = Sample Size
N = Population Size
e = Alpha Level or Margin Error

B. Data Analysis

The data analysis was done using the Relative importance index (RII) in order to achieve an accurate analysis. The Relative Importance Index (RII) is expressed by:

$$RII = \frac{\sum W}{AN} = \frac{1_{n1}+2_{n2}+3_{n3}+4_{n4}+5_{n5}}{5N} \quad (2)$$

where

w = the weighting given to each factor by the respondent, ranging from 1 to 5. For example, n_1 = number of respondents for very insignificant, n_2 = number of respondents for not significant, n_3 = number of respondents for undecided, n_4 = number of respondents for significant, n_5 = number of respondents for very significant. A is the highest weight (i.e. 5 in the study) and N is the total number of respondents. The Relative Importance Index (RII) ranges from 0 to 1 [9].

III. Results and Discussion

The analysis of results gathered from the data obtained on the details of the Relative

Importance Index (RII) of each insurgency factor as it affects the performance of construction projects delivery in Borno State were ranked in order of importance.
Tables 2,3 and 4 shows the performance evaluation in terms of cost ,time and qualiy.

It is necessary to input that 220 questionnaires were administered to the construction professionals who have knowledge and experience in construction projects.

Table 2: Insurgency Risk Factors Limiting Project Performance in terms of Cost

Factors	Civil Engineers (RII)	Architects (RII)	Quantity Surveyors (RII)	Builders (RII)	Project Managers (RII)	Overall Weight (RII)	Rank
Cost of liquidated damages caused by insurgency	0.71	0.71	0.78	0.78	0.74	0.74	1st
Financial constraint faced by the state due to insurgency	0.69	0.73	0.72	0.65	0.71	0.70	2nd
Irregular supervision due to insurgency	0.53	0.60	0.76	0.68	0.82	0.71	3rd
Price inflation due to persistent attack	0.74	0.67	0.57	0.72	0.78	0.69	4th
Unavailability of construction manpower due to insurgency	0.63	0.61	0.82	0.66	0.45	0.67	5th
Enforcement of curfew due to persistent attack	0.68	0.63	0.53	0.71	0.76	0.66	6th
Extension of contract period due to insurgency risk	0.58	0.58	0.62	0.70	0.75	0.65	7th
Improper cost control system	0.73	0.70	0.66	0.48	0.63	0.64	8th
Wastes due to insurgency	0.57	0.62	0.61	0.76	0.64	0.64	8th
Frequent attack on the construction workers	0.70	0.51	0.67	0.65	0.66	0.63	9th
Cost of variation orders due to wastes caused by insurgency	0.71	0.49	0.60	0.67	0.70	0.63	9th
Shortage of fund due to insurgency	0.45	0.69	0.74	0.63	0.62	0.62	10th
Failure to payment contractor when due	0.66	0.57	0.63	0.64	0.51	0.61	11th
Failure to conduct site meetings regularly	0.66	0.57	0.63	0.64	0.51	0.60	12th
Divergent of project budget to security purposes	0.65	0.60	0.57	0.58	0.57	0.59	13th
Escalation of material prices caused by insurgency	0.62	0.59	0.67	0.73	0.54	0.58	14th
High project labour cost due to insurgency risk	0.61	0.57	0.70	0.50	0.56	0.58	14th
Project design cost due to non-availability of professionals	0.70	0.58	0.56	0.51	0.49	0.56	15th
Insufficient safety budget	0.53	0.74	0.37	0.67	0.50	0.56	15th
Improper budget	0.70	0.62	0.65	0.76	0.61	0.54	16th
Inadequate cash flow	0.76	0.50	0.49	0.56	0.41	0.54	16th

Inaccurate cost estimation	0.64	0.47	0.51	0.43	0.48	0.52	17th
Mistakes in estimating of project costs	0.58	0.47	0.59	0.47	0.42	0.51	18th
Irregular project budget update	0.61	0.69	0.32	0.43	0.47	0.50	19th

Table 3: Insurgency Risk Factors Limiting Project Performance in terms of time

Factors	Civil Engineers (RII)	Architects (RII)	Quantity Surveyors (RII)	Builders (RII)	Project Managers (RII)	Overall Weight (RII)	Rank
Excessive overtime due to insurgency	0.80	0.62	0.52	0.74	0.70	0.76	1st
Delay in payment to suppliers due to insurgency	0.66	0.68	0.64	0.79	0.76	0.72	2nd
Late supervision to construction sites caused by insurgency	0.56	0.67	0.81	0.73	0.71	0.70	3rd
Delays in site preparation caused by insurgency risk	0.73	0.51	0.84	0.80	0.66	0.70	3rd
Delays in material procurement caused by insurgency	0.61	0.56	0.77	0.68	0.86	0.69	4th
Delays in delivery of material as a result of military check points	0.63	0.66	0.58	0.71	0.72	0.68	5th
Time needed to rectify defects caused by insurgency	0.61	0.61	0.65	0.64	0.78	0.67	6th
On-site transportation difficulties due to insurgency	0.72	0.68	0.65	0.45	0.78	0.66	7th
New environmental laws caused by insurgency	0.49	0.61	0.79	0.65	0.69	0.65	8th
Unavailability of resources due to insurgency risk	0.59	0.60	0.73	0.62	0.66	0.64	9th
Percentage of orders delivered late due to insurgency risk	0.57	0.65	0.68	0.44	0.84	0.64	9th
Delay in regular payments caused by insurgency	0.60	0.66	0.57	0.55	0.73	0.62	10th
Average delay in claim approval	0.55	0.63	0.58	0.77	0.47	0.60	11th
Inadequate allocation of project duration	0.68	0.47	0.66	0.72	0.46	0.59	12th
Closures leading to shortage of materials	0.58	0.79	0.40	0.47	0.75	0.58	13th
Unavailability of drawings on time at site	0.41	0.56	0.42	0.57	0.55	0.56	14th
Lack of time needed to implement variation orders	0.53	0.64	0.61	0.48	0.49	0.55	15th

Slow response on doubts arising from the design drawing	0.77	0.55	0.61	0.48	0.50	0.53	16th
Lack of time needed for sufficient design detailing	0.54	0.71	0.63	0.67	0.44	0.51	17th

Table 4 Insurgency Risk Factors Limiting Project Performance in terms of quality

Factors	Civil Engineers (RII)	Architects (RII)	Quantity Surveyors (RII)	Builders (RII)	Project Managers (RII)	Overall Weight(RII)	Rank
Damages of material caused by insurgency	0.68	0.77	0.68	0.77	0.72	0.72	1st
Criminal acts in construction sites due to insurgency	0.62	0.78	0.69	0.68	0.77	0.70	2nd
Unsafe working conditions due to insurgency	0.63	0.53	0.80	0.79	0.72	0.69	3rd
Improper project feasibility study due to persistent attack	0.45	0.48	0.74	0.4	0.76	0.69	3rd
Improper quality assessment system due to insurgency risk	0.76	0.64	0.76	0.56	0.68	0.68	4th
Disputes between construction players	0.71	0.73	0.64	0.51	0.73	0.68	4th
Delays in site preparation due to insurgency	0.69	0.50	0.78	0.70	0.0	0.67	5th
Unavailability of competent staffs due to insurgency	0.51	0.73	0.70	0.49	0.80	0.65	6th
Poor performance of project team members	0.76	0.59	0.81	0.57	0.57	0.64	7th
Ineffective strategic plan	0.77	0.67	0.55	0.54	0.68	0.64	7th
Ineffective quality control due to insurgency risk	0.59	0.62	0.63	0.65	0.66	0.63	8th
Project complexity	0.75	0.60	0.50	0.71	0.63	0.63	8th
Poor scheduling of projects	0.60	0.64	0.61	0.54	0.73	0.62	9th
Improper project coordination	0.58	0.69	0.73	0.55	0.58	0.61	10th
Absence of team work	0.78	0.63	0.52	0.67	0.47	0.61	10th
Lack of quality training	0.69	0.68	0.67	0.47	0.50	0.60	11th
Poor selection of subcontractors	0.62	0.81	0.78	0.49	0.57	0.60	11th
Improper project planning	0.64	0.42	0.78	0.59	0.56	0.59	12th
Poor safety awareness among top management	0.60	0.71	0.66	0.46	0.53	0.59	12th
Inefficient and untimely supply of materials	0.73	0.66	0.54	0.45	0.55	0.58	13th
Rework due to field errors committed by the project players	0.66	0.61	0.54	0.48	0.60	0.58	13th

Poor quality of procured materials	0.56	0.70	0.47	0.62	0.52	0.57	14th
Poor projects technology requirements	0.83	0.55	0.41	0.46	0.53	0.55	15th
Lack of decision making process by clients	0.70	0.57	0.56	0.39	0.44	0.52	16th
Non-availability of construction spare-parts	0.48	0.63	0.60	0.41	0.49	0.50	17th
Poor quality of tools provided for use	0.53	0.75	0.44	0.69	0.47	0.48	18th
Improper structured of site management	0.58	0.60	0.58	0.61	0.65	0.46	19th

Relatively, similar research was carried out by [10], using the Relative Importance Index (RII) and Principal Component Analysis (PCA) to categorize risk variables under Eight components which includes; Environmental, Technical, Resource-related, Conflict, Design-related, Profit-related, Liquidity and Revolution & Change. The Environmental risk variables include; Storms, New environmental laws, Lightning strikes, Heavy rainfall and flooding, Negative environmental influence of the project, fire & explosions, Earthquakes, Landslides, Re-construction and Market size and competition with RII of 0.86, 0.83, 0.82, 0.70, 0.68, 0.62, 0.61, 0.58, 0.54 and 0.52 respectively.

The Technical risk variables comprise, lack of appropriate infrastructure and technology, Specification incomplete or unclear, lack of skills and knowledge of one partner, lack of supervision and control, one of the partners is not financially stable, unskilled sub-contractors and lack of constructions with Relative Importance Index (RII) of 0.83, 0.68, 0.61, 0.58, 0.56, 0.53 and 0.52 respectively.

The Resource-related risk variables comprise of, delay of material delivery, Insufficient staff and workers, Material quality default, staff turn-over, Lack of materials, Unexpected soil conditions, Insufficiently skilled workers, Lack of machinery with RII of 0.75, 0.69, 0.68, 0.66, 0.65, 0.63, 0.52 and 0.51.

Conflict risk variables include; Termination of construction, Delay of conflict resolution, Locals' disagreement of the project, Criminal acts in construction site, conflict of project contract with Relative Importance Index (RII) of 0.77, 0.61, 0.61, 0.53 and 0.52 respectively.

Design-related risk variables consist of; Defects in drawings/specifications, Mistakes in estimating of project cost, change of design scope, Delay of drawings or information about the project having RII's of 0.78, 0.74, 0.69 and 0.68 respectively.

Profit-related risk variables include; Difficulties in insurance, Low productivity, Insufficient profit margin, Increase of interest rate with RII of 0.68, 0.65, 0.62 and 0.52 respectively.

Liquidity risk variables include Liquidity of contract, Liquidity of owner, Delay of government approvals & other documents with Relative Importance Index (RII) of -0.87, -0.85 and 0.57 respectively.

Revolution and Change risk variables consist of Government policy change, Revolution/uprising and Tax increase with RII of 0.61, 0.54 and 0.52 respectively.

Therefore, based on the average RII of all risk variables under each component, their results indicated that; Resources-related, Technical, Conflict and Revolution & Change were the most significant risk components affecting the

performance of construction projects during the unrest period in Yemen.

Based on the findings of this study, the risk factors/variables were categorized on the three (3) key factors that enhance the success of project delivery i.e. Cost, Time and Quality and were analysed according to order of importance.

The study identified caused of liquidated damages caused by the insurgency, financial constraints faced by the state due to insurgency, irregular supervision due to insurgency, price inflation due to persistent attack, unavailability of the construction workforce due to insurgency as the most critical risk factors limiting project performance in terms of cost.

More so, excessive overtime due to insurgency, delay in payment to suppliers due to insurgency, late supervision to construction sites caused by the insurgency, delays in site preparation caused by insurgency risk, delays in material procurement caused by insurgency and delays in delivery of the material as a result of military checkpoint were the most significant factors limiting project performance in terms of time.

The study further identified damages of material by insurgency, criminal acts in construction sites due to insurgency, unsafe working conditions due to insurgency, improper project feasibility and quality assessment due to persistent attack, the dispute between project players and delays in site preparation due to insurgency as the most significant factors affecting project performance in terms of quality.

Therefore, these components of risk variables/factors of the above findings represent two general types of risk factors namely: external and internal risk factors. The findings of [10], was similar to that of [11] where they found out that internal types of risk are common in construction projects in Yemen while in my findings, the result of my study indicated that external types of risk are common in construction projects in Maiduguri. This indicates the importance of paying attention to the management of external risk factors in order to achieve good project performance.

Furthermore, similar research was carried out by [12], where twenty-five (25) risk factors are categorized into five (5) groups i.e. Construction, Politics and Contract provision, Financial, Design and Environmental.

The construction risk factors include; Land acquisition, shortage of equipment, shortage of material, late deliveries of materials, poor quality of workmanship, site safety, insolvency of sub-contractors and suppliers, inadequate planning and weather.

Politics and contract provision risk variables consist of a change in law and regulation, delay in project approval and permit, inconsistencies in government policies, excessive contract variation, poor supervision, bureaucracy, compliance with the government.

Finance risk components include; delay in payment for a claim, cash flow difficulties, and lack of financial resources.

Design risk factors consist of improper design, change of scope while Environmental risk components include; pollution, ecological damage and compliance with law and regulation for an environmental issue.

Similarly, they collected their data using a questionnaire survey to understand the perception of the practitioners to the risk factors using the five-point likert scale adapted to identify the significance of risk factors i.e. 1-Not significant, 2-Slightly significant, 3-Moderate, 4-Very significant and 5-Extremely significant.

The results of their data gathered were analysed statistically using the Relative Importance Index (RII) to determine the relative significance and ranking of risk factors. The same approach was used in the findings of this study to analyse the data collected from the questionnaire surveys.

IV. Conclusion

Based on the Overall Weight of the Relative Importance Index (RII) and ranking of all insurgency risk variables limiting the performance of construction projects in terms of Cost, Time and Quality. The study identified twenty-four cost insurgency risk factors, eighteen insurgency risk factors in terms of time and twenty-seven quality insurgency risk factors. The study further determined and concluded that;

1. The top-ranked insurgency risk factors affecting the performance of construction projects delivery in terms of cost are, Cost of liquidated damages caused by the insurgency, Financial constraint faced by the state due to insurgency, Irregular supervision due to insurgency, Price inflation due to persistent attack and Unavailability of construction manpower due to insurgency with RII's 0.74, 0.70, 0.71, 0.69 and 0.67 respectively
2. The top-ranked insurgency risk factors limiting project performance in terms of time are; Excessive overtime due to insurgency, Delay in payment to suppliers due to insurgency, Late supervision caused by insurgency, Delays in site preparation caused by insurgency risk, Delays in material procurement and delays in material delivery as a result of military checkpoints. The Relative Importance Index (RII) of the Insurgency risk variables include; 0.76, 0.72, 0.70, 0.70, 0.69 & 0.68 respectively.
3. The top-ranked insurgency risk factors affecting the performance of project delivery in terms of quality are Damages of material caused by the insurgency, Criminal acts in construction sites by Boko haram, unsafe working conditions due to insurgency, Improper project feasibility study due to persistent attack, Improper quality assessment due to insurgency risk, Disputes between construction players and Delays in site preparation due to insurgency risk. The RII of the risk factors are; 0.72 0.70, 0.69, 0.69, 0.68, 0.68 and 0.67 respectively.

In view of the foregoing conclusions, the study recommends the following;

i. To reduce the probability of failure in construction projects, the severe risk factors deduced in this study should be handled properly in managing the risks.
ii. Providing continuous training and seminars on the management of insurgency risks in order to improve the performance of construction projects during insurgencies.
iii. Government should open a channel of awarding contracts of construction projects to the military, as these will drastically reduce delays and persistent attacks on construction sites caused by the sect.

Further research in other affected insurgency areas such as Yobe, Adamawa can be conducted in order to develop a generic insurgency risk management model for the professionals at both global and national levels.

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