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An Investigation into Risk Factors and Preventive Measures in Building Construction Projects in Abuja FCT, Nigeria.

Ibrahim, Dauda, Abdul – Bello Kagara

Industrial and Technology Education Department, Federal University of Technology, Minna.

Abstract- This study is design to investigate the risk factors and preventive measures in building construction projects in Abuja FCT, Nigeria. A descriptive survey research design was adopted for the study. Two research questions and one hypothesis guided the study. The study was carried out in the entire building construction project in Abuja, Nigeria. A total of 116 respondents comprising 58 contractors and 58 registered site engineers were used as population of the study. A structured questionnaire containing sixty six (66) items was developed by the researcher and used for the study. Cronbach Alpha, Mean and Standard Deviation were used as the statistical tools to analyze the data, while t- test statistic was employed to test the null hypothesis of the study at 0.05 level of significance. The findings of the study revealed among others that contracting companies should identify and adequately quantify project risk factors. Adding a risk premium to quotation and time estimation has to be supported by governmental owner organizations and other agencies in the local construction sector. Training courses should also be provided to construction professionals on how to deal with and minimize risks in building projects.

I. INTRODUCTION

Compared to other industries, the construction industry is at or near the top in the annual rate of business failures and resulting liabilities (Chapman 2001). This is because it is a risky business with too many uncertainties that management has to deal with. These uncertainties stem from a variety of external and internal factors. Faisal (2003) stated that Building construction industry is characterized by having many players of multiple disciplines who are brought together at various stages throughout a single project. This feature adds more complexity to the whole construction process which is a collection of time-consuming undertakings. There is no doubt that construction is a key activity in any economy, it influences, and is influenced by, the gross domestic product (GDP) of any nation. The construction industry is a vital part of the Nigeria economy (Musa 2005). It provides jobs for about 3 million people creating 8% slice of the Nigeria's gross domestic product (Levy, 2002). He also stated that in Nigeria, building construction industry directly employs about .9 million people and accounts for about 4% of the national GDP. Economically speaking, the building construction sector typically accounts for 35 to 40% of the construction market (Barrie and Paulson, 1992). Building construction produces structures ranging from small retail stores to urban redevelopment complexes, from grade schools to complete new universities, hospitals, commercial office towers, theaters, government buildings, recreation centers, light manufacturing plants and warehouses. Construction is also a vital activity in the Nigerian economy. It contributes substantially in the Nigeria GDP and employment generation. The building construction sector has played a crucial role in extending job opportunities for the Nigeria labor force. Expansion of construction activities has generated a lot of jobs for skilled, semi-skilled and unskilled workers. The number of domestic construction workers increased from 12.8 thousands in 1993 to 40.3 thousands in 2000 (Hillson 2002).

The management of risks is a central issue in the planning and management of any business venture. Unfortunately, the local construction industry seems to lack the ability to identify, analyze and assess risk associated with running the business. Throughout the world, the construction industry has changed rapidly over the past decade; companies are now faced with more risk and uncertainty than before. Clients are more likely to engage in litigation when things go wrong. Risk in construction has been the subject of attention because of time and cost overruns associated with projects. Perry and Hayes (2005) define risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective. Jaffari (2002) also defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam and Kartam, (2001) has defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment. Base on the foregoing, therefore, Musa, (2005) outlined some of the circumstance that constitute risk in building construction site to include; supply of defect materials, occurrence of accidents and variations in labor and equipment productivity. Similarly, Levy (2002) noted that some risk factors in building construction site include occurrence of accidents because of poor safety procedures; supply of defective materials and varied labor and equipment productivity. According to him, environmental factors, difficulty in accessing the site and adverse weather conditions also constitute the risk in our construction site. Defective design (incorrect), un-coordinated design (structural, mechanical, electrical), inaccurate quantities, lack of consistency between bill of quantities, drawings and specifications, rushed design and awarding the design to unqualified designers are some critical factors that resulted to risk in construction site (Jaffari 2002).

Simmons, Ahmed, Azhar and Ahmed (2001) provided a definition for the risk management as the sum of all proactive

management-directed activities, within a program that is intended to acceptably accommodate the possibly failures in elements of the program. Building construction industry is widely associated with a high degree of risk and uncertainty due to the nature of its operating environment. There exist no comprehensive study explaining the causes of risks among construction companies; moreover research covering the subject matter has tended to identify the symptoms rather than causes. It is within this analytical context that the study on the investigation into risk factors and preventive measures in building construction projects in FCT Abuja, Nigeria is been carried out.

II. Research Questions

The study provides answer to the following questions.

- What are the risk factors in building construction projects in FCT Abuja, Nigeria?
- What are the preventive measures of these factors in building construction projects in FCT Abuja, Nigeria?

III. Hypothesis

The null hypothesis was tested at 0.05 level of significance.

HO_1: There is no significance difference between the mean responses of contractors and site engineers on the risk factors in building construction projects in FCT Abuja, Nigeria.

IV. Materials and Methods

The research design adopted for this study is a descriptive survey research design where questionnaire are used to determine the opinions of respondents on the issue under investigation.

The study was carried out in some selected building construction site in Abuja FCT. A total of 100 respondents comprising 50 building contractor and 50 site engineers from Abuja FCT constitute the population for the study. A structured questionnaire developed by the researcher and validated by three experts from Industrial and Technology Education and Building Technology Department, Federal University of Technology, Minna was used as instrument for data collection.

V. Results

Research question 1

What are the risk factors in building construction projects in FCT Abuja, Nigeria?

Table 1. Mean Response of Contractors and site Engineers on the Risk Factors in Building Construction Projects in FCT Abuja, Nigeria.

SN	ITEMS		X_1	X_2	Xt	Remark	
1	Unavailable labor, materials and equipment	3.54	3.58	3.56		Agreed	
2	Undefined scope of working		3.23	3.08	3.16		Agreed
3	High competition in bids	3.08	3.75	3.42		Agreed	
4	Inaccurate project program		3.38	3.58	3.48		Agreed
5	Supply of defect materials,		3.42	3.31	3.37		Agreed
6	Occurrence of accidents and variations in labor and equipment productivity.		3.42	3.23	3.33		Agreed
7	Occurrence of accidents because of poor safety procedures;		3.42	3.46	3.44		Agreed
8	Supply of defective materials and varied labor and equipment productivity.		3.33	3.31	3.32		Agreed
9	Environmental factors,	3.33	3.62	3.48		Agreed	
10	Difficulty in accessing the site	3.46	3.50	3.48		Agreed	
11	Adverse weather conditions		3.75	3.31	3.53		Agreed
12	Defective design (incorrect),		3.58	3.15	3.42		Agreed
13	Un-coordinated design (structural, mechanical, electrical),		3.69	3.23	3.47		Agreed
14	Inaccurate quantities,		3.08	3.67	3.38		Agreed
15	Lack of consistency between bill of quantities, drawings and specifications,		2.85	3.50	3.18		Agreed
16	Rushed design	3.54	3.58	3.56		Agreed	
17	Awarding the design to unqualified designers	3.62	3.33	3.48		Agreed	
18	Poor communications between the home and field offices (contractor side)	3.50	2.50	3.00		Agreed	
19	Inflation	3.72	2.80	3.26		Agreed	
20	Delayed payments on contract	3.75	3.67	3.71		Agreed	
21	Financial failure of the contractor	3.62	2.89	3.26		Agreed	
22	Unmanaged cash flow		3.98	3.66	3.82		Agreed
23	Exchange rate fluctuation	2.79	3.44	3.12		Agreed	

24	Monopolizing of materials due to closure and other unexpected political conditions	3.22	3.45	3.34		Agreed	
25	Difficulty to get permits	2.67	2.98	2.83		Agreed	
26	Ambiguity of work legislations	3.03	3.21	3.12		Agreed	
27	Legal disputes during the construction phase among the parties of the contract	2.90	3.02	2.96		Agreed	
28	Delayed disputes resolutions		2.56	2.78	2.67		Agreed
29	No specialized arbitrators to help settle fast	3.23	3.10	3.17		Agreed	
30	Rushed bidding process	3.44	2.91	3.18		Agreed	
31	Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications		2.77	2.54	2.66		Agreed
32	Undocumented change orders		3.72	3.25	3.49		Agreed
33	Lower work quality in presence of time constraints		3.21	2.60	2.91		Agreed
34	Design changes	3.56	3.42	3.49		Agreed	
35	Actual quantities differ from the contract quantities		3.56	3.67	3.62		Agreed
36	Segmentation of Gaza Strip		2.67	2.55	2.61		Agreed
37	Working at hot (dangerous) areas	2.87	2.62	2.75		Agreed	
38	New governmental acts or legislations	3.87	3.00	3.44		Agreed	
39	Unstable security circumstances (Invasions)	3.49	3.78	3.64		Agreed	

Key N = Number of Contractor; N= Number of site Engineers; X_1 = Mean of Contractors; X_2 = Mean of site Engineers; X_t = Average Mean of Contractor and site Engineer.

Analysis of mean responses of the two groups of respondents from Table 1 revealed that all the items under this sub-heading are rated agreed with mean ranging from 2.61 – 3.71. This signifies that all the items are the risk factors in building construction projects in FCT Abuja, Nigeria.

Research question 2.

What are the preventive measures of risk factors in building construction projects in FCT Abuja, Nigeria?

Table 2: Mean Response of the Contractors and site Engineers on the Preventive Measures of Risk Factors in Building Construction Projects in FCT Abuja, Nigeria?

SN	ITEMS		X_1	X_2	Xt	Remark	
1	By paying true attention and coordinate correctly between design disciplines.		3.21	3.28	3.25		Agreed
2	By introducing insurance premiums for accidents and injuries		2.99	2.78	2.89		Agreed
3	By applying effective training and increasing awareness of safety precautions.	3.87	2.69	3.28		Agreed	
4	By sharing Inflation and exchange rate fluctuation risks		2.91	3.88	3.40		Agreed
5	By including contract clauses that define the required parameters and conditions for sharing.	3.44	3.08	3.26		Agreed	
6	By updating project information and add risk premiums to time estimation at the project planning stage		3.45	3.29	3.37		Agreed
7	By close supervision to subordinates for minimizing abortive work		3.77	3.81	3.79		Agreed
8	By increasing the working hours	3.01	3.12	3.07		Agreed	
9	By coordinating closely with sub-contractors	3.90	3.65	3.78		Agreed	
10	Change the sequence of work by overlapping Activities		3.34	2.98	3.16		Agreed

11	Increase manpower and/or equipment	3.78	3.09				
12	Available labor, materials and equipment	3.54	3.58	3.56		Agreed	
13	Well defined scope of working	3.23	3.08	3.16		Agreed	
14	Accurate project program	3.38	3.58	3.48		Agreed	
15	Supply of quality materials,		3.42	3.31	3.37		Agreed
16	Provision of adequate and proper safety procedures;		3.42	3.46	3.44		Agreed
17	Easy accessibility to the site		3.46	3.50	3.48		Agreed
18	Good design (correct),	3.58	3.15	3.42		Agreed	
19	Well coordinated design (structural, mechanical, electrical),		3.69	3.23	3.47		Agreed
20	Accurate quantities,		3.08	3.67	3.38		Agreed
21	Consistency between bill of quantities, drawings and specifications,		2.85	3.50	3.18		Agreed
22	Awarding the design to qualified designers	3.62	3.33	3.48		Agreed	
23	Proper and effective communications between the home and field offices (contractor side)	3.50	2.50	3.00		Agreed	
24	Prompt payments of contract		3.75	3.67	3.71		Agreed
25	Good management of cash flow	3.98	3.66	3.82		Agreed	
26	Proper documentation of change orders	3.72	3.25	3.49		Agreed	
27	Change the construction method	3.45	3.76	3.61		Agreed	

Key N = Number of Contractor; N= Number of site Engineers; X_1 = Mean of Contractors; $\overline{X_2}$ = Mean of site Engineers; X_t = Average Mean of Contractor and site Engineer.

Hypothesis one

There is no significance difference between the mean responses of contractors and site engineers on the risks factors in building construction projects in FCT Abuja, Nigeria.

Table 3. t-test Analysis of Contractors and site Engineers on the Risk Factors in Building Construction Projects in FCT Abuja, Nigeria. N_1=58, N_2= 58

SN	ITEMS		SD_1	SD_2	t	Remark	
1	Unavailable labor, materials and equipment	0.49	0.51	-0.20		NS	
2	Undefined scope of working		0.41	0.51	0.86		NS
3	High competition in bids	0.50	0.95	-0.63		NS	
4	Inaccurate project program		1.06	0.76	-0.06		NS
5	Occurrence of accidents and variations in labor and equipment productivity.		0.13	0.24	1.00		NS
6	Occurrence of accidents because of poor safety procedures;		0.50	0.76	-0.27		NS
7	Supply of defective materials and varied labor and equipment productivity.		0.58	1.19	0.98		NS
8	Environmental factors,	0.60	0.48	0.20		NS	
9	Difficulty in accessing the site	0.90	0.56	-0.67		NS	
10	Adverse weather conditions		0.44	0.19	-0.07		NS
11	Defective design (incorrect),		0.99	0.11	0.67		NS
12	Un-coordinated design (structural, mechanical, electrical),		0.76	1.06	0.44		NS
13	Inaccurate quantities,		0.78	1.12	-0.12		NS
14	Lack of consistency between bill of quantities, drawings and specifications,		0.88	0.34	0.79		NS
15	Rushed design	0.33	0.99	0.22		NS	
16	Awarding the design to unqualified designers	0.21	0.64	0.09		NS	
17	Poor communications between the home and field offices (contractor side)	0.45	0.54	0.66		NS	
18	Inflation	0.12	0.32	0.23		NS	
19	Delayed payments on contract	0.49	0.67	0.90		NS	

20	Financial failure of the contractor	0.40	0.79	0.34		NS	
21	Unmanaged cash flow		0.30	0.42	0.44		NS
22	Exchange rate fluctuation	0.67	0.66	-0.67		NS	
23	Monopolizing of materials due to closure and other unexpected political conditions	0.29	0.29	-0.08		NS	
24	Difficulty to get permits	0.39	0.48	0.67		NS	
25	Ambiguity of work legislations	0.27	0.67	0.55		NS	
26	Legal disputes during the construction phase among the parties of the contract	0.39	0.57	0.78		NS	
27	Delayed disputes resolutions		0.67	0.45	0.66		NS
28	No specialized arbitrators to help settle fast	0.54	0.34	0.44		NS	
29	Rushed bidding process	0.44	0.91	0.18		NS	
30	Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications		0.77	0.54	-0.66		NS
31	Undocumented change orders		0.72	0.25	0.49		NS
32	Lower work quality in presence of time constraints		0.21	0.60	-0.91		NS
33	Design changes	1.06	1.02	-0.49		NS	
34	Actual quantities differ from the contract quantities		0.56	0.67	0.62		NS
35	Segmentation of Gaza Strip		1.07	0.55	-0.61		NS
36	Working at hot (dangerous) areas	0.87	0.60	0.05		NS	
37	New governmental acts or legislations	1.17	1.00	0.44		NS	
38	Unstable security circumstances (Invasions)	0.49	0.77	-0.64		NS	

Key $\underline{N_1}$ = Number of Contractor; N_2= Number of site $\overline{\text{En}}$gineers SD_1= Standard deviation of Contractors; SD_2 = Standard deviation of site Engineers; t-test; S = Significant; NS= Not significant.

Table3 revealed that the t-test analysis accept all the null hypotheses of each items at 0.05 level of significance, meaning that there is no significance difference for all the items.

VI. Findings

The following are the Findings relating to the risk factors in building construction projects in FCT Abuja, Nigeria.

a. Unmanaged cash flow
b. Actual quantities differ from the contract quantities
c. Delayed payments on contract
d. Rushed design
e. Supply of defective materials and varied labor and equipment productivity.
f. Design changes
g. Occurrence of accidents because of poor safety procedures;
h. Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications

Findings related to the Preventive Measures of Risk Factors in Building Construction Projects in FCT Abuja, Nigeria

a. Consistency between bill of quantities, drawings and specifications,
b. Provision of adequate and proper safety procedures;
c. By including contract clauses that define the required parameters and conditions for sharing.
d. Coordinating closely with sub-contractors
e. Close supervision to subordinates for minimizing abortive work

VII. Discussion of Findings

Research question one dealt with the risk factors in building construction projects in FCT Abuja, Nigeria. The findings as indicated in Table 1 revealed that all the risk factors identified in building construction projects in FCT Abuja, Nigeria were correct. This finding is in agreement with the views of Musa, (2003) who stated that some circumstance that constitute risk in building construction site include; supply of defect materials, occurrence of accidents and variations in labor and equipment productivity. Supporting the above statement, Levy (2002) noted that some risk factors in building construction site include occurrence of accidents because of poor safety procedures; supply of defective materials and varied labor and equipment productivity. According to him, environmental factors, difficulty in accessing the site and adverse weather conditions also constitute the risk in our construction site. Defective design (incorrect), un-coordinated design (structural, mechanical, electrical), inaccurate quantities, lack of consistency between bill of quantities, drawings and specifications, rushed design and awarding the design to unqualified designers are some critical factors that resulted to risk in construction site (Jaffari 2001).

Research question two dealt with the preventive measures of risk factors in Building construction projects in FCT Abuja, Nigeria. The findings in Table two revealed that, all the twenty seven (27) items were accepted by both the contractors and the

engineers as the preventive measures of risk factors. This finding is in agreement with the view of

VIII. Recommendation

Based on the critical risk factors identified in the study, it was recommended that

1. Contracting companies should compute and consider risk factors by adding a risk premium to quotation and time estimation. This trend has to be supported by governmental owner organizations and other agencies in the construction sector.
2. Training courses should also be provided for engineers and project managers on how to deal and minimize risks in building projects.
3. Contractors should endeavor to prevent financial failure by practicing a stern cash flow management and minimizing the dependence on bank loans.
4. Contractors should learn how to share and shift different risks by hiring specialized staff or specialized sub-contractors.
5. Contracting firms should utilize computerized approaches used for risk analysis and evaluation such as a risk package which integrates with widely used programs like Microsoft Project and Microsoft Excel.

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Authors

First Author – Ibrahim, Industrial and Technology Education Department, Federal University of Technology, Minna.
Second Author – Dauda, Industrial and Technology Education Department, Federal University of Technology, Minna.
Third Author – Abdul – Bello Kagara, Industrial and Technology Education Department, Federal University of Technology, Minna.