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Causes and Effects of Accidents on Construction Sites (A Case Study of Some Selected Construction Firms in Abuja F.C.T Nigeria)

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Abstract:*As the growth of construction industry blossoms in Nigeria, this also causes an increase in competition of projects to execute between construction firms which are however achieved at the expense of the workers welfare and their safety. Therefore identifying the various causes and effect of accidents on construction sites and proposing ways and means of reducing these accidents should be acknowledged. This study examines the major causes of accidents and suggests ways of mitigating these accidents on construction sites. A designed questionnaire was administered and descriptive statistics tool such as frequency, mean, percentage and relative importance index were used for the analysis. Construction firms in Nigeria can be classified as Multinationals, Large Scale indigenous construction firms and Small Scale indigenous construction firms. From the research negligence is the main cause of accidents on construction sites, labourers are also the major victims of these site accidents, loss of time in project execution is the major effect caused by these accidents in project execution. To ensure safety and to reduce the occurrence of construction site accidents to the minimum, management of construction firms must undertake and implement some of the context of this study such as implementation of safety policy, use of safety items and gears, training on safety measures and accident prevention methods, ensuring safe working environment and enforcing safety rules etc.*
Key Words:*Building Sites, Construction Firms, Accidents, Causes, Effects, Safety.*

I. Introduction

Construction work is considered to be one of the most hazardous industrial activities in the country. The rate of injury in the construction industry is higher than any other industry. Every year many people fall victim to injury, harm and even death caused byaccidents on construction sites. Control of accident is vital in the construction industry employers are required to access risk and take practical measures to protect, ensure safety and health of their workers, minimizing risk by means of continuous surveillance and monitoring of where accidents are likely to occurOdetoyinbo O.A (1986). Lucy et al (1999) views accident as an unplanned and unexpected occurrence which upsets a planned sequence of work resulting to loss of production, injury to personnel, damage to plant and equipment and eventually interrupting production flow. O.S.H.A (2005) ascertained that there are at least 60,000 fatal accidents on construction sites annually around the world, the fatal injury rate for the construction industry is higher than national average among industries worldwide. Jaselskis and Suazo (1994) demonstrated a substantial lack of awareness or importance for safety at all levels of the construction industry.In addition, Laufer and Ledbetter (1986) assessed various safety measures. Some researchers examined costs of construction accidents to employers (Leopold and Leonard, 1987; Levitt and Samelson, 1993). Accidents prevention has become increasingly important aspect which could be a major cause of concern in the construction industry therefore any effort to identify and explore possible ways of preventing and controlling accidents should be sought after, hence the need for the study.

Objectives

The objectives of the study are to identify or examine various causes of accidents in building construction sites and appraise the safety of workers.To propose ways and means of reducing accidents on site.

II. Literature Review

Whether on a small project or for a major commercial development, on a daily basis construction workers must deal with some of the most dangerous working conditions faced by employees in any industry. I.L.O (2005). Construction site by its nature is full of hazards even for the very experienced worker. Accidents still occur and undoubtly continue to occur due to both the nature of work itself and the variety of hazards faced

by construction workers. The fault of accidents lies with the system, environment and the persons involved in construction activities. Sexies et al (1998) shows that occurrence of accidents differs from one site to another.

Causes Of Accidents

There are numerous and an enumerable cause of accidents that occurs on siteit is a duty of the site manager or supervisor to identify these causes and ways of eliminating them. Siri Wardena et al (2006) points that acts of God or disasters as related to construction are events or actions which causes severe damages to construction products, processes and stakeholders. Various acts of God that cause casualties on sites are rain, flooding, wind, earthquake, landslides etc. Adeniye (2001) states it is much easier to carry out construction works on site during the dry season than the wet season in event of rain workers on scaffold may lose his balance and step or slid of the plank hence resulting to fall. Sotoire (1992) also points out that since construction workers work on unsheltered environment adverse weather conditions should be avoided because continuous exposure to adverse weather could lead to general discomfort and illness. Continuous exposure to moderately high noise level or relatively high level of impulse noise such as explosives on site, noise produced by heavy equipment, welding noise etc. these are major causes of occupational deafness Adeniye (2001).Lucy et al (1999) states that human error is considered to be an undesirable human decision or action that reduces or has the potentials for reducing the effectiveness of safety or system performance. This is also due to failures on the part of construction workers, errors in judgements, lack of concentration at work, lack of awareness on the danger surrounding the activities and safety requirements. Therefore there must be adequate safety training for all construction and building site workers and personnel on site to raise their awareness level about safety. Furthermore different types of accidents with varying rates of occurrence and fatalities from previous works are scaffold accidents (O.S.H.A 2005; HSE, 2006; Mccann&Paine; 2002, U.S dept of labour 2005); accidents due to slip, trips and falls Tappin et al (2004); crane accidents (Neitzel 2001; Skinner et al, 2006).Ladderaccidents (O.S.H.A 2005; Mitra et al, 2007); and electrocution and electrical accidents (Taylor et al 2002; Crowley &Homce, 2001).

Construction Activities In Abuja

The essence of the case study in this context is to appraise of the safeties of Nigeria building industry with emphasis on Abuja being the capital city housing both indigenous and multinational construction companies. Therefore Abuja will be an excellent sample of what is happening in the country as a whole. A comprehensive selection of some reputable construction firms in Abuja F.C.T was carried out. This research gave detailed information for solutions to the problem of accidents on construction sites. The different construction firms in F.C.T can be grouped into

- Multinational Construction Companies
- Large Scale Indigenous Construction Companies
- Small Scale Indigenous Construction Companies

Multinationals:examples of these groups of construction firms who engage in construction activities in the country include JULUIS BERGER NIGERIA PLC, B.STABILINI, DANTATA&SAWOE etc. They have their headquarters overseas. They are mainly into industrial and engineering construction, commercial construction with road construction. Their total workforce ranges from 100 to 500 employees on a construction site.

Large Scale Indigenous Construction Companies: This group of construction companies includes SETRACO NIGERIA P.L.C, TRIACTA, NEWS ENGINEERING etc. they mainly have headquarters in Nigeria. They are mainly into engineering and industrial, commercial and domestic buildings and their total workforce ranges from 50 to 200 employees on a construction site.

Small Scale Indigenous Construction Companies: They engage also mainly in construction of residential building with site offices or buildings and no headquarters but head offices. Some offices in this category include PAUL B CONSTRUCTION, WATLINS, ZED CONCEPTS etc. they are basically into commercial and residential buildings. Their primary objective is to maximize profits. Their total workforce ranges from 10 to 50 employees.

III. Methodology

The information or data that was carried out used the following methods Questionnaire and Direct Personal Observations. The research is based on 70 returned questionnaire out of the 100 administered within F.C.T Abuja, the questionnaire contains the names of construction firms, category, the respondents profession and position, academic and professional qualification with years of experience, it also sought the opinions of the respondents on the frequency of occurrence of the various types of accidents identified from the literatures and their causes. The data collected from the questionnaire were analysed using the descriptive analyses tools such

as frequency, percentage and mean and relative importance index. The respondents were mostly site engineers, foreman/supervisors, artisans, labourers, architects and contractor/client.

Analysis

ClasssificationOf The Firm**Table 1**

	FREQUENCY	% VALID	%CUMMULATIVE
MULTINATIONALS	15	21.43	21.43
LARGESCALE INDIGENOUS FIRM	20	28.57	71.43
SMALL SCALE INDIGENOUS FIRMS	35	50.00	100.00
TOTAL	70	100.00	

Source field work 2014

70 numbers of questionnaires were administered amongst reputable construction firms in Abuja F.C.T out of these 70 questionnaires administered, 15 of them were multinationals, which represented 21.45%. and 20 were large scale indigenous firms which represented 28.5% and 335 were small scale indigenous firms representing 50%.

Major Cause Of Accidents On Construction Site **Table 2**

MULTINATIONALS	FREQUENCY	% VALID	% CUMMULATIVE
CARELESSNESS	3	20.00	20.00
NEGLIGENCE	5	33.33	53.33
SCAFFOLDS	1	6.67	60.00
IMPROPER USE / DEFECTIVE TOOLS AND MACHINES	1	6.67	66.67
FAULTY LADDERS	0	0	66.67
UNSAFE WORKING CONDITIONS /PRACTICES	0	0	66.67
FAILURE TO FOLLOW SAFETY RULES	2	13.33	80.00
IMPROPER USE OF SAFETY ITEMS	1	6.67	86.67
DROPPING/ THROWING FROM HIGH RISE PROJECTS	2	13.33	100.00
OTHERS	0	0	100
TOTAL	15	100	

Source field work 2014

LARGE SCALE INDIGENOUS FIRM	FREQUENCY	% VALID	%CUMMULATIVE
CARELESSNESS	1	5.00	5.00
NEGLIGENCE	6	30.00	35.00
SCAFFOLDS	2	10.00	45.00
IMPROPER USE DEFECTIVE TOOLS AND MACHINES	4	20.00	65.00
FAULTY LADDERS	1	5.00	70.00
UNSAFE WORKING CONDITIONS AND PRACTICES	1	5.00	75.00
FAILURE TO FOLLOW SAFETY RULES	2	10.00	85.00
IMPROPER USE OF SAFETY ITEMS	2	10.00	95.00
DROPPING/THROWING FROM HIGH RISE PROJECTS	1	5.00	100.00
OTHERS	0	0	100.00
TOTAL	20	100	

Source field work 2014

SMALL SCALE INDIGENOUS FIRM	FREQUENCY	% VALID	%CUMMULATIVE
CARELESSNESS	4	11.42	11.42
NEGLIGENCE	11	31.42	42.84
SCAFFOLDS	3	8.57	51.41
IMPROPER USE DEFECTIVE TOOLS AND MACHINES	9	25.71	77.12

FAULTY LADDERS	1	2.86	79.98
UNSAFE WORKING CONDITIONS AND PRACTICES	2	5.72	85.7
FAILURE TO FOLLOW SAFETY RULES	1	2.86	88.56
IMPROPER USE OF SAFETY ITEMS	2	5.72	94.28
DROPPING/THROWING FROM HIGH RISE PROJECTS	1	2.86	97.14
OTHERS	1	2.86	100
TOTAL	35	100	

Source fieldwork 2014

It was analysed that Negligence was the major cause of accidents on construction sites. Whether for the multinationals, large scale and small scale indigenous construction companies it contributed to 33.33% for multinationals, 24.7% for large scale indigenous company and 30% for small scale indigenous company of the major cause of accidents on construction sites. Some of the means of limiting this act of negligence on construction sites is by constant reminder to adhere to safety rules and measures and strict law on defaulters that are negligent and regular supervision and inspection by health and safety executives, supervisors and head of foreman, architects and engineers on site.

Those Responsible For Accidents On Construction Site**Table 3**

MULTINATIONALS CONSTRUCTION FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	8	53.33	53.33
ARTISANS	4	26.67	80.00
SUPERVISORS/FOREMAN	2	13.33	93.33
ENGINEERS/ ARCHITECTS	1	6.67	100
CLIENT	0	0	100
TOTAL	15	100	

Source field work 2014

LARGE SCALE INDIGENOUS FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	11	55.00	55.00
ARTISANS	6	30.00	85.00
SUPERVISORS/FOREMAN	3	15.00	100
ENGINEERS/ ARCHITECTS	0	0	100
CLIENT	0	0	100
TOTAL	20	100	

Source field work 2014

SMALL SCALE CONSTRUCTION FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	23	65.71	65.71
ARTISANS	6	17.14	82.85
SUPERVISORS/FOREMAN	4	11.43	94.28
ENGINEERS/ ARCHITECTS	2	5.72	100
CLIENT	0	0	100
TOTAL	35	100	

Source field work 2014

Labourers are the major contributors and cause of accidents on construction sites. They consist of 53.33%, 55.00%, and 65.71% for multinationals, large scale and small scale construction companies respectively. These group of workers are either been paid on a daily basis or finish and go method this creates an environment in which these workers hastily and impatiently carryout their work thereby ignoring safe working practices and creating grounds in which accidents are likely to occur. Firms should either stop the finish and go method of payment or constantly supervise their workers if they should adopt this method.

Class Of Workers/ People That Are Mostly Affected By These Accidents**Table 4**

MULTINATIONALS	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	8	53.33	53.33
ARTISANS	3	20.00	73.33
SUPERVISORS/FOREMAN	3	20.00	93.33
ENGINEERS/ ARCHITECTS	1	6.67	100.00
CLIENT	0	0	100.00
VISITORS	0	0	100.00
TOTAL	15	100	

Source field work 2014

LARGE SCALE	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	10	50.00	50.00
ARTISANS	5	25.00	75.00
SUPERVISORS/FOREMAN	3	15.00	90.00
ENGINEERS/ ARCHITECTS	2	10.00	100.00
CLIENT	0	0	100.00
VISITORS	0	0	100.00
TOTAL	20	100	

Source field work 2014

SMALL SCALE	FREQUENCY	% VALID	CUMMULATIVE %
LABOURERS	21	60.00	60.00
ARTISANS	7	20.00	80.00
SUPERVISORS/FOREMAN	4	11.43	91.43
ENGINEERS/ ARCHITECTS	2	5.71	97.14
CLIENT	0	0	97.14
VISITORS	1	2.86	100.00
TOTAL	35	100	

Source field work 2014

Labourers are the major class of workers that are mostly affected by these accidents statistics show that they consist of 53.33%, 50% and 60% amongst the multinationals, large scale and small scale respectively. The number of affected victims can be reduced by regular supervision and inspection by health and safety workers, constant training on the safe use of tools and equipments, regular maintenance of tools and equipments, proper use of safety items and attire, providing safety signs and notices on site, training, seminars and lectures should be organized for workers regularly.

Effects Of Accidents On Construction Sites**Table 5**

MULTINATIONALS CONSTRUCTION FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
TIME LOSS OF PROJECT EXECUTION	9	60.00	60.00
REPUTATION OF FIRM	4	26.67	86.67
PSYCOLOGY OF WORKERS	2	13.33	100.00
COST OF MEDICAL EXPENSES	0	0	100.00
OTHERS	0	0	100.00
TOTAL	15	100	

Source field work 2014

MULTINATIONALS CONSTRUCTION FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
TIME LOSS OF PROJECT EXECUTION	12	60.00	60.00
REPUTATION OF FIRM	4	20.00	80.00
PSYCOLOGY OF WORKERS	3	15.00	95.00
COST OF MEDICAL EXPENSES	0	0	95.00
OTHERS	1	5.00	100.00
TOTAL	20	100	

Source field work 2014

MULTINATIONALS CONSTRUCTION FIRMS	FREQUENCY	% VALID	CUMMULATIVE %
TIME LOSS OF PROJECT EXECUTION	17	48.57	48.57
REPUTATION OF FIRM	8	22.86	71.43
PSYCOLOGY OF WORKERS	5	14.29	85.72
COST OF MEDICAL EXPENSES	4	11.43	97.15
OTHERS	1	2.85	100.00
TOTAL	35	100	

From the table it indicates that the significant effect of accidents on construction sites is on time loss of project execution, as 60% of respondents in multinationals, 60% of respondents in large scale and 48.57% of small scale indigenous firms have similar views. Construction firms should therefore adopt measures from this study to reduce the chances of accidents occurring on site. Time frame and duration of project execution is vital in project management.

Using the RELATIVE IMPORTANCE INDEX the factors resulting to accidents on construction sites can be achieved according to importance. the respondents were asked regardless of category whether multinational, small scale or large scale to provide opinions on the importance of the factors affecting construction site safety by scores 1 to 5 where 1 represents least important and 5 most important. To determine the relative ranking of factors the scores were then transformed to importance indices based on the formula

$$\text{Relative importance/difficulty index} = \frac{\sum w}{AN} \qquad (1)$$

where w is the mean weighting given to each factor by the respondents, ranging from 1 to 5, A is the highest weight (i.e. 5 in the study) and N is the total number of samples (20 samples). Based on equation (1), the relative importance index (RII) can be calculated. Table 3 shows the relative importance index of each factor affecting construction site safety.

Table 6 Relative importance index of each factor affecting construction site safety

Ranking	Factors affecting site safety	Relative importance index
1	Lack of attention from leaders	0.92
2	Reckless action	0.90
3	Poor safety conscientiousness of managers	0.88
4	Non-certified skill labor	0.87
5	Lack of emergency measure	0.87
6	Poor equipment	0.85
7	Lack of training	0.80
8	Poor equipment maintenance	0.80
9	Non-rigorous enforcement of safety regulations	0.76
10	Non-definite organization commitment	0.75
11	Lack of experience of managers	0.75
12	Non-effective operation on safety regulation	0.75
13	Poor of education of laborers	0.74
14	Poor safety conscientiousness of laborers	0.73
15	Not-strict operation procedures	0.70
16	Lack of technique guide	0.70
17	Lack of personal protective equipment	0.68
18	Non-perfect of safety and regulations	0.67
19	Overtime work for labor	0.65
20	Lack of protection in material carrying	0.65
21	Lack of protection in material storage	0.64
22	Lack of teamwork	0.63
23	Shortage of safety management	0.60
24	Poor information flow	0.60
25	Lack of innovation technology	0.55

Source Fieldwok2014

The respondents ranked lack of attention from leaders as 1st with a relative importance index of 0.92, this indicates that workers need constant supervision on site with regards to ensuring safety on construction sites. Therefore the role of leaders on site is extremely important on construction sites in preventing accident1s and reducing the causes of site accidents to the barest minimum.

IV. Conclusion

Labourers happen to be the main class of workers that are responsible for accidents on construction sites and are also the major victims of construction sites accidents as shown in table 3 & 4. Negligence was the major cause of accidents on construction sites. The main effect of accidents on construction sites is the loss of time in project execution. To ensure a safe and accident free construction site, management must understand, undertake and implement all or some of the following measures which are regular supervision and inspection by safety officials and leaders on site, constant training on the use of tools and equipment, proper use of safety items and attire, signs and notices should be provided on construction sites and should belocated at strategic areas on site, training programs should be provided regularly which should include how to handle tools, equipment and plants, how to understand and interpret signs and symbols, management must ensure safety policies are obeyed, plants, machineries and equipments should be maintained regularly, medical test should be carried on employees for drug use, alcoholintake and other and future purposes.

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