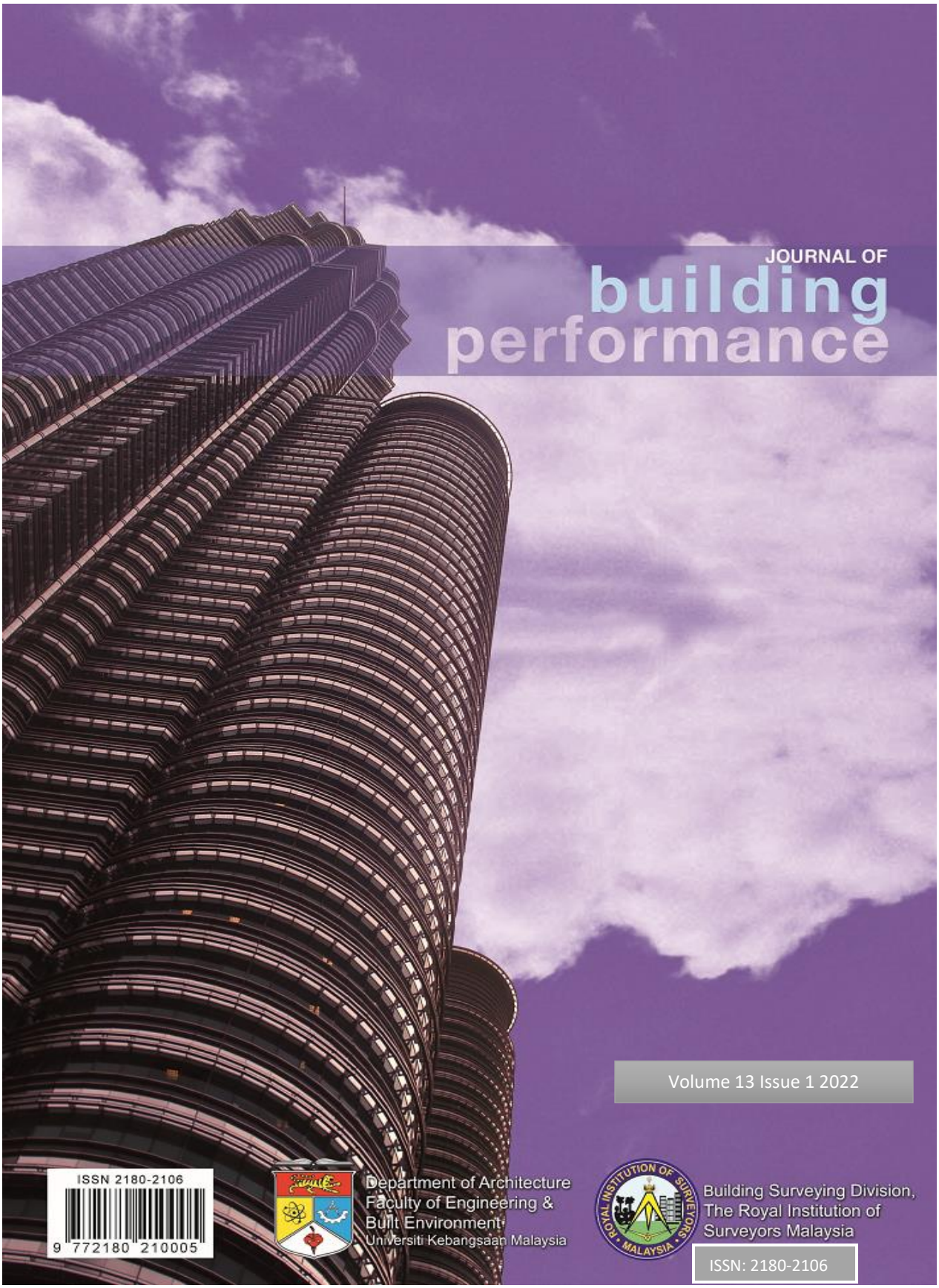

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Table of Contents

Articles

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IMPACT OF SAFETY MEASURES FOR HAZARD RECOGNITION ON THE RATE OF ACCIDENTS ON CONSTRUCTION SITES IN ABUJA, NIGERIA

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Abstract

This study evaluated the impact of safety measures for hazard recognition on the rate of accidents on construction sites in Abuja, Nigeria. A survey design was adopted through a quantitative study with the use of questionnaire for collecting data from 25 construction firms registered with Federation of Construction Industry in Abuja. Analysis of data was undertaken using Relative Importance Index (RII) and Mean Item Score (MIS). Findings from the study revealed that the most important safety measures for hazard recognition required for improving the safety performance of construction firms in Abuja is Conducting safety meetings (RII = 0.96); the most significant influence of safety measures for hazard recognition on the frequency of occurrence of accidents is Improvement of employees' and employers' safety behaviour (MIS = 4.38); and the most effective strategy for reducing the rate of accidents on construction sites is Management commitment (MIS = 4.57). It was thus concluded that the safety measures for hazard recognition have significant impact on the rate of accidents on construction sites in Abuja. It was recommended that construction firms should set up a mechanism for the effective implementation of the safety measures for hazard recognition.

Keywords: accidents; construction sites; influence; safety measures.

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INTRODUCTION

Construction is one of the world's biggest industries that include jobs as diverse as building, civil engineering, demolition, renovation, repair and maintenance (Tefera, 2016). Construction workers are exposed to a wide variety of hazards. Construction is therefore a high hazardous industry that comprises a wide range of activities involving construction, alteration, and/or repair (Kheni & Braimah, 2014). The fact that a construction job or work environment is considered as highly risky and hazardous does not mean that its susceptibility to accident is not controllable – this largely depends on "work situation" which is humanly controllable. Accident is an unplanned and uncontrolled event in which the action or reaction of an object, substance, person or radiation results in personal injury or the probability thereof (Shittu, 2016). Accident prevention has been defined as an integrated program, series of coordinated activities, directed to the control of unsafe personal performance and unsafe mechanical conditions (Oladiran *et al.*, 2009). There are many evidences in representing construction industry as hazardous and inconsistent industry.

Given the hazardous nature of the construction industry world over, the need for an effective safety management system which aims at forestalling the risks and hazards inherent on site has been reiterated by recent studies and applicable laws (Asanka & Ranasinghe, 2015). This system is driven by hazard recognition measures. Control of accident is therefore vital in the construction industry (Kadiri *et al.*, 2014). To do this, employers are required to assess 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 occur. Therefore, forecasting accidents for the future projects would be advantageous for the required pre preparations and budget allocations to minimize the overall damages to the organisations financial stability (Asanka & Ranasinghe, 2015).

In addition, the rapid growth of the construction industry in Nigeria has led to an increase in competition of projects execution amongst construction firms which are however achieved at the

expense of the workers welfare and their safety (Kadiri *et al.*, 2014). The construction industry in Nigeria and other developing countries face a wide range of challenges, one of which is the frequent occurrence of accidents in the work areas (Doko *et al.*, 2018). Accidents cause construction delays, cost overrun and sometimes ruin the reputation of the organisation, and losing the confidence among workforce or banning from tendering by government authorities (Asanka & Ranasinghe, 2015). It can cause dissatisfaction among stakeholders, be uncompetitive when tendering, financial losses due to property damages and penalties from authorities. In addition, Yandalu (2019) reported that accidents not only result in considerable pain and suffering but also retard project productivity, quality, and time and consequently add to the cost of construction.

Previous works on H&S focus more on the identification of causes and effects of accidents (Kadiri *et al.*, 2014; Doko *et al.*, 2018; Eze *et al.*, 2018). Measures for minimizing rate of accidents suggested in some of these studies were not based on hazard recognition practices. Measures for minimizing rate of accidents suggested by Doko *et al.* (2018) was not related to rate of accidents but generally to safety performance. As a result of this, the suggested strategies for minimizing rate of accidents in existing studies needs to be more effective by being emanated from specific hazard recognition measures in relation to rate of different categories of accidents on construction sites. In view of this background, this study evaluated the impact of hazard recognition measures on the rate of accidents on construction sites in Abuja. In order to solve the identified research problem, the study evaluated the impact of safety measures for hazard recognition on the rate of accidents on construction sites in Abuja, with a view to reducing the rate of accidents in construction projects. The following objectives were pursued in order to achieve the aim of the study:

i. To identify the practices which constitute effective safety measures for hazard recognition on construction sites in Abuja.
ii. To determine the influence of safety measures for hazard recognition on the frequency of occurrence of accidents on construction sites.
iii. To propose strategies for reducing the rate of accidents on construction sites.

LITERATURE REVIEW

Safety Measures for Hazard Recognition on Construction Sites

The activities of the construction industry have raised serious health and safety concerns amongst governments, health and safety stakeholders, health and safety professionals and researchers over the past few decades (Kheni, 2008). In response, H&S legislation has been developed to ensure management of construction businesses, and recently many other participants in a project, assume responsibility for managing the risks associated with construction projects. H&S management in the construction industry has evolved from measures adopted in accident prevention to more systematic and proactive approaches to minimising the risk of hazards in the industry.

In addition, Agumba & Haupt (2014) reported that health and safety performance measurement can be broadly classified in to two: lagging indicators and leading indicators or positive performance indicators. Leading indicators are either subjective (perception measures) or objective indicators (number of occasions an activity has been administered). Sadly, the construction industry continues to greatly depend on the traditional lagging indicators such as accident and workers compensation statistics. With the use of leading indicators, a more thorough and constant surveillance is required than when lagging indicators are used. Changes can be made and interventions introduced early to redress the weakness before accidents occur as a result of the adoption of leading health and safety indicators in construction. Hence, the use of leading indicators instead of lagging indicators is increasingly advocated (Hinze, 2005). Unfortunately, on the other hand, there is no consensus of the elements and measuring indicators that should be considered to be vital for improved health and safety culture which is a leading indicator of health and safety performance. It was therefore established by Agumba & Haupt (2014) that for health and safety performance to improve, the corporate health and safety culture should comprise health and safety commitment, health and safety incentives, sub-contractors involvement, health and safety accountability and disincentives.

From the review of the H&S management practices in the construction industry carried out in this section, the safety measures capable of enhancing good hazard recognition practices for enhancing H&S performance in the Nigerian construction industry are summarised in Table 1.

Table 1: Safety Measures for Hazard Recognition on Construction Sites

S/NO	SAFETY MEASURES FOR HAZARD RECOGNITION ON CONSTRUCTION SITES	CLASSIFICATION
1	Safety meetings	Communication
2	Communicating safety value to corporate stakeholders and Two-way safety communication	Communication
3	Focusing of monthly safety meetings on employees' attitudinal change towards safety	Communication
4	Use of posters and other signs to give safety education	Communication
5	Safety inductions	Education and training
6	Safety training and orientations	Education and training
7	Alcohol- and substance-abuse programmed	Education and training
8	Training and retraining of employees on safe work procedure	Education and training
9	Job hazard analysis	Health and safety planning
10	Safety pre-task planning	Health and safety planning
11	Accountability/responsibility and safety budget	Health and safety planning
12	Effective identification and hazard elimination/control	Health and safety planning
13	Post-accident investigation	Health and safety planning
14	Compliance with customer or regular certification schemes	Health and safety planning
15	Regulatory enforcement activity	Health and safety planning
16	Hazard management plan in use of plant and equipment	Health and safety planning
17	Emergency response plan	Health and safety planning
18	Employer-paid group insurance plan	Health and safety planning
19	Jobsite inspection	Health and safety planning
20	Formal safety inspection per month	Health and safety planning
21	Holding management accountable for health and safety	Health and safety planning

Source: Researchers' Compilation (2020)

Influence of Safety Measures for Hazard Recognition on the Frequency of Accidents on Construction Sites

Studies have established that construction workers are more likely to be injured than workers in other industries. In the United States, the construction sector has accounted for more than a thousand fatal injuries every year between 1995 and 2008. Despite efforts to improve safety performance, the construction sector continues to account for disproportionate injury rates. According to the Bureau of Labour Statistics, BLS (2011), more than a thousand fatal injuries have been recorded every year in the United States between 1995 and 2008. Moreover, injury statistics suggest that construction workers have consistently incurred more fatal injuries than in other industries (BLS, 2011).

In fact, fatality and disabling injuries among construction workers is estimated to be over three times higher than the all-industry average. Although incident rates have fallen over the past 30 years, the construction industry still accounts for the most on-the-job fatal injuries. Also, it has been suggested that the observed reduction in injury rates may be attributed to fiscal constraints that resulted in the decline in the number of hours worked, rather than the improvement in safety performance (BLS, 2011). Unfortunately, the unique characteristics of a construction site such as rotation and interaction of teams, changing weather and environmental conditions, higher proportion of unskilled labourers, high labour turnover, and presence of hazardous materials makes safety management and training for hazard recognition difficult. Moreover, hazard recognition skills among workers in the construction field are hindered because of the lack of knowledge transfer between projects, resource constraints on small projects, lack of standardized construction means and methods and the reliance on the tacit knowledge of workers, which is usually gained through experience. According to OSHA (2002), most hazards in the workplace are due to "unsafe equipment or installation; unsafe environment; or unsafe work practices".

Generally, in order to identify underlying dormant hazards that may exist or may be invoked by workers' behaviour, management documents a list of tasks and associated potential hazards. According to OSHA (2002), most hazards in the workplace are due to "unsafe equipment or installation; unsafe environment; or unsafe work practices". Following the recognition of possible hazards, the risk associated with the hazardous situation is analyzed to assess its significance level. Hence researchers are exploring new and innovative interventions to modify human behavior and apply management controls to improve safety performance. Improving safety performance requires the implementation of proactive worker hazard recognition and prevention programs.

Strategies for Reducing the Rate of Accidents on Construction Sites

Langford *et al.* (2000) identified several behavioural factors which were considered to generate positive attitudes and behaviour about safety and could lead to improved safety performance of construction firms. These behavioural factors were identified from the pilot interviews and literature review as factors that were strongly influential on construction worker behaviour and safety performance, described by Lingard & Rowlinson *et al.* (1993) as the behavioural element of the "basic safety infrastructure". Other factors identified by Lingard & Rowlinson *et al.* (1993) with important influence on construction worker behaviour and safety performance are: Historical factors; Economic factors; Human psychological factors; Technical development factors; Procedural factors; Organisational factors; and Environmental factors.

In addition, Amoah *et al.* (2012) identified twenty eight (28) strategies for reducing the rate of accidents on construction sites in the Ghanaian construction industry. Nineteen (19) of these strategies were summarised as hazard recognition related. These 19 strategies are availability of training proprietors and technicians; ability to delegate responsibility; availability of materials and equipment; availability of technology; existence of labour and labour unions; execution of other projects; understanding of weather conditions; adherence to Government policies; competition from other contractors; other professionals; traders' skills; health and safety consciousness; ability to work as a team and coordinate; client satisfaction; access to finance; interest rate; interim payments; honouring of payment certificates; and effective communication.

In view of the fact that H&S management in the Nigerian construction industry is poor, Idubor & Oisamoje (2013) suggested that something needs to be done and urgently because managing a healthy workforce is beneficial to all stakeholders, including government. The onus is therefore on Government, various regulatory bodies, Employees' unions or representatives, and employers of labour to brainstorm on the way forward and to be totally committed to effecting meaningful changes in the occupational health and management environment. Windapo & Jegede (2013) also recommended that small and medium-sized construction companies should institute a company Health, Safety and Environment (HSE) policy and monitor its application on their sites.

Okolie & Okoye (2013) reported that several researchers have identified different safety climate factors related to construction industry. Nine (9) of these safety climate dimensions were found to be most common. These include: belief and value; management commitment; risk level and hazards identification; management efficiency; workers involvement and commitment; safety institutes and specialists; safety education and training; site management; and standardisation. These safety climate factors, according to Okolie & Okoye (2013), can best be categorised into four (4) factors; namely: Management commitment; Workers involvement; Safety education and training; and Beliefs and perceptions. These factors are therefore critical and relevant in the analyses and discussion of safety climate for construction workers in Nigeria. This could also improve the safety performance of construction firms, thereby reducing the rate of accidents, fatalities and injuries on sites.

RESEARCH METHODOLOGY

A quantitative research approach was adopted in this study. The construction firms registered with Federation of Construction Industry (FOCI) with Abuja's business address constituted the population for the study. This is because a reasonable number of construction activities take place in Abuja because it experiences rapid population increase and new developmental projects daily as a result of rapid urbanization and rural-urban migration since it is the capital city of Nigeria (Kadiri *et al.*, 2014). The list of FOCI has 25 registered construction firms resident in Abuja. This makes the population size to be 25. The sample size for the study is the same as the population size (that is 25). This implies that all the Abuja construction firms on the list of FOCI were considered for data collection. Because of the fact that the population size is small, the study carried out a census of the whole 25 construction firms for data collection. This agrees with the assertion of Watson (2001) that if the population size is small (200 or less), then it is preferable to take a census of the total population.

The data for the study were collected with the aid of questionnaire. Questionnaire was employed to collect data on the respondents' perception on the research objectives based on a five-point Likert's Scale format. The questionnaire contains four sections. The first section addressed issues relating to the profile of respondents while the other sections addressed the study's objectives respectively. The questionnaire copies were administered to a safety officer and the professionals involved in the execution of projects on sites (Architect, Builder/Engineer and Quantity Surveyor) in

each of the construction firms. This implies that four copies of questionnaire were administered to each construction firm, giving a total of 100 copies of questionnaire which were administered.

Analysis of data was carried out using descriptive methods of analysis which include Frequency count, Percentage, Relative Importance Index (RII) and Mean Item Score (MIS). The decision rule adopted for the RII and MIS are summarised in Table 2.

Table 2: Decision Rule for Data Analysis

SCALE	Cut-Off Point		Interpretation		
	RII	*MIS*	*Level of Importance*	*Level of Significance*	*Level of Effectiveness*
5	0.81 - 1.00	4.51 - 5.00	Very Important	Very Significant	Very Effective
4	0.61 - 0.80	3.51 - 4.50	Important	Significant	Effective
3	0.41 - 0.60	2.51 - 3.50	Fairly Important	Fairly Significant	Fairly Effective
2	0.21 - 0.40	1.51 - 2.50	Less Important	Less Significant	Less Effective
1	0.00 - 0.20	1.00 - 1.50	Least Important	Least Significant	Least Effective

Source: Adapted and Modified from Shittu *et al.* (2015)

RESULTS AND DISCUSSION

Presentation of Respondents' Profile

The study employed the use survey design approach through questionnaire administered to 100 respondents. Of the 100 questionnaire copies administered, 65 copies were correctly completed, returned and used for data analysis. This gives a response rate of 65%. This section presents the demographic information of respondents. Table 3 gives the profile and demographic information of respondents.

Table 3: Profession of Respondents

Profession	**Frequency**	**Percentage (%)**
Architect	10	15
Builder	10	15
Civil Engineering	21	32
Services Engineer	2	3
Quantity Surveyor	22	34
Years of Experience	**Frequency**	**Percentage (%)**
1 - 5 Years	5	8
6 - 10 Years	32	49
11 - 15 Years	9	14
16 - 20 Years	13	20
21 - 25 Years	2	3
26 - 30 Years	3	5
31 - 35 Years	1	2
Project Role	**Frequency**	**Percentage (%)**
Architect	10	15
Builder	8	12
Engineer	23	35
Quantity Surveyor	16	25
Safety Officer	8	12

Source: Researcher's Field Survey (2020)

The professions of the respondents considered for field work in this study are shown in Table 3. It was shown that Architects and Builders respectively make up 15% (10 in number each) of the total number of respondents. Civil Engineers are 21 in number making up 32% of the total population of the respondents. Services Engineers are only two in number constituting 3% of the respondents' total population. The highest number of respondents is made of Quantity Surveyors which make up 34% (22 in number) of the total number of respondents. This therefore shows that majority of the respondents are professionals who are directly involved in decision making in project execution from inception to completion. Table 3 also shows the years of experience of respondents. It was revealed that most of the respondents (49%) have between 1 and 5 years of experience. Another reasonable population of the respondents (20%) have between 16 and 20 years of experience. It was also shown that 8% of the respondents have between 1 and 5 years of experience; 14% have between 11 and 15 years of experience; 3% have between 21 and 25 years of experience; 5% have between 26 and 30 years of experience; and 2% have between 31 and 35 years of experience. This indicates that the respondents are experienced enough to provide reliable information required for the study. The project role of the respondents, also shown in Table 3, indicated that 15% are Project Architects, 12% are Project Builders; 35% are Project Engineers, 25% are Project Quantity Surveyors; and 12% are Safety Officers for the

projects handled by the construction firms. This implies that the combination of the roles of the respondents gives a team of qualified professionals who can give reliable information on construction site health and safety.

Results and Discussion on Safety Measures for Effective Hazard Recognition on Construction Sites in Abuja

The use of Relative Importance Index (RII) was employed to rank the perception of respondents on the identified practices which constitute effective hazard recognition on construction sites in Abuja in order of importance. Table 4 presents the results of this analysis.

Table 4: Results on Safety Measures for Effective Hazard Recognition on Construction Sites

Code	Hazard Recognition Practice	RII	Rank	Decision
B1	***Communication***			
B1.1	Safety meetings	0.96	1st	Very Important
B1.2	Communicating safety value to corporate stakeholders and Two-way safety communication	0.90	2nd	Very Important
B1.4	Use of posters and other signs to give safety education	0.88	3rd	Very Important
B1.3	Focusing of monthly safety meetings on employees' attitudinal change towards safety	0.85	4th	Very Important
B2	***Education & Training***			
B2.1	Safety inductions	0.91	1st	Very Important
B2.4	Training and retraining of employees on safe work procedure	0.90	2nd	Very Important
B2.2	Safety training and orientations	0.88	3rd	Very Important
B2.3	Alcohol- and substance-abuse programmed	0.86	4th	
B3	***H&S Planning***			
B3.1	Job hazard analysis	0.90	1st	Very Important
B3.9	Emergency response plan	0.88	2nd	Very Important
B3.2	Safety pre-task planning	0.85	3rd	Very Important
B3.5	Post-accident investigation	0.85	3rd	Very Important
B3.4	Effective identification and hazard elimination/control	0.84	5th	Very Important
B3.6	Compliance with customer or regular certification schemes	0.83	6th	Very Important
B3.3	Accountability/responsibility and safety budget	0.81	7th	Very Important
B3.7	Regulatory enforcement activity	0.81	7th	Very Important
B3.8	Hazard management plan in use of plant and equipment	0.81	7th	Very Important
B3.10	Employer-paid group insurance plan	0.81	7th	Very Important
B3.11	Jobsite inspection	0.80	11th	Important
B3.13	Holding management accountable for health and safety	0.80	11th	Important
B3.12	Formal safety inspection per month	0.76	13th	Important
	Group RII	***0.85***		***Very Important***

It is shown from Table 4 that the safety measures for effective hazard recognition practices identified from the study are categorised into three: Communication; Education & Training; and H&S Planning. Under the Communication practices, the most important measures are: Safety meetings and Communicating safety value to corporate stakeholders and Two-way safety communication with RII values of 0.96 and 0.90 respectively. Use of posters and other signs to give safety education (RII= 0.88) and Focusing of monthly safety meetings on employees' attitudinal change towards safety (RII = 0.85) which were ranked least are also very important. Under the Education & Training practice, the most important measures are: Safety inductions (RII = 0.91) and Training and retraining of employees on safe work procedure (0.90). Safety training and orientations (RII = 0.88) and Alcohol- and substance-abuse programmed (RII = 0.86) which were the least ranked are also very important. Under the H&S Planning practice, Job hazard analysis (RII = 0.90) is the most important measure. The next nine measures ranging between Emergency response plan (RII = 0.88) and Employer-paid group insurance plan (RII = 0.81) are also very important. The three least ranked measures, ranging between Jobsite inspection (RII = 0.80) and Formal safety inspection per month (RII = 0.76), are important measures too. On the average, all the hazard recognition measures identified are very important (Group RII = 0.85).

The findings reported above are in line with findings of Hinze (2005) and Agumba & Haupt (2014). It was reported in the study of Hinze (2005) that the use of leading indicators instead of lagging indicators is increasingly advocated. Agumba & Haupt (2014) reported that for H&S performance to improve, the corporate H&S culture should be comprised of leading indicators such as H&S commitment, H&S incentives, sub-contractors involvement, H&S accountability and disincentives. Therefore, in order to improve the safety performance of employees and employers in the construction industry, the safety measures for effective hazard recognition should be implemented.

Results and Discussion on Influence of Safety Measures for Hazard Recognition on the Frequency of Occurrence of Accidents on Construction Sites in Abuja

The use of Mean Item Score (MIS) was adopted in order to determine the influence of safety measures for hazard recognition on the frequency of occurrence of accidents on construction sites in Abuja. Table 5 gives a summary of the results of this MIS analysis.

Table 5: Results on Influence of Safety Measures for Hazard Recognition on the Frequency of Occurrence of Accidents on Construction Sites in Abuja

CODE	Influence of Hazard Recognition Measures on Accidents Occurrence	MIS	RANK	DECISION
D1	Improvement of employees' and employers' safety behaviour	4.38	1st	Significant
D2	Reduction of "unsafe equipment or installation; unsafe environment; or unsafe work practices"	4.23	2nd	Significant
D3	Improvement of teamwork practices on construction sites.	4.15	3rd	Significant
D4	Improvement of the safety performance of n organisation	4.11	4th	Significant
D5	Enhancement of knowledge transfer between projects	4.00	5th	Significant
D6	Reduction in incidents and accidents rates	3.86	6th	Significant
D7	Reduction in injury rates	3.83	7th	Significant
D8	Reduction in fatality and disabling injuries rates	3.71	8th	Significant
	Group MIS	***4.03***		***Significant***

Table 5 shows the MIS results of the influence of safety measures for hazard recognition on the frequency of occurrence of accidents on construction sites in Abuja. It was shown that the most significant influence of hazard recognition measures on the frequency of occurrence of accidents is Improvement of employees' and employers' safety behaviour (MIS = 4.38). The remaining seven ways in which hazard recognition measures influences the frequency of occurrence of accidents are also significant. These range between Reduction of "unsafe equipment or installation; unsafe environment; or unsafe work practices" (MIS = 4.23) and Reduction in fatality and disabling injuries rates (MIS = 3.71). On the average, all the identified influences of hazard recognition measures on the frequency of occurrence of accidents on construction sites in Abuja are significant (Group MIS = 4.03). This finding agrees with the studies of OSHA (2002) and BLS (2011) where it was gathered that following the recognition of possible hazards, the risk associated with the hazardous situation is analyzed to assess its significance level. Therefore, improving safety performance requires the implementation of proactive workers' hazard recognition and prevention programs. This indicates that it is advisable for construction firms to establish and implement these safety measures for hazard recognition in order to enjoy these significant benefits or influences for improved safety performance.

Results and Discussion on Strategies for Reducing the Rate of Accidents on Construction Sites in Abuja

The use of MIS was also adopted in order to rank the identified strategies for reducing the rate of accidents on construction sites in Abuja in order of effectiveness. The results of this analysis are summarised in Table 6.

Table 6: Results on Strategies for Reducing the Rate of Accidents on Construction Sites in Abuja

CODE	Strategies for Reducing Accidents Rate	MIS	RANK	DECISION
E1	Management commitment	4.57	1st	Very Effective
E2	Monitoring of the application of company's Health, Safety and Environment (HSE) policy on construction sites	4.55	2nd	Very Effective
E3	Institution of a company Health, Safety and Environment (HSE) policy	4.42	3rd	Effective
E4	Workers involvement	4.37	4th	Effective
E5	Building of effective health and safety consciousness by employees and employers	4.22	5th	Effective
E6	Ability to work as a team and coordinate	4.15	6th	Effective
E7	Provision of training proprietors and technicians	4.06	7th	Effective
E8	Government Agencies, construction firms and Trade Unions to jointly implement and regulate the implementation of Occupational Health and Safety Management on sites	3.95	8th	Effective
E9	Ability to delegate responsibility	3.89	9th	Effective
E10	Honouring of payment certificates	3.63	10th	Effective
E11	Beliefs and perceptions	3.54	11th	Effective
	Group MIS	***4.12***		***Effective***

Table 6 summarises the results of the MIS analysis on the strategies for reducing the rate of accidents on construction sites in Abuja. The study identified eleven main strategies for reducing the rate of accidents on construction sites. The most effective strategies for reducing the rate of accidents on construction sites are: Management commitment (MIS = 4.57) and Monitoring of the application of company's Health, Safety and Environment (HSE) policy on construction sites (MIS = 4.55). The remaining nine strategies are also effective. These vary between Institution of a company Health, Safety and Environment (HSE) policy (MIS = 4.42) and Beliefs and perceptions (MIS = 3.54). Averagely, all the identified strategies for reducing the rate of accidents on construction sites in Abuja are effective (Group MIS = 4.12). The study of Langford *et al.* (2000) where it was reported that these identified strategies were considered to generate positive attitudes and behaviour about safety and could lead to improved safety performance of construction firms also supports the findings of this study. Okolie & Okoye (2013) also reported similar conclusions about these strategies that they are critical and relevant in the analyses and discussion of safety climate for construction workers in Nigeria. Therefore, the effective provision and implementation of these strategies could improve the safety performance of construction firms, thereby reducing the rate of accidents, fatalities and injuries on sites.

CONCLUSION AND RECOMMENDATIONS

Findings from the analysis of data led to vital conclusions which are stated in this section. Conducting safety meetings; and communicating safety value to corporate stakeholders and two-way safety communication are the most important safety measures for hazard recognition required for improving the safety performance of construction firms in Abuja. The most significant influence of the safety measures for hazard recognition on the frequency of occurrence of accidents is the improvement of employees' and employers' safety behaviour. The most effective strategies for reducing the rate of accidents on construction sites are Management commitment and Monitoring of the application of company's Health, Safety and Environment (HSE) policy on construction sites. It is therefore concluded that the safety measures for hazard recognition have significant impact on the rate of accidents on construction sites in Abuja, Nigeria.

In view of the findings and conclusions of this study, the following recommendations were made:

i. The management of construction firms should always record down accidents and the level of severity of injuries from such accidents when they occur and should report same to the appropriate authorities for adequate preventive measures to be taken in future.
ii. Construction firms should set up a mechanism for effective implementation of the safety measure for hazard recognition identified in this study with major emphasis on Safety meetings and communicating safety value to corporate stakeholders and two-way safety communication. This will enable the construction firms to enjoy the significant benefits or influences of the hazard recognition measures for improved safety performance.

References

Agumba, J. N., Haupt, T. C. (2014). Implementation of Health and Safety Practices: Do Demographic Attributes Matter? *Journal of Engineering Design & Technology*. Emerald Group Publishing Limited. 12(4): 531 – 550. Retrieved from www.emeraldinsight.com/1726-0531.htm on 27/11/2020

Amoah, P., Ahadzie, D. K., Dansoh, A. (2012). Factors Affecting Construction Performance in Ghana: Perspective of Small-scale Building Contractors. In: *The Ghana Surveyor*. 41-48.

Asanka, W. A., Ranasinghe, M. (2015). Study on the Impact of Accidents on Construction Projects. 6th *International Conference on Structural Engineering and Construction Management*. Kandy, Sri Lanka. 11th – 13th December. 58 – 67.

Doko, A. U., Shittu, A. A., Oke, A. A. (2018). Influence of Hazard Recognition Measures on Safety Performance of Building Workers in Abuja, Nigeria. *Proc: 6th National Economic, Management and Technology Conference: Development Issues & Challenges that Affects Infrastructure, Employment, Property Reduction & Food Security in Nigeria*. Abubakar Tafawa Balewa University, Bauchi. Bauchi State, Nigeria. 5th – 6th December, 2018. 107 – 115.

Eze, C. J., Ayuba, P. & Shittu, A. A. (2018). Assessment of Accidents Hazard Impact in Nigerian Building Industry. *Centre for Human Settlement and Urban Development Journal (CHSUDJ)*. Centre for Human Settlement and Urban Development, Federal University of Technology, Minna; May, 2018. 7(1): 208 – 226. ISSN NO: 2141 – 7601.

Hinze, J. (2005). Concealing the Occurrence of Construction Injuries. In: *The W99 Triennial Conference, Rethinking and Revitalizing Construction Safety, Health, Environment and Quality* (edited by Haupt, T. C. and Smallwood, J.). Construction Research Education and Training Enterprises, Port Elizabeth, 714-727.

Idubor, E. E., Oisamoje, M. D. (2013). An Exploration of Health and Safety Management Issues in Nigeria's Effort to Industrialize. *European Scientific Journal*, April, 2013 Edition. (12): 154-169.

Kadiri, Z. O., Nden, T. Avre G. K., Oladipo, T. O., Edom, A., Samuel. P. O., Ananso. G. N (2014). Causes and Effects of Accidents on Construction Sites (A Case Study of Some Selected Construction Firms in Abuja F.C.T Nigeria). *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*. 11(5): 66-72.

Kheni, N. A. (2008). *Impact of Health and Safety Management on Safety Performance of Small and Medium-Sized Construction Businesses in Ghana*. An unpublished PhD Thesis. Loughborough University, UK.

Kheni, N. A., Braimah, C. (2014). Institutional and Regulatory Frameworks for Health and Safety Administration: Study of the Construction Industry of Ghana. *International Refereed Journal of Engineering and Science (IRJES)*. 3(2): 24 – 34

Langford, D., Rowlinson, S., Sawacha, E. (2000). Safety Behaviour and Safety Management: Its Influence on the Attitudes of Workers in the UK Construction Industry. *Engineering, Construction and Architectural Management*. Blackwell Science Ltd. 2000. (7)2: 133–140.

Lingard, H., Rowlinson, S. (1994). Construction Site Safety in Hong Kong. In *Construction Management & Economics*. E & F Spon, U K; 12: 501-510.

Okolie, K. C., Okoye, P. U. (2013). Appraising the Influence of Cultural Determinants of Construction Workers Safety Perception and Behaviour. *International Journal of Engineering and Medical Science Research*. European Centre for Research Training and Development UK. 1: 11-24, March 2013. Retrieved from www.ea-journals.org on 22/12/2020.

Oladiran, O. J., Ogunsanmi, O. E., Soyingbe, A. A. (2009). *Control Measures of Accidents: Nigerian Building Projects' Case*. CIB W065/055 Commissions: Transformation through Construction.

Rowlinson, S., To, T., Yuen, P.H. (1993). Leadership style of construction managers in Hong Kong. *Journal of Construction Management and Economics*, 11, 455–465.

Shittu, A. A. (2016). *Influence of Organisational Characteristics on Health and Safety Practices of Small and Medium-sized Construction Companies in Abuja*. Unpublished PhD Thesis. Department of Quantity Surveying. Faculty of Environmental Design, Ahmadu Bello University, Zaria, Nigeria.

Shittu, A. A., Ibrahim, A. D., Ibrahim, Y. M., Adogbo, K. J. (2015). Assessment of Level of Implementation of Health and Safety Requirements in Construction Projects Executed by Small Firms in Abuja. In D. R. Ogunsemi, O. A. Awodele and A. E. Oke (Eds). *Proceedings of the 2nd Nigerian Institute of Quantity Surveyors Research Conference*. Federal University of Technology, Akure. 1st – 3rd September. 467 – 482.

Tefera, T., Gebreegziabher, L., Hailesilase, N., Araya, N. (2016). Identifying causes of building construction site accidents in Tigray region, towards a safe construction industry. Research Article. 1 – 6.

Watson, J. (2001). *How to Determine Sample Size: Tip sheet #60*, University Park, P.A: University Cooperative Extension, Pennsylvania State University.

Windapo, A. O., Jegede, O. P. (2013). A Study of Health, Safety and Environment (HSE) Practices of Nigerian Construction Companies. Retrieved from http://www.academia.edu/5981184/A_Study_of_Health_Safety_and_Environment_HSE_Practices_of_Nigerian_Construction_Companies on 22/03/2020

Yandalu, M. M., Shittu, A. A., Jibril, A. M. (2019). Assessment of Cost Implication of Health and Safety Measures in Construction Projects in Nigeria. In A. D. El-Ladan (Ed.). *International Journal of Strategic Research in Education, Technology & Humanities (IJSRETH)*. Lextra Education Ltd., UK. January, 2019. 6(1): 97 - 106. ISSN Print: 2465-731X; ISSN Online: 2467-818X.