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Strategies for Communicating Health and Safety Information on Construction

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Abstract: Accidents are common problems on construction sites globally. The occurrence of these accidents usually leads to loss of time and productivity of site personnel, payments for treatment of the injured and burial expenses for the dead. Previous studies identified poor communication of information on Health and Safety as one of the major causes of accidents on construction sites. This study examined and analyzed the strategies for communication. Mean and standard deviations were used to analyze the strategies. The opinions of supervisors and operatives were tested through an independent t-test and Spearman's rank correlation. Findings revealed project briefings, operating procedures, and safety manuals as the most frequently used communication strategies. No significant differences exist between the two groups of respondents in their rankings. The correlation coefficient revealed a positive relationship. In other words, respondents concurred in their opinions regarding these communication strategies. This paper, therefore, recommends the adoption of significant strategies identified in this study. In addition, future research can be conducted in other countries in order to explore the research area globally.

Keywords: Health and safety, communication strategies, accident, construction sites.

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1. Introduction

Occupational accidents, particularly on construction sites, are of grave concern for both practitioners and researchers all over the world. International Labour Organization (2011) estimated that about 60,000 fatal accidents happen on construction sites annually around the world, which is one in every six of all fatal work-related accidents. Statistics presented by researchers from different countries revealed that the accident rate on construction sites is very high when compared with other sectors (Muiruri and Mulinge, 2014; Orji et al., 2016).

In developed countries such as Britain, the economic cost of accidents on construction sites in 2014/2015 amounts to £0.9bn (Pound) and about 1.7 million lost working days. In the United States, accidents on construction sites account for about 20% of all fatal accidents (Forst *et al.,* 2013). Ejiugwo (2013) found up to 25% in Italy. According to Ling et al., (2009) construction accidents in Japan account for 30% - 40% of the overall total of occupational accidents, and as high as 50% and 59% in Ireland and Singapore respectively.

Studies conducted in developing countries corroborate evidence of this relatively high proportion of accidents on construction sites. For instance, in Cambodia between 2011- 2015, more than 1,500 labourers died because of accidents on construction sites (Durdyev et al., 2017). Kwofie (2015) revealed a poor state of Health and Safety (H&S) on Ghanaian construction sites. Umeokafor (2017), Agwu and Olele (2014) found that the situation is quite pathetic in Nigeria because there is no existing functional legislation to that effect. In Nigeria, there is no reliable data on accident cases on construction sites because contractors neither keep proper records nor report at the appropriate ministry (Adeogun and Okafor, 2013; Windapo and Jegede, 2013). The occurrence of accidents on construction sites usually leads to site closure for investigation, loss of time, loss of output, loss of corporate reputation, payment of burial expenses/compensation for the dead.

Various studies were carried out to determine the causes of these accidents. Findings from research studies have pointed to poor communication of information on H&S (Phoya, 2012; Kwofie, 2015; Akunyumu, 2016; Jokkaw and Tongthong, 2016). Communication is therefore critical to achieving a safe work environment. This is by giving and receiving information about hazards and risk controls. Through communication, personnel on sites are informed and educated about protective actions. They are warned about disasters and taught how to manage emergencies.

Various communication strategies were identified to be used on construction sites; these include photographs, diagrams, induction training, handbooks, team briefings, and toolbox talks. Ahadzie et al., (2014) emphasized that the communication strategies used on construction sites are crucial to attaining an acceptable level of safety of personnel. These strategies often determine whether the information will be understood or not (Zungu, 2014).

This study is significant because there is a dearth of previous studies on strategies used in communicating information on H&S on construction sites. Many of the previous studies focused on adherence to H&S rules and regulations by the construction personnel. The objectives of this paper include examining strategies adopted in communicating information on H&S and to determine the strategies that are significant on construction sites. The study will, therefore, assist site personnel to achieve safe working environment during the construction activities. It is when these personnel are in a good state of health and are physically sound that the work can go on smoothly on sites.

2. Communication on Construction Sites

Construction activities are becoming more complex, multi-faceted, and technically inclined globally. These involve the participation of multi-disciplinary and interrelated operations on sites (Okoye and Okolie, 2014, Lessing et al., 2017; Kawuwa et al., 2018). Therefore, communication keeps the site personnel updated on organizations' H&S regulations and policies (Adebiyi, 2018). It also informs them of the progress of their operations, helps them to maintain good relationships, improve teamwork, and enable better collaboration (Alatalo, 2012; Akunyumu, 2016).

Aiyewalehinmi (2013) found that communication among site personnel is of maximum importance irrespective of the fact that the projects are well planned, organized, and managed by experienced and qualified personnel. Communication also informs them about the use of personal protective equipment, warning about disasters, and first aid procedures. Communication of information is important in enhancing the performance of construction projects as researchers have hypothesized that a positive correlation exists between effective communication and safely delivery of construction projects (Ceric, 2011; Zulch, 2012; Chen et al., 2013; Ramsing, 2013, Liao et al., 2014; Adebiyi, 2018). Since safely delivery of construction projects relies on effective communication of information on H&S, it is, however, vital that all the participants can communicate. The inability to read information by some of the site operatives causes communication difficulties and can result in increased risks. Safety of these operatives should be considered the number one priority so that the work can go on smoothly on sites, hence the need for an effective communication strategy.

Communication strategies are regarded as an action plan for an organization's outreach efforts to disseminate information. Vecchio-Sadus (2007) acknowledged that there are various ways by which different organizations communicate and deciding on the strategy to use depends on the type of information and the recipients of the information. Information about the organization can be communicated through organizations' mission statement, policy, and strategic plan, or through risk assessment.

An in-depth review of relevant literature revealed strategies for communicating information on H&S, such as induction training, project briefings, toolbox talks, meetings, operating procedures and through several publications (Vecchio-Sadus, 2007; Phoya, 2012; Ejiugwo, 2013; Muiruri and Mulinge, 2014). Safety induction is carried out by H&S officers and supervisors on-site rules and requirements, emergency procedures and incident reporting to enable new employees, visitors, and operatives to carry out their duties in a safe manner from the moment they come on site. There is a wide variety of publications on H&S issues such as simple instructional leaflets, operating manuals, checklists, and guides to legislation. These are mostly printed in several languages if the operatives are multicultural. It is possible to communicate H&S through an organization's in-house newsletter.

Posters in the form of photographs, diagrams, signs, and symbols are commonly used where site operatives cannot read safety manuals and handbooks. To maintain attention, posters are kept on a special display board. They consist of standard, reflective, and illuminated signs with appropriate colour code. There are different colours for different purposes: red for prohibition signs, yellow for warning signs, blue for mandatory signs, and green for safe condition signs.

Reporting the outcome of accident investigations demonstrates organizations' commitment to identifying and addressing underlying causes to avoid recurrence. It is important to encourage the operatives to report accidents and injuries as many of them will not report for fear of recrimination. With the advancement in technology, information on H&S is available on the internet. It is essential to note that critical information on H&S is readily available and accessible on H&S websites to keep the personnel informed about potential risks and how to prevent them. The organization's H&S intranet provides a one-stop-shop that includes the safety manual, policies, and fact sheets. For the H&S website to be effective, site personnel need to know of its existence, they need to be motivated to access the information and the information needs to be updated regularly.

A safety week can also be organized annually with the aim of promoting a happier and healthier work environment for the personnel. This raises the level of awareness amongst them and also demonstrates a commitment from the side of the management of the organization. Events like these can include organizing seminars on health talk, conferences, film shows on case studies, and health checks. Safety week provides an excellent opportunity to showcase H&S at its best and creative activities can also be offered.

3. Method

The main objective of this study is to identify and assess different strategies used for communicating information on H&S on construction sites. To achieve the objective, a comprehensive literature review was carried out to identify these communication strategies. Thirty (30) strategies were identified which formed the basis for designing the preliminary questionnaire. A pilot interview was undertaken to refine these strategies. A total of twenty-four (24) strategies were adopted as relevant to the Nigerian construction sites and were used to design the questionnaire. The questionnaire was

designed with the objective of determining the significant strategies for communicating H&S information on the construction site.

The target population was construction firms that are registered with the Lagos State Public Procurement Agency (LSPPA). LSPPA maintains a database of registered construction firms and describes their classification and categorizations based on contract value. According to LSPPA Directory (2020), registered construction firms were classified into five (5): Class A, B, C, D, and E as shown in Table 1

Table 1. Classification of registered construction firms under LSPPA

Class	Contract value/threshold (₦)
A	0.5 million - 10 million
B	10 million - 100 million
C	100 million - 250 million
D	250 million - 1 billion
E	Above 1 Billion

The firms registered under categories D and E were identified to participate in this study. They are high caliber, well-structured firms with wide experience in construction operations. They are noted for executing projects with huge contract sums and also have records of H&S policies with a wide variety of on-site personnel. In addition, these firms have established offices making their location relatively easier.

The pilot survey conducted for the purpose of this study revealed that there were fifty-five (55) active construction organizations that have on-going projects in the study area at the time of the study. Therefore, this study adopted the purposive sampling technique, which is an example of non-probability sampling techniques. Sampling units were selected based on purpose. This technique was employed to select a sample size of fifty-five (55) construction sites. On each site visited, a supervisor and three site-operatives were randomly selected from bricklayers, carpenters, iron benders, electricians, and plumbers depending on the level of ongoing construction activities on the sites. Table 2 shows a sample size of fifty-five (55) supervisors and one hundred and sixty-five (165) site-operatives. Therefore, the total sample size was two hundred and twenty (220) altogether.

The questionnaire was structured and divided into two sections: the first section was designed to get information about personal data of the respondents such as education and professional qualifications, year of experience on construction sites, and the number of projects handed in the last ten years. The second section was designed with the purpose of determining the most significant strategies used in communicating information on H&S. Respondents were therefore requested to rate the importance of the 24 variables identified from literature review on a five-point Likert scale from 1 = Not Used; 2 = Seldomly Used; 3 = Moderately Used; 4 = Often Used; 5 = Very often Used.

Table 2. Numbers of respondents

Class	Supervisors	Operatives	Total
E	34	102	136
D	21	63	84
Total	55	165	220

4. Results and Discussions

A total of one hundred and sixty-one (161) completed questionnaires were returned and analyzed resulting in an effective response rate of 73%. Though the response rate was high but comparative analysis of response rates from several studies considered it adequate especially where responses were collected by hand (Durdyev et al, 2017; Umeokafor, 2017; Rehman, 2020). A total of 22% of the respondents are supervisors while the remaining 78% are site personnel as revealed in Table 3.

Table 3. Response rate of the questionnaire administered

Respondents	Questionnaire distributed	Questionnaire retrieved	Response rate
Supervisors	55	35 (64%)	22%
Operatives	165	126 (76%)	78%
Total	220	161 (73%)	100

4.1. Demographic Information of the Respondent

The reliability of any study is partly dependent on the source of data and the rigorousness of the analysis employed. For the findings of this study to be reliable, information about the background of the respondents was sought. Table 4 revealed detailed information about the site-supervisors, as categories of company registration with the government, type of organization, education qualification, and years of experience. From the results, the majority of the supervisors have obtained a minimum of the first degree (71%) and have experience in the construction industry. These findings can be said to be enough to provide reliable information required.

Table 5 reveals the name of the trade, types of the employer in the organization, mode of engagement, educational qualifications, and year of experience of site-operatives surveyed. The result revealed that about 48% of site personnel have a very low level of education (not more than primary education), which can be a challenge to communication and the way they perceive H&S risks. The years of construction experience of the respondents are credible, about 78% of the respondents have more than 10 years of construction experience. The results show that although the majority of them have a low level of education, their levels of experience on construction sites are commendable. It is therefore plausible to conclude that the data provided by both supervisors and operatives are credible and reliable because of their experience.

4.2. Ranking of Communication Strategies

The supervisors and the operatives were asked to rate the communication strategies used on construction activities with respect to their frequency of usage on a scale of 1-5. The mean score and the standard deviation were used to rank the frequency of usage of the strategies. The results of the twenty-four (24) strategies

in the questionnaire are presented in Table 6. The table shows that operating procedure is the most frequently used strategy to communicate health and safety information on construction sites from the supervisors' point of view. It was ranked first with a mean score of 3.89 and a standard deviation of 0.718. Project briefing was ranked second though with the same mean value of 3.89 with the operating procedure but with a higher standard deviation of 0.871.

The use of safety warning signs as a communication strategy was ranked third; obtaining a mean score of 3.77 with a standard deviation of 1.003.

Safety manual is another important strategy that was ranked fourth, with a mean score of 3.54 and a standard deviation of 0.741. Supervisors also ranked training/workshop as the fifth frequently used strategy with mean score and standard deviation of 3.34 and 0.938 respectively. These were considered the most significant in this research study.

Table 4. Site supervisor's profile

Profile	Frequency	Percentage (%)	Cumulative %
Categories of company's registration with Lagos State			
Government			
Category D	21	60.0	60
Category E	14	40.0	100
Total	35		
Type of contracting organization			
Building engineering	15	42.9	42.9
Civil engineering	13	37.1	80.0
Industrial engineering	5	14.3	94.3
Service engineering	2	5.7	100.0
Total	35		
Highest educational qualification of respondents			
Higher national diploma (HND)	10	28.6	28.8
Bachelor's degree (BSc./B.Tech)	16	45.7	74.3
Master's degree (MSc./M.Tech)	9	25.7	100.0
Total	35		
Length of service with the company			
0-5 years	8	22.9	22.9
6-10 years	11	31.4	54.3
11-15 years	7	20.0	74.3
16-20 years	6	17.1	91.4
Above 20 years	3	8.5	100
Total	35		
Years of experience on construction sites.			
0-5 years	12	34.3	34.3
6-10 years	8	22.9	57.2
11-15 years	8	22.9	80.1
16-20 years	5	14.3	94.4
Above 20 years	2	5.7	100
Total	35		
Number of projects undertaken in the last 10 years			
1-5 projects	2	5.7	5.7
6-10 projects	9	25.7	31.4
11-15 projects	9	25.7	57.1
16-20 projects	11	31.4	88.5
Above 20 projects	4	11.4	100
Total	35		

Table 5. Site operatives' profile

Profile	Frequency	Percentage (%)	Cumulative %
Name of trade of site-operatives			
Bricklayer/plasterer	30	23.8	23.8
Carpenter/joiner	28	22.2	46
Roofers	10	7.9	53.9
Electrician	3	2.4	56.3
Plumber	3	2.4	58.7
Glazier	12	9.5	68.2
Painter/decorator	5	3.9	72.1
Welder	12	9.5	81.6
Laborer	11	8.7	90.3
Others	12	9.5	100
Total	126		
Type of employers in organization			
Main contractor	40	31.7	31.7
Sub-contractor	80	63.5	95.2
Others	6	4.8	100
Total	126		
Modes of engagement			
Part-time	26	20.6	20.6
Full-time	92	73.0	93.6
Temporary (daily)	8	6.4	100
Total	126		
Highest education qualification			
ND/NCE	15	11.9	11.9
Secondary education with vocational skills	17	13.5	25.4
Secondary education	31	24.6	50.0
Primary education with vocational skills	13	10.3	60.3
Primary education	40	31.7	92
Trade test	4	3.2	95.2
Others	6	4.8	100
Total	126		
Years of experience on construction sites.			
0-5 years	32	25.4	25.4
6-10 years	47	37.3	62.7
11-15 years	27	21.4	84.1
Above 15 years	20	15.9	100
Total	126		

Results from Table 6 also show that site-operatives ranked project briefing as the most frequently used communication strategy on sites. It was ranked first with a mean of 3.43 and a standard deviation of 0.938. The use of training/workshop as a strategy for communication was ranked second with a mean value of 3.41 and a standard deviation of 0.871. The use of the safety manuals as communication strategy was also ranked third; obtaining a mean score of 3.32 with a standard deviation of 0.984. Operating procedure is another important strategy that was ranked fourth, with a mean score of 3.13 and a standard deviation of 1.168.

Site operatives also ranked meetings as the fifth frequently used strategy with mean score and standard deviation of 3.02 and 0.926 respectively. Nevertheless, its safety alarm, notice boards, safety alert, and posters/photographs were also used as communication strategies on-site albeit not frequently.

From the overall mean scores, project briefings and operating procedures were the most frequently used strategies for communication of health and safety information (mean score of 3.66 and 3.51 respectively). Table 6 also shows that safety manuals and training/workshops were also frequently used communication strategies on construction sites (mean score of 3.43 and 3.38 respectively). Other frequently used communication strategies were: warning signs (3.35) and organizing meetings (3.18). The least used strategies according to the findings include safety week, project intranet, video, PowerPoint presentations, and brochures.

Table 6. Strategies adopted for communicating health and safety information on construction

Communication Strategies	Site-Supervisors			Site-Operatives			Overall		Sig.
	Mean	Standard Deviation	Rank	Mean	Standard Deviation	Rank	Mean	Rank	
Project briefings	3.89*	0.832	2	3.43	0.938	1	3.66	1	.301
Operating procedures	3.89*	0.718	1	3.13	1.168	4	3.51	2	.001**
Safety manuals	3.54	0.741	4	3.32	0.984	3	3.43	3	.152
Training/workshop	3.34	0.938	5	3.41	0.871	2	3.38	4	.029**
Warning signs	3.77	1.003	3	2.92	0.843	8	3.35	5	.001**
Meetings	3.34	1.027	6	3.02	0.926	5	3.18	6	.029**
Safety alarm	3.29	0.893	7	2.97	0.865	7	3.13	7	.076
Safety alert	3.23	0.808	9	2.98	1.073	6	3.11	8	.000**
Notice boards	3.26	0.817	8	2.91	0.924	9	3.09	9	.907
Safety induction for operatives	3.14	0.845	11	2.90	0.720	10	3.02	10	.203
Posters/photographs	3.17	0.822	10	2.45	0.816	13	2.87	11	.000**
Risk assessment	2.97*	0.785	12	2.65	0.870	12	2.85	12	.273
Graphics e.g. safety signs & diagrams	2.97*	0.923	13	2.74	0.931	11	2.81	13	.656
Operating checklist	2.91	0.781	14	2.08	1.191	14	2.50	14	.416
Handbooks	2.86	1.061	15	1.76	0.894	17	2.31	15	.166
Toolbox talks	2.66*	0.906	17	1.90	0.945	15	2.28	16	.547
News letter	2.66*	0.838	16	1.83	1.132	16	2.25	17	.825
Health and safety conference	2.37	1.215	18	1.67	1.165	18	2.02	18	.656
Health and safety websites	2.34	0.968	19	1.56	0.890	20	1.95	19	.255
Brochures	2.14*	0.912	21	1.62	1.186	19	1.88	20	.255
Power point presentations	2.14*	0.944	20	1.55	1.170	22	1.85	21	.416
Videos	2.00	0.907	23	1.54	1.115	23	1.77	22	.899
Project intranet	2.03	0.954	22	1.48	1.033	24	1.76	23	.001**
Safety week	1.97	1.043	24	1.56	1.135	21	1.75	24	.307

*Same mean score, the standard deviation was used to rank
**: T-test is significant at 5%

Findings from this study were in line with the research conducted on improving safety communication of ethnic minorities in the construction industry of Hong Kong. The study revealed that the main communication strategies were morning briefings, safety training, toolbox talks, and informal discussions. (Chan et al., (2014). In the same line of study, another research on the practice of communication of H&S risk information at construction sites in Tanzania confirmed that toolbox meetings, informal discussion, written posters, and symbols were the common strategies of communicating H&S information (Phoya, 2017).

As against the least adopted communication strategies revealed from this study, email, cellphone, the internet, and extranet were innovative technologies for effective communication processes for building design, construction, and management in Lebanon (Khoury, 2019). The strategies permit projects to be organized 24 hours, 7 days a week. Ulang et al., (2012) found out that only big companies allocate budgets for H&S training for their staff while small companies do not have adequate training on H&S matters.

An independent sample t-test was conducted to see how the two groups of respondents (supervisors and site-operatives) rated the H&S communication strategies at 0.05 level of significance. The results in Table 6 show that significant differences exist among the groupings on only 7 strategies out of the 24 considered in the study. The following are the items: operating procedures, warning signs, training/workshop, Meeting, and safety alert, posters/photographs, and project intranet with ($p<0.05$). What this means in essence is that the supervisors and site operatives vary in their opinion with respect to the ranking of these H&S communication strategies.

The opinions of supervisors and operatives differ in operating procedures because the supervisors believe the strategy gives direction on safe work practice and therefore ranked it higher. Whereas operatives were of the opinion that operating procedures reduce their workplace individuality and will not allow them to their job the way they want to, consequently, ranked the strategy lower. The warning sign was also ranked higher by the supervisors to avoid fines and to reduce administrative hassles, meanwhile, the operatives

believe that warning signs may not be the solution to various hazards that may occur on the sites.

Due to the waste of valuable resources such as time and money, supervisors ranked training/workshop and Meetings lower compared with ranking by the operatives. The organizations need to spend money, time and probably hire other personnel to adopt the strategies. The supervisors also ranked Safety alert lower compare with the ranking by the operatives because of prohibitive cost, very expensive and catastrophic system failure especially on a long-term project.

Posters/photographs were more adopted by the supervisors simply to overcome the language barrier and can easily attract attention especially when placed conspicuously. Despite the fact that project intranet provides a one-stop-shop that includes the safety manual, policies and fact sheets, supervisors rarely adopt the strategy, while site-operatives never, due to unavailability of the resources to keep them informed about risks and to prevent incidents and injuries. For the rest of the factors, there are no significant differences exist between the supervisors and site operatives in their opinions, which is an indication that their opinion rating is not at 0.05 level of significance. In other words, the respondents concurred in their opinions regarding these H&S communication strategies.

Spearman's correlation coefficient was carried out to check the significance of the relationship between the ranking of communication strategies by the supervisors and the operatives. The hypothesis (H_0) for this study was that, there is no correlation between the ranking of supervisors and operatives on the strategies for communicating H&S information on construction. The correlation coefficient reveals a positive relationship with 83.1% correlation. The p-value was found to be statistically significant at a 1% level of significance with the P-value <0.05. There is enough evidence to reject the null hypothesis (H_0). Therefore, it can be concluded that there is a strong relationship between strategies adopted in communicating H&S information on construction sites by the supervisors and the operatives.

5. Conclusion

This study serves as an aid to construction practitioners in communicating H&S information on sites by identifying significant strategies. The study concluded that the operating procedure is the most significant strategy. The operating procedures provide the guideline to operate equipment and advice on safe work practices to prevent incidents. Project briefing is also significant on sites to enable the workers to carry out their duties in a safe manner from the moment they arrive on site. Safety warning signs, safety manuals, training/ workshop, and meetings were also considered frequently used communication strategies. They are the most essential methods to address and solve H&S risks and hazard issues on sites.

The study went further to examine the variation in the opinions of supervisors and operatives on the significance of the strategies. There is no significant difference between their rankings. In fact, there is a strong relationship between strategies adopted in communicating H&S information on construction sites by the two groups of respondents. In other words, they concurred in their opinions regarding these communication strategies.

Adopting appropriate communication strategies will help the site personnel in carrying out their activities correctly and safely, thereby reducing accidents and improving their safety. This research work is also a reference point through the provision of sources for which communication of health and safety information can be assessed.

The research work was limited to high-class contracting firms that are registered with Lagos State Public Procurement Agency, Nigeria (class D and E). Other categories were not considered. Moreover, the study of communication of H&S on construction proved to be very challenging due to the complex and fragmented nature of the operations on sites. Therefore, it was difficult to observe how supervisors communicate H&S information to the operatives. The respondents had to recall the processes that they went through in a construction project based on experience. The data collection was mainly based on the respondents' experiences.

There are many studies to be explored as regard H&S of workers on sites. This study analyses communication strategies in Nigeria, further research can be carried out in other countries in order to get a load of the research area globally.

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