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## Improving Construction Site Workers' Safety Behaviour Through Visual Communication: A Case Study of Nigerian Construction Industry <sup>1</sup>

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### Abstract

Visual communication has long been recognized as one of the essential management tools to improve workplace safety. In contrast little or no research into visual communication and construction site worker safety behavior has been conducted in Nigeria. This study seeks to examine the extent Nigerian construction companies employ this simple safety management tool to improve site worker safety behavior. The descriptive survey method was used with quantitative data gathering using structured questionnaire and qualitative data gathering through semi-structured interviews. The questionnaire was structured from health and safety (H&S) literature and administered to managers, supervisors and site workers. The questionnaire survey was complimented with walk about and interviews conducted with site managers, supervisors and site workers from five purposively selected companies: one large, two medium and two small sized construction companies within the Lagos State. SPSS package version 10 was used for the data analysis. The empirical results revealed that majority of the construction companies did not provide visual safety signages on their sites. The interviews results also indicated that none of the medium and small construction companies provided safety signages on their sites. Provision of safety signages on site is a candid demonstration of management commitment towards workers' health, safety and wellbeing (HSW). The study therefore, recommends that construction companies in respective of size should provide and maintain safety signages on site at a strategic point for easy visibility to workers.

**Keywords:** Construction, site worker, safety behaviour, visual communication, Nigeria

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## INTRODUCTION

The Nigerian construction industry is one of the most vibrant sectors of her economy. According to Okorie and Emuze (2019), the Nigerian construction sector contributes 5.8% of the nation's Gross Development Product (GDP). The industry is also the largest employer of labour both skilled and unskilled. It has the potential to contribute much more due to high demand of buildings and infrastructural facilities as a developing country. Naoum (2010) states that the construction industry globally, trains and hones skills of all types. Despite the importance of this sector to the economy development of Nigeria, the industry has been known for its high risks, accidents and fatalities (Okorie and Musonda, 2019, Okorie and Emuze, 2020).

The causes of unsafe behaviors or unsafe acts of workers on construction sites, according to researchers and scholars amongst Lingard and Rowlinson (2005); Health and Safety Executive (HSE, 2010); Okorie (2014); and Phoya (2017), are attributed to: poor leadership and lack of commitment to site workers' H&S by the top management. The World health organization (WHO, 2010), also notes that poor H&S attitude of site supervisors, inadequate H&S training of workers, and lack of a proactive approach to H&S management contribute to unsafe behaviour of workers on site. The International Labour Organisation (ILO, 2010) on major causes of construction site accidents pointed out that failure to provide safety signages on sites could contribute to accidents and incidents. The use of visual signages on construction sites have been noted to impact positively on workers' H&S behaviours (Okorie & Smallwood, 2012). The ILO (2010) added that picture speaks more than thousand words and create listening impressions. Hughes and Ferrett (2008) and ILO (2011) averred that ineffective site safety communication leads to misunderstanding, mistake, injuries and even fatalities on construction sites.

Research conducted by Okorie and Musonda (2018) on supervisor's ability and competency to conduct construction site health and safety induction training in Nigeria, noted that small and medium construction enterprises commonly use written documents in conducting their training over visual safety signs such as pictures, symbols, images etc. Perhaps, this finding could be more common in developing countries where cost of procuring colourful posters, animations and cartoons are very high. Nonetheless, Phoya (2017) noted that the use of written H&S policy manuals for safety communication has some limitations, as many construction site workers are rural migrants with little or no education. Thus, the idea to communicate safety policies through images, pictures, animations, illustrations etc. was based on the premise that an informed worker is more likely to perform his / her tasks at relatively low risk. This is the myth behind the introduction of Safety-First posters in workplaces. Therefore, the study aimed at investigating the

perceptions of managers, supervisions and site workers on extend the use of visual safety communication on construction site will improve workers' safety behaviours.

## **Literature review**

### **Visual communication**

Visual communication is the art of using posters, pictures, symbols, images, graphics, infographics, and animations to communicate information and ideas to people. The use of pictorial representation as a means of communicating safety in workplaces, particularly at construction site has been in existence for decades. The ISO 38664 safety colours and safety signs were developed in an attempt to standardised colours and symbols for safety signs around the world (Hughes and Ferrett, 2010; Goetsch, 2013). Visual safety signs that have been used in the workplaces; construction sites inclusive are shown in Figure 1 illustration. Goetsch (2013) posits that visual safety signs aid people to do right things even when no one is watching them. For example, safety signs on the use of safety equipment as illustrated in Figure 1 and 2 helps workers to wear the appropriate personal protective equipment (PPE). In addition, instances have shown that the use of cartoons in H&S training, induction training, weekly toolbox talks has significantly improved site workers' safety behaviours (ILO, 2010; Okorie and Smallwood, 2012).

Presenting safety information in picture forms, according to ILO (2010) help workers to comprehend the information better. The ILO further argues that human brain is capable of processing pictorial representation easily than texts. Research conducted by Vazquez and Stinker (2004) in America among Latino construction site workers assert that visual safety signs play crucial role in communicating and disseminating safety information to everyone on workplace regardless of nationalities, differences in languages and varying literacy levels among the workers. The ILO (2010) emphasized that visual safety signs are simple, easily comprehend and creates effective means of transferring knowledge to the viewers. Figure 1 below illustrates common safety signs in workplaces construction sites inclusive.



Figure 1, An illustration of safety signs

### Importance of Visual safety communication on construction site

The construction industry by its very nature is complex (Goetsch, 2013; ILO, 2010), and the complexity is compounded by high level of illiteracy among the site workers (Okorie and Smallwood, 2012). Consequently, the use of pictures, symbols etc. in communicating safety at construction sites will be one of the veritable tools to improve workers' safety behaviours as English is a second language to many.

According to Hughes and Ferrett (2010) workers are directly affected by site activities, and also the ones that carry out site operations. Going by this, the ILO (2010) standard on occupational safety and health promoting safe and healthy working environment mandated construction enterprises in respective of size to provide safety signages at strategic position on their sites for easy visibility by workers. Additionally, such safety posters/signages may include local languages as majority of the site workers are rural migrants with low level of education (Okorie and Smallwood, 2012). The negative impact of low education on safety behaviour among construction site workers is supported by Vazquez and Stainker. They assert that the inability to read written safety instructions, among Latino construction site workers resulted in poor H&S behaviours.

Similarly, Torrance (2004), surveyed urban immigrant workers in an immigrant community in Northern Virginia, and found that they face a high risk of occupational injuries, with adverse H&S outcome.

Research that has been conducted in social science domain concluded that pictures, images etc. create lasting impression to the viewers. Bust et al. (2008) citing Oller and Giardetti (1999) assert that from an advertising perspective, using animated images to capture attention of parents for Polio vaccination worked effectively. This follows that using coloured images to represent safety signs and mandatory PPE on construction sites will positively impact on workers' H&S behaviours. Visual safety signages according to Hughes and Ferrett (2010) are tools management used to emphasize their commitment towards free accidents workplace and promote workers' safety behaviour. Below is an illustration of some safety signs with explanations common seen on construction worksites.



Figure 2: An illustration of safety signs with explanation

### **Advantages of using visual safety signs to communicate H&S on worksite**

Since prehistoric times, pictures, images, symbols etc. have been used to communicate information and ideas to people. More importantly, nothing works better than pictures, it creates a lasting impression. Research conducted by Bust et al. (2008) on the use of visual communication to improve construction site H&S stated that sometimes, getting your message across in a clear, concise way can be difficult with words alone, particularly among illiterate construction site workers. The use of pictures, images, symbols to communicate workplace H&S to workers of diverse cultures have been accepted globally. According to Bust et al. (2008), the use of cartoons in workplace H&S training, visual (videos), picture and images has significantly improved workers H&S behaviours. Bust et al. (2008) and Hughes and Ferrett (2010) listed the followings benefits of using pictures, images symbols to communicate sites H&S:

- **Effective for illiterate site workers:** Construction industry according to Vazquez and Stalnaker (2004) is the highest employer of illiterate workers who migrant to urban cities after done with their farm works. The use of safety visual communication tools during weekly tool box talks, induction training will be more effective in communicating site H&S.
- **It aids in oral safety communication:** A picture speaks more than thousand words; therefore, pictures, images, cartoons used to demonstrate facts during H&S training sessions will in no doubt aid in better understanding of the topic by workers. According Hughes and Ferrett (2010) oral safety communication becomes more meaningful if key elements such as graphs, pictures and diagrams are used.
- **The use visual artifacts such as pictures, cartoons, animations during safety training session make explanation easier:** According to Hughes and Ferrett (2010), the use of graphical representation in communicating H&S to workers has been of tremendous benefit in achieving safety communication goals. Easy explanation has made visual safety communication more popular.
- **Using visual techniques to communicate safety at workplaces make it simpler:** Geotsch (2013) argues that communicating complex information and ideas to trainees become simpler and easier with the use of images, cartoons, figures, diagrams etc.
- **Time is very important to site supervisors, using representations to demonstrate to workers what are required of them at a particular point in time can easily be achieved with the use of pictures, images cartoons etc.** The use of visual communication help to prevent waste of time compared to using written and oral communication methods which takes much time to communicate the same information and ideas to workers (Geotsch, 2013).

- The use of visual safety communication helps in quick decision making among site workers: Visual safety communication helps site workers to take quick decisions as picture speaks more than thousand words.
- Graphic representation is believed to be more popular and appears attractive than long written documents (Geotsch, 2013). Safety signs presented with colourful background need not long explanation. Bust et al. (2008) stated that visual safety signages are more popular among illiterate site workers, they do not like much speech and long explanation rather than pictures, images, animations, charts etc. The use of safety representation on construction sites limits the need for long speeches and voluminous safety manuals.
- Research has shown that there is a strong link between safety visual communication and improved site workers safety behaviour, as pictures, images, cartoons, infographics add impact to the information, quicker understanding and create lasting impression to the target audience.

### **Research methodology**

Seven construction companies were randomly selected within the Lagos metropolis, for the purpose of this study. Five companies accepted to participate for the study, one large, two medium and two small. Questionnaires were administered to managers, supervisors and workers on five companies that accepted to participate for the survey. The workers who completed the questionnaire were those that can read and write. The questionnaire was designed to elicit information from site managers, supervisors and workers on ways to improve construction site workers' safety behavior through visual communication. The questionnaire was complimented with walk about and interviews conducted with managers at head and site offices and workers randomly selected among those who completed the questionnaire were those that can and write from the five construction companies that participated for the study.

One hundred and ten (110) questionnaires were distributed, seventy-five (75) were returned, and this resulted in a response rate of 68%. The response rate achieved for this research is similar to that achieved in other surveys (Sutrisna, 2009). It could be inferred from Dainty (2008) and Sutrisna (2009) that performing a statistical analysis in survey within the response rate equal to or above the threshold of thirty (30) is acceptable. Thus, 68% response rate achieved in this survey provides reasonable data for analysis. Interviews were also conducted with five managers at the head offices from each of the five companies and randomly selected literate workers. An interview is an interaction between two or more people to gain insight relative to problems (Leedy and

Ormrod, 2010). The aim of the interviews was, to share their perceptions/views on ways to improve construction site workers' safety behavior through visual safety communication.

Three framed questions and a 5-point Likert-scale measurement was used to obtain the opinions of the respondents and to analysis the results. Leedy and Ormrod (2010) maintain that Likert scales are effective to elicit participants' opinions on various statements. The statistica (version 10.0) was used to generate the descriptive and inferential statistics. When using Likert scales, it is imperative to calculate and report Cronbach's *alpha* coefficients as well as the internal consistency and reliability (Gliem and Gliem, 2003). Maree and Pietersen (2007) suggest that the following guidelines for the interpretation of Cronbach's *alpha* coefficient: 0.90 – high reliability; 0.80 – moderate reliability, and 0.70 - low reliability. The questionnaire survey shows a high reliability Cronbach's alpha of 0.90.

### **Data analysis**

The majority of the responses (65%) were received from the site managers/supervisors and workers of the large, medium and small sized construction companies. Over 52% of the respondents have been involved in construction for the past 10 years; 20% have Bachelor degrees in various disciplines, while 40% have Ordinary National Diploma and Trade Tested Qualifications in construction-related trades.

### **Provision of visual safety signs on construction site**

Table 1 indicates the respondents' perceptions of the "Yes" "No" and "Not sure" question relating to provision of visual safety signs on construction site. The data analysis shows that 24% of the respondents indicated that their companies provide visual safety signs such PPE posters at strategic point for visibility to workers, 49.33% indicated that their companies did not provide any safety visual signage or cartoon at head and site offices and while 26.67% were not sure. However, during the walk about, the researcher found that it was only one large company which is multinational provided PPE poster at both head office and site. This research finding corroborated the work of (Okorie and Smallwood, 2012) that the use of visual safety signages, pictures images, symbols are not common among medium and small construction enterprises in Nigeria.

**Table 1: Provision of visual safety signage/caution on construction site**

Statement	Frequency	Percentage
Yes	18	24
No	37	49.33
Not sure	20	26.67
Total	75	100

**Importance of visual safety communication on worker safety behaviour**

Table 2: below shows the respondents' perceptions relating to question on the importance of visual safety communication on worker safety behaviour. The data analysis revealed that 24.00% indicated that visual safety communication could lead to promote effective use of PPE on site, 21.33% indicated that it will build strong H&S culture on site, 20.00% indicated that it creates workplace safety awareness, 20.00% indicated that it brings lasting impression to worker and 14.67% indicated that it improves workers' behaviours. The empirical findings showed that provision of visual safety signs on construction sites at a strategic point for workers' visibility will improve workers' attitudes and behaviours towards site H&S rules and regulations. This research finding corroborated the work of Bust et al. (2008) that the use of cartoons in workplace H&S training, visual (videos), picture and images has significant relationship with workers' positive H&S attitudes and behaviours.

**Table 2: Importance of visual safety communication on worker safety behaviour**

Statement	Frequency	Percentage
It promotes the use of PPE on site	18	24.00
It builds strong H&S culture	16	21.33
It creates workplace safety awareness	15	20.00
It creates lasting impression on workers	15	20.00
It improves workers' safety behaviours	11	14.67
Total	75	100

**Advantages of using visual safety signs to communicate H&S on worksite**

Table 3: below shows the respondents' perceptions relating to question on the advantages of using visual safety signs to communicate H&S on worksite. The data analysis revealed that 21.33% indicated that it aids in H&S oral communication, 20.00% indicated it is useful to illiterate site workers, 20.00% indicated that it makes explanation of safety rules easy and simple, 16.00% indicated that it is popular among site workers, 13.33% indicated that it prevents wastage of time and 9.33% indicated that it helps in quick decision making among site workers. The finding revealed that using visual safety signs to communicate H&S on construction site have enormous advantages. Globally, construction site is made up of people with little or no education, using pictures, images in communicating H&S to such group of workers will be easier, and more comprehensible. This research finding supported literature in that Okorie and Smallwood (2012) noted that the use of written H&S policy manuals for safety communication has some limitations, as many construction site workers are rural migrants with little or no education.

**Table 3: Advantages of using visual safety signs to communicate H&S on worksite**

Statement	Frequency	Percentage
It aids oral communication	16	21.33
it is very useful to illiterate site workers	15	20.00
it makes explanation easy and simpler	15	20.00
it is popular among site workers	12	16.00
It prevents wastage of time	10	13.33
It helps in quick decision making	7	9.33
Total	75	100

The questionnaire examines managers, supervisors and workers views on ways to improving construction site workers' safety behaviour through the use of visual safety communication. Table 4 indicates the respondents' perceptions/views relative to the identified statements. It shows in terms of percentage responses to a scale of 1 (minor) to 5 (major), and mean score (MS) ranging between 1.00 and 5.00. It is notable that all the statements were above the midpoint of 3.00, which, with an average MS of 3.34, indicates that the respondents perceived that all the identified statements are relevant in improving construction site workers' safety behaviour through the use of visual safety communication tools such PPE posters at a strategic point on site for workers visibility. It is also useful during site H&S training like induction and weekly tool box talks. The

use of visual safety tools/aids on construction site globally, has resulted in improving site workers' safety attitude and behaviour (Hughes and Ferrett, 2010) and Okorie and Smallwood, 2012).

**Table 4: Perceptions of respondents view on the use of visual safety signs on construction site**

Statement	Unsure	Response (%)					MS	Rank
		Minor.....Major						
		1	2	3	4	5		
It is very useful to illiterate site workers	4.1	6.3	11.2	25.1	28.2	23.2	3.52	1
It helps in building strong workplace H&S culture	6.4	4.6	8.9	28.6	28.6	20.5	3.51	2
It aids oral safety communication	7.7	5.6	15.2	23.3	28.3	21.2	3.49	3
It makes explanation easy	8.3	7.4	11.3	28.4	31.3	13.6	3.48	4
It prevents wastage of time	7.4	7.8	12.4	29.1	29.3	13.1	3.45	5
It helps in creating workplace safety awareness	5.4	8.4	11.1	25.1	27.1	13.1	3.42	6
It helps in quick decision making	6.2	7.2	10.7	25.1	27.2	12.1	3.41	7
It shows management commitment to the use of PPE on site	6.1	7.3	10.3	23.6	26.8	12.1	3.40	8
It is a demonstration of management commitment towards workplace H&S	6.2	7.2	10.1	23.3	26.2	12.2	3.98	9
Management places value over workers' safety than production	5.7	7.1	9.8	21.6	25.5	11.8	3.87	10
It is a demonstration that management put emphasis on safety over profit	5.3	6.7	8.9	20.4	23.8	10.3	3.86	11

Literature review supported the research findings. According to Bust et al. (2008); Hughes and Ferrett (2010), visual safety communication promotes workplace H&S culture, it is very useful to illiterate site workers, it makes presentation of information and ideas easier and simpler. Workers' attitude and behaviour are positively impacted through the use of visual safety signs and posters on sites. Top management should place high premium on workers' health, safety and wellbeing since they are always on the frontline of site operations (Hughes and Ferrett, 2010).

Interviews with managers at head offices and sites of the five companies that participated revealed that visual safety communication could be of immense value to site workers and management like. One of the managers at the head office made this statement:

*“Visual safety communication tools such as PPE posters, images and animations used during H&S training sessions make explanation of information to site workers, particularly the illiterate ones simpler and easier”.*

One of the interviewees agreed that visual safety communication tools have the potential to improve construction site workers' safety attitude and behaviour, and that its applicability in the industry should be researched. He went further to make the following statements.

*“Visual safety tools prevent wastage of time” “It also aids oral communication during H&S induction of new workers”. “Above all it is popular among illiterate site workers who cannot read safety rules and regulations written with English”.*

Literature corroborated these findings, that the use of visual safety tools/aids on construction site globally, has resulted in improving site workers' safety attitude and behaviour (Bust el al., 2008).

### **Interviews with site workers**

Interviews conducted with site workers revealed that the use of visual safety tools such as PPE posters in communicating safety, promote the use of PPE and build a strong H&S culture among workers. Literature corroborated the findings, as indicted by the research conducted by Bust et al. (2008) on the use of visual communication to improve construction site H&S stated that sometimes, getting your message across in a clear, concise way with illiterate site workers can be difficult with words alone. This question was asked to site workers. Do you think that having safety signs on site can improve workers' safety behaviours?

All the interviewees answered yes. However, one of the workers from small construction enterprise made the following statements.

*“In this part of the world, owners and management of medium and small construction enterprises do not place premium on health, safety and wellbeing of their workers”. “They place emphasis on production and profits”.*

It was also noted in the literature by the research conducted on occupational fatalities of Hispanic construction site workers from 1999-2000 that small and medium construction enterprises commonly use written documents in conducting weekly and tool box talks over pictures, symbols, images etc (Dong and Platner, 2004). Perhaps, this finding could be more common in developing countries like Nigeria where cost of providing colourful posters, animations and cartoons are very

high (Okorie and Smallwood, 2012). Nonetheless, visual safety signs facilitate easy communication of H&S information to people of different nationalities and cultural background, thereby resulting in improved workers' safety behaviour.

### **Conclusions and recommendations**

Based on the research finding of this study it could be concluded that the use of visual safety communication signs at construction site by Nigerian construction enterprises both large, medium and small sized are very low. The study also revealed that provision and use of visual safety signs by construction enterprises will build better and strong H&S culture on construction sites leading to improved site workers safety behaviour. The results of interviews conducted with managers/supervisors and workers indicated that visual safety signs make explanation of H&S information to site workers, particularly the illiterate ones simpler and easier. The use of visual safety signs at construction sites both during the H&S induction training of new workers and weekly tool box talks by site supervisors have found to be of great importance in contributing to improving workers' safety behaviour. The study therefore recommends that:

- Management of construction enterprises irrespective of size should demonstrate visible leadership and commitment towards workers' H&S by providing H&S signages at strategic points in their sites for easy visibility,
- Site managers/supervisors should incorporate visual safety signs into their induction training and weekly toolbox, talks and manuals,
- Management should see provision of visual safety signs on construction sites as mandatory duty they owe to their workers as a majority of them are people with little or no education.

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