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Evaluating the effectiveness of strategies for implementation of health and safety programs on construction sites in Nigeria: A mixed-method study

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ABSTRACT

Introduction: Empirical and anecdotal evidence show that construction projects are delivered on work sites where unsafe acts and conditions abound. Researchers have investigated the strategies that can be adopted to effectively implement health and safety (H&S) in projects so as to reduce the high rates of accidents, injuries and fatalities. However, the effectiveness of these strategies have not been marginally established. Therefore, this study established the effectiveness of H&S implementation strategies on accidents, injuries, and fatalities reduction in Nigerian construction projects. *Method:* A mixed-method research design was adopted for data collection in the study. Physical observations, interviews, and a questionnaire were the instruments used for data collection in the mixed-method research design. *Results*: The resultant data identified six appropriate strategies for enabling the desired levels of H&S program implementation on construction sites. Setting up statutory bodies such as the Health and Safety Executive to promote awareness, good practices, and standardization was adjudged pertinent as one of the effective H&S implementation programs that can be used to reduce accidents, incidents, and fatalities in projects. It is expected that the adoption of these strategies would culminate in effective H&S program implementation and subsequently a reduction in the prevalence of accidents, injuries, and fatalities in projects.

1. Introduction

The construction industry plays a vital role in the development of any nation. For instance, in Nigeria, the industry serves as the prime source of employment generation for the populace (Oladinrin, Ogunsemi, & Aje, 2012). This implies that the Nigerian construction industry occupies a superior place in the nation's economy (1.4 % of its GDP). Hence, the sector has contributed immensely to the economy of the nation through its activities (Okoye, 2016; Olanipekun & Saka, 2019). Despite the stated benefits of Nigeria's construction industry to the nation's economy, the industry continued to witness setbacks. According to Mohammed and Ahmad (2017), some of these drawbacks include projects delays and associated cost overrun. Tanko, Abdullah, and Ramey (2017) revealed that one main factor responsible for the drawback in Nigerian construction industry is inadequate implementation of health and safety (H&S) programs during project execution.

Nigerian construction is highly hazardous to workers' H&S (Babalola, Oluwatuyi, Akinloye, & Aiyewalehinmi, 2015). Literature shows that the number of or the statistics of occupational accidents in Nigeria construction projects is not very clear or documented (Eguh & Adenaiya, 2020). However, Eigege, Aka, and Agbo (2020) pointed out that the rate at which accidents, injuries, and fatalities occur in the Nigerian construction industry is higher than any other industry across the globe. This is due to the fact that the Nigerian construction industry still relies on approximately 50 % of manual labor (Tanko et al., 2017). According to Mamlouk and Zaniewski (2017), a construction project can be described as the organized process of constructing, renovating, refurbishing a building, structure or infrastructure. Its process usually starts with certain requirements that need to be developed through the creation of a brief, feasibility studies, design, financing, and construction.

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The pervasive use of manual labor contributes to accidents, injuries, and diseases among construction workers in Nigeria (Tanko et al., 2017). The state of H&S program implementation in the Nigerian construction projects is a concern when compared to other developed and developing countries across the globe. It requires urgent interventions to limit harm to construction workers (Manu, Emuze, Saurin, & Hadikusumo, 2020). The importance of workers' H&S in any organization cannot be overemphasized. Jimoh, Oyewobi, Isa, and Momoh (2017) emphasized that work can only go on smoothly when workers are healthy and in a good state of mind. This denotes that task completion on a construction site depends on workers' H&S for effective execution. In other words, the H&S of construction workers on sites is vital to achieving project success (Orji, Enebe, & Onoh, 2016). In effect, unhealthy or unsafe work sites lead to negative project experiences (Jimoh et al., 2017). The reality is that accidents and injuries continually occur on construction sites, and most of these events lead to loss of lives and properties (Manu et al., 2020).

Thus, H&S is one of the parameters that affects the project deliverables and should be given due consideration (Abas, Jalani, & Affandi, 2020). Manu et al. (2020) indicated that the lack of H&S program implementation on construction projects is more pronounced in developing nations. Similarly, previous studies have reported that the efforts undertaken to get rid of hazards where possible or reduce their risks to an acceptable level on construction sites are unsatisfactory in developing countries, including Nigeria (Eze, Ayuba, & Shittu, 2018; Kheni & Braimah, 2014; Shittu, Ibrahim, Ibrahim, Adogbo, & Mac-Barango, 2016). This has made the construction industry in developing nations, in general, perform far below expectations (Jimoh et al., 2017; Li et al., 2016). The situation in Nigeria is worse as most employers fail to provide a safe working environment on construction sites (Cheah, 2007). Numerous factors that inhibit effective implementation of H&S programs in construction in developing countries have been reported. Such factors include the lack of legislation and regulations, or lax enforcement of compliance (Buniya et al., 2021; Umeokafor, Evangelinos, & Windapo, 2022). These factors (barriers) have led to complete neglect of H&S implementation in many countries' construction projects (Tanko et al., 2017). H&S measures employed on construction sites in developing countries such as Nigeria are inadequate due to deliberate neglect by project actors (Eze et al., 2018; Makinde, 2014; Olusoga & Fagbemi, 2018; Shittu et al., 2016; Tanko et al., 2017). According to the reviewed literature, the factors that can hinder effective implementation of H&S programs on construction sites are summarized in Table 1. These factors allow near misses, accidents, injuries, diseases, and fatalities to proliferate in construction projects. Measures are, however, the strategies that counteract the workings of the barriers.

Based on the reviewed literature, the measures that can be used to effectively implement construction H&S programs are summarized in Table 2.

In general, researchers have investigated the barriers to effective implementation of H&S programs in construction projects in developed and developing countries. Similarly, there are studies on the strategies that could be adopted to enable effective implementation of H&S programs on construction sites to ensure the safety of workers in every construction projects. However, there seems to be scant literature on the effectiveness of these strategies toward enabling accidents, injuries, and fatalities reduction in projects. Despite the strategies put forward by the previous researchers for effective implementation of H&S programs in construction, accidents are rampant in Nigerian projects. In addition, Eze, Sofolahan, and Siunoje (2020) recently identified poor implementation of H&S practices as the root cause of accidents causing injuries and fatalities in Nigeria. This implies that H&S program implementation has not been given adequate attention in the Nigerian construction industry context. Therefore, this study investigates the effectiveness of H&S program implementation strategies in engendering accidents, injuries, and fatalities reduction in Nigerian construction projects. Understanding the effectiveness of existing strategies in the literature on accidents, injuries, and fatalities reduction will enable site managers to recognize the appropriate strategy (ies) to use when executing projects to

Table 1
Hindrances to effective H&S program implementation in construction projects.

The specific factors	Code	Sources
Weak statutory occupational H&S regulations/provisions	BR1	Idoro (2008) (Eigege et al., 2020)
Lack of management and stake holder's commitment to occupational H&S	BR2	Idoro (2008); Shittu *et al.* (2021)
Lack of enforcement of H&S regulations by the enforcement authority	BR3	Spillane and Oyedele (2013)
Exclusion of construction industry from the factory Act of 1990	BR4	Olusoga and Fagbemi (2018)
Bribery and corruption	BR5	Huertey, Dadadzogbor, and Atsrim (2018)
Absence of H&S officers on site (inspectors) to monitor implementation	BR6	Idoro (2008)
Neglect of human right	BR7	Jimoh et al. (2017)
Client's influence on compliance with implementation of H&S regulation on construction site	BR8	Tanko et al. (2017)
Inadequate training of construction workers	BR9	Olusoga and Fagbemi (2018)
Lack of awareness and improper medium for proper communication of H&S information	BR10	Spillane and Oyedele (2013)
Leaving the implementation of H&S practice at the discretion of the construction firms or employer	BR11	Jimoh et al. (2017)
Inadequate/untimely provision of personal protective equipment	BR12	Olusoga and Fagbemi (2018); Shittu et al. (2016)
Lack of H&S signs and notice on site	BR13	Tanko et al. (2017)
Lack of regular H&S audit	BR14	ILO (2011)
Lack of H&S plan	BR15	ILO (1999)
Insecurity	BR16	Idoro (2008)
Wilful interference by employees with anything provided in the interest of H&S	BR17	Monteiro et al. (2020)
Lack of adequate knowledge on H&S empowerment regulation	BR18	Zulu and Muleya (2019)
Lack of H&S orientation for new employees	BR19	Maiti and Choi (2019)
Lack of regular H&S meetings	BR20	Yap, Lee, Rose, and Skitmore (2020)
Neglect by government and industry	BR21	Makinde (2014)
Perception that accidents are arts of God as such many contractors do little or nothing to comply with H&S regulation on site	BR22	Williams et al. (2018)
Perception that H&S regulations are being used for political or victimization reasons	BR23	Rao, Sreenivasan, and Babu (2015); Shittu et al. (2016)
Inadequate projects fund to implement the several strategies involved in H&S	BR24	Tanko et al. (2017)

Table 2
Construction H&S implementation strategies.

The specific strategies	Code	Sources
Establishment of National Commission for H&S regulation	ST1	ILO (1999); Shittu *et al* (2021)
Inclusion of H&S training in education curriculum specifically at higher institutions	ST2	Idubor and Osiamoje (2013); Eigege et al. (2020)
Consultation with social partners/collaboration with all stakeholders	ST3	Spillane and Oyedele (2013)
Setting of standards for H&S practice	ST4	ILO (2011); Mohammed (2014)
Provision of H&S expertise for effective monitory in all relevant field	ST5	Umeokafor, Umeadi, and Jones (2014)
Inclusion of records of performance on H&S by contractors in tender documents.	ST6	Rao et al. (2015); Shittu *et al.* (2021)
Enforcement of minimum H&S standards in line with Factory Act (1990) on construction industry	ST7	Jimoh et al. (2017); Eigege et al. (2020)
Development of guidelines on H&S managements systems	ST8	Olusoga and Fagbemi (2018)
Involvement of all tiers of government in H&S practice	ST9	Goma and Wordu (2018)
Establishment of an institute for H&S in Nigeria	ST10	Williams et al. (2018)
Establishment of H&S officers to adequately cover all geopolitical zones	ST11	Umeokafor *et al.* (2020)
Implementation of H&S plan at all levels	ST12	Idubor and Osiamoje (2013)
Implementation of continuous education on H&S	ST13	Yap et al. (2020)
Appropriate training of employees on the provision/policy implementation	ST14	Goma and Wordu (2018)
Production of guidelines; codes of practice and setting standard on H&S practice	ST15	Maiti and Choi (2019)
Introduction of robust and functional legal structure on H&S practice	ST16	ILO (2011)
Adequate orientation for new employees on matters relating to construction H&S	ST17	Spillane and Oyedele (2013)
Adequate funding for provision of H&S items on construction site	ST18	Williams et al. (2018)
Regular H&S audit	ST19	Goma and Wordu (2018)

facilitate the likelihood of zero harm to workers and the public operating within the Nigerian construction industry.

2. Research methodology

The research evaluated the effectiveness of the strategy (ies) for implementing health and safety programs on construction projects to reduce accidents and accompanying injuries/fatalities therein. A mixed methods research design was adopted to achieve the aim of the study. This approach was used as it complements the shortcomings of a single method (Pinto & Patanakul, 2015). The mixed methods research design involved the collection of both qualitative and quantitative data through on-site physical observation (PO), unstructured interview, and structured questionnaire. In the study, PO exercise was first conducted to establish the fundamental H&S practice being implemented on sites in comparison to standards in the safety literature (Aka, Bamgbade, Ibrahim, & Balogun, 2019). This implies that the PO exercise was adopted to obtain a snapshot of specific H&S practices in Nigerian construction sites (Eigege et al., 2020), which enabled the researchers to assess the extent and effectiveness of H&S implementation in the study context construction industry.

After the PO exercise, unstructured interviews were conducted to examine the barriers to effective H&S program execution and remedies to gaps in practice. Lastly, the questionnaire survey was conducted for further data elicitation to enhance the reliability of the study data as suggested by Saunders, Lewis, and Thornhill (2009). It was also conducted to evaluate the effectiveness of H&S implementation strategies on accidents, injuries, and fatalities reduction in construction projects. The study population included all the construction-related firms registered with the Federal Capital Development Authority (FCDA) Abuja, Nigeria. Abuja, the capital city of Nigeria, was selected for the study due to the rapid population increase, which makes construction activities more frequent than any other city in the country (Aka et al. 2021, 2020; Shittu, Odine, Tsado, & Aka, 2022). Preliminary investigations on the registered firms with federal capital development authority (FCDA) Abuja during the study indicated that all categories (small, medium, and large) that were registered with FCDA Abuja was 188. This 188 served as the target population of the study. A purposive sampling technique was adopted to obtain the population's accurate representation (Bernold & Lee, 2010). This implies that emphasis was placed on the firms with ongoing projects, out of the 188 registered construction firms, where their employees were willing to participate in the study. These conditions were used to reduce the total number of firms to 34, used for the study.

3. The qualitative strand

As earlier stated, the study commenced with PO followed by unstructured interview and a questionnaire survey. The PO and unstructured interviews contributed to the qualitative strand of the study, whereas the questionnaire contributed to the quantitative strand. It is imperative to note that PO has been the hallmark of much of the research conducted in anthropological and sociological studies (Angrosino, 2005; Kawulich, 2005). To conduct the PO exercise, a checklist was prepared using the National Policy on Occupational Safety and Health regulations (OSHR) handbook (2007). The Policy (2007) contains explicit information on the required H&S practice for contractors, clients, and workers on construction sites.

Therefore, the checklist compiled acted as a benchmark on the provision of H&S items by contractors, clients, and workers on construction sites in Nigeria. The decision implies that the checklist was used to measure compliance with the implementation of H&S programs on construction sites in the study context. Typical forms of H&S items that were observed in each site visited by the researchers during the PO study are: construction plants and equipment, personal protective equipment, site hazard information, workers safety training, necessary site instructions, first aid equipment, display of safety caution signs, availability of qualified occupational health and safety personal, emergency exit, clinical services, regular safety audit, appropriate workplace, and provision for adequate compensation for accident victims. Before the actual date of the PO exercise, invitations were initially sent to managers of the selected sites for the study. The essence of the invitations was to enable the manager of each site to understand clearly the aim and objectives of the study. It also availed the manager in each site to make the necessary arrangements, and schedule a convenient time for the success of the PO study (Aka et al., 2019; Eigege et al., 2020).

During the PO exercise, the researchers moved from one site to another, checking the items provided for H&S by construction firms. The items provided were checked from the checklist according to the level of compliance. The site visits to all the sites being handled by the selected 34 firms (a site per firm) allowed the

researchers to observe the various H&S equipment, facilities, and materials provided by the contractors on each site. The field work lasted for three months. It was conducted from Monday to Saturday, and the researchers spent at least 3 hours on each site before moving to another one. For consistency, the researchers also visited each study site at least three times during the study (Stringer, 2014). The suggestion of Morenikeji (2006) was adapted to establish the level of compliance with H&S by the sampled construction firms. This implies that a Likert scale of 1 to 5 was used to calculate the Mean Item Score (MIS) of H&S items provided by the various sites visited. After obtaining the MIS of the various items in the 34 studied sites, the compliance level was determined.

MIS ranging from 1.0 – 1.49 were rated as non-compliance, 1.50 – 2.49 as near non-compliance, 2.50 – 3.49 as limited compliance, 3.50 – 4.49 as near compliance, and $\geq$ 4.50 as compliance. It is essential to note that during the PO exercise, the researchers briefly conducted face-to-face unstructured interviews with the managers for each site to determine additional factors that can hamper the effective implementation of H&S programs and the strategies that can be adopted to reduce the incidence of such factors. In all, 34 site managers were interviewed during the study. Typical forms of the questions raised in the interviews are the barriers to effective implementation of H&S on construction projects and the strategies that can remedy the situation. The academic qualifications of all the managers ranged from B Tech/BSc to MSc. All the participants of the interview exercise were well experienced as they have been involved in different projects and have been working with different construction firms for more than 10 years. Demographic information of the interviewees is presented in Table 3.

Each of the interviews conducted ranged between 30 to 45 minutes in duration. Both the PO and the interview exercise took approximately-three months in duration. The interviews were recorded, transcribed, and thematically analyzed using content analysis (Krippendorff, 2012). The themes that were extracted in the interview were used to prepare a structured questionnaire that formed the last phase of the study (Bryman, 2004).

4. The quantitative strand

After the PO and face-to-face unstructured interview exercises, a questionnaire survey was conducted. The survey study enabled the researchers to seek broader agreement from a wider population of respondents on a range of factors predetermined from the literature, PO, and interviews, to enhance the reliability of the data. It also allowed the researchers to determine the effectiveness of the identified H&S implementation strategies toward facilitating accidents, injuries, and fatalities reduction on construction sites. The questionnaire consisted of close-ended questions that focused mainly on the barriers to effective implementation of H&S programs in Nigerian construction, the strategies that can be adopted to implement H&S programs and, the effectiveness of each strategy for accidents, injuries, and fatalities reduction on sites. The questionnaire was designed and pre-tested with a pilot study to avoid poor response rate and ambiguity, which are associated with questionnaire surveys (Love et al., 2018). The pilot study was conducted with five randomly selected construction professionals. The designed questionnaire was administered directly to 177 construction professionals that were randomly selected from construction firms located in the study context where there were several ongoing projects when the study was conducted. This implies that the survey study was conducted using respondents outside the scope of the 34 firms.

Out of the 177 questionnaires distributed, 109 were completed and returned, thus representing a response rate of 61.58 %. This response rate is adequate for a survey study that intends to obtain information from industry practitioners (Lucko & Rojas, 2010). In the questionnaires distributed, the respondents were required to indicate on a five-point Likert scale, their agreement concerning the factors that hinder effective implementation of H&S programs on construction sites. Further, the respondents were asked to indicate the frequency of any or a combination of the previously identified strategies that were being deployed for implementing H&S programs on construction sites using the five-point Likert scale, and, to rank the effectiveness of each strategy based on their respective utility in enabling accidents, injuries, and fatality reduction on sites, using the five-point Likert scale, 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree (see Aka et al., 2019; Adamu, Nensok, & Aka, 2012; Bamgbade, Jimoh, Oyewobi, & Aka, 2020; Doloi, Sawhney, Iyer, & Rentala, 2012 for similar scales).

The academic qualifications of the respondents in the survey study range from first degree to doctorate. The respondents were experienced as they have been involved in different construction projects. The data obtained were analyzed through descriptive and inferential statistics, which consist of four distinct steps:

- Cronbach's alpha (α), Standard deviation (SD), Skewness and Kurtosis tests used to determine the reliability of the outcome of the five-point Likert scale (Curran, West, & Finch, 1996; Gliem & Gliem, 2003). In the analysis, variables with mean item score (MIS) of 3.0 and above were considered significant (Sakaram & Bougie, 2010).
- Regression analysis was used to establish the effectiveness of the identified strategies on accidents, injuries, and fatalities reduction on construction sites. The identified strategies served as independent variables in the regression analysis test, while accidents, injuries, and fatality were the dependent variables.

Table 3
Demographic information of the study respondents.

Variables	Characteristics	Number of respondents	Percentage
Educational Qualification	PhD	4	11.8
	MSC	8	23.5
	BSC/HND	20	58.8
	ND/NCE	2	5.9
Work Experience	10 – 15yrs	5	14.7
	15 – 20yrs	17	50.0
	20 – 25yrs	8	23.5
	25 – 30yrs	4	11.8
Work Designation	Architects	4	11.8
	Builders	10	29.4
	Engineers	7	20.6
	Quantity Surveyors	8	23.5
	Contractors	5	14.7

5. Results and interpretations

5.1. Demographic information of the study respondents

The demographical information of the respondents is presented in Table 3.

The study participants' demographic information revealed that all the respondents are professionals with varying specialties. They are also experienced and have the requisite knowledge to answer the questions asked in the study.

Table 4
Level of compliance with health and safety practice in construction projects.

Requirement	Decision
Provide plant and equipment that is safe for use on-site (P1)	Limited Compliance
Adequate and timely provision of personal protective equipment (PPEs) (P2)	Near Compliance
Provision of adequate information's on the hazard (P3)	Near non– Compliance
Provision of safety training for workers (P4)	Non-Compliance.
Instruction and supervision to help the workers to do work safely (P5)	Total Compliance
Provision of first aid (P6)	Limited Compliance
Proper display of safety caution signs (P7)	Limited Compliance
Provision of qualified occupational health and safety personal on-site (P8)	Non– Compliance
Provision of emergency exit (P9)	Near non– Compliance
Availability and adequacy of clinical services (P10)	Non-Compliance.
Regular Safety audit (P11)	Non– Compliance
Arrange workplace to ensure safety and absence of risk to health in use handling storage and transportation of articles and substance (P12)	Near non– Compliance
Research to keep abreast of new scientific and technical knowledge necessary to comply with safety and health regulation (P13)	Non– Compliance
Provide compensation for work-related to unforeseen accidents (P14)	Near non– Compliance

6. Qualitative results

6.1. Level of compliance with health and safety requirements on construction site

Based on Morenikeji (2006) benchmark adapted in this study during the PO and interview exercise, the level of compliance with H&S requirements in each site visited is summarized in Table 4.

Table 4 shows the data results obtained concerning compliance with H&S practices on construction sites visited in Abuja, Nigeria. Based on the ranking scale adopted, only P_5 achieve compliance with mean scores of 4.72. This implies that this item was the only H&S requirement that is prevalent in the study context. Similarly, P_2 was close to compliance, while P_6, P_7, and P_1 received limited compliance as they were available in few of the sites visited during the study. Among those items that received near non-compliance were, P_3, P_9 and P_{12}.

In contrast, items such as P_4, P_8, P_{10}, P_{11} and P_{13} received non-compliance. The findings on compliance with H&S programs on construction sites in this study concur with findings from previous studies (Othman, 2012). Othman (2012) investigated the causes and effects of the contractor's non-compliance with H&S practices in South Africa construction projects and realized a high level of non-compliance with the provision of training on H&S regulation to workers.

From the interview sessions, two new barriers that can hinder the effective construction H&S implementation in Nigeria were identified. These two factors are entirely different from those observed in the literature. The two discoveries include the lack of financial provision for H&S from the inception stage of projects (BR25) and lack of consideration for H&S; its maintenance and upkeep at the design stage of a project (BR26). Similarly, additional strategies that can be engaged with to effectively implement H&S programs on construction site in Nigeria include the standardization of H&S compliance as part of contract agreements and inclusion in the Bill of Quantity (ST20), and integration of workers H&S into design and planning state (ST21). The study participants contended that ST20 could overcome BR25, while project actors can adopt ST21 to overcome BR26. Other strategies pointed out by interviewees include awareness of H&S benefits through regular science engagement (ST22), the introduction of H&S desk officers in every construction firms for effective enforcement (ST23), the establishment of H&S secretariats in every state to encourage total commitment by 'all and sundry'(ST24), establishment of temporal H&S office on every construction site for complete enforcement (ST25), and establishment of H&S institute for training and education of construction workers (ST26).

7. Quantitative results

7.1. Ranking of the level of compliance

From Table 5, it can be discerned that there was a total compliance with instructions and supervision to assist workers to perform their work safely on sites. This result was in sync with the

Table 5
Details the respondents' ranking of their perceptions of the level of compliance on the projects that they have been involved.

Requirement	MIS	Ranking
Provide plant and equipment that is safe for use on-site (P1)	2.86	5th
Adequate and timely provision of personal protective equipment (PPEs) (P2)	4.41	2nd
Provision of adequate information's on the hazard (P3)	2.36	8th
Provision of safety training for workers (P4)	1.39	10th
Instruction and supervision to help the workers to do work safely (P5)	4.72	1st
Provision of first aid (P6)	3.36	3rd
Proper display of safety caution signs (P7)	3.24	4th
Provision of qualified occupational health and safety personal on-site (P8)	1.35	12th
Provision of emergency exit (P9)	2.20	9th
Availability and adequacy of clinical services (P10)	1.31	11th
Regular Safety audit (P11)	1.32	13th
Arrange workplace to ensure safety and absence of risk to health in use handling storage and transportation of articles and substance (P12)	2.41	6th
Research to keep abreast of new scientific and technical knowledge necessary to comply with safety and health regulation (P13)	1.29	14th
Provide compensation for work-related to unforeseen accidents (P14)	2.39	7th

findings from the PO and the unstructured interviews. It showed that a lot of effort was being dissipated in providing instructions and supervision on sites. However, the contribution of this singular aspect on H&S program implementation pales in significance when the rankings of other aspects are considered.

8. Barriers to effective construction H&S program implementation

Table 6 presents details of the respondents' opinions of the survey exercise on factors that can hinder effective construction H&S implementation in Nigeria projects. The α values obtained for all the respondents (0.983: excellent) show the data reliability and acceptability. The standard deviations (SD) are within acceptable ranges (Agresti & Franklin, 2007). Further, examination of the skewness and kurtosis values in Table 5 revealed the accuracy of the analyzed data given the suggestion of Curran et al. (1996). Curran et al. (1996) believed that data can be considered excellent when the skewness range is less than 2, and the kurtosis is less than 7. In this study, the skewness values are less than 2 and kurtosis are less than 7.

Table 6
Barriers to effective construction H&S practice implementation.

Barriers (BR)	MIS	SD	Ranking	Skewness	Kurtosis
BR1	3.84	1.51	9th	1.075	0.391
BR2	3.12	0.78	18th	−0.368	−1.047
BR3	4.58	0.84	3rd	−1.021	0.023
BR4	3.11	0.5	19th	−0.476	−1.467
BR5	3.72	1.51	10th	0.074	−1.332
BR6	3.52	1.44	11th	1.093	0.318
BR7	1.63	0.39	26th	−0.379	−1.074
BR8	4.21	1.11	8th	−1.043	0.031
BR9	3.50	1.51	12th	−0.321	−1.579
BR10	2.51	0.78	20th	0.071	−1.321
BR11	4.56	0.84	4th	1.075	0.381
BR12	2.44	0.5	21st	−0.279	−1.057
BR13	3.45	1.51	13th	−1.034	0.133
BR14	3.37	1.44	14th	−0.461	−1.477
BR15	1.72	0.39	25th	0.179	−1.323
BR16	4.34	1.11	7th	2.085	0.381
BR17	3.36	1.51	15th	−0.371	−1.047
BR18	2.31	0.78	22nd	−1.014	0.013
BR19	4.52	0.84	5th	1.085	−1.677
BR20	2.21	0.5	23rd	−0.379	−1.323
BR21	3.21	1.51	16th	−1.044	0.282
BR22	3.16	1.44	17th	−0.481	−1.037
BR23	1.91	0.39	24th	1.085	0.034
BR24	4.45	1.11	6th	−0.379	−1.777
BR25	4.84	1.51	1st	−1.044	−1.223
BR26	4.31	0.78	2nd	−0.481	0.123

In general, 26 barriers (24 from the reviewed literature and two from the interviews) were identified and ranked by the respondents. The MIS ranges from 1.63 to 4.84. More than 19 of the variables have MIS above 3.0. This implies that the 19 variables are the significant factors that inhibit the successful implementation of H&S in the study context. These findings are synonymous with the observation of Goma and Wordu (2018). The authors investigated the challenges of health management schemes among Nigerian construction sites and realized that BR15, BR17, BR10, BR2 and BR23 have a substantial effect on H&S management implementation. Similarly, Kheni, Dainty, and Gibb (2008) and Idubor and Osiamoje (2013)reported that bribery and corruption and lack of project funds are significant factors limiting the effective construction H&S implementation in developing countries.

9. Strategies for effective construction H&S practice implementation

Table 7 presents the respondents' perceptions on strategies that can be adopted for effective construction H&S implementation. The α values obtained for all the respondents (0.987: excellent) show the data reliability. The SD obtained are within the acceptable ranges, as can be observed in the table. The skewness and kurtosis values indicate that the analyzed data are also accurate in this study section.

In Table 7, twenty-two variables have MIS above 3.0. It can be argued that such variables are essential for promoting compliance

Table 7
Strategies for effective construction health and safety program implementation in Nigeria.

Strategies (ST)	Barriers (BR)	MIS	SD	Ranking	Skewness	Kurtosis
ST1	BR1	3.54	1.685	17th	−0.317	−0.563
ST2	BR9	2.87	0.701	23rd	−1.221	0.267
ST3	BR2	3.45	1.848	19th	−1.675	1.36
ST4	BR5	3.21	1.635	20th	−3.103	2.37
ST5	BR6	3.61	1.785	15th	−0.382	−1.66
ST6	BR8	4.15	0.976	9th	−2.121	1.36
ST7	BR3 and BR4	4.72	0.581	2nd	−1.305	2.37
ST8	BR7	3.51	1.757	18th	−0.419	−1.66
ST9	BR8	3.70	1.475	13th	−1.271	2.903
ST10	BR10	2.64	0.634	24th	−1.645	−0.163
ST11	BR20	2.32	0.718	25th	−3.103	0.467
ST12	BR11	3.11	1.431	22nd	−0.382	1.36
ST13	BR15 and BR23	2.11	1.157	26th	−2.021	2.37
ST14	BR17 and BR18	4.19	1.148	7th	−1.305	−0.763
ST15	BR18	3.67	1.764	14th	−0.119	0.467
ST16	BR16	3.72	1.871	12th	−1.471	1.36
ST17	BR19	3.55	0.701	16th	−1.245	2.37
ST18	BR24	3.19	1.848	21st	−3.103	−1.66
ST19	BR14	4.17	1.635	8th	−0.382	−0.363
ST17	BR22 and BR25	4.87	1.148	1st	−2.021	0.467
ST21	BR26	3.91	1.764	10th	−1.205	1.36
ST22	BR12 and BR13	3.89	1.871	11th	−1.675	2.37
ST23	BR9 and BR23	4.41	1.635	6th	−3.103	−1.66
ST24	BR21	4.67	1.785	3rd	−0.382	2.903
ST25	BR3	4.65	0.976	4th	−2.121	−0.563
ST26	BR9	4.45	0.581	5th	−1.305	0.467

and effective implementation of H&S in construction projects in the study context. The opinions of the respondents' support some of the findings of the literature. For instance, Idubor and Osiamoje (2013) and Eigege et al. (2020) stated that the regulatory institution's lack of enforcement had made compliance with H&S program implementation on construction site a problematic task. They argued that strict monitoring and enforcement would result in effective implementation of H&S programs on the construction site. Also, Nzuve and Lawrance (2012) opined that low level of inspection and examination of workplaces determines the level of compliance with the implementation of H&S. Also, Monteiro, Masiero, and De Souza (2020) and Umeokafor *et al.* (2020) argued that inclusion of records of construction performance as a prerequisite for tendering would enhance compliance in implementing H&S on construction sites.

10. Effectiveness of H&S program implementation strategies on accidents, injuries, and fatalities reduction on construction sites

Table 8 abridges the respondents' agreement on the effectiveness of the identified H&S implementation strategies on accidents, injuries, and fatalities reduction in construction projects. The α values obtained for all the respondents (0.93: excellent) indicates that the data obtained in this section of the study are also reliability. The SD obtained are within the acceptable ranges. The skewness and kurtosis values indicate that the analyzed data are accurate.

In Table 8, twenty-two strategies have MIS above 3.0. It can be emphasized that such strategies have effective impact on the reduction of accidents, injuries, and fatalities occurring on construction projects. In order to streamline the 22 identified variables into a proportion that can be easily adopted by construction practitioners, regression analysis was conducted (Digital Bridge Institute, 2018) (see Table 8).

11. Multiple regression analysis

The data presented in Table 8 were subjected to multiple regression analysis to establish the significant strategies that have notable reductions of accidents, injuries, and fatalities in construction projects. The results of the multiple regression analysis are presented in Tables 9a and 9b, respectively.

The individual model variables in Table 9a indicate that ST7 (β(i) = 2.905), ST24 (β(i) = 3.678), ST26 (β(i) = 3.060), ST25 (β(i) = 3.978), ST22 (β(i) = 2.979) and ST23 (β(i) = 2.302) were found to have significant reductions of accidents, injuries, and fatalities at P less than 0.05. While other variables such as ST20, ST14, ST16, ST21 and ST11 were found to have negative relationships due to their β(i) values (Gravetter & Wallnau, 2008; DBI, 2018). Therefore, there is a statistically significant relationship between ST7, ST24, ST26, ST25, ST22, ST23 and accidents, injuries, and fatalities reduction in construction projects. This infers that if each of the underlying strategies is appropriately used by project actors, construction H&S practices will be effectively implemented and accidents, injuries and fatalities will be minimized. The regression analysis results also indicate that the model has a good predictive ability (Table 9b). With the value of the coefficient of determination (R^2) at 0.683, more influence can be exerted on accidents, injuries, and fatalities on site by the various strategies. Therefore, the assumption that certain construction H&S implementation strategies such as ST7, ST24, ST26, ST25, ST22 and ST23 may have more significant impact on ameliorating the incidence of accidents, injuries, and fatalities when compared to other strategies like ST20, ST14, ST16, ST21, and ST11, which has been proven by the results from this study. Based on the regression analysis outcomes, it can be contended that ST7, ST22, ST23, ST24, ST25 and ST26 are very effective H&S implementation strategies that can be used to overcome accidents, injuries, and fatalities on sites.

12. Discussion of results

The continued underperformance of the Nigerian construction industry, especially as it pertains to H&S, remains a challenge to the industry's overall performance. Various studies have adduced several reasons ranging from the lack of a coherent H&S legislation to the lack of proper education and sensitization of the workforce. These challenges have continued unabated despite the plethora of studies and recommendations seeking to stem this tide. However, most of these studies have focused on the determination of the

Table 8
Effectiveness of H&S program implementation strategies on accidents, injuries, and fatalities reduction in projects.

Strategies (ST)	MIS	SD	Ranking	Skewness	Kurtosis
ST1	3.55	1.691	17th	−0.227	−1.563
ST2	2.87	0.702	23rd	−1.222	1.267
ST3	3.45	1.841	19th	−1.675	1.26
ST4	3.21	1.635	20th	−3.103	2.47
ST5	3.62	1.785	15th	−0.382	−1.76
ST6	4.14	0.976	9th	−2.121	1.38
ST7	4.89	0.591	1st	−1.205	2.33
ST8	3.52	1.857	18th	−0.319	−1.33
ST9	3.71	1.475	13th	−1.271	2.903
ST10	2.64	0.634	24th	−1.645	−0.163
ST11	2.32	0.718	25th	−3.103	0.467
ST12	3.11	1.431	22nd	−0.382	1.369
ST13	2.11	1.157	26th	−2.021	2.377
ST14	4.19	1.148	7th	−1.305	−0.763
ST15	3.67	1.764	14th	−0.119	0.467
ST16	3.73	1.871	12th	−1.471	1.365
ST17	3.54	0.701	16th	−1.245	2.374
ST18	3.19	1.848	21st	−3.103	−1.669
ST19	4.17	1.635	8th	−0.382	−0.363
ST17	4.75	1.148	2nd	−2.021	0.467
ST21	3.92	1.764	10th	−1.205	1.281
ST22	3.88	1.871	11th	−1.675	2.221
ST23	4.41	1.635	6th	−3.103	−1.694
ST24	4.64	1.785	4th	−0.382	2.912
ST25	4.68	0.976	3rd	−2.121	−0.463
ST26	4.45	0.581	5th	−1.305	0.437

Table 9a
Multiple Regression analysis between H&S program implementation strategies, accidents, injuries, and fatalities in construction projects.

Independent Variables	Regression Coefficient b (i)	Standard Error Sb (i)	Standardized Coefficient	T-Statistic to Test H0: β(i) = 0	Prob Level	Power of Test at 5 %
Intercept	83.23137	25.676145	0.0000	3.957	0.0059	0.8825
ST20	−2.73458	1.019084	−2.0433	−2.978	0.0831	0.3896
ST7	2.85981	0.972898	3.9237	2.705	0.0877	0.3674
ST24	3.11497	0.319912	3.1507	3.678	0.6487	0.0723
ST26	3.77838	1.834497	4.7853	3.060	0.0695	0.4426
ST14	−0.04257	0.201451	−0.0794	−0.301	0.7546	0.0527
ST25	3.73458	1.019084	2.0433	3.978	0.0831	0.3896
ST6	−1.85981	0.972898	−2.9237	−1.905	0.0877	0.3674
ST21	−2.13459	1.027084	−2.0489	−2.919	0.0731	0.3157
ST22	2.55456	1.046081	2.0337	2.979	0.0732	0.3694
ST23	2.03254	1.701451	2.0593	2.302	0.6548	0.0426
ST11	−0.02253	0.901462	−0.0492	−0.205	0.7541	0.0328

Table 9b
Analysis of Variance.

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
11	0.830	0.683	0.636	0.471	0.673	18.416	23	206	0.0001
b. Dependent Variable: 1 (Effective H&S implementation)									

causative factors influencing the current levels of H&S underperformance in the Nigerian construction industry, whereas others, taking cognizance of these factors, sought to prescribe ways through which H&S performance can be improved across construction sites and organizations operating in the country's construction industry. One facet that stands out in these studies is the underwhelming levels of H&S practice implementation at project and organizational levels. Studies seeking to assess the level of effectiveness of strategies recommended for improving the implementation of H&S practices in the contexts remain limited. It is expected that such an assessment would provide better guidance to relevant stakeholders for facilitating effective implementation of H&S practices therein. This is the gap that this study sought to fill.

To achieve this objective, this study elicits various barriers to effective H&S practice implementation on construction sites. Barriers established as critically negating such implementation include the lack of financial provision for H&S from the inception stage of projects (BR25) by clients and contractors alike; the lack of consideration for H&S; its maintenance and upkeep at the design stage of a project (BR26) by contracting parties; and the lack of enforcement of H&S regulations by the enforcement authorities therein (BR 27). These barriers are congruent with those identified by similar studies focusing on the same phenomenon. For instance, Buniya et al. (2021) identified insufficient resources as a major barrier to the implementation of the safety programs in developing country contexts using an Iraqi exemplar. Similarly, in another study, Yiu, Sze, and Chan (2018) lamented the salient contribution of insufficient resources to the implementation of safety management systems in Hong Kong. The lack of consideration for H&S by construction stakeholders in the Nigerian construction industry has also been elucidated in Idoro (2008) and Umeokafor (2018). This lack of consideration was attributed to the presence of a dysfunctional occupational health and safety legislation (Manu et al., 2019). To buttress the debilitating impact of the lack of adequate legislation, Idoro (2008) refers to the continued use of OHS legislations, which could best be referred to as vestiges of colonial era in the country. According to the scholar, such legislations failed to take into consideration contextual peculiarities thereby negating effective compliance. For instance, Idoro (2011) highlighted the non-consideration of the features associated with the construction project environment in the definition of the premises in the Factories Act CAP F1, ILO, 2011. Corroborating this perspective, Umeokafor (2018) admitted to the increasing reliance on community-based approaches to superintending the implementation of H&S programs by contractors due to the absence of an effective legislation. However, the author admitted that this had led to abysmal H&S performance as allegations of bribery and corruption empaneled by community participation remains rife (Umeokafor, 2018).

In pursuit of its second objective, an evaluation of the degree of effectiveness of various strategies in facilitating optimal H&S program implementation in the Nigerian construction industry was conducted using regression analysis. Results from this analysis indicated that 6 strategies out of a possible 26 were deemed to be most effective. These strategies are presented in order of significance: (a) the enforcement of the minimum H&S standards in line with the Factories Act CAP F1, ILO, 2011 (ST7); (b) the establishment of H&S secretariats in every state (federating unit) of the country (ST24); (c) establishment of H&S institutes/agencies for training and education of construction workers (ST26); (d) setting up temporal H&S offices on construction sites (ST25); (e) increasing awareness of H&S benefits among construction workers through science engagement (ST22); and (f) introducing H&S desk officers in construction firms (ST23). These results are in sync with the results presented by similar studies within the same country context. Admitting to the impact of the regulatory challenges witnessed within the Nigerian construction industry on H&S performance therein, Umeokafor et al. (2022) outlined similar strategies for resolving most of these challenges. According to the authors, the setting up of an H&S regulatory agency and the attainment of homogeneity in the H&S regulation remained strategies for enabling enforcement of the extant H&S legislations. Besides these, they espoused the need for a contextualization of the H&S laws according to the local realities (Umeokafor et al., 2022). Obviously, these strategies are congruent with ST7, ST24, ST25 and ST23. Manu et al. (2019) highlight the significance of enforcing H&S legislations in forestalling the incidence of unsafe behavior and accidents in the Nigerian construction industry, and elsewhere. Education and sensitization of the construction workers regarding the benefits accruable from an optimal H&S program was highlighted as cardinal strategies in this study. The objectives sought by these strategies (ST22 and ST26) were also articulated by Umeokafor et al. (2022), who opined that orientation and sensiti-

zation of construction workers, using various platforms, had the potential to engender improved education and awareness of the benefits of effective H&S regulation in the Nigerian construction industry.

Summarily, it can be discerned that the deployment of these strategies, underpinned by a comprehensive overhaul of the extant H&S legislation in the Nigerian construction industry will facilitate effective implementation of H&S programs therein. This would bring about improved H&S performance on construction projects situated in this country context.

13. Conclusion and recommendations

This study set out to establish the barriers negating the effective implementation of H&S programs on projects within the Nigerian construction industry. Furthermore, it sought to determine the appropriate strategies for enabling the desired levels of H&S program implementation therein. A sequential mixed method research design was deployed toward eliciting and analyzing the data to achieve the study's objectives. The study's results study highlighted the barriers confronting effective implementation of H&S programs, the strategies for managing these barriers, and the degree of effectiveness of these strategies. It is expected that the adoption of these strategies would culminate into effective H&S program implementation and subsequently a reduction in the prevalence of accidents, injuries, and fatalities in construction projects. This, with implication, ensures the safety of construction workers in Abuja and guarantees timely and cost-effective delivery of projects with the required international standard.

The study's results highlight the lack of financial provision for H&S from the inception stage of projects (BR25) by clients and contractors alike; the lack of consideration for H&S; its maintenance and upkeep at the design stage of a project (BR26) by contracting parties; and the lack of enforcement of H&S regulations by the enforcement authorities therein (BR27) as significant barriers. Also, strategies like the setting up of statutory bodies such as the Health and Safety Executive (HSE) to promote awareness, good practices, standardization, and guidelines customized for projects in Nigeria was adjudged pertinent alongside the prioritization of funding allocation for H&S-related programs across the lifecycle of a project.

The study is limited to construction firms in Abuja, Nigeria based on the perception that there might be more ongoing projects in this location compared to any other city in the country. Therefore, to extend the findings, similar research should be conducted in other major Nigerian cities such as Lagos and Port Harcourt, where several projects may also be available. It is expected that the findings of this study will contribute toward the development of a framework for enabling effective implementation of H&S programs by relevant stakeholders within the Nigerian construction industry.

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