

Health and Safety Information Management on Construction Sites in Lagos State, Nigeria

Ranti Taibat Adebisi^{1*}, Ganiyu Amuda Yusuf¹, Abdulkadir Shehu Rasheed¹ and Lukman Olanrewaju Olorunoje¹

¹Department of Quantity Surveying, University of Ilorin, Ilorin, Nigeria

ARTICLE INFO

Article history:

Received 02 October 2023
Revised 21 November 2023
Accepted 23 December 2023
Online first
Published 01 July 2024

Keywords:

Construction Sites
Hazards
Health and Safety
Information Management
Site-operatives

DOI:

10.24191/bej.v21i1.481

ABSTRACT

Management of health and safety information helps to achieve a safe work environment by educating construction participants on risks and hazards on sites. This study therefore identified and assessed health and safety information on construction sites with a view to enhancing safe work environment. Data for the study were collected from site operatives on construction sites of registered construction organisations in Lagos State, Nigeria. On each site visited, three (3) site operatives were randomly selected from bricklayers, carpenters, iron benders, and so on working on the identified sites. This gave a sample size of one hundred and sixty-five (165). Questionnaire administration was adopted for data collection. The total number of copies of the questionnaire retrieved was one hundred and twenty-six (126) -76% response rate. Mean score and standard deviation were the analytical tools used to rank the information, while Kendall's Coefficient of Concordance was used to determine the degree of agreement among the respondents. The analysis revealed that the most frequent health and safety information on construction sites were first aid procedures, safety signs and symbols, protective equipment. Kendall's Coefficient of Concordance revealed strong agreement among the respondents on the ranking. The safety of operatives should be considered the number one priority; hence, the contractor should ensure the provision of adequate and well-equipped first-aid boxes on every site. Posters, safety, and warning signs indicating different hazardous working conditions should be provided on the sites. When these operatives are healthy, work can go smoothly on construction sites.

^{1*} Corresponding author. *E-mail address:* adebiyi.rt@unilorin.edu.ng
<https://doi.org/10.24191/bej.v21i1.481>

INTRODUCTION

Providing Health and Safety (H&S) information is a highly-sensitive management responsibility for achieving organisational goals in the modern construction environment. According to Suparna & Jaiswal (2021), organisational goals include identifying hazards in the workplace, determining the risks associated with the identified hazards, and establishing a safe working environment by communicating information about hazards and risk control to all workers. Efficient H&S information management is required to identify, evaluate, and assess workplace hazards for better safety performance. Wang & Wu (2018) noted that H&S information management is a performance-oriented approach to construction by establishing a safe working environment free of accidents and ill-health. According to Chan et al. (2023), the primary cause of accidents on construction sites is improper H&S information management. Wang & Wu (2018) pointed out that one of the leading causes of fatal human accidents is inadequate provision of H&S information. To minimise the occurrences of accidents and risks on construction sites, effective knowledge and information sharing on H&S are becoming imperative (Boadu, et al., 2020).

The study by Eze et al. (2020) concluded that there was a low implementation of H&S information management practices on construction project sites by construction organisations. This conclusion was based on the high occurrence of major accidents observed in the study. Construction organisations are thus required to implement good H&S management practices by communicating a large amount of H&S information to site operatives, visitors, and the general public to enjoy the full benefits inherent in a safe work environment. In this regard, Tanko et al. (2020) referred to policies to guide the management of H&S information in the industry. Notwithstanding that, measures and techniques have also evolved to minimise accidents and the risks of hazards better, ensuring effective H&S management in the industry. Adebisi et al. (2020) pointed out that for a successful project delivery, construction organisations should provide H&S information, instruction, and training to site operatives in a clear, concise, and correct manner so that they can carry out their responsibilities fully aware of risks involved and measures to prevent them. Against this background, this study was conducted to identify and assess H&S information on construction sites to manage the information effectively to enhance a safe work environment.

Wang & Wu (2018) identified some H&S information such as the company's H&S policy, accident statistics, risks associated with the current job, potential risks to the H&S of the workers, location and nature of hazards in the workplace, and emergency and first aid procedures. Ignacio et al. (2019) and Tanko et al. (2020) highlighted using, maintaining, and replacing protective equipment. Adebisi et al. (2020) also pointed out some H&S information, such as preventive and protective measures for the risks and hazards on site, procedures for safe operation, site rules, and best practices in the company. Other H&S information includes injury and incident reporting procedures, accident investigation, procedures for resolving H&S issues, disciplinary policy, learning from accidents, the identities of those who have a role within the organisation's H&S management system (Chan et al., 2023, Gungor, 2023).

LITERATURE REVIEW

Management of Health and Safety Information

The effective management of H&S information is crucial for ensuring the successful delivery of construction projects, as previous studies have suggested a positive correlation between effective H&S information management and project success (Fang et al., 2020; Chen et al., 2020; Nassereddine et al., 2022, and Chan et al., 2023). The efficient flow of safety information significantly impacts the performance and productivity of site operatives, which are critical factors in the successful execution of construction projects (Ramadan et al., 2023). This aligns with the findings of Gerami and Fayek (2019), who identified

site operatives' declining productivity and performance due to accidents and ill health on construction sites as a significant challenge to project success.

Suparna & Jaiswal (2021) emphasised that H&S information management plays a crucial role in educating site operatives on achieving a safe work environment by providing information about hazards, risk controls, the construction organisation's H&S policy, use of personal protective equipment, disaster warnings, first aid procedures, and emergency management. H&S information management enables the purposeful and cooperative interaction of people, tasks, processes, and systems to achieve organizational goals. Okoye (2018) highlighted the critical role of H&S management in minimising safety risks in construction, attracting site operatives, and shaping human behaviour to prevent accidents. Duryan et al. (2020) and Ramadan et al. (2023) underscored the importance of effective communication and information handling for project success.

Poor information management within project teams is a significant challenge facing the construction industry. Ineffective communication between safety personnel and site operatives, lack of training on key H&S issues, and a lack of understanding of workplace safety rules contribute to accidents on construction sites (Adeagbo et al., 2019). Failure in information management can lead to project failure, emphasising the critical role of H&S information management in ensuring safety on construction sites (Adebiyi et al., 2020; Ramadan et al., 2023). The safety of workers should be the top priority on every construction site, highlighting the necessity for effective H&S information management. The successful management of H&S involves transferring information followed by feedback from site operatives to the sender, indicating an understanding of the message.

Roles of Stakeholders in Management of Health and Safety Information

Traditionally, most developing countries' responsibility for Health and Safety (H&S) information management falls on contractors, who are often held accountable for accidents and ill health on construction sites due to poor information management (Chen *et al.*, 2020). According to Osei-Asibey *et al.* (2021), H&S management on construction sites involves various stakeholders in the construction industry. Stakeholders, as defined by Osei-Asibey *et al.* (2021), include clients, consultants, contractors, subcontractors, site operatives, manufacturers or suppliers of construction materials, equipment and tools, regulating institutions, local government, beneficiaries or users, and sometimes financiers and insurers.

Chan & Oppong (2018) emphasised that every stakeholder in a construction project plays a role in ensuring the seriousness of H&S on site, emphasising that safety is a collective responsibility. Clients, standing at the top of the hierarchy, have a crucial role in influencing safety implementation and adherence. They make significant decisions during the procurement phase, such as awarding projects to contractors with proven safety performance records (Umeokafor, 2017). As Osei-Asibey *et al.* (2021) advised, governments and regulating institutions can promote better H&S by monitoring and enforcing safety regulations within construction organisations. Effective enforcement can significantly enhance the safety of site operatives and reduce accidents and health hazards.

According to Chen *et al.* (2020), contractors are responsible for providing a work environment free from recognised hazards that could cause death or grave harm to site operatives. They must ensure compliance with H&S regulations on site, provide H&S training, and ensure the use of appropriate Personal Protective Equipment (PPE) by site operatives (Tanko *et al.*, 2020). Site operatives, in turn, are responsible.

Construction Site Operatives in Health and Safety Information Management

The construction industry faces significant challenges in Health and Safety (H&S) management, with frequent injuries and fatalities, creating an unsafe environment for site operatives (Yap *et al.*, 2022; Kang & Wu, 2020). In developing countries like Nigeria, site operatives are particularly exposed to hazards and

fatalities due to the labour-intensive nature of construction activities, involving various categories of workers at every stage of construction work (Priya, 2021). Tanko et al. (2020) emphasised that site operatives directly engaged in executing works face various degrees of hazards and fatalities, constituting a crucial backbone of the construction industry.

In this study, site operatives encompass craftsmen or artisans, including carpenters, masons, plumbers, plasterers, painters, glaziers, and other non-built environment professionals. They work in teams comprising skilled, semi-skilled, and labourers with varying levels of awareness regarding H&S matters (Yap et al., 2022). Injuries on construction sites result from conventional work processes, extensive human involvement with limited technology, and unsafe attitudes of site operatives (Yap et al., 2022). The exposure to hazards varies by trade, job, and time, emphasising the intermittent and short-duration nature of the hazards, likely to reoccur (Winge et al., 2019). Site operatives may not only encounter primary hazards in their jobs but may also be exposed as bystanders to hazards generated by nearby or upwind workers in other trades.

Effective H&S information management requires a clear understanding of the information to be communicated, the target audience, and the strategy used for information transmission. Adebisi et al. (2020) noted that site operatives consistently identify the management of H&S information as an integral area requiring improvement during post-project assessments. Site operatives believe that troubled projects could have run smoother with adequate information on H&S provided. Therefore, enhancing the understanding and communication of H&S information is crucial for promoting a safer work environment for construction site operatives.

METHODOLOGY

The research was conducted within the scope of construction firms registered with the Lagos State Public Procurement Agency (LSPPA) in Nigeria. The LSPPA maintains a database of registered contractors, categorising them based on contract value. Construction firms falling under categories D and E were chosen due to their involvement in projects with substantial contract sums and their records of Health and Safety (H&S) policies. Site operatives working on the sites of these identified construction firms involved in public projects were selected for the study, following the approach of Adebisi et al. (2020) and Tanko et al. 2020.

A pilot survey identified fifty-five (55) active construction firms with ongoing public projects. The study employed purposive sampling to select sites of the identified firms, similar to the approach used by Simpeh & Amoah (2023). On each visited site, three (3) site operatives were randomly selected from various roles, such as bricklayers, carpenters, iron benders, electricians, and plumbers working for the identified firms. This resulted in a sample size of one hundred and sixty-five (165) site operatives. Questionnaires were used for data collection, with 126 copies retrieved, representing a 76% response rate. Research assistants actively participated in the distribution and retrieval of questionnaires to achieve this high response rate. The analytical tools used included Mean Score (MS), Standard Deviation (SD), and Kendall's Coefficient of Concordance.

The questionnaire was divided into two (2) categories. The first category gathered information about the personal data of the respondents, including education, profession, roles, and years of experience in the construction industry. The second set of questions was designed to establish the usage of H&S information. Respondents were asked to rate their agreement with 23 variables identified from the literature review on a five-point Likert scale, ranging from one (1) = not used to five (5) = very often used. Additionally, respondents were invited to state and rate other H&S information not included in the questionnaire that could be relevant to construction sites in the study area.

FINDINGS AND DISCUSSIONS

Given the high illiteracy level among most site operatives, ample time was provided for them to answer the questions. In some cases, questions were read aloud to facilitate their expression of professional opinions on the sites' management of Health and Safety (H&S) information. One hundred twenty-six (126) copies of the questionnaire were retrieved, representing a commendable seventy-six percent (76%) response rate.

Analysis of Respondents' Biodata

The reliability of any research is contingent on the data source and the robustness of the analysis employed. Questionnaires were used to gather information about the respondents' background, enhance reliability, and instil confidence in the findings. Table 1 reveals the categories of construction organisations registered with the Lagos State Government under the Lagos State Public Procurement Agency (LSPPA). Most organisations whose sites were visited fall under Category D (62%), while others are in Category E (38%). This finding indicates that a significant portion of the surveyed construction organisations is high-calibre, well-structured, and recognised for executing projects with substantial contract sums. The type of construction organisations reflects the nature of their projects.

Table 1. Categories of construction sites visited and response rate

Categories of Contractors	Construction sites visited	Site Operatives	Questionnaire Retrieved
D	34	102	77
E	21	63	49
Total	55	165	126

Table 2 disclosed the types of trades of each surveyed operative. The table reveals that twenty four percent (24%) of the operatives are bricklayers/plasterers, twenty-two percent (22%) are carpenters/joiners, eight percent (8%) are roofers, two percent (2%) are electricians, and two percent (2%) are plumbers. Other operatives include ten percent (10%) glaziers, four percent (4%) painters/decorators, ten percent (10%) welders, and nine percent (9%) labourers. Another ten percent (10%) of operatives do not fall into any trade stated in the questionnaire.

Table 2. Site Operatives' Profile

Profile	Frequency	Percentage (%)	Cum %
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
Labourer	11	8.7	90.3
Others	12	9.5	100
Total	126		
Type of Employers in Organisation			
Main Contractor	40	31.7	31.7
Sub-contractor	80	63.5	95.2
Others	6	4.8	100
Total	126		

Modes of Engagement

<https://doi.org/10.24191/bej.v21i1.481>

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
	4	3.2	95.2
Primary education	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		

Table 2 also illustrates the types of employers that engage the operatives. The results indicate that sub-contractors employed the majority of site operatives (64%), while the main contractors employed thirty-two percent (32%). Other four percent (4%) were neither employed by the main contractors nor sub-contractors. The modes of engagement for site operatives are also presented in Table 2, with most employed full-time. These results suggest that managing and implementing health and safety information on construction sites may not be challenging.

Additionally, Table 2 displays the highest education qualification of the site operatives. The results reveal that the majority have a minimal level of education, which could challenge how they understand health and safety information. Respondents were also asked to indicate their experience on construction sites in Lagos State, and the results show that despite their limited education, the majority have commendable experience on construction sites.

Analysis of Health and Safety Information on Construction Sites

The examination of health and safety data on construction sites revealed twenty-three (23) pertinent factors gleaned from the existing literature. According to Table 3, first aid procedures emerged as the most frequently used health and safety information, obtaining the top rank with a mean score of 3.89 and a standard deviation of 0.896. Safety signs and symbols secured the second position with a mean value of 3.69 and a standard deviation of 0.834. Protective equipment, maintenance, and replacement claimed the third spot, with a mean score of 3.53 and a standard deviation of 0.838. Procedures for safe operation ranked fourth and had a mean score of 3.40 and a standard deviation of 0.706. Site regulations rounded out the top five, with a mean score of 3.38 and a standard deviation of 0.924. All these health and safety information items are crucial in preventing injuries and promoting well-being on construction sites.

Table 3. Health and Safety Information on Construction Sites

Health and Safety Information	Mean	Standard Deviation	Rank
First aid procedures	3.89	0.896	1
Safety signs and symbols	3.69	0.834	2
Use, maintenance and replacement of protective equipment	3.53	0.838	3
Procedures for safe operation on-site	3.40	0.706	4
Site regulations	3.38	0.924	5
Preventive and protective measures for the risks and hazards on-site	3.35	0.861	6

<https://doi.org/10.24191/bej.v21i1.481>

Company's health and safety policy	3.33	0.736	7
Best practices in the company	3.31	0.853	8
Safety performance	3.29	0.916	9
Site rules	3.28	0.882	10
Knowledge of emergency procedures	3.26	0.837	11
Company's philosophy	3.23	0.939	12
The identities of those who have a role within the organisation's health and safety management system	3.21	0.915	13
Procedures for resolving health and safety issues	3.17	0.840	14
The potential risk to the health and safety of the workers	3.16	0.804	15
Nature of hazard in the workplace	2.97	0.929	16
Safety inspection reports	2.96	0.785	17
Disciplinary policy	2.65	0.844	18
Location of hazard	2.92	0.850	19
Injury and incident reporting procedures	2.91	0.867	20
Accident statistics and records	2.83	0.830	21
Accident investigation	2.78	0.809	22
Minutes of safety review meetings	2.68	0.789	23

Table 3 highlights that respondents ranked safety performance, site rules and regulations, knowledge of emergency procedures, and the company's health and safety policy as information used on-site, although not frequently. On the other hand, the least frequently used information includes minutes of safety review meetings, accident investigations, accident statistics and records, injury and incident reporting procedures, and the location of hazards. This distribution of information usage provides insights into the varying levels of emphasis placed on different aspects of health and safety practices on construction sites.

Degree of Agreement among the Respondents with respect to their Rankings of the Health and Safety Information

Kendall's Coefficient of Concordance (W) was employed to assess the level of agreement among respondents regarding their rankings of Health and Safety (H&S) information. Deng, et al. (2022) noted that this measure of association is suitable for variables measured on at least an ordinal scale, allowing the ranking of objects or individuals in an ordered series.

Table 4 reveals the degree of agreement among various groups of respondents, such as bricklayers or plasterers, carpenters or joiners, roofers, electricians, plumbers, glaziers, painters or decorators, welders, labourers, and others, concerning their rankings of H&S information. The computed value χ^2 and χ^2 critical table were included to illustrate the significance of agreement among the respondents. This statistical approach aids in understanding the consensus or variation in the perceptions of different occupational groups regarding the importance of various H&S information on construction sites.

Table 4. Computed Value χ^2 and χ^2 Critical Table

Variables	Kendal Coefficient of Concordance (W)	Chi-square statistic as $\chi^2 = k(N-1)W$	Computed Value χ^2	Critical table χ^2 at 0.05	Inference
H&S information	0.7330	10(22) 0.7330	92	41.33	Significant

The Kendall coefficient of concordance (W) for health and safety (H&S) information is 0.7330, indicating a high value and strong agreement among respondents in their rankings. This suggests a significant consensus regarding the perceived importance of various H&S information.

DISCUSSION OF FINDINGS

In the discussion of findings, the respondents' ranking of first aid procedures as the most frequently used H&S information aligned with the previous study by Ali, Habib & Sharaa (2021). However, concerns about the adequacy of first aid supplies on construction sites were raised, echoing recommendations for improved equipment and training (Karima et al., 2019). Similarly, the high ranking of safety signs and symbols is supported by Gungor (2023). The study emphasised their crucial role in conveying information on construction sites, especially regarding traffic control.

The study also emphasised the importance of protective equipment, maintenance, and replacement, in line with the study carried out by Ignacio et al. (2019), that it is a requirement for site operatives to wear personal protective equipment consistently. Additionally, the ranking of procedures for safe operation aligned with the concept of guiding operatives through essential steps on construction sites. This was described by Iliya (2019) as a series of important steps that guide the operatives on tasks to be carried out on sites. Site regulations are underscored as vital H&S information, consistent with research conducted by Akanbi et al. (2022).

Overall, the findings reflect a robust agreement among respondents on the significance of various H&S information elements, emphasising the importance of these measures in promoting safety on construction sites.

CONCLUSION

In conclusion, this study identifies first aid procedures as the most crucial health and safety (H&S) information on construction sites, given the frequent occurrence of accidents and injuries. The perception among site operatives that construction sites are inherently dangerous underscores the need to provide adequate first aid resources. Safety signs and symbols are also highlighted as essential H&S information due to their clear communication with operatives. In contrast, information on using, maintaining, and replacing personal protective equipment is vital.

The significant degree of agreement among all respondent groups in ranking H&S information emphasises a strong consensus on the importance of these measures. Stakeholders are urged to ensure the provision of well-equipped first aid boxes on every construction site, along with clear safety signs and instructional materials accessible to all workers, including those who may be illiterate. Translation of written materials into local languages is recommended for better understanding.

Ultimately, prioritising the safety of operatives is paramount on construction sites, and the study underscores the need for adequate H&S information to maintain a healthy and secure working environment.

ACKNOWLEDGEMENTS

The authors express their gratitude to the Lagos State Public Procurement Agency (LPPA) and their Registered Construction Organisations (Categories D&E) for their valuable support in the data collection for this research project. The authors would also like to thank all the survey participants, beginning from the Research Assistance to all the Respondents (Site-operatives), without whom this research would not be possible. The opinions, findings, conclusions, and recommendations expressed by the authors in this paper reflect the respondents' views.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest in the research and agree that this research was conducted in the absence of self-benefits or financial conflicts.

AUTHORS' CONTRIBUTION

The authors confirm contribution to the paper as follows: study conception and design: *Ranti Taibat Adebisi* and *Ganiyu Amuda-Yusuf*; data collection: *Lukman Olanrewaju Olorunoje*, analysis and interpretation of results: *Ranti Taibat Adebisi*, *Ganiyu Amuda-Yusuf* and *Lukman Olanrewaju Olorunoje*, draft manuscript preparation: *Abdulkadir Shehu Rasheed*. All authors reviewed the results and approved the final version of the manuscript.

REFERENCES

- Adeagbo, D. O., Dakas, A. I. I., & Izam, Y. D. (2019) Safety practices on building construction sites for sustainable development in Nigeria. *Journal of Sustainable Development in Africa*, 21(4), 111-120. https://jsdafrica.com/Jsda/2019%20V21%20No4%20Winter/PDF/Safety%20of%20Workers%20on%20Building%20Construction_Dorcas%20Adeagbo.pdf
- Adebisi, R. T., Babalola, O., Amuda-Yusuf, G., Rasheed, S. A., & Olowa, T. O. (2020) Effect of knowledge and compliance of health and safety information on construction sites workers' safety in Nigeria. *International Journal of Safety and Security Engineering*. <https://doi.org/10.18280/ijssse.100215>
- Akanbi T. I., Abdulrashid, S., & Aliyu, H. I. (2022) Overview of Building Construction Safety and Legislations in Nigeria. *International Journal of Scientific Advances*. 3(4) 637- 640. <https://doi.org/10.51542/ijscia.v3i4.31>
- Ali, M. I. E., Habib, N. S. & Sharaa, H. M. (2021) Effect of first aid training program on construction workers' self-efficacy in Egypt. *Pakistan Journal of Medical & Health Sciences*. 15(1) 403-406. <https://pjmhsonline.com/2021/jan/403.pdf>
- Boadu, E. F., Wang, C. C., & Sunindijo, R.Y. (2020) Characteristics of the construction industry in developing countries and its implications for health and safety: An exploratory study in Ghana. *International Journal of Environmental Research and Public Health*. 17:4 110. <https://doi.org/10.3390/ijerph17114110>
- Chan, A. P. C., Guan, J., Choi, T. N. Y., Yang, Y., Wu, G., & Lam, E. (2023) Improving safety performance of construction workers through learning from incidents. *International Journal of Environmental Research and Public Health*. 20(5):4570. <https://doi.org/10.3390/ijerph20054570>
- Chan, A. P. C. & Opong, G. D. (2018) Managing the expectations of external stakeholders in construction projects. *Engineering Construction & Architectural Management* 20(5) 234 –239 <http://dx.doi.org/10.1108/ECAM-07-2016-0159>
- Chen, W. T., Tsai, I. C., Merrett, H. C., Lu, S. T., Lee, Y. I., You, J. K., & Mortis, L. (2020). Construction safety success factors: A Taiwanese case study. *Sustainability (Switzerland)*, 12(16), 145- 151. <https://doi.org/10.3390/su12166326>
- Deng, W., Wang, J. & Zhang, R. (2022) Measures of concordance and testing of independence in multivariate structure. *Journal of Multivariate Analysis*. 191(1), 344- 349. <https://doi.org/10.24191/bej.v21i1.481>

<https://doi.org/10.1016/j.jmva.2022.105035>

- Duryan, M., Smyth, H., Roberts, A., Rowlinson, S., & Sherratt F. (2020) Knowledge transfer for occupational health and safety: Cultivating health and safety learning culture in construction firms. *National Center for Biotechnology Information*. 139(1). <https://doi.org/10.1016/j.aap.2020.105496>
- Eze, E., Sofolahan, O., & Siunoje, L. (2020). Health and safety management on construction projects: the view of construction tradespeople *CSID Journal of Infrastructure Development*, 3(2) 152-172. <http://dx.doi.org/10.32783/csid-jid.v3i2.165>
- Fang, D., Huang, Y., Guo, H., & Lim, H. W. (2020) LCB approach for construction safety. *Safety Science* 128(5) 104761. <https://doi.org/10.1016/j.ssci.2020.104761>
- Gerami, S. N. & Fayek, A. R. (2019). Factors influencing multifactor productivity of equipment-intensive activities. *International Journal of Production Performance Management*. 69 (9), 2021–2045. <https://doi.org/10.1108.IJPPM-07-2018-0250>
- Gungor, C. (2023) Safety sign comprehension of fiberboard industry employees. *Heliyon*. 9(6), 1-9. <https://doi.org/10.1016/j.heliyon.2023.e16744>
- Iliya, J. (2019) Safety procedure and method of accident prevention on construction sites *Thrixian's Research Work* 2015(1). https://www.academia.edu/41928198/SAFETY_PROCEDURE_AND_METHOD_OF_ACCIDENT_PREVENTION_ON_CONSTRUCTION_SITES
- Ignacio, J., Santos, E., Socorro, P., Florencondia, N., Pascual, L. & Subia, G. (2019) Safety Measures and Safety Warning Signages of Road Construction Projects: An Assessment. *International Journal of Advanced Engineering, Management and Science* 5(8) 500-503. <http://dx.doi.org/10.22161/ijaems.58.3>
- Kang, I., & Wu., C. (2020). Evaluating the safety performance of China's provincial construction industries from 2009 to 2017. *Journal of Civil Engineering and Management* 26(5), 435 -446. <https://doi.org/10.3846/jcem.2020.12646>
- Karima, N., Nuraeni, A. & Mirwanti, R. (2019). Knowledge and self- efficacy on first responder in giving first aid. *Journal of Nursing Care. JNC*. 2(1) 17-22. <https://doi.org/10.24198/jnc.v2i1.18644>
- Nassereddine, H., Hanna, A. S., Veeramani, D., & Lotfallah, W. (2022). Augmented reality in the construction industry: Use-cases, benefits, obstacles, and future trends. *Front. Built Environment*. 8, 730094. <https://doi.org/10.3389/fbuil.2022.730094>
- Okoye, P. U. (2018). Occupational health and safety risk levels of building construction trades in Nigeria. *Construction Economics and Building*, 18(2), 92–109. <http://dx.doi.org/10.5130/AJCEB.v18i2.5882>
- Osei-Asibey, D., Ayarkwa, J., Adinyira, E., Acheampong, A. & Amoah, P. (2021) Roles and responsibilities of stakeholders towards ensuring health and safety at construction site. *Journal of Building Construction and Planning Research*, 9, 90-114. <https://doi.org/10.4236/jbcpr.2021.91008>
- Ramadan, B., Nassereddine, H., Taylor, T. R. B., Real, K., & Goodrum, P. (2023). Impact of technology use on workforce performance and information access in the construction industry. *Frontiers in Built Environment* 9(1) 1-15. <https://doi.org/10.3389/fbuil.2023.1079203>
- Simpeh, F. & Amoah, C. (2023) Assessment of measures instituted to curb the spread of COVID-19 on construction site. *International Journal of Construction Management*. 23(3), 383-391. <https://doi.org/10.24191/bej.v21i1.481>

<https://doi.org/10.1080/15623599.2021.1874678>

- Suparna, N. S. & Jaiswal, A. (2021) The occupational health and safety *Anthropo-Indialogs* 1(3) 261-269. [https://www.arfjournals.com/image/catalog/Journals%20Papers/Anthropo/no%203%20\(2021\)/10_Suparna%20NS.pdf](https://www.arfjournals.com/image/catalog/Journals%20Papers/Anthropo/no%203%20(2021)/10_Suparna%20NS.pdf)
- Tanko, B. L., Ting, L. C., & Idiako, J. E. (2020). Compliance with the use of personal protective equipment (PPE) on construction sites in Johor, Malaysia. *International Journal of Real Estate Studies*, 14(1), 123–138. <https://intrest.utm.my/index.php.intrest/article/view/141>
- Ulang, N. M. (2012) Communication of construction health and safety information in design. *Civil and environmental Research*. 2(5), 25-32. <https://repository.lboro.ac.uk/account/articles/9455636>
- Umeokafor, N. (2017) An appraisal of the barriers to client involvement in health and safety in Nigeria's construction industry. *Journal of Engineering, Design and Technology*, 15(4), 471-487. <https://doi.org/10.1108/JEDT-06-2016-0034>
- Wang, B., & Wu, C. (2018) Safety-related information provision: The key to reducing the lack of safety-related information. *Journal of Intelligent*. 37:146–153. <http://open.oriprobe.com/articles/found.htm?keyword=safety-related+information+provision+lack+of+safety-related+information>
- Winge, S., Albrechtsen, E., & Arnesen, J. (2019) A comparative analysis of safety management and safety performance in twelve construction projects. *Journal Safety Research* 71(1) 139 - 152. <https://doi.org/10.1016/j.jsr.2019.09.015>
- Yap, J. B. H., Lam, C. G. Skitmore, Y. M., & Talebian, N. (2022). Barriers to the Adoption of New Safety Technologies in Construction: A Developing Country Context. *Journal of Civil Engineering and Management* 28 (2), 120-133. <https://dx.doi.org/10.3846/jcem.2022.16014>



© 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY-NC-ND 4.0) license (<http://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>).