



IMPROVEMENT MEASURES FOR SAFETY AND HEALTH ON CONSTRUCTION SITES

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ABSTRACT

Safety concerns have consistently emerged as a significant challenge and top priority within the global construction industry. This industry is widely recognized as highly hazardous, with a significant number of accidents and fatalities occurring. This paper provides an overview of safety and health improvement measures within the construction sector. The study conducted a survey using a standardized five-point Likert scale questionnaire among 155 experienced professionals working in the construction industry. A random sampling technique was employed to ensure representation from various roles, including clients, consultants, and contractors. The key findings highlight the importance of reviewing and updating health and safety laws, implementing safety monitoring systems, and ensuring compliance with personal protective equipment (PPE) requirements. The study proposes potential solutions such as safety awareness and training, ergonomic workplace practices, effective information flow and site monitoring, management commitment, and supportive workplace policies. The paper emphasizes the significance of adopting improvement measures ranging from new employee orientation to safety audits and the provision of PPE to enhance safety performance, prevent accidents, and improve safety management practices. The findings and recommendations presented in this paper serve as valuable guidance for construction professionals, government authorities, and organizations seeking to improve safety records and mitigate risks, particularly in developing countries.

KEYWORDS: Construction industry, Safety, Construction accidents, Improvement measures.

1. INTRODUCTION

The construction industry plays an important role in economic and social development. However, it is also widely recognized as the most hazardous industry in terms of personal safety and health (Charehzehi & Ahankoob, 2012). The construction industry has experienced elevated rates of accidents attributed to various factors such as the inherent nature of the work, the management system in place, the equipment utilized, the techniques employed during tasks, the pace of operations, and other pertinent elements (Jafari et al., 2014).

Safety in the construction industry is confronted by significant challenges, including inadequate communication, failure to use PPE, incorrect work postures and activities, insufficient training, psychological factors such as stress and burnout, absence of safety orientation and culture, and non-compliance with relevant legislation (Samanta & Gochhayat, 2021).

Enhancing safety in the construction sector continues to be a top priority worldwide due to its prominent role in contributing to severe and fatal accidents (Melagoda & Rowlinson, 2022). The issue of safety on construction sites demands immediate attention and is of utmost importance (B. Li et al., 2022). To address this, a crucial requirement within the construction industry is to cultivate greater engagement among professionals toward active safety management and the implementation of awareness programs. These programs need to be specifically designed and executed for construction workers, aiming to enhance their awareness of potential risk factors and equip them with the necessary knowledge to mitigate these risks (Vitharana et al., 2015). The urgent and significant need for measuring and evaluating safety performance arises to enhance safety management practices and prevent accidents (Darshana, 2017). Similarly, implementing effective safety training practices decrease the fatality rate (W. Li et al., 2022). Employee safety behavior plays a pivotal role in the management of construction safety, with employee safety awareness and skills emerging as vital elements influencing safety incidents (Gao et al., 2023). It is crucial to furnish all workers with PPE to safeguard their well-being. It is essential to implement appropriate remedies and measures at every construction site to proactively prevent the likelihood of any accidents occurring (Benny & Jaishree, 2017).

Safety climate in the construction industry is often assessed using various indicators. These indicators include evaluating management's dedication to safety, the presence of effective

safety policies, availability of resources and training, supervisors' commitment to safety, the organization's overall commitment to safety, co-workers' dedication to safety, open and effective safety communication, worker involvement in safety initiatives, and the appraisal of risks and risk-taking behavior. Additionally, the incorporation of a mindfulness organizing scale as a means to assess the safety climate. This approach helps identify potential shortcomings in current safety improvement practices within the construction industry (Melagoda & Rowlinson, 2022). By implementing effective training and safety awareness programs, construction workers can be equipped with the knowledge and skills to identify and mitigate risks, make informed decisions regarding safety practices, and respond appropriately in hazardous situations. This ultimately leads to a safer working environment, reduced accidents and injuries, and improved health and well-being for construction workers (Giri, 2020).

Primary responsibility for enhancing safety performance on construction sites lies with key construction professionals, including top management and government authorities. Their active involvement and commitment are crucial for driving safety improvements (Durdyev et al., 2017). Utilizing audio and visual display devices effectively on construction sites, conducting internal safety training for workers, and ensuring the presence of a dedicated safety manager on each construction site can significantly enhance workers' safety practices. Implementing these measures will have a substantial positive impact on overall safety standards at construction sites (Ogundipe et al., 2018).

Construction site safety improvement in developing countries refers to the lack of comprehensive studies and knowledge regarding effective strategies and measures to enhance safety performance in the construction industry of these countries. While safety concerns in construction are recognized worldwide, low-income countries often face unique challenges due to various factors such as limited research, resources, inadequate regulatory frameworks, and cultural differences.

2. MATERIALS AND METHODS

The data for this study were collected using a five-point Likert scale questionnaire administered to professionals involved in the construction industry, including consultants, contractors, and engineers. The sample size was determined using a random sampling technique. After data collection, the collected data were analyzed using SPSS (Statistical

Package for the Social Sciences) software. The analysis involved calculating frequencies, to summarize the responses and provide an overview of the data.

Additionally, a Chi-square goodness of fit test was conducted to assess the agreement between the observed frequencies and the expected frequencies for different views or response categories. This test helps determine whether there is a significant difference between the observed and expected frequencies, indicating potential divergences in the views of the participants. The results of the analysis, including frequencies, averages, percentages, and the findings of the Chi-square goodness of fit test, were then presented to provide insights into the participants' responses and the level of agreement or divergence among them.

3. RESULT AND DISCUSSION

Table 2 displays various improvement measures for safety and health in construction sites. The table also provides the frequency of responses for each improvement measure, ranging from 0 to 76. Additionally, the total number of responses for each measure is calculated, along with the average frequency for measures 4 and 5. The measures cover a wide range of safety and health aspects in construction. They include providing appropriate orientation to new employees regarding safety inspections, incorporating safety guidelines in project contracts, motivating construction workers through safety awards, considering safety during the design phase, establishing safety regulations and policies, conducting accident investigations and record-keeping, increasing workers' awareness of risk factors, ensuring top management commitment to safety, assigning safety responsibility to all levels of management and workers, planning safety budgets, implementing safety management at the organizational level, conducting safety meetings, maintaining tidy construction sites, performing safety and health audits, and providing PPE to workers.

The responses vary for each improvement measure, indicating the varying levels of implementation or consideration for different measures. The table also includes a total frequency column, representing the proportion of responses for each measure out of the total responses provided by the participants. Overall, the table provides an overview of the different improvement measures for safety and health in construction sites, highlighting the frequencies and priorities assigned to each measure by the respondents.

Table 1: Improvement measures for safety and health in construction sites.

SN	Improvement Measures	1	2	3	4	5	Total	Average of 4 and 5
1.	Ensuring new employee on the project site is given an appropriate orientation regarding safety and health inspections.	0	7	10	75	63	155	69
2.	Setting safety guidelines in the conditions of the contract for a project.	0	7	12	65	71	155	68
3.	The motivation of construction operatives by instituting safety awards.	9	0	14	76	56	155	66
4.	Taking into consideration safety and health matters during the design phase of a facility.	9	7	8	63	68	155	65.5
5.	Creating safety regulations and policies.	0	9	16	65	65	155	65
6.	Accident investigation and record keeping on construction sites.	0	7	18	54	76	155	63.5
7.	Increasing workers' awareness of risk factors will be useful to increase productivity and reduce the risk associated with construction activities.	0	0	28	51	76	155	63
8.	Top management commitment to worker health and safety.	9	7	14	67	59	156	62.5
9.	Assignment of safety responsibility to all levels of management and workers.	0	16	14	60	65	155	60.5
10.	Planning short and long-term safety budgets to ensure the adequacy of safety implementation on site.	0	7	27	59	62	155	59.5
11.	Implementing total Safety and health management at the organizational level in construction companies.	0	7	23	54	65	149	59.5
12.	Conducting weekly formal safety meetings at the project level.	0	9	27	68	51	155	59.5
13.	Maintaining the construction site tidy.	1	14	12	58	61	146	59
14.	Safety and health auditing by Safety and health committees.	0	7	24	71	47	149	59
15.	Providing PPE to the workers always.	0	14	24	14	98	150	56
Total Percentage		1	5	12	39	43	100	

The goodness of Fit Test

Table 2 presents the results of a Chi-square goodness of fit test conducted to assess the agreement between observed and expected frequencies across different views or response categories. The views include "Strongly disagree," "Disagree," "Neutral," "Agree," and "Strongly agree." The actual frequencies of responses were compared to the expected frequencies, which were assumed to be equal for all categories. The $(O-E)^2$ values were calculated by taking the squared difference between the observed and expected frequencies.

The Chi-square test statistic was computed as the sum of all $(O-E)^2$ values, resulting in a value of 1731.3. With 4 degrees of freedom and a predetermined significance level (alpha) of 0.01, the critical Chi-square value was 13.277. The obtained test statistic significantly exceeded the critical value, indicating a substantial deviation between the observed and expected frequencies. Furthermore, the extremely low p-value of 0.000 provided strong evidence to reject the null hypothesis, supporting the conclusion that there is a significant difference between the observed and expected frequencies of the views.

Table 2: Goodness of fit test (Chi-square Test).

Views	Actual Frequency (O)	Expected Frequencies (E)	$(O-E)^2$
Strongly disagree	29	463	188356
Disagree	120	463	117649
Neutral	274	463	35721
Agree	904	463	194481
Strongly agree	988	463	275625
Sum	2315	2315	811832
Chi-square Test Statistic			1731.3
d.f.			4
Alpha			0.01
Critical Chi-square value			13.277
P-value			0.000

Famakin et al., (2023) conducted a study focusing on the challenges associated with implementing health and safety regulations in the construction industry, specifically in a developing economy. The researchers identified several challenges, including manhandling and external management, internal management, human error, enforcement systems, working conditions, and human and environmental factors. The study suggests that to effectively address these challenges, it is necessary to review and update existing health and safety laws to align with present circumstances. To improve construction site safety monitoring and tracking workers' on-site movements, as well as ensuring their compliance with PPE requirements is vital. By focusing on these aspects, construction companies can effectively mitigate risks and create a safer working environment for their personnel (Cheng et al., 2022).

Several potential solutions to enhance occupational safety in construction sites by Samanta & Gochhayat, (2021) are improving safety awareness and training, emphasizing workplace ergonomics, facilitating information flow and site monitoring, fostering a safety-oriented mindset among management, enhancing workplace support practices, and promoting

workplace spirituality. By increasing worker safety awareness and introducing safe working practices through training and induction programs, construction sites can experience a significant reduction in safety incidents (Giri et al., 2023).

The construction industry is to increase professionals' engagement in active safety management and the implementation of awareness programs targeted at construction workers. It is crucial to enhance their awareness regarding potential risk factors and equip them with the knowledge to effectively mitigate these risks (Vitharana et al., 2015). Likewise, enforcement mechanisms play a vital role in health and safety management. It is essential to establish an organizational framework that enables the effective implementation of safety policies across all construction companies. This framework should include a well-defined structure that assigns duties and responsibilities at different levels, ensuring that safety is integrated (Darshana, 2017).

4. CONCLUSION

Safety in the construction industry is a critical concern due to its high incidence of accidents and fatalities. The sector faces various challenges such as manhandling, poor management, human error, enforcement systems, and working conditions. This study provides a comprehensive overview of improvement measures by utilizing a standardized five-point Likert scale questionnaire survey from 155 experienced professionals working in the construction industry. The collected data were analyzed using the statistical software SPSS, which allowed for the calculation of frequencies and other statistical measures. Additionally, a Chi-square goodness of fit test was performed. The identified measures encompass various aspects, including orientation for new employees, safety guidelines in project contracts, safety awards, consideration of safety during the design phase, establishment of regulations and policies, accident investigations and record-keeping, worker awareness of risk factors, top management commitment to safety, assignment of safety responsibility, planning safety budgets, implementation of safety management, safety meetings, site cleanliness, safety and health audits, and provision of PPE. Additionally, it is crucial for construction professionals, government authorities, and organizations to actively implement these improvement measures to enhance safety and health standards in the construction industry ultimately creating a safer working environment for all involved.

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