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STATUS OF OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM FOR CONSTRUCTION INDUSTRY IN MYMENSINGH CITY OF BANGLADESH

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ABSTRACT

The research explores the occupational health and safety (OHS) status in the construction industry of Mymensingh City, Bangladesh. The study uses a mixed-methods approach, involving surveys, interviews, and literature review, to examine the implementation of the Occupational Health and Safety Management System (OHSMS) in the city. Key findings from the study expose notable gaps in the provision of safety measures within the construction industry. A significant 80% of the surveyed workers reported not receiving the necessary safety equipment, while 85% expressed dissatisfaction with the adequacy of safety training provided before commencing their tasks. The observation of workplace hazards by 77% of respondents underscores the necessity for a more robust safety management system. Furthermore, 70% of participants questioned the adequacy of authority responsibility during workplace hazards. The availability of Personal Protective Equipment (PPE) and first aid resources presented a mixed scenario, with 66% lacking necessary PPE and only 34% reporting its provision. On a positive note, 31% of respondents noted the presence of first aid kits in their workplace. Access to fundamental amenities such as clean drinking water and sanitation is largely positive, with 92% having access to clean drinking water and 38% reporting proper sanitation facilities. PPE usage frequency is infrequent and a significant 82% of respondents reported experiencing accidents on construction sites, highlighting the urgent need for comprehensive safety interventions. To address these gaps, the research proposes practical recommendations, including enhanced safety training programs, strengthened regulatory compliance, safety culture promotion, investment in safety technology, worker empowerment, community engagement, and public awareness campaigns.

Key words: Occupational health and safety, Construction industry, PPE, Management system.

Introduction

The construction industry is crucial for global economic growth and directs growth in developing nations, stands as one of the most hazardous sectors due to its unique characteristics, characterized by frequent accidents and inherent risks, uncertainties, and project complexities (Hasan *et al.*, 2017). Bangladesh, a country with significant achievements in human development indicators, faces persistent challenges, including poverty, environmental degradation, and the looming threats of climate change. Despite advancements in human development, more than 63 million people in Bangladesh live below the poverty line, highlighting the urgency of sustainable development efforts (Akter, 2019). As a developing nation, Bangladesh's construction industry is rapidly expanding, contributing around 7.6 percent to the country's gross domestic product (GDP) and employing over 3.3 million people (Hossain and Ahmed, 2019). Despite the industry's significant contribution, safety management concerns persist, reflecting a stark disparity. In Bangladesh, the construction industry witnesses a disproportionately high rate of injuries to both physical properties and labor, surpassing other sectors (Islam *et al*., 2017). Each year, a significant number of individuals suffer injuries, with some cases resulting in serious harm or even death due to construction site accidents (Chowdhury *et al*., 2020). The gravity of the situation is evident from the annual toll of accidents. In Bangladesh, approximately 150 individuals lose their lives and thousands sustain injuries due to construction-related accidents (Ahmed *et al*., 2018). Tragically, the numbers remain consistently high, with reported deaths numbering 179 in 2017, 145 in 2016, and 172 in 2015. These figures underscore the urgent need for improved safety practices and management within the construction industry (Ahmed, 2019). Bangladesh Occupational Safety, Health, and Environment Foundation (OSHE Foundation) monitored

workplace accidents in 2022 and revealed that 1195 workers were injured in various sectors across the country. Among them, 967 fatalities and 228 injuries occurred, with the construction sector alone accounting for 134 fatalities, including 105 deaths and 29 injuries (OSHE Foundation, 2023).This compelling data emphasizes the urgent need for a heightened emphasis on improving occupational health and safety procedures within the construction sector, which is the central theme of this research. Building initiatives like the Coastal Embankment Improvement Project (CEIP) implemented by the Bangladesh Water Development Board (BWDB) are among the most recent attempts to address this problem, which is essential to Bangladesh's development agenda and aims to increase the resilience of construction workers (Islam, 2018). It is imperative to explore opportunities for incorporating appropriate public health practices into construction operations to increase worker well-being and reduce environmental risks. Construction projects may help Bangladesh achieve a better and more sustainable future by reviewing existing eco-friendly practices and ensuring compliance with occupational health and safety procedures. This study intends to fill current knowledge and practice gaps while also making suggestions for improving public health outcomes in construction work across the country. The prime objectives of this study are as follows: i) to assess the current implementation of OHSMS for the construction industry in Mymensingh City, ii) To identify obstacles and gaps that impede effective OHSMS adoption in the construction sector and iii) to propose practical measures for improving safety practices and compliance within the construction industry based on identified gaps in Bangladesh.

Materials and Methods

This research utilized a mixed-methods approach, incorporating both quantitative and qualitative data collection techniques, to comprehensively explore the implementation of the Occupational Health and Safety Management System (OHSMS) within Mymensingh City's construction industry.

Study area: Mymensingh City Corporation Area is situated in the Mymensingh District of Bangladesh. Specifically located at the geographical coordinates of approximately 24.7606° N latitude and 90.4166° E longitude (Fig. 1), it lies within the broader context of the country's evolving urban fabric. The area's importance as a central hub of urban growth makes it the ideal location for investigating how safety practices align with the booming construction activities that define contemporary urbanization. This comprehensive understanding is crucial for bolstering safety management in construction activities, leading to a safer work environment for those engaged in construction work.

Data collection: The research focuses on understanding common occupational hazards and the contributing factors to accidents in the construction industry within Mymensingh City. To ensure a diverse representation, a total of 120 construction workers were purposively selected and interviewed from 16 construction sites. These workers are drawn from different construction sectors within Mymensingh City, including residential, commercial, and industrial projects.

Questionnaire design: The survey questionnaire was thoughtfully crafted to capture essential insights from the research participants. The questions were designed to understand their familiarity with safety protocols, investigate regulatory compliance, and provide a nuanced understanding of the safety ecosystem within the construction sector of Mymensingh City.

Quantitative data collection: A structured survey was conducted among a carefully selected sample of construction workers, contractors, supervisors, and managers. A statistical analysis of this quantitative data was performed to identify trends, correlations, and variations in OHSMS understanding and application.

Qualitative data collection: In-depth interviews were conducted with prominent industry experts, stakeholders, and representatives. These qualitative interviews provided valuable insights into the intricate aspects of OHSMS implementation, offering a deeper understanding of challenges faced, barriers encountered, and potential strategies for improvement. The qualitative data complemented the quantitative findings, enriching the overall analysis.

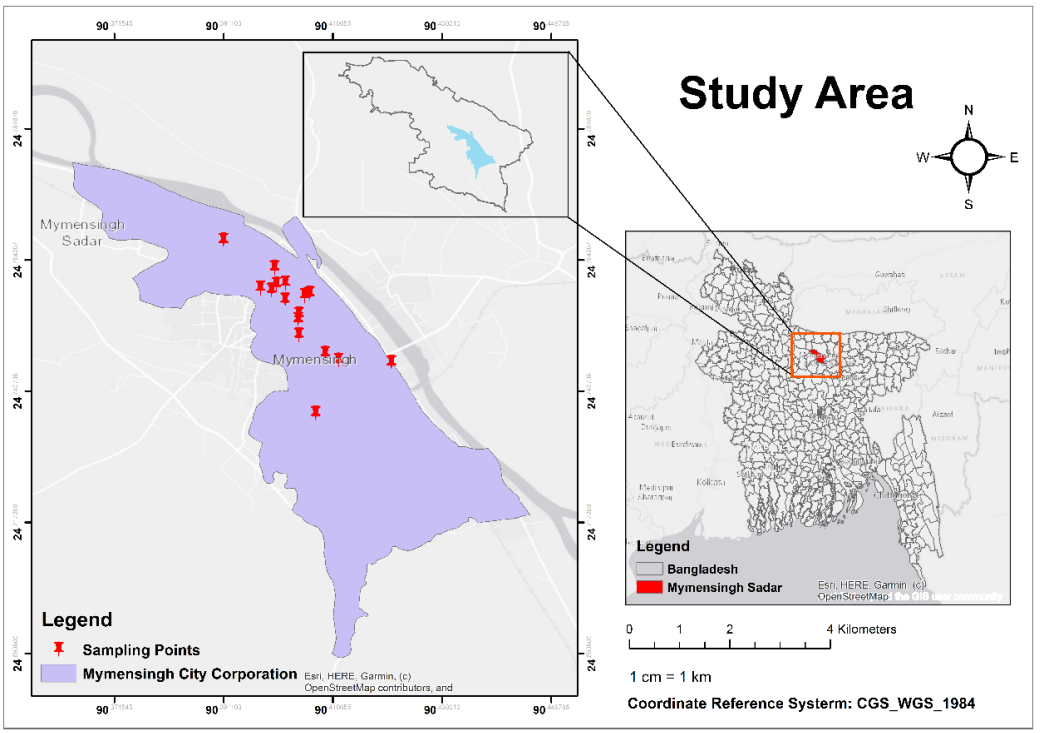

Fig.1. Map showing the study area.

Data analysis: Descriptive statistics, including frequencies and percentages, provided an overview of the data.Additionally, the Chi-square test, a statistical method for assessing the independence between categorical variables, was employed to perform hypothesis testing.The Chi-square test formula used in this study is as follows:

$$\chi^2 = \sum (O_i - E_i)^2/E_i$$

Where:

- χ^2 is the Chi-square test statistic,
- O_i represents the observed frequency in each category,
- E_i represents the expected frequency in each category.

This formula allowed us to evaluate the association between variables such as the provision of personal protective equipment and the frequency of usage, provision of safety training and frequency of accidents in the construction sites etc. providing valuable insights into the occupational health and safety practices within the construction industry of Mymensingh City.The qualitative data from interviews was thematically analyzed, revealing recurrent patterns, noteworthy insights, and diverse viewpoints.The integration of quantitative and qualitative data yielded a comprehensive perspective on OHSMS implementation. By triangulating insights from distinct data sources, the research ensured a robust and validated exploration of the subject matter.

Results and Discussion

The survey covered diverse aspects, including the provision of safety equipment, training, hazard observations, authority responsibility, and the prevalence of accidents and occupational hazards.

Basic amenities: Clean drinking water and sanitation are fundamental needs of workers and are paramount for ensuring safety of construction workers. Our survey of 120 respondents in Mymensingh City sheds light

on the provision of clean drinking water and proper sanitation facilities on construction sites (Figs. 2-3). A significant 92% of respondents reported the availability of clean drinking water, demonstrating a positive step towards promoting hydration and overall health among workers. Additionally, 38% confirmed the existence of proper sanitation facilities, contributing to the hygiene and comfort of the workforce.

Accidents and occupational hazards: The prevalence of accidents (Fig. 4) and exposure to occupational hazards (Fig. 5) within the construction industry constitutes a critical area of concern, profoundly influencing the health and safety of the workforce. Alarmingly, a significant proportion (82%) of respondents reported either witnessing or personally experiencing accidents on construction sites, signaling a pressing need for immediate and comprehensive safety interventions. Furthermore, respondents detailed exposure to a spectrum of occupational hazards, including falls, struck-by incidents, electrocution, trips and slips, fire and explosions, vehicle-related incidents, demolition hazards, ground collapse, chemical exposure, fatigue, cuts, repetitiveness, dust, and noise. This diverse array of risks emphasizes the multifaceted challenges faced by construction workers daily.

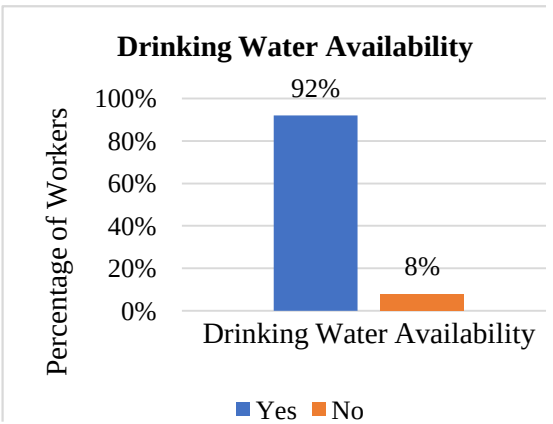

Fig. 2. Availability of drinking water

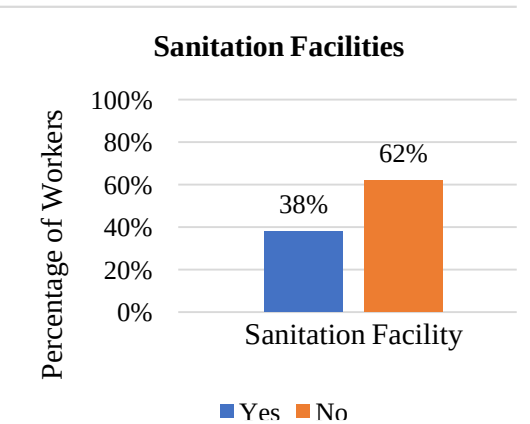

Fig. 3. Availability of sanitation

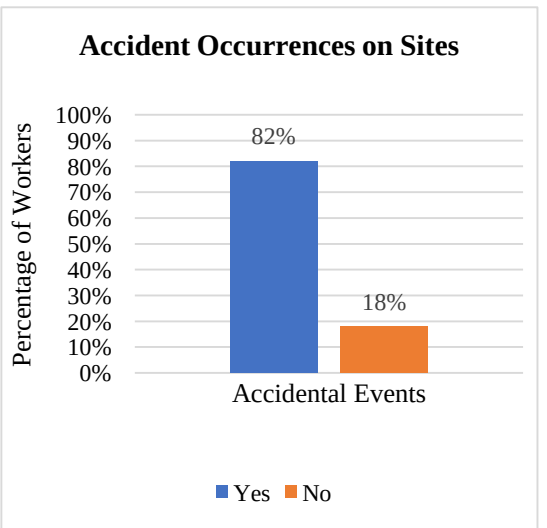

Fig. 4. Accidental occurrences on site

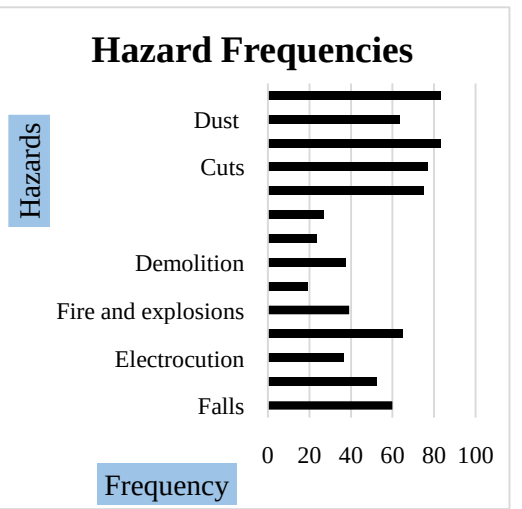

Fig. 5. Frequency of occupational hazards

Personal protective equipment (PPE) and first aid: The availability and utilization of PPE and immediate access to first aid resources play pivotal roles in ensuring the well-being of construction workers. About, 31% of respondents affirmed the presence of first aid kits on construction sites (Fig. 8), reflecting a proactive approach to addressing immediate medical needs. Our survey reveals a mixed scenario. While 34% of respondents reported receiving necessary PPE such as safety helmets, safety shoes, and safety glasses, a concerning 66% indicated a lack of such equipment (Fig. 7). This highlights a critical area for improvement in safeguarding workers against potential occupational hazards. Insights from 120 construction workers have unveiled nuanced patterns in the frequency of PPE usage (Fig. 8). While a segment of respondents diligently reported frequent and consistent usage (Always and Often), a notable percentage indicated a concerning trend of infrequent usage (Sometimes, Rarely, and Never). This gap underscores the importance of cultivating a steadfast culture of PPE usage among workers.

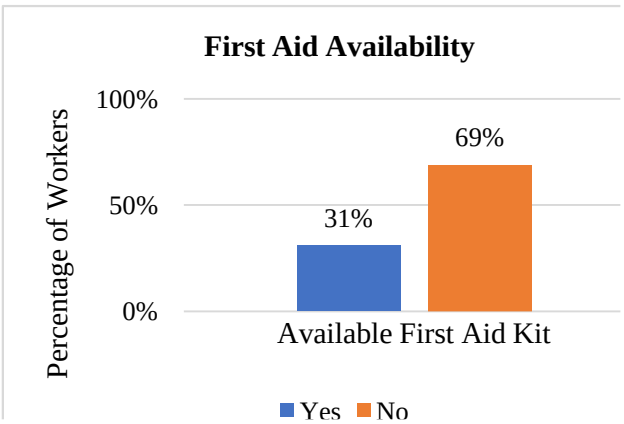

Fig. 6. First aid kit availability

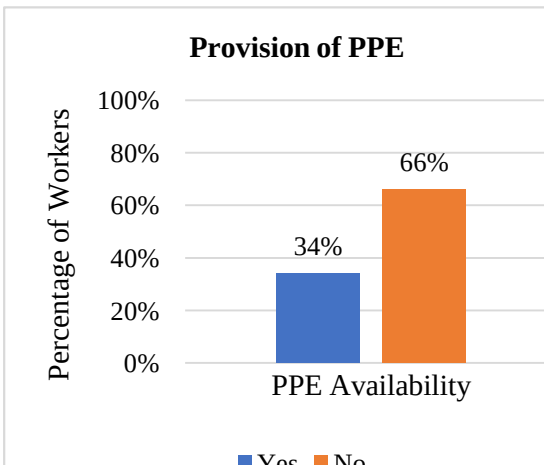

Fig. 7. Provision of PPE

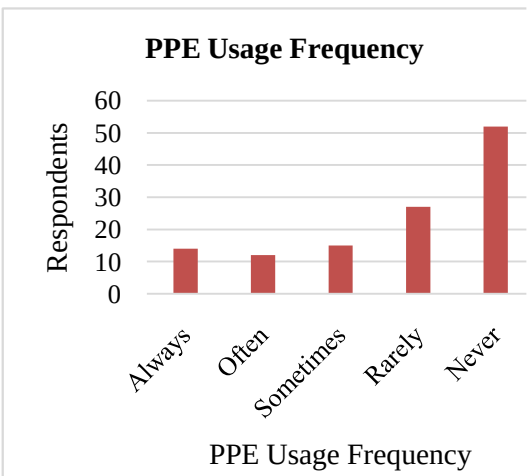

Fig. 8. Frequency of PPE uses

Workplace hazards and authority responsibility: The identification and mitigation of workplace hazards, coupled with a prompt and responsible approach from authorities during such incidents, are integral to fostering a safe working environment. However, the outcomes of our survey among 120 construction workers in Mymensingh City reveal noteworthy concerns in these critical domains. A

substantial 77% of respondents reported observing safety hazards in their workplace, signaling a need for a more robust safety management system to address and alleviate potential risks effectively (Fig. 9). Equally concerning is the perception among 70% of respondents that the authority does not adequately shoulder responsibility during workplace hazards (Fig. 10).

Safety equipment and training: The provision of necessary safety equipment and the adequacy of safety training are pivotal aspects for ensuring the occupational health and safety of workers within the construction industry. However, our survey of 120 construction workers in Mymensingh City illuminates notable deficiencies in these key areas. A substantial 80% of respondents conveyed they did not receive the necessary safety equipment before commencing their tasks, highlighting a critical gap in ensuring the workers' safety (Fig. 11). Additionally, an alarming 85% expressed dissatisfaction with the sufficiency of safety training provided before undertaking their roles (Fig. 12). These outcomes stress the immediate need for a reassessment and improvement of safety protocols in the construction sector, addressing disparities in the provision of safety equipment and the quality of training received by workers.

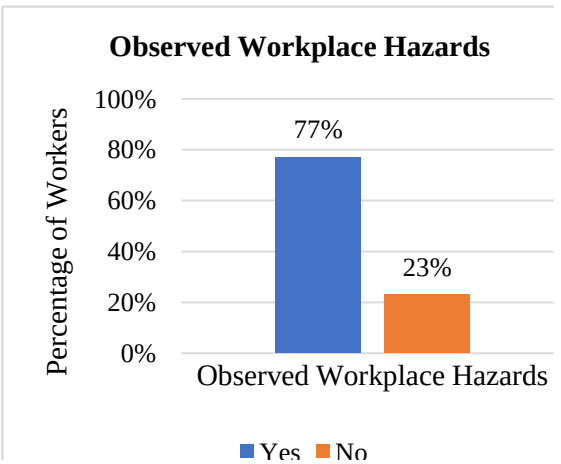

Fig. 9. Hazards in work place

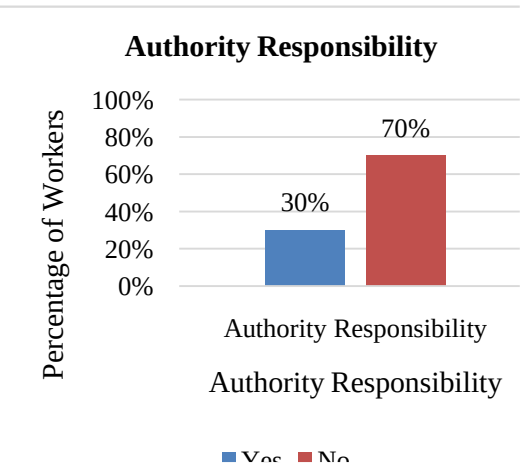

Fig. 10. Authority Responsibility

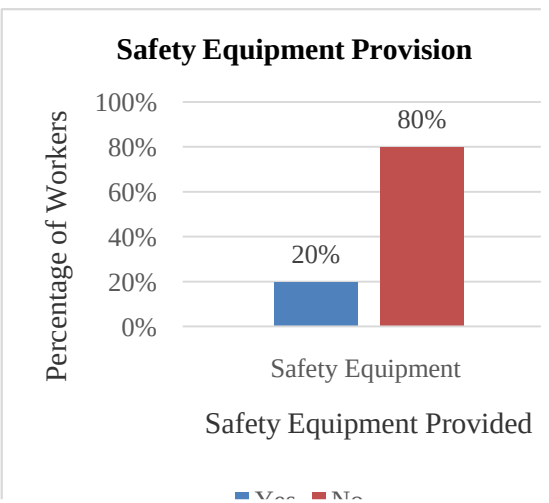

Fig. 11. Provision of safety equipment

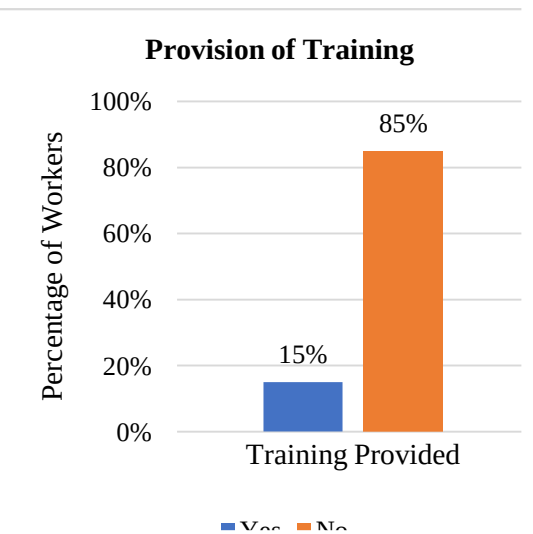

Fig. 12. Provision of training

Safety training and frequency of accidents (Chi-Square Analysis): We conducted a chi-square test to investigate the association between safety training adequacy and the frequency of accidents on construction sites. The observed and expected frequencies for the contingency table are as follows:

	Expected frequency of accident			Observed frequency of accident		
	Yes	No	Total	Yes	No	Total
Yes (Safety Training)	14.7	3.3	18	11	7	18
No (Safety Training)	84.11	18.89	103	87	15	102
Total	98	22	120	98	22	120

Calculation of Chi-Square Statistic:

$$\chi^2 = (11-14.7)^2/14.7 + (7-3.3)^2/3.3 + (87-84.1)^2/84.1 + (15-18.9)^2/18.9$$
$$= 0.931 + 4.148 + 0.1 + 0.804 = 5.983$$

Degrees of Freedom (df): df = (2-1)*(2-1) = 1, **Significance Level (α):** $\alpha = 0.05$

Critical Chi-Square Value at α = 0.05:

For df = 1, the critical chi-square value at $\alpha = 0.05$ is approximately 3.841.

The chi-square test results indicate a statistically significant association. There is evidence to suggest that inadequate safety training is associated with a higher frequency of accidents on construction sites among the surveyed workers.

Legislation and regulatory framework

In Bangladesh, construction sites frequently neglect safety precautions, leading to a significant number of workplace injuries. While there isn't a specific law exclusively addressing the safety of construction workers, statutes like the Bangladesh Labour Act, 2006 (BLA), Bangladesh National Building Code, 2006 (BNBC), and Bangladesh Labour Rules, 2015 (BLR) are important legal references (Khan *et al.*, 2022). To minimize workplace hazards related to construction machinery, chapter 6 of the BLA specifically prohibits the use of defective machinery and mandates regular monitoring and maintenance (Hossain and Ahmed, 2018). Rule 57 of the BLR takes it further by requiring employers to pay additional fees for the use of dangerous machinery and ensuring that workers are provided with sufficient safety equipment and proper training (MOLM, 2015). Section 78A of the BLA emphasizes that employers cannot make workers operate machinery without adequate safety equipment and training (MOLM, 2006). Addressing the need for basic safety kits, Section 89 of the BLA mandates that every workplace must have sufficient basic medical aid for workers, detailing the necessary components in Rule 76 (MOLM, 2006). Saumik, (2023) reveals a grim reality, with around 228 workplace-related injuries in 2022 alone. The primary reason behind this alarming number is that employers often ignore legal standards, compelling workers to operate in unsafe conditions. Complicating matters, the constant turnover of workers on construction sites poses an additional challenge to implementing effective safety measures. In the absence of a national monitoring system, the responsibility for safety often falls on building owners, private developers, or contractors. Even when companies enforce safety rules, the lack of safety awareness among workers and society at large becomes a significant barrier to effective safety implementation on construction sites.

Conclusion

The research reveals alarming gaps in the provision of safety equipment, training, and hazard management. The association between inadequate safety training and a higher frequency of accidents is a stark reminder of the industry's vulnerability. The regulatory framework, while existing, faces challenges in enforcement and awareness. The discrepancy between legal safeguards and ground reality necessitates a renewed focus on implementation, with a call for greater accountability from building owners, developers, and contractors.

Recommendations and practical measures for long-term sustainability: Ensuring the long-term sustainability of safety practices in the construction industry demands a strategic and multifaceted approach. Based on the findings of our comprehensive study on the OHSMS implementation in Mymensingh City, Bangladesh, the following recommendations and practical measures are planned:

- Robust occupational health and safety training programs are imperative for construction sites.
- Promotion of Safety Culture
- Investment in Safety Technology
- Worker Empowerment
- Community Engagement
- Public Awareness Campaigns

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