2026; 2-2(2026) | pp.87-93

Health and Medical Research Advances

E-ISSN: 3121-9411 |P-ISSN: 3121-942X

Volume 2, Issue 2 | Published: June, 2026
(An Academians Publishers of Research & Academic Resources)

Research Article

Analysis of Health, Safety, and Environment Status in Construction Workers, Dhaka Airport, Bangladesh

Wazid Hasan[1], Md. Mominul Haque[2]*
[1]*Department of Environmental Protection Technology, University of German University Bangladesh, Gazipur, Bangladesh*
[2]*Department of Environmental Science and Technology, University of German University Bangladesh, Gazipur, Bangladesh*

Abstract: The construction industry is recognized as one of the most hazardous occupational sectors with a high incidence of work-related injuries, illnesses, and fatalities. This study assesses the HSE status of construction workers engaged in development projects at Hazrat Shahjalal International Airport, Dhaka, Bangladesh. A cross-sectional mixed-method approach was employed, combining structured questionnaires, on-site safety observations, environmental measurements (noise, dust, and heat), and document reviews. The workforce is predominantly male (90.9%) and young, mostly aged 21-50 years. The health issues reported were musculoskeletal pain (38.6%), respiratory problems (27.3%), and headache/fatigue (18.2%). These conditions were mainly attributed to manual labor, prolonged exposure to dust, and insufficient rest periods. Only 60% of workers received formal safety training. PPE compliance is uneven; helmets and safety shoes are commonly used, but eye protection and reflective vests are underutilized. Cuts, bruises, and falls were the most frequently reported accidents. Half of the respondents reported no accidents, but underreporting cannot be ruled out. Noise levels in active zones often exceeded WHO limits, posing a risk of hearing loss. Dust levels (PM-2.5 and PM-10) in construction areas frequently exceeded DoE standards, exposing workers to respiratory hazards. Inconsistent housekeeping, poor scaffolding safety, and limited use of warning signage were noted. Safety management practices vary among contractors, indicating gaps in HSE enforcement. The study provides evidence- based recommendations to improve HSE performance, including targeted training programs, enhanced supervision, and stricter environmental control measures, thereby supporting safer, more sustainable airport construction operations in Bangladesh.

Keywords: *Construction safety; HSE guidelines & compliance; Airport construction; Occupational health.*

1. Introduction:

Health, safety, and environment (HSE), as a systematic and integrative management system developed in the 1980s, aims to assure safe production, reduce risks, prevent accidents, and achieve sustainable development [1]. Integrating occupational health risks, safety risks, and environmental risks in production processes, HSE has been gradually applied in high-risk industries, such as petroleum enterprises [2], paint manufacturing facilities [3], gas refineries [4], petrochemical plant, and oil and gas transportation plant [5].

As is known that construction work is a combination of various disciplines, both in terms of construction engineering and non-technical aspects, and includes elements of human resources. Factors that positively influence and are significant to the success of the project with its end goal are quality, cost, time, HSE environmental health and safety, and stakeholder satisfaction [6]. The implementation of this construction work must meet the provisions on engineering, occupational safety and health, labor protection, and local environmental management to ensure the orderly realization of construction work, with occupational safety and health costs from the smallest is for road construction projects, then bridge construction projects, drainage construction projects and the largest for building construction projects [6]. The percentage of HSE environmental health and safety costs ranges from 1.94% to 2.01% [7], 2.17% to 3.70% of the contract value [8], with the correlation criteria of the relationship between building work and work accidents being strong, sufficient, weak, or uncorrelated [9]. Cost component of HSE environmental health and safety. The incidence of occupational accidents and occupational diseases, especially at airports, does not only occur on a national [10], [11] or international scale. On a national scale,

Received: 08 May, 2026; Accepted: 20 June, 2026; Available Online: 29 June, 2026

Corresponding Author: Emeagha, Wazid Hasan

there is a trend of increasing cases until 2022. Risk management [12] is needed, which is the essence of HSE environmental health and safety for risk management to prevent work accidents or adverse events.

In Bangladesh, construction is a rapidly expanding sector due to large-scale infrastructure projects such as highways, bridges, and airport expansions. Hazrat Shahjalal International Airport (HSIA) in Dhaka has been undergoing extensive development, including runway extensions, new terminal buildings, and modernized airfield facilities. While such projects are essential for economic growth and improved air connectivity, they involve complex operations with significant health, safety, and environmental (HSE) challenges [9]. Construction safety risk management contains at least job descriptions, hazard identification, and determination of construction safety risk levels in construction work [14]. This study was conducted (i) To assess the health, safety, and environmental status of construction workers at Dhaka Airport and identify factors influencing compliance, (ii) Quantify PPE and safety procedure compliance rates among workers, (iii) Measure noise, dust, and heat levels in active work areas, (iv) Identify demographic, occupational, and organizational factors associated with non- compliance.

2. Methodology:

2.1 Study Area: This study investigates the current situation of health, safety, and environmental (HSE) practices among construction workers engaged in the Hazrat Shahjalal International Airport (HSIA) Expansion Project in Dhaka showed as figure 1.

Figure 1: Study Area (HSIA T3 Expansion Project)

2.2 Sample Design: The research adopted a mixed-methods approach, combining both quantitative (e.g., surveys, environmental measurements, statistical analysis) and qualitative (e.g., interviews, observations) techniques. This approach allowed for a comprehensive understanding of both measurable safety indicators and workers lived experiences.

2.3 Research Design: A descriptive and analytical cross-sectional research design was used.

2.3.1 Descriptive: To document the existing conditions of health, safety, and environmental compliance at the site.

2.3.2 Analytical: To identify patterns, correlations, and relationships between variables such as PPE usage and accident rates.

2.3.3 Cross-sectional: Data was collected during a fixed period (three months) to obtain a “snapshot “of HSE practices at the construction site.

2.4 Sample Size Determination

The sample size was calculated using **Yamane’s (1967) formula** for finite populations:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

- n = sample size
- N = total target population (~500 workers)

- e = margin of error (0.05 for 95% confidence level)

Table 01: Sampling Distribution

Worker Category	Estimated % of Workforce	Sample Size (n)
Skilled Labor	40%	88
Unskilled Labor	40%	88
Supervisory Staff & Engineers	15%	33
Safety & Environmental Officers	5%	11
Total	100%	220

In Table 01 indicates that the majority of respondents are from skilled and unskilled labor categories, each representing 40% of the workforce with a sample size of 88 respondents each. These groups form the largest portion of the sample, reflecting the dominant presence of operational workers in the industry. In addition, supervisory staff and engineers account for 15% of the respondents, with a sample size of 33. This group represents individuals responsible for supervision, technical oversight, and project management. A smaller proportion of the respondents, 5% (11 individuals), consists of safety and environmental officers, who are responsible for implementing safety regulations and environmental compliance at the workplace. Overall, the sample of 220 respondents provides representation from different workforce levels, with a strong emphasis on skilled and unskilled labor, ensuring that the perspectives of those directly involved in operational activities are well captured, while also including supervisory and safety professionals for a more comprehensive understanding of the workforce structure.

2.5 Data Collection Methods: The study used both primary and secondary data sources.

2.5.1 Primary Data Collection

- Demographics – age, gender, education, work experience.
- Safety Practices – PPE usage, safety training, accident history.
- Health Indicators – common illnesses, fatigue, injuries.
- Environmental Perceptions – noise, dust, waste management.

2.5.2 Secondary Data Collection

- Daily and monthly HSE compliance reports.
- National labor laws and environmental regulations.
- Previous research articles on construction site safety in Bangladesh.

2.6 Data Analysis

Quantitative Data: Entered into SPSS v26 for analysis; **Descriptive statistics:** Mean, standard deviation, frequencies, and percentages; **Inferential statistics:** Chi-square tests to examine relationships (e.g., between safety training and accident rates); **Qualitative Data:** Thematic analysis of interview responses to identify recurring safety concerns and environmental challenges; **Environmental Data:** Compared against Bangladesh Department of Environment (DoE) standards and WHO guidelines.

3. Results and Discussion:

3.1 Demographic Characteristics of Respondents

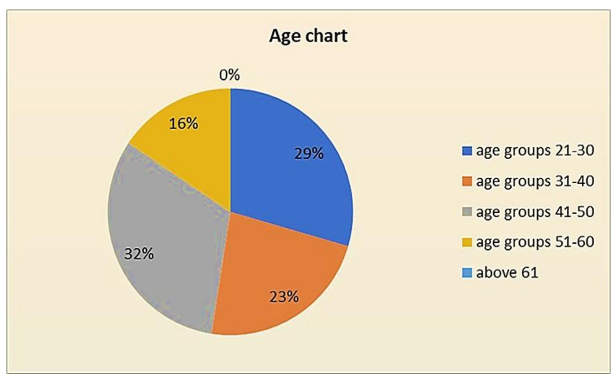

Figure 2: Age Distribution of Respondents

In Figure 2 represent, Respondents are distributed across five age groups: 21–30, 31–40, 41–50, 51–60, and above 61 years. The largest group of respondents (32%) falls within the 41–50 years age category. The second largest group (29%) is in the 21–30 years age range. About 23% of respondents are aged 31–40 years. A smaller proportion, 16%, belongs to the 51–60 years age group. None of the respondents (0%) are above 61 years. Overall, the data indicates that the majority of respondents are between 21 and 50 years old, suggesting that the survey mainly captured middle-aged and young adult participants, while older individuals above 61 years were not represented in the sample. Discussion:

3.2 Health Status of Workers

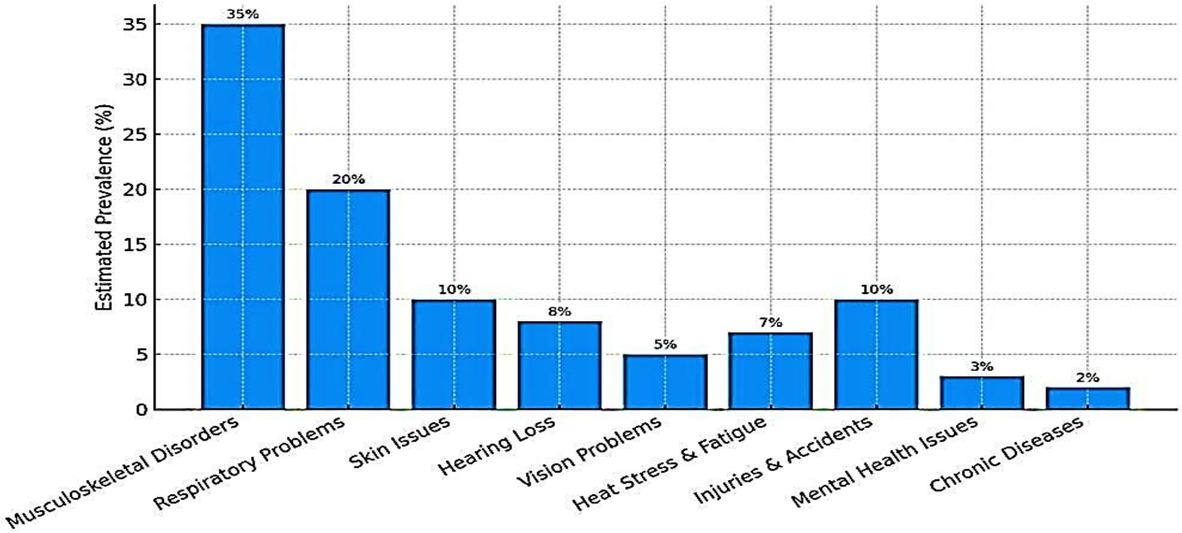

Figure 3: Health Status of Workers

In Figure 3 represent that many workers experience various occupational health issues. Musculoskeletal disorders are the most common, affecting 35% of workers, mainly due to heavy physical work, repetitive movements, and poor posture. Respiratory problems are the second most prevalent at 20%, often caused by exposure to dust, fumes, and poor workplace ventilation. Other health issues include skin problems (10%) and mental health issues (10%), which may result from chemical exposure and work-related stress. Hearing loss (8%) and heat stress and fatigue (7%) are also notable problems, particularly in noisy or high-temperature work environments. Vision problems (5%) and injuries and accidents (3%) occur less frequently but still impact workers' wellbeing. Chronic diseases (2%) represent the lowest proportion among the listed conditions.

3.3 Safety Practices

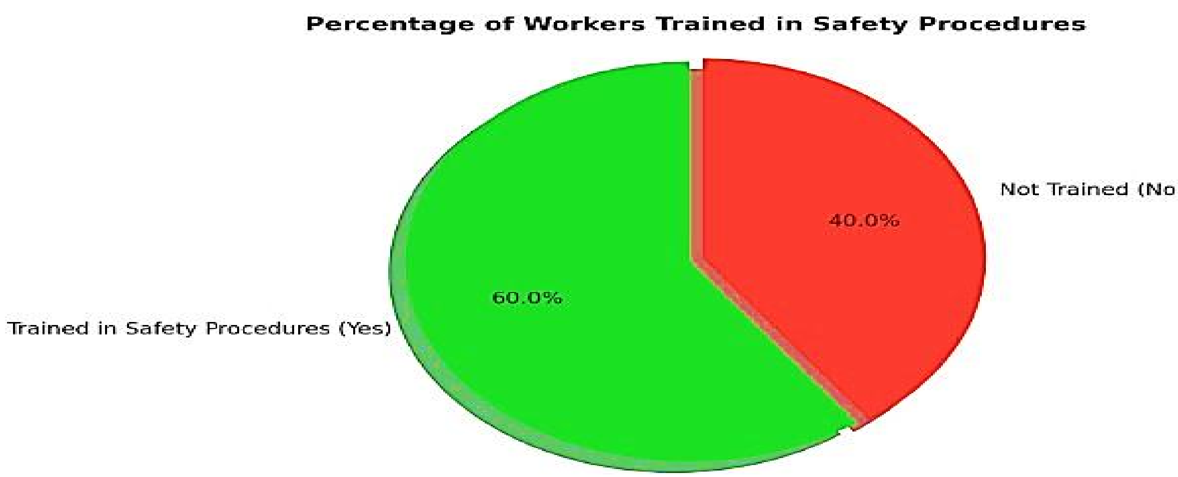

Figure 4: Percentage of Workers Trained in Safety Procedures

In Figure 4 represent that More than half of the workers have received safety training, which is a positive sign for workplace safety. A large portion (40%) of workers are still not trained, which could increase the risk of: Workplace accidents, Unsafe handling of equipment, Poor emergency response. The organization shows moderate safety practice implementation. However, training coverage is not yet sufficient to ensure full workplace safety.

3.4 PPE Usage

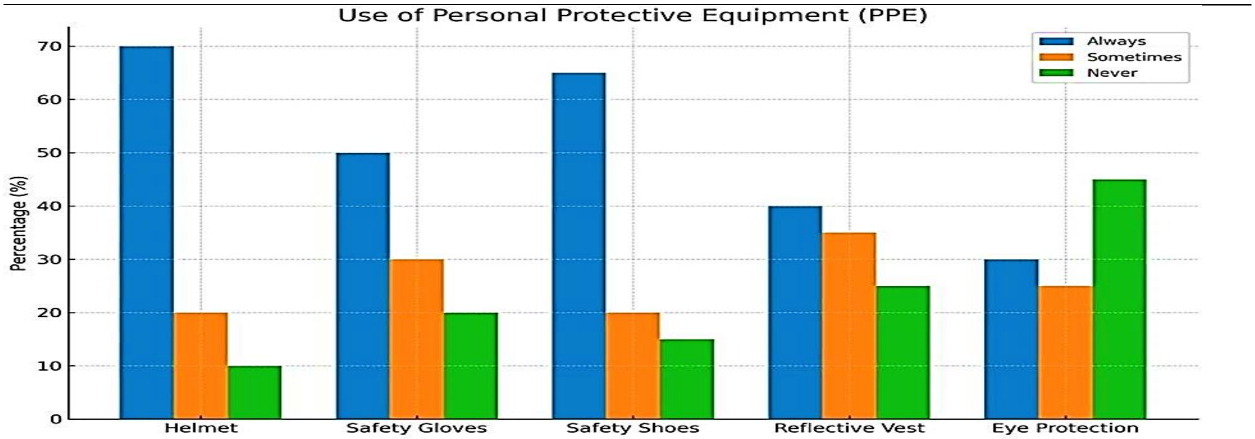

Figure 5: Use of Personal Protective Equipment

In figure 5 illustrates the overall usage of Personal Protective Equipment (PPE) among workers, categorized into Always, Sometimes, and Never for five types of protective equipment. Overall, helmets and safety shoes show the highest compliance, with 70% of workers always wearing helmets and 65% always using safety shoes. This indicates that workers generally recognize the importance of protecting the head and feet in the workplace. The use of safety gloves is moderate, with 50% always using them, while 30% sometimes use them and 20% never use them, suggesting that hand protection is not consistently practiced by all workers. For reflective vests, only 40% of workers always wear them, while 35% sometimes use them and 25% never use them. This shows moderate compliance but highlights a need for improvement, especially in environments where visibility is critical for safety. The lowest compliance is observed in eye protection, where only 30% always use it, 25% sometimes use it, and 45% never use it. This suggests a significant gap in awareness or enforcement of eye safety measures.

3.5 Accidents and Injury Records

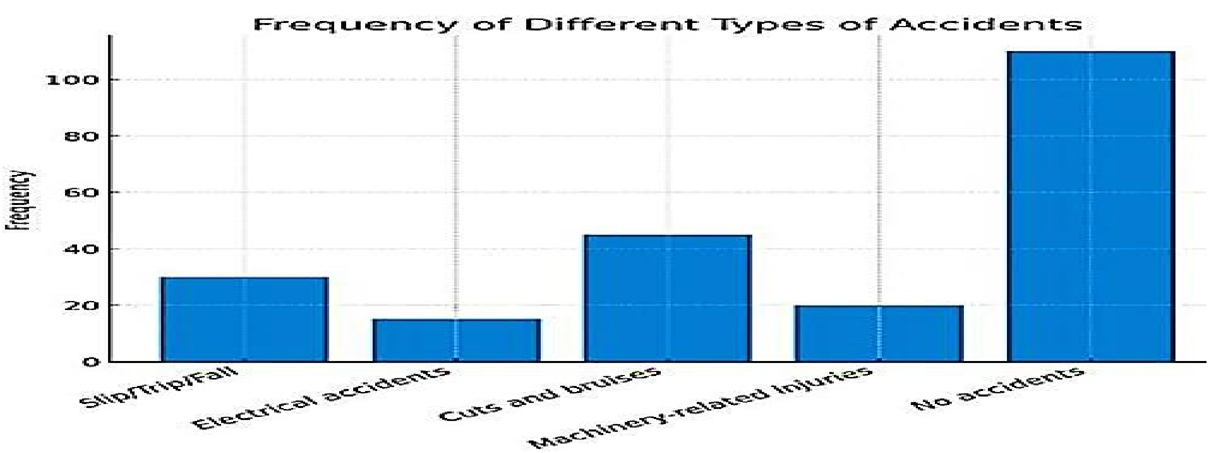

Figure 6: Accidents and Injury Records

In figure 6a, represents the distribution of workplace accidents and injury records among workers. The results show that 50% of workers reported no accidents, indicating that half of the workforce experienced a safe working environment without incidents. Among the reported accidents, cuts and bruises were the most common, accounting for 20.5% of cases. These injuries are typically minor but suggest the need for improved handling practices and protective measures. Slip, trip, and fall accidents represented 13.6% of the incidents, indicating potential issues with workplace conditions such as slippery surfaces, uneven floors, or poor housekeeping. Machinery-related injuries accounted for 9.1%, which highlights the importance of proper machine operation training and safety precautions when working with equipment. The least common type of accident was electrical accidents, representing 6.8% of the total cases. Although relatively low, electrical incidents can be highly dangerous and require strict safety controls.

3.6 Environmental Conditions

3.6.1 Noise Levels

Table 2: Noise Level Measurements (dB)

Site Zone	Measured dB	WHO Limit (dB)	Compliance
Runway Construction	92	85	Non-compliant
Terminal Building	88	85	Non-compliant
Utility & Services Area	80	85	Compliant

The table 2 shows the measured noise levels in three different site zones compared to the recommended WHO noise limit of 85 dB. The Runway Construction area recorded a noise level of 92 dB, which is above the WHO limit, making it non-compliant. This high noise level is likely caused by heavy construction equipment and machinery operating in the area. Similarly, the Terminal Building area recorded 88 dB, which also exceeds the recommended limit of 85 dB. As a result, this zone is also non-compliant, indicating that workers in this area may be exposed to potentially harmful noise levels. In contrast, the Utility and Services Area recorded 80 dB, which is below the WHO limit, making it compliant with the recommended noise standards. This suggests that noise exposure in this zone is within safe limits.

3.6.2 Air Quality

Table 3: Dust Level Measurements

Zone	PM-2.5 (µg/m³)	PM-10 (µg/m³)	Standard Limit (µg/m³)
Runway Extension	120	180	50 (PM2.5) /100 (PM10)
Terminal Construction	90	140	50 / 100
Storage & Utility Area	45	80	50 / 100

The table 3 shows the measured concentrations of particulate matter (PM2.5 and PM10) across different zones compared with the standard limits of 50 µg/m³ for PM2.5 and 100 µg/m³ for PM10. The Runway Extension area recorded the highest levels of particulate matter, with PM2.5 at 120 µg/m³ and PM10 at 180 µg/m³, both of which significantly exceed the recommended standard limits. This indicates poor air quality in this zone, likely due to intensive construction activities and dust generation. Similarly, the Terminal Construction area also exceeded the standard limits, with PM2.5 measured at 90 µg/m³ and PM10 at 140 µg/m³. These results suggest that construction operations in this area contribute to elevated dust levels in the environment. In contrast, the Storage and Utility Area recorded PM2.5 levels of 45 µg/m³ and PM10 levels of 80 µg/m³, both of which are within the acceptable standard limits. This indicates that air quality in this zone is comparatively better and compliant with environmental standards.

4. Conclusion:

This research critically evaluated the existing health, safety, and environmental (HSE) conditions of construction workers engaged in the Hazrat Shahjalal International Airport (HSIA) expansion project. The findings revealed that although partial compliance with HSE standards exists, the overall safety culture remains underdeveloped. Workers often face physical, ergonomic, and environmental risks due to limited training, inconsistent PPE usage, and inadequate supervision. Environmental monitoring results showed that both noise and particulate matter ($PM_{2.5}$ and PM_{10}) levels frequently exceed acceptable standards, which can lead to long-term respiratory and auditory health impacts. Moreover, the underreporting of minor accidents and limited access to medical surveillance indicate a lack of systematic safety management. The study highlights that improving HSE performance requires more than just policy enforcement - it demands behavioral change, management accountability, and continuous worker engagement. Integrating safety awareness, environmental control, and effective communication among all stakeholders can significantly reduce accidents and improve worker well-being. In conclusion, the successful implementation of a comprehensive HSE management framework - supported by strong leadership commitment, regular monitoring, and a participatory safety culture - can transform Bangladesh’s construction sector into a safer and more sustainable industry.

Acknowledgement

I would like to express my deepest appreciation to my research supervisor for their invaluable guidance, constructive feedback, and continuous support throughout the course of this research. Their expertise and encouragement have been essential in completing this research successfully.

Author Declaration:

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

Wazid Hasan contributed to data collection, field surveys, data analysis, and preparation of the initial draft of the manuscript, data collection, data organization, interpretation of results, and contributed to the preparation and editing of the manuscript. ***Md. Mominul Haque*** provided overall research supervision, conceptual guidance, methodological support, and critical review and revision of the final manuscript. All authors read and approved the final version of the manuscript.

Data Availability Statement

The data supporting the findings of this study are available within the article and its supplementary materials. Additional data are available from the corresponding author upon reasonable request.

Ethical Approval

The authors certify that this manuscript is original, has not been previously published, and is not under consideration for publication elsewhere.

Conflict of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

References:

Norway Petroleum Safety Authority: "Regulations relating to health, safety and the environment in the petroleum activities and at certain onshore facilities", 2016.

Yan, L., Zhang, L., Liang, W., Li, W., & Du, M.: "Key factors identification and dynamic fuzzy assessment of health, safety and environment performance in petroleum enterprises". *Journal of Safety Science*, 2017, Vol 94, pp 77–84.

Chang, J. I., & Liang, C. L.: "Performance evaluation of process safety management systems of paint manufacturing facilities*", Journal of Loss Prevention in the Process Industries*, 2009, Vol 22(4), pp 398–400.

Azadeh, A., Saberi, M., & Saberi, Z.: "Performance optimization of organizations considering economic resilience factors under uncertainty: A case study of a petrochemical plant", *Journal of Cleaner Production,* 2011, Vol 231, pp 1526–1541.

Kang, J., Zhang, J., & Gao, J.: "Improving performance evaluation of health, safety and environment management system by combining fuzzy cognitive maps and relative degree analysis", *Journal of Safety Science,* 2016, Vol 87, pp 92–100.

Marleno, R., Surjokusumo, S., Oetomo, W., Setiawan, M. I., & Abdullah, D.: "The influence of stakeholder factors affecting the success of construction projects in Indonesia", *Journal of Physics: Conference Series,* 2018, Vol 1114(1), pp 012135.

Jatrawan, I. W. G., Hermawati, P., & Santiana, I. M. A.: "Analisis biaya K3 berdasarkan risiko kecelakaan kerja pada proyek gedung parkir motor Bandara I Gusti Ngurah Rai", *Journal of Proceedings,* 2021, Vol 9(1), pp 108–117.

Calvin, B., & Johan, J.: "Analisis risiko dan pencegahannya pada pelaksanaan proyek pembangunan gedung bertingkat tinggi dari sisi kontraktor" *Journal Muara Sains, Teknologi, Kedokteran dan Ilmu Kesehatan,* 2020, Vol 4(1), pp 97–108.

Latief, Y., Machfudiyanto, R. A., & Devi, A.: "Analysis of relation between safety cost and OHS performance in building construction to improve safety performance", *International Journal of Civil & Environmental Engineering*, 201, Vol 17(5), pp 10–15.

Faqih, N., & Prabowo, A. B.: "Analisis penerapan keselamatan kerja pada proyek konstruksi pengembangan fly over Bandara Internasional Sultan Hasanuddin di Makassar". *Journal of Economic, Management, Accounting and Technology,* 2023, Vol 6(1), pp 151-155.

Dharma, I. W. W., Ardika, I. N., & Yuni, N. K. S. E.: "Analisis proporsi biaya keselamatan dan kesehatan kerja (K3) konstruksi pada pembangunan Liga Tennis Sanur". *Journal of Proceedings,* 2021, Vol 9(1), pp 172–180.

Akbar, R. C., Muktiaji, H. R., & Prasetyo, A. H.: "Asesmen risiko PT Empat Pilar Anugerah Sejahtera berbasis ISO 31000: 2018". Journal of Emerging Business Management and Entrepreneurship Studies, 2022, vol 2(2), pp 128–145.