range. These results collectively suggest that the survey or questionnaire effectively captures and measures the different hazards, with varying degrees of internal consistency across the distinct hazard categories.

Table 2: Coefficient of Cronbach's Alpha.

Different Hazards	Cronbach's Alpha
Physical hazards	0.858
Chemical hazards	0.798
Electrical hazards	0.793
Physiological hazards	0.793
Psychological hazards	0.784

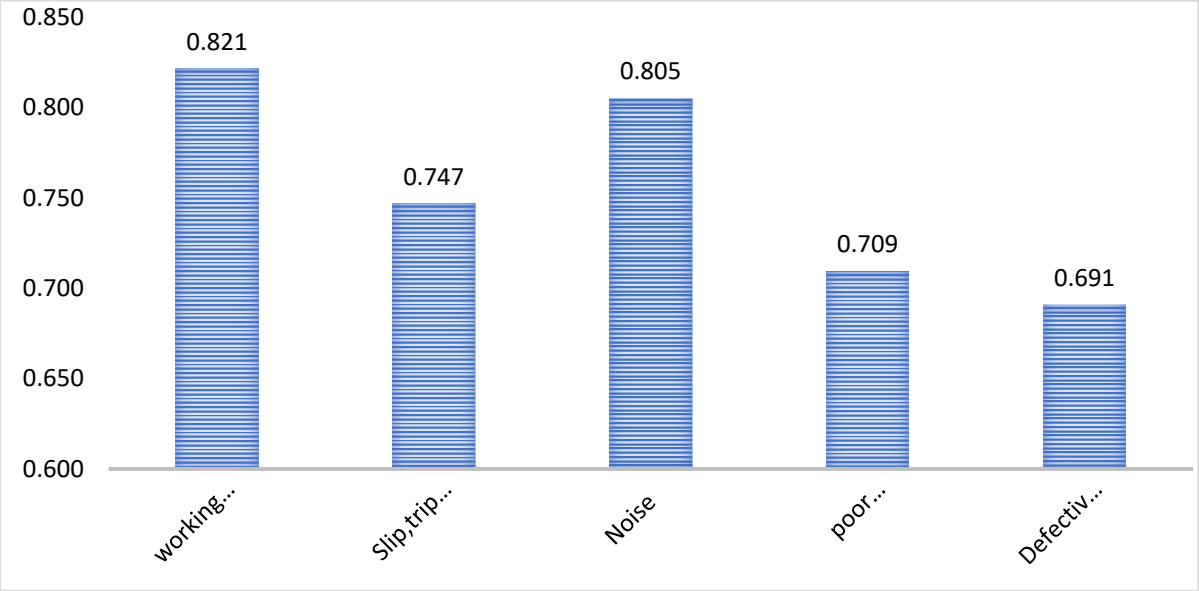
Source: Field Survey, 2023

Identification of Occupational Hazards in Construction Projects

Various hazards were surveyed among construction project stakeholders, including engineers, developers, and representatives from contractors and sub-contractors. The collected data underwent analysis using statistical tools such as SPSS and RII. This method allowed for a comprehensive examination of diverse hazard types and provided valuable insights into the risk perceptions within the construction industry.

Physical Hazards in Construction Projects

Figure 1 illustrates the predominant physical hazards in construction projects based on responses from a questionnaire survey. Working at height emerges as the foremost concern, garnering the highest RII value of 0.821, as indicated by respondents. Following closely, noise ranks as the second major hazard with an RII of 0.805, while slip trips and low falls secure the third position at 0.747. Poor lighting and ventilation, along with defective equipment, machines, and tools, claim the fourth and fifth spots, respectively, with RII values of 0.709 and 0.691. KII, which emphasizes the significance of addressing hazards related to working at height in construction projects, further supports this consensus.



Source: Field Survey, 2023

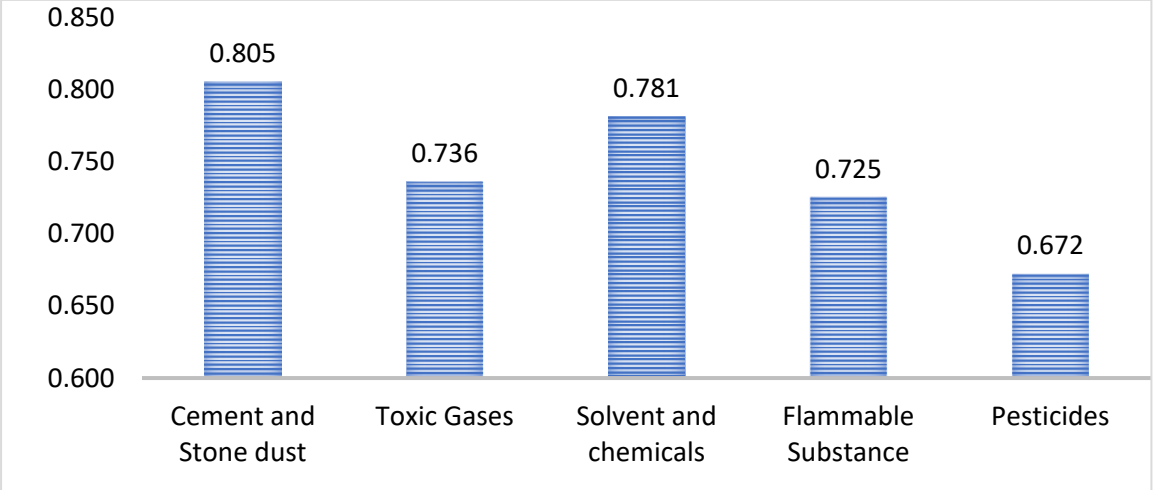
Figure 1: Source of physical hazards in construction projects.

Working at height was observed as the major physical hazard, as there was different work that should be performed in building construction work, such as installing steel frames, concrete pouring, window

installation, and facade work, often requiring workers to operate on scaffolds, platforms, and narrow ledges. The potential for slips, trips, and missteps is heightened, and the consequences of falling from significant heights are far more severe compared to ground-level accidents.

Chemical Hazards in Construction Projects

In Figure 2, respondents in a construction project questionnaire survey highlight cement and stone dust as primary chemical hazards, securing the highest RII at 0.805. Toxic gases come in third on the site (RII 0.736), after solvents and chemicals (RII 0.781). Flammable substances and pesticides are placed fourth and fifth, with RII values of 0.725 and 0.672, respectively. Corroborated by KII, the findings underscore cement and stone dust as the main chemical hazards, emphasizing the need for robust safety measures to address these specific risks in construction projects.



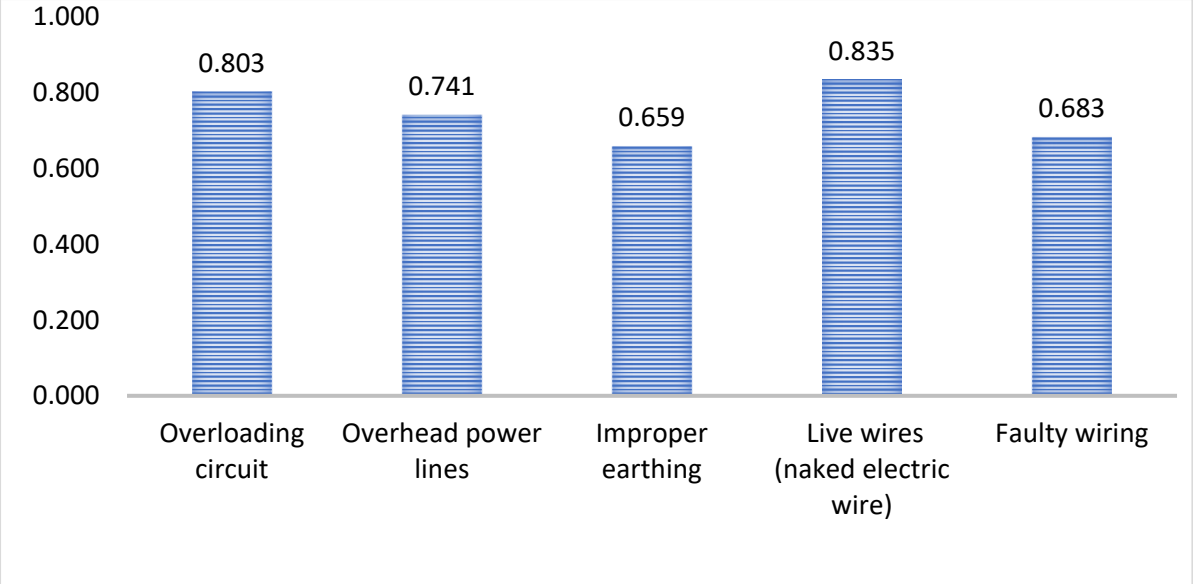
Source: Field Survey, 2023

Figure 2: Source of chemical hazards in construction projects

Dust and chemicals emitted from cement and stone pose health risks to both workers and nearby individuals. These substances may contain harmful elements, leading to lung issues, skin-related diseases, eye irritation, and other health concerns. Despite the use of ready-mix concrete with a hydraulic concrete distributor boom for extensive concreting, manual mixing of cement is noted for specific tasks like mortar, tiles, marble, and stone work. Recognized as significant chemical hazards on construction sites, cement and stone dust necessitate precautionary measures such as wearing masks and implementing proper handling systems to mitigate dust exposure and safeguard the health of workers and those in the construction site vicinity.

Electrical Hazards in Construction Projects

In Figure 3, respondents in a construction project questionnaire survey identify live wire (naked electric wire) as the foremost electrical hazard, holding the highest RII at 0.835. Overloading circuits come in second place (RII 0.803), with overhead powerlines coming in third (RII 0.747). Additionally, faulty wiring and improper earthing are noted as the fourth and fifth electrical hazards, with RII values of 0.683 and 0.659, respectively. The findings, which are consistent with KII, highlight live wire as the main electrical hazard and emphasize the need for increased attention to electrical safety measures in construction projects.



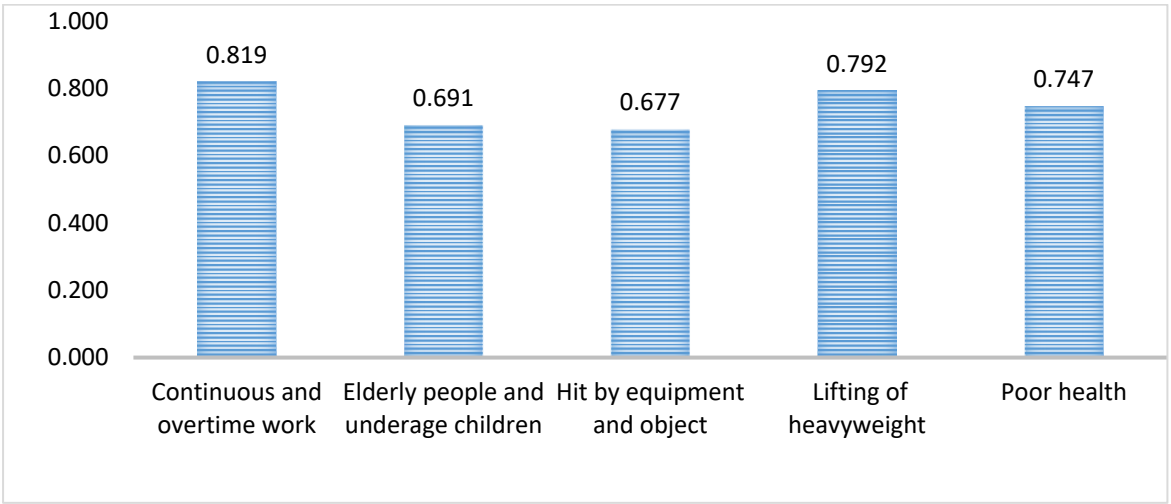
Source: Field Survey, 2023

Figure 3: Source of electrical hazard in construction projects.

The complexity of high-rise construction projects involves a lot of electrical work, including wiring for lighting, power outlets, and equipment. This abundance of electrical installations increases the likelihood of exposed live wires. When a worker accidentally comes into contact with a live wire, electricity can flow through their body, causing severe injuries or even fatalities. Live wires can easily come into contact with water or wet surfaces, such as rain or puddles, on construction sites. When electricity meets water, it can create a dangerous situation where the water acts as a conductor, increasing the likelihood of electrical accidents.

Physiological Hazards in Construction Projects

In Figure 4, respondents in a construction project questionnaire survey highlight continuous and overtime work as the predominant physiological hazard, with the highest RII at 0.819. Poor health is third on the site (RII 0.747), lifting heavy weights is second (RII 0.792). The survey places hitting by equipment and objects as the least dangerous physiological hazard (RII 0.677), while elderly people and children under the age of 18 rank fourth (RII 0.691). The findings, which have the support of KII, emphasize the importance of addressing continuous and overtime work for the wellbeing of construction workers.



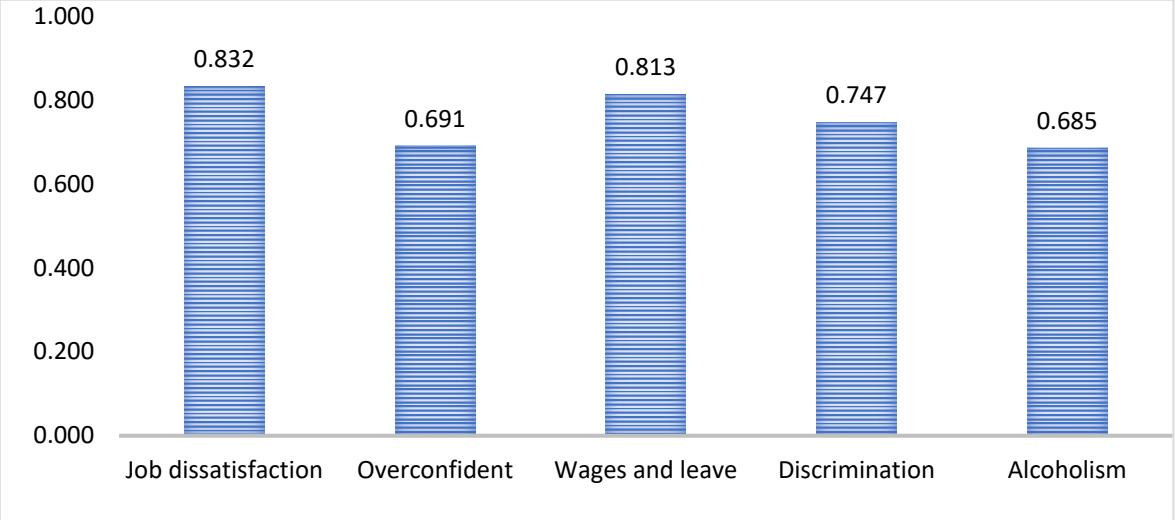
Source: Field Survey, 2023

Figure 4: Source of physiological hazard in construction projects

The demanding nature of construction work, characterized by extended hours and overtime, leads to mental and physical exhaustion, causing fatigue and muscle strain. Recognized as a major physiological hazard, continuous and overtime work poses serious health risks to construction workers, elevating the potential for accidents and injuries. To safeguard workers' well-being, construction companies must strategically manage work schedules and ensure sufficient rest periods, mitigating the adverse effects associated with prolonged and strenuous work conditions.

Psychological Hazards in Construction Projects

Figure 5 illustrates the collective views of respondents on the sources of psychological hazards in construction projects, derived from a questionnaire survey. Job dissatisfaction emerges as a significant concern, ranking highest with an RII value of 0.832. Wages and leaves follow closely as the second psychological hazard at 0.813, while discrimination on-site ranks third with an RII value of 0.747. The survey, corroborated by Key Informant Interviews, identifies job dissatisfaction as the primary psychological hazard in construction projects.



Source: Field Survey, 2023

Figure 5: Source of psychological hazard in construction projects.

The Occupational Safety and Health Administration (OSHA) of the United States classifies falls, object strikes, electrocutions, and caught-in/caught-between incidents as major hazards in construction. Notably, slip, trip, and fall occurrences emerge as the primary contributors to fatalities in the construction industry (Satapathy, 2022). Rani *et al*. (2022) emphasize crucial factors influencing the well-being of construction site workers, encompassing aspects such as salary packages, working hours, workers' welfare, working environment, monitoring, communication, and collaborative project leadership. In high-rise building construction projects, Raamkumar and Indhu (2022) highlight significant risk factors, including physical aspects of work, a safe working environment, safety behavior, and protective measures. Additionally, a study by Samanta and Gochhayat (2023) in India identifies significant safety issues affecting construction sites. These challenges include inadequate communication, non-use of personal protective equipment, incorrect work postures, a lack of training, psychological stress, an absence of safety orientation and culture, and issues related to compliance with legislation. Enhancing the health and safety of construction workers necessitates the crucial implementation of effective training and awareness programs on construction sites (Giri, 2020).

Construction jobs entail demanding physical labor, exposure to harsh weather, and safety risks, causing both physical and mental stress. The temporary nature of many roles adds uncertainty about employment, benefits, and career growth. These challenges contribute to job dissatisfaction, identified as a significant hazard. Addressing this issue is crucial for enhancing working conditions and safeguarding the overall well-being of construction workers.

Conclusion

Occupational hazards encompass potential sources, conditions, or situations at a workplace that pose risks to employees' well-being. Hazard identification involves recognizing potential dangers at a job site, anticipating possible harm, and implementing measures to enhance safety for all involved in construction. Research focuses on high-rise building construction hazards, aiming to understand and address occupational risks for worker health and safety. To achieve the research objective, primary data were gathered through questionnaire surveys involving engineers, supervisors, sub-contractors, and workers. KII, along with project managers and on-site field observations, assessed risks. Additionally, secondary data from journals, reports, and construction site documents, obtained from various sources, supplemented the comprehensive analysis of occupational hazards in high-rise building projects.

This study employed a comprehensive methodology to identify and assess potential hazards during high-rise building construction in Pokhara Metropolitan City, Nepal. Risk assessment was conducted by evaluating the likelihood and severity of identified hazards using SPSS for data analysis. In the study involving 75 respondents, key occupational hazards in high-rise building construction were identified through the RII. Working at height was the predominant physical hazard (RII 0.821), while chemical risks were notable with cement and stone dust (RII 0.805). Live wires (RII 0.835), physiological risks from continuous and overtime work (RII 0.819), and psychological issues related to job dissatisfaction (RII 0.832) were the three main electrical hazards. These insights underscore the multifaceted nature of occupational risks in construction. The findings emphasize the importance of recognizing and addressing occupational hazards, offering insights for preventive measures. The study advocates for the implementation of strategies to reduce or eliminate identified hazards, promoting a safer workplace environment for construction workers. By prioritizing preventive measures, the construction sector can mitigate potential accidents, enhance worker well-being, and contribute to an overall healthier and safer work environment in high-rise building projects.

Acknowledgment

The authors express gratefulness to the School of Engineering, Pokhara University, Nepal, for their invaluable support and encouragement during the research endeavor.

Conflict of Interest

The authors declare no financial conflicts or personal relationships influencing the reported work, ensuring research integrity and unbiased findings in this paper.

References

Ajith, S., Sivapragasam, C., & Arumugaprabu, V. (2019). Quantification of risk and assessment of key safety factors for safe workplace in Indian building construction sites. *Asian Journal of Civil Engineering*, *20*(5), 693-702. https://doi.org/10.1007/s42107-019-00136-y

Balkis, A., Janani, M. S., & Gandhi, D. A. G. M. (2021). A Study on critical risk assessment and safety management for a high-rise building. *International Research Journal of Engineering & Technology (IRJET)*, *8*(4), 324-331.

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*(11), 4110. https://doi.org/10.3390/ijerph17114110

Durdyev, S., & Ismail, S. (2012). Role of the construction industry in the economic development of Turkmenistan. *Changes*, *64*(0).

Giri, O. P. (2020). Factors causing health and safety hazards at construction sites. *Technical Journal*, *2*(1), 68-74.

Giri, O. P. (2023). Improvement measures for safety and health on construction sites. *World Journal of Engineering Research and Technology*, *9*(8), 215-223.
Giri, O. P., Poudel, K., & Shrestha, S. K. (2023). Safety management in public building construction: A case study of Pokhara Valley. *Journal of Business and Management*, *7*(01), 90-101. https://doi.org/10.3126/jbm.v7i01.54548 https://doi.org/10.1016/j.matpr.2021.05.707
Kayastha, R. (2023). Assessment of Factors Affecting Fall Accidents Among Construction Workers. https://hdl.handle.net/10877/17100
Koranyi, I., Jonsson, J., Rönnblad, T., Stockfelt, L., & Bodin, T. (2018). Precarious employment and occupational accidents and injuries a systematic review. *Scandinavian Journal of Work, Environment & Health*, *44*(4), 341-350. https://www.jstor.org/stable/26567015
Lari, M. (2024). A longitudinal study on the impact of occupational health and safety practices on employee productivity. *Safety Science*, *170*, 106374. https://doi.org/10.1016/j.ssci.2023.106374
Manzoor, B., Othman, I., & Manzoor, M. (2021). Evaluating the critical safety factors causing accidents in high-rise building projects. *Ain Shams Engineering Journal*, *12*(3), 2485-2492. https://doi.org/10.1016/j.asej.2020.11.025
Manzoor, B., Othman, I., & Waheed, A. (2022). Accidental safety factors and prevention techniques for high-rise building projects–A review. *Ain Shams Engineering Journal*, *13*(5), 101723. https://doi.org/10.1016/j.asej.2022.101723
Memon, M. H., Abas, N. H., & Sohu, S. (2023, June). Ranking the critical causes of accidents in construction projects of Sindh: Perspective of safety professionals. In *IOP Conference Series: Earth and Environmental Science*, *1205*(1), 012035. IOP Publishing. https://doi.org/10.1088/1755-1315/1205/1/012035
Mishra, K., & Aithal, P. S. (2021). Operational risk analysis of common activities of building construction projects. *Turkish Journal of Computer and Mathematics Education*, *12*(11), 6507-6524. https://ssrn.com/abstract=3857173
Mouras, F., & Badri, A. (2020). Survey of the risk management methods, techniques, and software used most frequently in occupational health and safety. *International Journal of Safety and Security Engineering*, *10*(2), 149-160. https://doi.org/10.18280/ijsse.100201
Osei-Asibey, D., Ayarkwa, J., Acheampong, A., Adinyira, E., & Amoah, P. (2023). Impacts of accidents and hazards on the Ghanaian construction industry. *International Journal of Construction Management*, *23*(4), 708-717. https://doi.org/10.1080/15623599.2021.1920161
Raamkumar, J. S., & Indhu, B. (2022). A Study on the Assessment of Risk Management in High-Rise Buildings. In *Advances in Construction Management: Select Proceedings of ACMM 2021* (pp. 47-56). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-16-5839-6_5
Rani, H. A., Radzi, A. R., Alias, A. R., Almutairi, S., & Rahman, R. A. (2022). Factors affecting workplace well-being: Building construction projects. *Buildings*, *12*(7), 910. https://doi.org/10.3390/buildings12070910
Rimal, B., Baral, H., Stork, N. E., Paudyal, K., & Rijal, S. (2015). Growing city and rapid land use transition: Assessing multiple hazards and risks in the Pokhara Valley, Nepal. *Land*, *4*(4), 957-978. https://doi.org/10.3390/land4040957
Saidi, S. S., & Siew, N. M. (2019). Investigating the Validity and Reliability of Survey Attitude towards Statistics Instrument among Rural Secondary School Students. *International Journal of Educational Methodology*, *5*(4), 651-661. https://doi.org/10.12973/ijem.5.4.651
Sakhare, M. V., & Chougule, M. B. (2019). Construction Equipment Monitoring: By Using Relative Important Indices (Rii) Analysis.
Samanta, S., & Gochhayat, J. (2023). Critique on occupational safety and health in the construction sector: An Indian perspective. *Materials Today: Proceedings*, *80*, 3016-3021.
Satapathy, S. (2022). Work place discomfort and risk factors for construction site workers. *International Journal of System Assurance Engineering and Management*, *13*(2), 668-680. https://doi.org/10.1016/j.ssci.2022.106043
Sharma, A. (2019). Safety Issues in Nepalese Construction Industry. *Deakin University*.
Sukamani, D., & Wang, J. (2020). SEM Model for Investigating Factors of an Accident Affecting Safety Performance in Construction Sites in Nepal. *Engineering Letters*, *28*(3).
Tubis, A., Werbińska-Wojciechowska, S., & Wroblewski, A. (2020). Risk assessment methods in mining industry a systematic review. *Applied Sciences*, *10*(15), 5172. https://doi.org/10.3390/app10155172
Vredenburgh, A. G. (2002). Organizational safety: which management practices are most effective in reducing employee injury rates? *Journal of Safety Research*, *33*(2), 259-276. https://doi.org/10.1016/S0022-4375(02)00016-6
Waqar, A., Othman, I., Shafiq, N., Deifalla, A., Ragab, A. E., & Khan, M. (2023). Impediments in BIM implementation for the risk management of tall buildings. *Results in Engineering*, *20*, 101401. https://doi.org/10.1016/j.rineng.2023.101401