

¹Abdulla Omar
Alzarooni

Enhancing Safety Management in UAE Construction Sites through Site Manager Performance Evaluation



Abstract: - The construction industry is one of the most high-risk domains, having the highest number of occupational accidents compared to other industries globally. One of the main reasons for worker injuries and deaths is the site managers' unsafe behaviour on the construction sites, which creates an environment that normalizes further unsafe acts and leads to the personnel's inability to recognize and identify various hazards within the construction site. This research aims to investigate and evaluate the site manager's contribution towards safety through specific indicators that include their safety-oriented performance, provision of safety equipment, and conduction of safety training. Data was collected from the workers and managers on construction sites through a comprehensive survey that constituted the three main mentioned indicators. The surveyed sample included 174 participants from different construction organizations across the UAE. The data was then analyzed using the 3-way ANOVA technique to study the relationship between the named three variables. Monte Carlo Simulation was used to study the uncertainty and variability of the interactions of the three factors in the construction site. The obtained results showed that the three factors were all statistically significant, indicating that the three independent variables had a positive effect on the safety score of the site manager. The interaction effect between the safety-oriented performance & provision of safety equipment was significant indicating that there was a combined effect between them on the safety score. A set of recommendations are provided to ensure more safety methods are implemented across the entire UAE construction sector.

Keywords: Construction Manager, Construction Safety, Construction Site, Safety Management, Site Manager, Worker Safety

I. INTRODUCTION

The construction industry is one of the deadliest industries for people to work in if they were not being careful. Since 2012, the construction industry has experienced the most workplace deaths than any other industry (NSC, 2023). In 2021, there has been 986 fatalities recorded, and an average of 949 deaths from 2012 – 2021 (NSC, 2023). In order to minimize the number of fatalities and maintain the safety of the personnel in the workplace, it is recommended to have a site manager that oversees the workers and prioritizes their safety by creating a comprehensive site safety plan, conducting regular safety training, providing new and high-quality equipment, and communicating, documenting, and tracking safety incidents (Tracy, 2023).

A construction site manager is regarded to have a big performance impact on the safety of the construction sites. Moreover, site managers are regarded as key figures; therefore, they should lead based on influence and not by authority, and this can be achieved by sharing the project vision, set the direction and the pace of the work to be done, empowering and coaching the team, easing the communication between all stakeholders, and demonstrating good character and attitude (Rowe, 2007).

Site safety training is an essential requirement to be done within any industry. It is a structured educational program focused on ensuring safety and to minimize risk within the workplace (Caburao, 2023). Since most fatalities are preventable, a comprehensive safety training will minimize the number of fatalities and in addition will ensure the workers' safety, boost operational productivity, and increase cost-savings within a company (Caburao, 2023).

Having new and high-quality equipment in the workplace have benefits that are twofold than old equipment. Site manager's that provide new and modern safety equipment can help productivity and reduces body strain that can lead to musculoskeletal injuries. Moreover, it can defend the two common hazards in the workplace: "Struck-by" & "Caught-in" Incidents (Tracy, 2023).

The UAE are thriving to enhance the safety in the construction site by implementing rules and regulations to take

¹ Hamad Sulaiman Jumma Rashid Industrial Engineering and Engineering Management Department University of Sharjah

Sharjah, UAE U21100904@sharjah.ac.ae, hamad.rashid@sharjah.ac.ae

Copyright © JES 2024 on-line : journal.esrgroups.org

into consideration of the worker's safety. Recently a new law was implemented that doesn't permit personnel to work from 12:30PM – 3:00PM during summer [Hot weather]. A fine of 50,000 AED will be implemented to anyone who

violates this law. In addition, other points were specified such as:

- Hiring a health & safety officer to ensure workers are protected from various risks in the workplace.
- Workers should be provided with safety gear and suitable clothing to protect themselves from any injuries on site.
- The employers must take all necessary measures to ensure the safety and protection of employees from injuries, diseases, or any hazards.
- Workers are obliged to use protective gear and follow instructions at all times after being briefed by the employer. Failing to do so will impose penalties to the workers.

The study assesses the safety score of the site manager by looking into their current overall performance and seeing how it can be elevated further to sustain an injury-free environment in the UAE.

II. LITERATURE REVIEW

A. *Impact of Supervisors' Safety Violations on an Individual within a Construction Crew:*

Site Managers have the responsibility of planning, organizing, and facilitating daily construction operations, while providing the personnel with the necessary technical guidance and social support. They communicate with the workers more frequently than others and are more likely to influence the worker's safety-related attitude and behaviors. Most studies focus on the positive effects of a site manager on the safety-related behavior, while studies of negative social influence of site managers on workers are rare. When workers observe the bad safety regulations of the supervisor, they will most likely break safety regulations.

Social learning and social information are used to explain work-related attitude of individuals (Liang & Zhang, 2019). Social learning suggests that individuals observe and imitate attitudes of others, while social information uses the social or physical environment characteristics, which results in individuals to react based on the situation that is related to the environment of the place and the overall scenario, which will guide their behavior (Liang & Zhang, 2019).

The Human Factors Analysis and Classification System (HFACS) is a broad human error framework that provides a tool to assist in the investigation process, target training, and prevention efforts (Skybrary). By using this framework, investigators can systematically identify active and latent failures within an organization that resulted in the accident (Skybrary). HFACS is used to understand the underlying causal factors that lead to an accident, and not to blame other people for their mistakes (Skybrary). To further emphasize the importance of the supervision level, HFACS placed unsafe supervision on Level 3 in the framework. The safety of the project and people is greatly influenced by the supervisor's inadequate supervision, inappropriate operation planning, failure to correct known problems, and most importantly supervisory violations towards safety.

B. *A Better Contribution to Safety as a Site Manager:*

Occupational accidents cause approximately 300,000 fatalities every year (Takala, et al., 2017) and over 960,000 injuries every day (Hämäläinen, 2009). Occupational safety research indicates that the way managerial leadership is executed may significantly affect how occupational risks are managed and occupational safety is advanced (Grill & Nielsen, 2019). Both direct and indirect leadership behaviors affect safety culture.

Indirect leadership practices, such as coordinating work by establishing a frequent meeting structure, planning the physical layout of the site, managing safety aids and resources, and structuring the work by establishing and following rules, guidelines, and plans, have a positive impact on safety (Cramogroup, 2019). Direct management practices, such as proactively monitoring and correcting risks, managing safety risks and violations, and acting as a role model for professional workers and subcontractors have a favorable effect towards safety (Cramogroup,

2019).

Leadership Behaviors that are characterized by a lack of active leadership responsibility, unclear communication and not making risk analyses results in reduced safety at the construction site. The core leadership behaviors that positively influence safety were found to be continuous planning and coordination, role modelling, monitoring work and proactively correcting deviations (Grill & Nielsen, 2019). Safety could be improved further by offering site managers leadership development training and education that focuses on communicating clear expectations, carrying out collective risk analyses, and executing proactive monitoring and feedback procedures (Grill & Nielsen, 2019).

C. How Safety Leadership Styles Impact Employee Safety Behaviour:

Safety in the workplace involves a variety of challenges and difficulties for management at multiple levels (McRae, 2023). At an individual level, workers are urged to follow safety regulations and procedures while engaging in social interactions and activities that foster a safer work environment (McRae, 2023). At a department and team level, managers and supervisors are expected to allocate some of their time to creating goals, observing employee behaviors, providing feedback, executing corrective actions when necessary, and giving incentives to promote excellent safety behaviors (McRae, 2023). At the organizational level, managers and supervisors are in charge of assisting employees in realizing that safety is prioritized, valued, and supported in order to build a culture of well-being and trust both inside and beyond the organization (McRae, 2023).

Leaders have a crucial role in promoting safety-related activities in the workplace. The commitment of a leader in regards to safety is a key factor that influences the effectiveness of internal safeguards and an organization's safety outcomes. Leadership plays a vital role in creating a positive work atmosphere to the workers in regards to safety and health, since workers can be very insightful about how leadership and management value safety of individuals within an organization (McRae, 2023).

Employees are more likely to adhere to safety policies in the workplace when they perceive management to be devoted to safety. When leaders make it clear via their actions and practices that they are committed to ensure the integrity of safety into daily operations, employees can clearly understand where leadership stands in regard to safety, and some examples of this can be:

- Management ensuring that personal protective equipment (PPE) is procured, easily accessible, and simple to use (McRae, 2023).
- Capital Investments in machine guarding, safety interlocks, and controls on equipment to protect workers (McRae, 2023).
- Motivating employees to continuously meet goals for key performance indicators that leads to safety (McRae, 2023).
- Ensuring a safety culture where employees feel comfortable in reporting workplace hazards by providing them with sufficient training and resources (McRae, 2023).

Safety being valued by management will in return result in the promotion of a positive mindset/behaviour and promote a sense of security within the employees.

D. Factors Influencing Safety at the Construction Site:

The construction industry is known as the most hazardous and dangerous industry which scored the highest number of deaths over more than 10 years in a row (Abas, et al., 2020). The incidents and accidents that occurred at the construction site has caused delays in project completion, increase in project costs, reduction of productivity, and created negative impressions to the organization (Abas, et al., 2020). It is critical to ensure safety and health at the workplace by considering different safety factors. Among the most frequently cited factors that affect safety performance of the construction project are construction site manager's performance towards safety, provision of safety equipment, and conduction of safety training (Abas, et al., 2020).

1) *Construction Site Manager's Performance Towards Safety:*

The site manager's performance towards safety can positively affect the safety environment of the workplace, which leads to establishing safety culture between the workers in the site. Lack of actions from the site manager creates workplace hazards, and this can be avoided by spreading safety knowledge across all personnel, having solid leadership that puts health and safety as a top priority, ensuring that all safe work practices and procedures are being followed (Scotia).

2) *Provision of Safety Equipment:*

The most common safety equipment found in the construction site are personal protective equipment (PPE) which are protective clothing that protects most body parts and serves as a final line of defense when engineering controls are not enough to reducing or eliminating the risk (Tarlengco, 2023). It is utilized to keep an individual free of risk from physical hazards to avoid injuries and fatal accidents. There are many major benefits of using safety equipment such as: It prevents unnecessary injury in the workplace, protects employees from chemical exposure, helps businesses comply with regulatory requirements, and improve employee productivity and efficiency (Tarlengco, 2023).

3) *Conduction of Safety Training:*

Conducting safety training in the workplace can help employees gain the necessary knowledge and skills to identify hazards, and use proactive measures to prevent accidents and incidents from occurring (HSENetwork, 2023). For example, in the construction industry, including good safety training will ensure everyone in the team uses the correct tools, make employees aware of potential hazards and know how to respond to them, which will ensure a safe environment with no injuries. Moreover, conducting safety training will decrease employee turnover rate, costs, and illness/injury, while increasing productivity morale of the workers (Regan, 2023).

III. METHODOLOGY

Academic research designs can be divided into four main categories that guide researchers in their exploration of new frontiers with a systematic approach. These categories include Action Research or Applied Research, which involves using scientific methods to analyze and solve real-life problems. Qualitative Research is another type that involves collecting and analyzing data from observations in natural and social settings, while Quantitative Research focuses on using statistical, mathematical models, and logical techniques to generate numerical data and facts. Finally, Mixed Methods combines both Qualitative and Quantitative methods to reduce the weaknesses associated with using a single research design while maximizing strengths, validity, and reliability.

An illustrative flow diagram of the applied methodology is presented in Figure 1:

Figure 1: The Applied Research Methodology

Phase 1: Main Literature Review
The main literature review will focus on the effect of the site manager and their impact on the employees in regards to the safety. It showcases how safety violations can affect safety, and how different safety leadership styles can enhance the site manager's safety performance.
Phase 2: Methodology Finalization
The final framework in which defining of the roadmap of this thesis will be implemented in order to achieve the study's research objectives.
Phase 3: Data Collection
Structured questionnaires will be distributed to different site managers, safety officers, and workers which will focus on the construction manager's role in regards to safety management, factors that influence their decisions, and the challenges faced in the workplace.
Phase 4A: Data Analysis: 3-Way ANOVA
A 3-Way ANOVA approach will be conducted after collecting the relevant data from site managers, by taking into consideration the construction site manager's performance as a critical element safety in the workplace.
Independent Variables:
1) Construction Site Manager's Performance Towards Safety: <ul style="list-style-type: none"> - High Safety Performance - Medium Safety Performance - Low Safety Performance
2) Safety Equipment: <ul style="list-style-type: none"> - Excellent Equipment - Average Equipment - Poor Equipment
3) Safety Training <ul style="list-style-type: none"> - Excellent Training - Average Training - Poor Training
Dependant Variables:
1) Safety Score of the Site Manager
Phase 4B: Data Analysis: Monte Carlo Simulation
Monte Carlo Simulation is a risk simulation method that was used in this study to generate multiple scenarios of site manager performance and assess their impact on safety outcomes. The Monte Carlo Simulation was used later to compare the results that was obtained from the questionnaires.
Phase 5: Significance
The study's findings will yield fruitful knowledge and contribute to enhance the construction site management practices, minimize the risk of accident to occur, and improve safety outcomes. This will benefit both construction industry stakeholders and the participants that are working on the project.

A. Questionnaire Development:

A structured questionnaires was developed and distributed among different site managers, safety officers, and workers which was used to evaluate the safety score of the site manager in the construction site. The Questionnaire consisted of (1) demographic section, (3) main sections, and (5) multiple choice questions for each main section. The sections included the following variables: construction sit manager's performance towards safety, provision of safety equipment, and conduction of safety training. The main sections' responses were then turned into values to do the data analysis section of the thesis.

B. Sampling Design & Sample Size:

Target population of this study consists mostly of workers that work in the construction site, since they are directly under the site manager's supervision, and know the most about his interactions with them. Since most of the workers don't speak a specific language and can't read, the questionnaire was designed and distributed in different ways: **1. Electronic Questionnaire:** The Online questionnaire was designed and distributed to members of the construction industry to provide their feedback.

2. Hard Copy Questionnaire in 3 Different Languages: As mentioned, since most workers in the construction site can only read in a single language, the questionnaire was designed to have 2 version, Arabic & English, and

distributed upon the workers. Since most workers there were Indians who speak Urdu, a foreman who can read the questionnaire sat with each worker individually and explained to them in Urdu to get the relevant data from them during their break sessions.

After the data collection period was done, the total sample size obtained from the questionnaire was $n = 174$.

C. Data Analysis Techniques:

To fulfill the objectives and validity of the study, a 3-Way ANOVA was used to test the relationship between the variables on the safety score of the site manager. Moreover; a Monte Carlo Simulation was used to generate multiple scenarios of site manager performance and assess their impact on safety outcomes. The Monte Carlo Simulation was used later to compare the results that was obtained from the questionnaires.

IV. RESULTS & DISCUSSION

In this section, a descriptive analysis was used to showcase the demographics of the people that answered the questionnaire. Following that, a preliminary analysis was used to study the assumptions of the tests used such as homogeneity and normality. The final section presents the results obtained of the 3-Way ANOVA and Monte Carlo Simulation that was used in this study and discusses in detail the effect of the independent variables on the dependent variable, and displays the overall safety score of the construction site managers in the UAE. All analysis were conducted on a 95% confidence interval.

A. Descriptive Analysis:

The online and hard copy version of the questionnaire were distributed among the workers in different construction sites across all the UAE. A total of 174 responses was obtained overall, and was used in the SPSS Statistics program to generate all the relevant results for this study. The following section displayed the demographics of the respondents who contributed in adding their inputs for this study.

- **Job Title:** The Majority of the respondents were workers in the construction field being 67.24% of the total amount of respondents.
- **Years of Experience in the Construction Field:** People between 6-10 years of construction experience yielded 32.18% of the total amount of respondents, making them the major group. Following that in, 1-5 years of experience yielded 27.01%, 11-15 years of experience yielded 25.29%. Other age groups ranging between 16-20 years, more than 20 years, less than a year contributed 8.05%, 4.02%, and 3.45% respectively.
- **Construction Sector:** Most companies are specialized in Residential Construction with 125 responses. Following it is the commercial construction with 62 response, industrial construction with 45 responses, energy & utilities with 6 responses, and infrastructure & transportation with 4 responses.
- **Organization Sector:** The Majority of the respondents work in the private sector, consisting of 90.23% of the total amount of respondents, while 6.90% consisted of workers from the government sector, and 2.87% consisted of workers from the semi-government sector.
- **Size of the Organization with Most Experience:** In terms of size of the organization, the majority of the companies had more than 200 employees being 76.24% of the total amount of respondents. Meanwhile, 15.52% consisted of companies with 50-200 employees, and 8.05% consisted of employees with less than 50 employees.
- **Most Experience from Construction Site Projects in the UAE:** Most workers had experience in Dubai with

72 responses, following that is Sharjah with 60 responses, Umm Al Quwain with 52 responses, Abu Dhabi with 19 responses, Ajman with 16 responses, Fujairah with 8 responses, and Ras Al Khaimah with 2 responses. In addition to that, 10 responses were obtained stating that they got experience for all of the seven Emirates equally.

B. Preliminary Analysis:

- Homogeneity Test:** One of the main assumptions to be done in order to conduct an ANOVA test, is the homogeneity test. In our study we implemented a quick “Levene’s Test of Equality of Error Variance” to check where our variables have the same variance in the population. Based on the obtained results, since the p value is less than 0.001 which is less than our α value (0.05), we reject the null hypothesis of homogeneity of variances. The Assumption of homogeneity is violated, which means that the Levene’s test showed that the variances in the group were not equal ($F(10,163) = 8.703, p < 0.001$). There is a school of thought that suggests that ANOVA is Robust to violations of homogeneity of variance if we have a sample size of greater than 30 and equal sample sizes, so this assumption can be assumed to be valid.
- Normality Test of the Variables & Residuals:** The normality of the variables & residuals can be derived from the Skewness & Kurtosis of our data. Looking into the Skewness & Kurtosis Table and by dividing the statistic value by the Standard Error, we can derive that the z value for most pairs is between -3.29 & 3.29, concluding that the data is normally distributed.
- Reliability and Validity of the Test:** In order to test the internal consistency of the items in the study, Cronbach’s Alpha reliability test was conducted. The minimum acceptable Cronbach’s Alpha value should be no less than 0.60, and the greater the value, the more reliable the result. Moreover, in order to check the validity of the tests, the Corrected Item-Total Correlation should be between 0.30 and 0.70 for a good scale (Ferketich, 1991). The following table summarizes the results obtained from the Cronbach’s Alpha test for each variable:

Variable	Item	Corrected Item-Total Correlation	Cronbach’s Alpha Coefficient	Cronbach’s Alpha if item Deleted
Safety Performance	SP01	0.550	0.814	0.795
	SP02	0.743		0.731
	SP03	0.510		0.804
	SP04	0.622		0.773
	SP05	0.622		0.774
Safety Equipment	SE01	0.606	0.784	0.727
	SE02	0.626		0.724
	SE03	0.514		0.761
	SE04	0.508		0.760
	SE05	0.563		0.742
Safety Training	ST01	0.540	0.793	0.765
	ST02	0.664		0.722
	ST03	0.595		0.747
	ST04	0.624		0.738
	ST05	0.483		0.785

Figure 2: Reliability and Validity Test

Based on the table above, the results obtained is reliable and valid, since the corrected item-total correlation ranged between 0.30 to 0.70, and Cronbach’s Alpha reliability test is above 0.60.

C. Reporting the Effects of 3-Way ANOVA:

A factorial ANOVA [3-Way ANOVA] was conducted to compare the main effects of **Construction Site Manager’s Performance towards Safety, Safety Equipment, and Safety Training** as well as their interaction effects on the **Safety Scores**.

A summary of the results is as follows:

- The main effect: Construction Site Manager’s Performance Towards Safety** was statistically significant, meaning that it has an effect on the safety score of the site manager.
- The main effect: Safety Equipment** was statistically significant, meaning that it has an effect on the safety score of the site manager.
- The main effect: Safety Training** was statistically significant, meaning that it has an effect on the safety score of the site manager.
- The interaction effect: Construction Site Manager’s Performance Towards Safety and Safety Equipment** was significant, indicating that there was a combined effect for Construction Site Manager’s Performance Towards Safety and Safety Equipment on the Safety Scores.

The rest of the interaction effects were not significant, meaning that it had negligible combined effect on the study.

D. Reporting the Effects of Monte Carlo Simulation:

The Monte Carlo Simulation is used in this study to generate multiple random scenarios of site manager performance and assess their impact on safety outcomes. The worker’s behaviors were observed during the site visits around the UAE, and based on that, the overall behavior of all workers was assumed and turned into a probability in order to test the Monte Carlo Simulation. The overall score for each factor was rated out of 25, and the probability assumed of each overall score can be seen below:

Number	Probability	CDF
5	0.82%	0.00
6	0.82%	0.01
7	0.82%	0.02
8	0.82%	0.02
9	0.82%	0.03
10	0.82%	0.04
11	0.82%	0.05
12	0.82%	0.06
13	1.26%	0.07
14	1.26%	0.08
15	8.26%	0.09
16	8.26%	0.17
17	8.26%	0.26
18	8.26%	0.34
19	8.26%	0.42
20	8.26%	0.50
21	8.26%	0.59
22	8.26%	0.67
23	8.26%	0.75
24	8.26%	0.83
25	8.26%	0.92

Figure 3: Probability out of 25 for the Monte Carlo Simulation

Based on the probability, random scores out of 25 were being generated for 10,000 different scenarios to measure how effective the site managers are in terms of enhancing safety in the workplace. The random numbers generated yielded the following results:

- 42% of the site managers have good safety performance.
- 53% of the site managers have neutral safety performance.
- 5% of the site managers have bad safety performance.

Construction Site Manager Safety Rank	Count	Probability
Good	4203	42.03%
Neutral	5263	52.63%
Bad	534	5.34%

Figure 4: Monte Carlo Simulation Results

Comparing the Monte Carlo result to the results obtained from the questionnaire we can see that it is approximately the same result:

Construction Site Manager Safety Rank	Count	Probability
Good	84	48.28%
Neutral	87	50.00%
Bad	3	1.72%

Figure 5: Questionnaire Results

REFERENCES

- [1] Abas, N. H., Yusuf, N., Suhaini, N. A., Kariya, N., Mohammad, H., & Hasmori, M. F. (2020). Factors Affecting Safety Performance of Construction Projects: A Literature Review. *Journal of Materials Science & Engineering*.
- [2] Caburao, E. A. (2023, October 22). *Strengthening Workplace Safety through Site Safety Training*. Retrieved from Safety Culture: <https://safetyculture.com/topics/workplace-safety/site-safety-training/>
- [3] Cramogroup. (2019, April 25). *HOW SITE MANAGERS CAN CONTRIBUTE TO BETTER SAFETY*. Retrieved from Cramogroup: <https://www.cramogroup.com/en/how-site-managers-can-contribute-to-better-safety/>
- [4] Ferketich. (1991). Focus on psychometrics: Aspects of item analysis. *Research in Nursing & Health*, 165- 168.
- [5] Grill, M., & Nielsen, K. (2019, April). Promoting and impeding safety – A qualitative study into direct and indirect safety leadership practices of construction site managers. *Safety Science*, 148-159.
- [6] Hämäläinen, P. (2009). Global trend according to estimated number of occupational accidents and fatal work-related diseases at region and country level. *Journal of Safety Research*, 125-139.
- [7] HSE Network. (2023, March 01). *The Role Of Health and Safety Training In Preventing Accidents and Injuries*. Retrieved from HSE Network: <https://www.hse-network.com/the-role-of-health-and-safety-training-in-preventing-accidents-and-injuries/#:~:text=Having%20important%20thorough%20health%20and,if%20an%20emergency%20does%20occur.>
- [8] Liang, H., & Zhang, S. (2019, December). Impact of Supervisor's Safety Violation on an Individual Worker Within a Construction Crew. *Safety Science*, 679-691.
- [9] McRae, M. (2023). How Safety Leadership Styles Impact Employee Safety Behaviors. *Safety Science*, 1-138.
- [10] NSC. (2023). *Most Dangerous Industries*. Retrieved from National Safety Council: <https://injuryfacts.nsc.org/work/industry-incidence-rates/most-dangerous-industries/#:~:text=In%202021%2C%20depending%20on%20the%20measure%20used%2C%20each,involving%20days%20away%20from%20work%20per%2010%2C000%20workers>
- [11] Regan, R. (2023, September 11). *What is Workplace Safety Training and Why Do You Need It?* Retrieved from Connecteam: <https://connecteam.com/workplace-safety-training-need/#:~:text=But%2C%20you%20may%20be%20surprised,the%20moral%20thing%20to%20do!>
- [12] Rowe, S. F. (2007). *Managing and leading small projects*. Retrieved from pmi: <https://www.pmi.org/learning/library/managing-leading-small-projects-7245>
- [13] Scotia, N. (n.d.). *Five Key Factors Contributing to Safety Hazards*. Retrieved from farmsafetyns: <https://farmsafetyns.ca/farm-safety-plan/five-key-factors-contributing-to-creating-hazards/>
- [14] Skybrary. (n.d.). *Human Factors Analysis and Classification System (HFACS)*. Retrieved from Skybrary: <https://www.skybrary.aero/articles/human-factors-analysis-and-classification-system-hfacs>
- [15] Takala, J., Hämäläinen, P., Nenonen, N., Takahashi, K., Chimied-Ochir, O., & Rantanen, J. (2017, June 14). Comparative Analysis of the Burden of Injury and Illness at Work in Selected Countries and Regions. *Central European Journal of Occupational and Environmental Medicine*, article number: 11.
- [16] Tarlengco, J. (2023, September 12). *Everything You Need to Know About PPE Safety*. Retrieved from Safety Culture: <https://safetyculture.com/topics/ppe-safety/>
- [17] Tracy, T. (2023, August 23). *7 Ways to Improve Construction Site Safety*. Retrieved from Procure: <https://www.procure.com/library/improve-construction-site-safety> AUTHORS PROFILE



Abdulla Alzarooni from the UAE is a Civil Engineer at the Roads & Transport Authority (RTA) and works in the Innovative and Self Driving Transportation Systems Section under the Transportation Systems Department, and currently is finalizing his thesis study in Engineering Management at the University of Sharjah.



Hamad Sulaiman Rashid is an Assist. Professor, an aeronautical engineer, and a PhD in engineering management holder in the field of industrial safety and accident investigations. Professionally, he is a certified chartered aircraft accident investigator, a lead auditor of

the international standard ISO-10015 for quality in higher and vocational education, a member of the Royal Aeronautical Society-UK, and a fellow of the Higher Education Academy. He is an experienced consultant engineer and skilled academic with records of achievements in engineering consultancies, teaching, and research. These are manifested through 31 years of experience in aeronautical engineering, engineering systems safety, risk management, quality, performance enhancement, leadership and innovation, teaching, and supervision of research at the post graduate level with strong focus towards UK and worldwide industry.