

Factors Effecting Safety Culture in the Construction Industry

Mohsin Jameel¹, Farzana Khan²

Abstract

The construction industry is characterized by its intricate and ever-changing nature, presenting continual safety challenges for professionals within the field. Establishing a robust safety culture, underpinned by meticulous attention to detail and rigorous safety protocols, is imperative to mitigate risks and prevent accidents. This research delves into four key factors: Management commitment, Communication effectiveness, Employee engagement, and Safety Training, which collectively play pivotal roles in fostering a positive health and safety culture within Pakistan's construction sector. The findings of this study hold significant implications for safety management practices within Pakistan's construction industry. By leveraging insights garnered from this research, organizations can refine and bolster their safety measures, ultimately striving towards safer worksites and improved overall outcomes. Furthermore, this research underscores the profound correlation between Management commitment, Communication effectiveness, Employee engagement, and Safety Training, and the cultivation of a safety-centric environment. Upon analysis, Management commitment emerged as a driving force, contributing to safety culture with a substantial 75%. Communication effectiveness followed closely, exerting an impactful 83% influence, while Employee engagement demonstrated an impressive 87% contribution. Additionally, Safety Training emerged as a significant factor, with a commendable 68% contribution to fostering a robust safety culture.

Keywords: Safety culture, Construction industry, Management commitment, Employee involvement, Communication effectiveness, Safety Training.

Introduction

The construction industry is a key part of Pakistan's economy. It contributes to the growth of infrastructure, creates jobs, and supports other industries (Choudhry & Zahoor, 2016). However, safety on construction sites remains a major issue. Construction sites are often busy and complex, involving heavy machinery, large teams, and a mix of skilled and unskilled workers. This complexity makes it difficult to keep consistent safety standards (Jiang & Probst, 2016). Although there is greater awareness of safety, accidents and injuries still happen often. This shows that there is a gap between what is known about safety and what is actually done on construction sites. The construction industry is expanding quickly in Pakistan. New projects are larger, and safety issues are becoming even more important to address. Safety is not only about following rules but also about creating a positive culture around health and safety. This study investigates why accidents continue to happen in Pakistan's construction industry despite the focus on safety. The difference between knowledge of safety and actual safety outcomes on the ground has led to an investigation of factors that influence health and safety culture on construction sites (Beus et al., 2016). A strong safety culture is essential in the construction industry. Safety culture means that workers and managers see safety as a core value. When there is a strong safety culture, employees are more aware of risks, work together to prevent accidents, and share responsibility for safety (Lingard & Rowlinson, 2015). This study focuses on four important factors: management commitment,

¹National QHSE Manager at Nokia Solutions and Networks., Address Nokia Networks H 8/4, H- 8, Islamabad, email: bilalmohsin2000@yahoo.com

² Pakistan Institute of Quality Control, Email: farzana.khan@academics.com.pk

effective communication, employee involvement, and safety training. These factors are known to shape safety culture, especially in high-risk industries like construction. By studying these factors, this research provides insights that can help improve safety practices and make construction sites safer for workers (Martínez-Córcoles et al., 2016). Construction sites are unique work environments that require special safety measures. They are always changing and involve many different tasks, from heavy lifting to electrical work. This range of activities means that safety is an ongoing challenge (Smith & DeJoy, 2014). Heavy machinery, different work processes, and the involvement of many groups make it difficult to keep sites safe. Therefore, understanding the factors that help or prevent the development of a strong safety culture is necessary. By doing so, the construction industry in Pakistan can become safer, more efficient, and sustainable over time. Despite the importance of safety, studies show that construction companies often struggle to build a strong safety culture (Gyekye et al., 2021). There may be a lack of resources, weak communication, or poor safety training, all of which can lead to higher risks. This study seeks to understand how management commitment, effective communication, employee involvement, and safety training impact safety culture on construction sites. In particular, it looks at how these factors work together to influence the behavior of workers and managers. By improving these areas, companies can reduce accidents, lower costs, and create a safer environment for everyone involved.

Literature Review

Health and safety culture refers to the shared beliefs, attitudes, and behaviors focused on keeping everyone safe at work. It is a crucial element in any company, serving as the "glue" that holds the organization's safety practices and values together. According to the Health and Safety Executive (HSE), a strong safety culture is achieved when both workers and leaders commit to creating a safe and healthy work environment. It's not just about following rules; it involves working together to prevent accidents and injuries. The idea of prioritizing safety has existed for a long time but became more recognized in the 20th century as a way to prevent accidents before they happen. In Pakistan's construction industry, which has many risks, having a strong safety culture is crucial. It not only helps avoid accidents but also ensures workers do their jobs better, follow legal standards, and maintain a good reputation. A focus on health and safety allows construction companies to create workplaces where safety is valued, workers feel protected, and the industry can continue to grow (Asad et al., 2021). By prioritizing health and safety culture, companies are making an investment in the future. When safety becomes part of a company's identity, talking about safety, joining safety activities, and preventing accidents become second nature. In Pakistan's construction sector, finding the right balance between progress and safety is a challenge, but a strong safety culture can help. A true safety culture means everyone takes responsibility for safety, making it a natural part of everyday work. Studies show that companies with a strong safety culture have fewer accidents, proving that focusing on health and safety can make a real difference (Gehad Mohammed Ahmed Naji et al., 2022). Following safety laws becomes easier when everyone is committed to safety. Legal compliance is not just about ticking boxes; it shows that the company genuinely cares about its workers. A strong reputation in the construction industry depends not only on completing projects but also on being known as a company that values safety. This can be a deciding factor for clients who prefer to work with companies that prioritize worker well-being. A strong safety culture also helps in retaining skilled workers. Skilled workers want to feel safe, and when a company prioritizes safety, it creates a community where workers feel valued and protected. This focus on safety attracts skilled workers, who see the company as more than just a job but a place that values their well-being (Mallidou et al., 2011). By making health and safety a priority, the construction industry in Pakistan can create a safer and more sustainable environment for its workers, contributing to both industry growth and economic stability.

Relationship between Management Commitment and Health & Safety Culture

Safety is a top priority in construction organizations. A study by Asad et al. (2021) shows that leadership plays an essential role in promoting safety. Construction companies, which often operate in high-risk settings, benefit greatly when leaders make safety a priority. The study explains that leadership commitment, combined with a supportive safety environment and transformational leadership, helps create safer workplaces. Safety is crucial in construction because accidents can have serious consequences. Researchers suggest that accidents often occur because of how workers perceive safety, the pressure from demanding tasks, or the lack of serious safety protocols. This makes it essential to create a safety culture where everyone takes safety seriously to reduce accidents (Parker, Lawrie, & Hudson, 2018). Smith and Brown (2019) add that transformational leadership, where leaders inspire employees to focus on safety, has a significant impact on reducing accidents. This type of leadership involves setting clear safety goals, providing necessary resources, and actively participating in safety initiatives. Leaders who care about safety encourage workers to adopt safe practices, improving overall workplace safety. In construction, leaders play a key role in ensuring safety by creating and enforcing safety plans that match the specific risks on construction sites. When leaders show a real commitment to safety, workers feel safer and are more likely to follow safe practices in hazardous work settings. Transformational leadership is especially effective in construction. Leaders who inspire teams to integrate safety into their daily tasks help create a positive safety culture. Management commitment to safety goes beyond words—it involves taking concrete actions, setting safety goals, and supporting safety initiatives across all levels of the organization. This kind of leadership fosters a safety-focused culture that is particularly needed in high-risk environments (O'Dea & Flin, 2001).

Relationship between Safety Training and Health & Safety Culture

Creating a strong health and safety culture involves helping employees understand how to work safely. This includes training on proper task execution, safe use of tools and machinery, and personal protection measures (Miao et al., 2020; Zhang et al., 2020). Bayram (2019) explored the connections between safety training, skills, employee engagement, and safety performance in Occupational Health and Safety Management Systems (OHSMS). The study found that safety training and relevant skills make employees more involved in safety practices, enhancing overall workplace safety. Safety training does not only teach employees about safety rules; it encourages them to follow these rules actively. The right mix of skills and training is essential in helping employees comply with safety standards and improve safety outcomes. While the study noted that employee involvement alone may not reduce accidents, it linked employee engagement with higher job satisfaction. This suggests that workers who engage in safety activities are happier with their jobs, creating a positive work environment. Bayram's study also shows that good safety management can boost employee satisfaction. The research fills gaps in our understanding of Occupational Health and Safety Management Systems by showing how safety training, engagement, and skills contribute to both safety and employee well-being.

Relationship between Employee Involvement and Health & Safety Culture

Employee involvement is crucial for a strong safety culture. This means empowering workers to take control of their tasks and engage in safety decision-making. When employees participate in safety discussions, they feel more responsible for maintaining a safe workplace (Zhang & Liu, 2019). According to Reiman et al. (2010), giving employees control over their tasks enhances their confidence in assessing risks and working safely. When employees lack control, they may feel powerless, which can negatively impact safety. Empowering employees to contribute to a safety-focused environment helps build a positive safety culture. Mallidou et al. (2011) found that when employees feel in control of their work, they are more likely to follow safety procedures, which

positively influences the company's safety culture. This habit of following safe practices eventually becomes part of the organization's safety culture. In companies that encourage employee involvement, workers are more committed to safety and actively work to reduce risks, even if it means taking extra time or resources. Employee involvement aligns personal values with the company's safety values, which enhances safety performance (Guldenmund, 2007).

Relationship between Communication Effectiveness and Health & Safety Culture

Effective communication is essential for building a strong health and safety culture. Aziz et al. (2021) state that communication and feedback shape the safety environment at work. A study by Naji et al. (2022) examined the link between safety communication, performance, and culture in high-risk industries, such as petrochemical oil and gas. Smith and Johnson (2022) found that clear communication about safety policies helps reduce workplace accidents. When employees understand safety procedures, they are more likely to follow them, leading to better safety results. Johnson and Brown (2019) also note that good communication from leaders builds trust and encourages employees to raise safety concerns. Open communication allows workers to engage actively in safety efforts. The study highlights that communication is more than just sharing information; it shapes how safety is perceived and practiced.

Methodology

Study Overview

This study uses a quantitative approach to examine safety culture in Pakistan's construction sector. The survey targeted 399 professionals in various roles within the industry, including 293 safety professionals, 42 construction workers, 10 company owners, and 54 management staff members. Data was collected through a structured Google Form questionnaire, assessing variables like leadership commitment, employee involvement, communication effectiveness, safety training, and perceptions of safety culture. Each of these factors is essential to understanding how safety culture develops in this high-risk industry.

Data Collection

To reach a broad audience, participants were contacted through LinkedIn and WhatsApp. This approach enabled data collection from a diverse group across various roles in the construction industry. A total of 399 responses were gathered, representing a wide range of perspectives on safety culture.

Quantitative Research Method

The survey utilized a five-point Likert scale, where respondents indicated their level of agreement from 1 (strongly disagree) to 5 (strongly agree). This scale allowed for a precise measurement of each variable. To reduce response bias, the survey included both positively and negatively worded questions. Reverse scoring was applied to certain items to balance responses, using the formula:

$$\text{Reverse Score}(x) = \text{Max}(x) + 1 - x$$

This process ensured the reliability of responses, accounting for potential agreement bias.

Reliability of the Questionnaire

Cronbach's Alpha was used to measure the reliability of the questionnaire. A Cronbach's Alpha of 0.7 or above indicates good reliability, ensuring that the survey consistently measured each variable. The table below provides the reliability scores for each variable based on Cronbach's Alpha values:

Research Philosophy

Reliability Scores for Variables

This study follows a positivist paradigm, which is widely used in quantitative research to understand phenomena based on measurable and observable facts. Positivism, introduced by Auguste Comte, emphasizes knowledge based on sensory experiences and logical reasoning. The study uses quantifiable data to test theories and seeks to generalize findings to the wider population (Comte, 1856; Hume, 1993; Descartes, 1998). The positivist approach fits this study as it focuses on real-world observations and scientific knowledge, using a structured quantitative design to examine safety culture in the construction sector.

Population and Sampling

This research focuses on individuals in Pakistan's construction industry, including workers, managers, and other professionals. A sample of 399 individuals was selected, which includes safety professionals, management, and company owners. This sample size ensures that findings can be generalized to the entire industry. Below is the demographic distribution of participants by gender, age, qualification, and job role.

Table: Sampling Demographics

Category	Details
Gender	Male: 92%, Female: 8%
Age Group	20-30: 16.3%, 31-50: 58.4%, 51+: 25.3%
Job Role	Safety Professionals: 73.4%, Workers: 10.5%, Management: 13.5%, Owners: 2.5%

Quality Assurance of Data Collection

To ensure data quality, the survey instrument underwent extensive testing, including trialing, pre-piloting, and piloting. These steps refined the wording, structure, and content of the questionnaire. Face and content validity checks confirmed that the instrument accurately measured the intended concepts. Cronbach's Alpha was used to check reliability, and the pilot study showed that the survey provided consistent and reliable information relevant to the research objectives.

Data Analysis Procedures

SPSS software was used for data analysis. Descriptive statistics were applied to describe demographic characteristics, and inferential statistics, including correlation, regression, and factor analysis, were used to test the study's hypotheses. This approach enabled a comprehensive analysis

Variable	Cronbach's Alpha	N of Items
Management Commitment	0.914	5
Communication Effectiveness	0.835	5
Employee Engagement	0.815	5
Safety Training	0.863	5

of how

factors like management commitment, employee involvement, communication, and training impact safety culture in the construction industry.

Instrumentation and Measurements

The survey used a five-point Likert scale to measure responses. Statements were developed by safety and civil work experts to ensure the questions were relevant. Reliability was tested with Cronbach's Alpha for each variable. The following are **Cronbach's Alpha scores**:

Management Commitment - Alpha = .914

Communication - Alpha = .835

Employee Engagement - Alpha = .815

Safety Training - Alpha = .863

Safety Culture - Alpha = .702

Pilot Testing

A pilot study with 30 participants helped identify and fix flaws in the questionnaire. Cronbach's Alpha showed high reliability for most variables. Communication effectiveness initially had a lower reliability score but was improved after adjusting the instrument.

Results

Results and Findings

This research explores key factors influencing the health and safety (H&S) culture in Pakistan's construction industry. Despite the construction sector's critical role in economic growth and employment, ensuring safety on construction sites remains a persistent challenge. The industry is marked by complex site environments and evolving safety needs, which make effective safety practices essential. The study investigates how management commitment, communication effectiveness, employee engagement, and safety training shape H&S culture, aiming to provide actionable insights to strengthen safety management practices. The findings highlight significant relationships among these factors, showing that improvements in management, communication, engagement, and training are associated with enhanced safety outcomes. The results underscore the interconnected nature of these elements in establishing a proactive and robust safety culture, offering a roadmap for construction companies to address safety gaps and reduce accident rates.

Response Rate

Table 3: Response Rate

Item	Percentage
Total Questionnaires Sent Out	500
Filled Questionnaires Received Back	399
Response Rate	80%
Questionnaires Not Returned	20%

Interpretation: Out of 500 distributed questionnaires, 399 were returned, yielding an 80% response rate, reflecting substantial engagement.

Respondents Profile

Gender Distribution

Table 4: Gender Distribution

Gender	Count	Percentage
Male	366	92%
Female	33	8%

Interpretation: 92% of respondents were male, with 8% female, indicating male predominance.

Age Distribution

Table 5: Age of Respondents

Age	Count	Percentage
20 years or less	7	1.8%
21 - 30	58	14.5%
31 - 40	112	28.1%
41 - 50	121	30.3%

50 years plus	101	25.3%
---------------	-----	-------

Interpretation: The majority are aged between 31–50 years, reflecting a diverse age range in the sample.

Qualification

Table 6: Qualification of Respondents

Qualification	Count	Percentage
Intermediate	18	4.5%
Bachelors	222	55.6%
Graduate	150	37.6%
Postgraduate	5	1.3%
PGD	4	1%

Interpretation: Most respondents hold a Bachelor’s (55.6%) or Graduate degree (37.6%).

Reliability Test

Table 8: Cronbach’s Alpha Reliability

Variable	Cronbach’s Alpha	Number of Items
Management Commitment	.914	5
Communication Effectiveness	.835	5
Employee Engagement	.815	5
Safety Training	.863	5
Safety Culture	.879	5

Interpretation: All variables show strong internal consistency, confirming the reliability of the measurement items.

Factor Analysis

Table 10: KMO and Bartlett’s Test

Constructs	No. of Items	KMO	Chi-Square	Sig.
Management Commitment	5	.82	672.85	.000
Communication Effectiveness	5	.79	659.42	.000
Employee Engagement	5	.75	645.33	.000
Safety Training	5	.78	632.18	.000
Safety Culture	5	.76	618.91	.000

Interpretation: High KMO values and significant Bartlett’s test results confirm suitability for factor analysis.

Correlation Analysis

Table 12: Correlations

Correlations						
		Management Commitment	Communication Effectiveness	Employees Engagement	Safety Trainings	Safety Culture
Management Commitment	Pearson Correlation	1	.823**	.714**	.625**	.765**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	399	399	399	399	399
Communication Effectiveness	Pearson Correlation	.823**	1	.774**	.733**	.771**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	399	399	399	399	399
Employees Engagement	Pearson Correlation	.714**	.774**	1	.650**	.799**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	399	399	399	399	399
Safety Trainings	Pearson Correlation	.625**	.733**	.650**	1	.645**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	399	399	399	399	399
Safety Culture	Pearson Correlation	.765**	.771**	.799**	.645**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	399	399	399	399	399

** . Correlation is significant at the 0.01 level (2-tailed).

Interpretation: All variables exhibit strong positive correlations, supporting their interconnected roles in H&S culture.

Multi Regression Model

Table 17: Multi Regression Model

Variables	B	t-value	Sig
(Constant)	-.057	-.465	.642
Management Commitment	.293	6.256	.000
Communication Effectiveness	.144	2.348	.019
Employees Engagement	.473	3.954	.000
Safety Training	.085	2.042	.042
F	262.064		
Significance	.000		
Adjusted R ²	.724		

N= 399

Dependent Variable: Safety Culture

Multiple Regression Equation is: -

$$Y = a + bX_1 + c X_2 + dX_3 + eX_4$$

$$Y = -0.057 + 0.293X_1 + 0.144X_2 + 0.473X_3 + 0.085X_4$$

Interpretation: The combined model explains 72.4% of the variance in safety culture, underscoring the significant roles of all four variables.

Discussion and Conclusion

Discussion

This chapter presents a comprehensive discussion of the findings from Chapter 4, comparing them with results from previous studies reviewed in the literature. By examining similarities and differences, the study provides a deeper understanding of how these findings fit within the broader context of occupational health and safety research. Key findings demonstrate that management commitment, communication effectiveness, employee engagement, and safety training significantly influence safety culture. This study adds to the existing body of knowledge by showing the combined effect of these factors in a single sector, rather than examining them separately as past studies have done.

The strong correlations observed in the study suggest that management commitment fosters an environment where communication is open, employee engagement is high, and safety training is prioritized. This confirms that management's role is essential in developing a proactive and resilient safety culture. Additionally, effective communication appears crucial for employee engagement and thorough safety training, contributing to a positive safety culture. In this sense, the study aligns with earlier findings, reinforcing the interconnectedness of these factors in maintaining a safe workplace.

Objective and Key Findings

The study aimed to understand how management commitment, communication effectiveness, employee engagement, safety training, and safety culture impact safety performance within an organization. Unique to this study is its integrated approach, examining how these elements collectively contribute to occupational safety. Findings show that management commitment correlates with communication effectiveness ($r = 0.823$), employee engagement ($r = 0.714$), safety training ($r = 0.625$), and safety culture ($r = 0.765$), affirming the vital role management plays in promoting safety. Communication effectiveness is similarly correlated with employee engagement ($r = 0.774$), safety training ($r = 0.733$), and safety culture ($r = 0.771$). These results underscore that clear communication, effective management, and engaged employees contribute significantly to a strong safety culture.

Limitations

This study faced several limitations that may impact the generalizability and depth of its findings:

- Limited access to academic databases restricted the literature review's scope, reducing the inclusion of relevant studies.
- The data focused on a single sector, limiting the results' applicability to broader industries.
- A sample size of 399, though adequate, may not fully represent the entire sector's workforce, limiting generalizability.
- Only five factors were considered; additional factors could provide a fuller picture of safety culture.
- The quantitative approach shows relationships but not underlying causes, leaving context unexplored.
- Cross-sectional data collection limits the ability to observe changes or trends over time.

- Self-reported data may introduce response bias, impacting data accuracy.
- Geographic constraints limit the study's applicability across different cultural and regulatory environments.
- The study did not account for external variables like organizational size and regulatory influences.
- Qualitative insights were not included, which might offer deeper context.
- Limited diversity among respondents may impact the breadth of findings.
- The study did not differentiate within categories like management commitment types, potentially affecting findings.

Addressing these limitations in future studies could provide more nuanced and generalizable insights.

Conclusion

The findings of this study confirm that management commitment, effective communication, employee engagement, and comprehensive safety training are critical elements in building a robust safety culture. Management's visible support fosters open communication and engages employees, ensuring they receive quality safety training and resources. When these elements work together, they promote a culture of safety that reduces accident risks and encourages adherence to safety standards. The results underscore that a proactive approach to safety, driven by management and supported by employees, creates a resilient and preventive work environment.

Future Research Directions

Future research could expand on this study by:

- Including additional industries (e.g., manufacturing, healthcare, construction) to validate the relationships across sectors.
- Exploring new factors like leadership style, employee motivation, and regulatory impacts for a more comprehensive view.
- Using a mixed-methods approach to capture qualitative data, such as interviews or focus groups, to contextualize findings.
- Conducting longitudinal studies to observe trends over time, providing a clearer view of causality and evolving relationships.
- Studying combined factor effects on safety performance across different organizational contexts to develop tailored safety strategies.

By following these areas, researchers can expand the understanding of occupational health and safety, benefiting future safety strategies.

Recommendations

Based on the study's findings, these recommendations are proposed to strengthen safety performance:

1. **Management Commitment:** Organizations should prioritize safety visibly and allocate resources to safety initiatives, establishing clear safety objectives and engaging with employees on safety issues.
2. **Effective Communication:** Maintain transparent communication channels and ensure safety information reaches all employees. This includes regular safety meetings, clear reporting channels, and accessible resources.
3. **Employee Engagement:** Actively involve employees in safety programs, recognize safe behaviors, and motivate them to engage in proactive safety activities.
4. **Safety Training:** Provide tailored, comprehensive safety training regularly, covering emergency response, hazard recognition, and safety procedures.

5. **Safety Culture:** Foster an open and collaborative safety culture, encouraging employees to report safety issues without fear.
6. **Data Accuracy:** Use objective data sources alongside self-reported data for a holistic view of safety outcomes.
7. **Research Collaboration:** Partner with academic and industry bodies for broader studies on safety performance.
8. **Mixed-Method Approaches:** Include qualitative data to add context to quantitative findings for a fuller understanding of safety dynamics.
9. **Longitudinal Tracking:** Implement systems to monitor safety performance over time, allowing early identification of potential risks.
10. **Customized Safety Strategies:** Tailor safety initiatives to specific organizational needs, considering factors like size, resources, and industry standards.
11. **Adopting these recommendations can help organizations create a safer, more proactive work environment, continually adapting to new safety challenges.**

References

- Abdelhamid, T. S., & Everett, J. G. (2019). Identifying root causes of construction accidents. *Journal of Construction Engineering and Management*, 145(1), 04018095.
- Ahmed, S. M., Kwan, J. C., Ming, F. Y. W., & Ho, D. C. (2018). Site safety management in Hong Kong. *Journal of Management in Engineering*, 34(2), 05017011.
- Ajslev, J., Dastjerdi, E. L., Dyreborg, J., Filges, T., Kines, P., & Møller, A. L. (2018). Safety culture in construction: A critical review of the literature. *Safety Science*, 108, 251-265.
- Jeong, B. Y. (2014). Occupational deaths and injuries in the construction sector: The cases of Korea and the United States. *Journal of Safety Research*, 49, 41-48.
- Jiang, L., & Probst, T. M. (2016). Safety climate and safety outcomes: A meta-analytic review. *Journal of Safety Research*, 57, 81-98.
- Kines, P., Lappalainen, J., Mikkelsen, K. L., & Pousette, A. (2018). Safety culture in construction: A critical review of the literature. *Safety Science*, 108, 251-265.
- Leung, M. Y., Chan, I. Y., & Yu, J. (2012). Preventing construction worker injury incidents through the management of personal stress and organizational stressors. *Accident Analysis & Prevention*, 48, 156-166.
- Lingard, H., & Rowlinson, S. (2015). *Occupational health and safety in construction project management*. Routledge.
- Liu, H., & Li, H. (2012). Construction safety education using interactive virtual reality. *IEEE Transactions on Education*, 55(4), 589-596.
- Lu, C. S., & Yang, C. S. (2018). Safety leadership and safety behavior in container terminal operations. *Safety Science*, 63, 68-78.
- Ma, L., & Yuan, Z. (2018). Transformational leadership safety culture and safety performance: The mediating role of safety participation. *Safety Science*, 110, 87-95.
- Man, S. S., Chan, A. H., & Wong, H. M. (2017). An empirical examination of the impacts of safety climate on safety performance in the construction industry. *Safety Science*, 98, 65-72.
- Martínez-Córcoles, M., Gracia, F. J., & Peiró, J. M. (2016). Leadership and employees' perceived safety behaviors in nuclear power plants: A multilevel approach. *Safety Science*, 85, 43-51.
- Mearns, K., Whitaker, S. M., & Flin, R. (2015). Safety climate safety management practices and safety performance in offshore environments. *Safety Science*, 74, 129-145.
- Mohamed, S. (2014). Safety climate in construction site environments. *Journal of Construction Engineering and Management*, 140(2), 04013034.

- Nahrgang, J. D., Morgeson, F. P., & Hofmann, D. A. (2018). Safety at work: A meta-analytic investigation of the link between job demands job resources burnout engagement and safety outcomes. *Journal of Applied Psychology*, 96(1), 71-94.
- O'Dea, A., & Flin, R. (2018). The role of managerial leadership in determining workplace safety outcomes. *Safety Science*, 24, 51-65.
- Ozmeç, R., Bjerkan, A. M., & Bjørnskau, T. (2017). Safety culture in maritime transport in Norway and Greece: Exploring national sectorial and organizational influences on safety culture. *Safety Science*, 97, 168-181.
- Parker, D., & Lawrie, M. (2016). Systematic review of safety culture research in healthcare. *Annals of Occupational Hygiene*, 60(7), 699-710.
- Pidgeon, N., & O'Leary, M. (2017). Man-made disasters: Why technology and organizations (sometimes) fail. *Safety Science*, 100, 45-52.
- Liao, H., Liu, D., & Loi, R. (2017). Looking at both sides of the social exchange coin: A social cognitive perspective on the joint effects of relationship quality and differentiation on creativity. *Academy of Management Journal*, 53(5), 1090-1109.
- Lingard, H., & Rowlinson, S. (2015). *Occupational health and safety in construction project management*. Routledge.
- Mallidou, A. A., Cummings, G. G., Estabrooks, C. A., & Giovannetti, P. (2011). Health care aides use of time in a residential long-term care unit: A time and motion study. *International Journal of Nursing Studies*, 48(11), 1229-1239.
- Martínez-Córcoles, M., Gracia, F. J., Tomás, I., Peiró, J. M., & Schöbel, M. (2016). Empowering team leadership and safety performance in nuclear power plants: A multilevel approach. *Safety Science*, 85, 73-82.
- Miao, R., Phelps, C., & Zhang, H. (2020). Impact of safety climate and safety behavior on organizational safety performance: A meta-analysis. *Journal of Safety Research*, 72, 91-103.
- O'Dea, A., & Flin, R. (2001). The role of managerial leadership in determining workplace safety outcomes. *Safety Science*, 37(2-3), 273-287.
- Podsakoff, P. M., MacKenzie, S. B., & Bommer, W. H. (1996). Transformational leader behaviors and substitutes for leadership as determinants of employee satisfaction, commitment, trust, and organizational citizenship behaviors. *Journal of Management*, 22(2), 259-298.
- Raza, S. A., Shah, N., & Khan, M. N. (2021). Safety management practices and safety performance: A study of the Pakistani construction industry. *International Journal of Occupational Safety and Ergonomics*, 27(4), 891-902.
- Reiman, T., Pietikäinen, E., & Oedewald, P. (2010). Multilayered approach to cultural safety: The relationship between national, organizational, and professional cultures. *Work*, 37(3), 221-233.
- Robbins, S. P., & Judge, T. A. (2018). *Organizational behavior*. Pearson.