Transforming Construction with Off-site Methods and Technologies (TCOT) Conference: Designing Tomorrow's Construction, Today

August 20-22, 2024, Fredericton, New Brunswick, Canada

The Role of Human Dimension to Safe Working Condition in the Construction Industry: A conceptual framework

Alejo, A.O[1,*], Aigbavboa, C.O[1], and Aghimien, D.O[2]
[1]Sustainable Human Settlement and Construction Research Centre, Faculty of Engineering and the Built Environment, University of Johannesburg, Johannesburg, South Africa
[2] School of Arts, Design and Architecture, De Montfort University, Leicester, United Kingdom
[*] 222200352@student.uj.ac.za

Abstract: This study aims to introduce the concept of human aspects in safe working conditions for the construction industry and identify application domains. Although human dimension is a field that has been around for a while in most safety-critical industries, it is still relatively new to many developing countries' construction industries. The primary goal of this study was to determine how important human variables are to safe working conditions in the construction industry. The framework of human aspects to safe working conditions in the construction sector was developed through a survey of the literature. The contribution of human dimensions to safety in the construction industry was measured using factors such as physical aging, knowledge of safety, forbidding drinking habits, influence of marital status and number of dependents, educational level and status, attitude of the individual, and communication. Results showed that safe and productive work environments can provide several advantages for both companies and employees. These findings contribute to the development of a more sustainable, productive, and healthy work environment. The construction industry in developing nations should be able to produce safer projects using this framework in accordance with Sustainable Development Goals 3 and 9 (SDGs), which translates into a workable solution to the industry's hazardous character.

Keywords: Human dimension, safe, working conditions, construction industry

1 INTRODUCTION

The construction industry is regarded as an extremely dangerous one (Zhao et al., 2014). As such, determining the measures associated with safety management and analysing accident cause are challenging tasks (Harvey et al., 2018) given that the global accident rate is consistently high (Dumrak et al., 2013). The unique characteristics of the construction industry are what determine this condition (Cheng et al.,2010). There are several factors that contribute to the high rate of accidents and injuries, such as frequent employee turnover, subcontracting, stringent contract deadlines, working outdoors in all weather conditions, a shortage of highly skilled workers, the use of antiquated equipment, frequent site changes, and having multiple businesses operating simultaneously on the same property (Carrillo-Castrillo et al., 2017). Significant social and economic ramifications are also associated with these phenomenon (Mahfuth et al., 2019). In actuality, the enhancement of worker safety depends on lowering hazards associated with certain tasks that take human dimensions into account (Fargnoli et al., 2018). According to Mitropoulos et al. (2009), analysing the aspects of working tasks is necessary to address such complexity because normative approaches seldom take the peculiarities of workplace procedures into adequate consideration. So, since ensuring the safety of the different activities is a requirement for ensuring a higher degree of safety from a project and an operational standpoint, specific work scenarios should be given more thought (Sousa et al., 2014). This implies that the study of human dimension needs to receive greater attention (Di Pasquale et al., 2015). Enhancing worker safety and well-being is one of the main goals of the human dimension complex role in maintaining safe conditions for workers in the construction sector. This will be achieved through viable human dimension factors to enhance safe and productive work environments for offsite and onsite activities in the construction industry.

2 HUMAN DIMENSION IN SAFE WORKING CONDITION

Workers generally become more productive when they feel protected from injuries and are content with their working environment (Luria and Yagil, 2010; Dode et al., 2016). However, it is not always easy to learn from past mistakes, and theoretical understanding of human dimensions and the bound of human performance is not always applied in daily practice to the degree that management anticipates, for instance, in compliance with safety standards and laws (Griffin and Neal, 2000; Bahari, 2013). While safety training may be provided, most people learn safety skills from experience. According to Griffin and Neal (2000), Cheyne et al. (2002), Nesheim et al. (2014), and other authors, the experience that more seasoned employees share with less seasoned employees is a major factor in the development of positive attitudes about safety. Junior employees typically pick up these skills—which are related to performance management and observing safety regulations—over time, whereas older employees may have learned pertinent information through practice and training. Furthermore, employees' views about actively participating in safety procedures are influenced by their position within the organization (Ahasan, 2002; Denkowski et al., 2016) more so than by prior work experience in different facilities (Nesheim et al., 2014; Havold, 2005). The variations in safety perceptions across job experience levels that were previously discussed are indicative of the different ways that workers manage conflicting objectives while doing their duties. Efficiency and thoroughness will always have to be traded off in the workplace, where employees must fulfil a variety of sometimes conflicting goals at the same time (such as productivity, quality, safety, and security) (Hollnagel 2009; Fritzsche et al., 2014) and face uncertainty and conundrums when making decisions (Nathanael et al., 2016). According to Dekker (2011), having insufficient or inadequate resources—such as time, expertise, and tools—influences how well people work both individually and as a group. It can also lead businesses into dangerous circumstances and unintended consequences, such as safety mishaps and lower-quality deliverables. If managers consider the interdependence of these two goals and recognize the need to create an equilibrium, they have other options besides a competing relationship between production and safety (Kramer, 2013; Dekker, 2013).

3 PREVIOUS FRAMEWORK OF HUMAN DIMENSION

Human dimensions are traditionally understood to be the study of how people interact with their surroundings and the tools they use at work (Thevendran and Mawdesley, 2004). Assessing human error has been shown to improve performance and lower the likelihood of mishaps (Islam et al., 2017). Several tools that help achieve this objective—also known as Human Reliability Analysis (HRA) —can be seen in the literature (Kirwan, 1992). In safety-critical industries like nuclear power plants (Alvarenga, 2014), marine systems [Strand and Haskins, 2018], the railroad and aviation sectors (Kunlun et al., 2011), chemical facilities, etc., the study of human factors has been widely implemented. However, due to the complexity of their resource requirements and computing needs, these tools are not commonly employed in different work situations (Marhavilas et al., 2011). Most of the research in the construction sector analyse worker behaviour from an ergonomics standpoint (Mittal et al., 2013), particularly those that concentrate on the features of work equipment (Su et al., 2015). Choudhry (2014), for instance, examined several case studies of businesses and employees who have effectively used the behaviour-based safety (BBS) strategy to reduce injuries. Consequently, Li et al. (2015) suggested an enhanced BBS model, which successfully increased safety management's efficiency. Additionally, behaviour-based safety has been examined via the lens of system dynamics to highlight the feedback effects of this kind of model (Guo et al., 2018). Wu et al. (2018) developed a stress scale specifically for construction workers and discovered a correlation between the variables related to occupational stress and safety behaviour. However, because these studies demand a long enough observation period and specialized knowledge for result analysis, they can be resource- and time-intensive, making it challenging for small businesses to adopt them (Embrey, 2004). According to certain research (Seo et al., 2015; Zhou et al., 2013), applying visual aids and cutting-edge technology can improve safety performances by lowering human mistake. Small and medium-sized businesses' (SMEs') safety requirements may differ from those of major corporations; hence it is necessary to research how the models might be implemented in these settings (Zaira and Hadikusumo 2017). Additionally, employees of SMEs perceived less safety knowledge than employees of large companies (Guo et al., 2018). This is primarily because SMEs lack resources and a structured management organization (Aneziris et al., 2012), and because task switching frequently results in a low level of specialization (Fargnoli et al., 2018). Lean construction strategies can reduce human error and improve safety performance in building projects, according to Moaveni et al. (2019), who focused more on the analysis of human dependability. A better technique for determining the Human Factors Analysis and Classification System (HFACS) that can aid in enhancing safety performances was also proposed by Ye et al. (2018). The construction sector continues to devote little attention to assessing and monitoring employee behaviour with a focus on human reliability, despite the significance of the insights offered in these works (Asilian-Mahabadi and colleagues, 2018). A more thorough process for effective safety management should be provided by a bottom-up approach, which will make it possible to achieve solutions that are more in line with workers' needs for safety. Their recommendations are typically top-down and best applied at the project level (Zhou et al., 2015). It is vital to conduct more research on the variables impacting workers' risky behaviour in the sector while taking human reliability concerns into consideration, as these aspects are closely linked to safe working conditions in the construction industry.

4 RESEARCH APPROACH

The purpose of this study is to provide a framework on the human aspect of safe working conditions in the construction industry. The proposed human dimension of safe working conditions in the construction industry was developed using secondary data. This secondary data served as the benchmark for the systematic review of this research work. The Scopus databases and ISI Web of Science were searched for literature using the keywords "working condition," "human dimension," and "construction industry." Based on Guz and Rushchitsky's (2009) submission, which states that the Scopus archives and ISI Web of Science have the most widely used sources of research publications pertaining to scientific subjects, these databases were selected. Over 200 papers were found throughout the search, and these were carefully reviewed to see if they had anything to do with the main topic of the study. A total of 79 articles satisfied the requirements to be deemed for this investigation; having limited the search to publication between 2002-2019 due to overlapping of some research papers. However, the search was restricted to publications, and it was further refined by benchmarking the search on journal and conference papers. In the end, it was determined that 62 published works that addressed human dimension studies of both developed and developing construction industries worldwide were pertinent. Therefore, all indicators used to gauge safe working conditions on construction projects within the examined construction industries are included in the study's definition of the "human dimension."

This is being done to delineate the essential human dimension variables needed to create safe working conditions in the construction sector. The seven dimensions that make up these sustainable human dimensions construct is physical aging, safety knowledge, forbidding drinking habits, the impact of marital status and the number of dependents, educational attainment and status, attitude of the person or individual, and communication (figure 1). By using this framework, the construction industry should be able to produce safer projects that meet Sustainable Development Goals 3 and 9 (SDGs), which translates into workable solutions.

5 DISCUSSION

Hinze (1997) discovered that an individual's safety behaviour may be significantly influenced by demographic factors such as age and other personal characteristics like gender, marital status, degree of education, and prior job experience in the field. Siu et al.'s (2004) study on the differences in safety attitudes and performance between older and younger Hong Kong construction workers included 374 Chinese workers from 27 distinct construction sites. The survey indicated that older workers had more pro-safety sentiments. Additionally, senior employees are more concerned about workplace safety than younger employees, according to experts. Workers' physical bravery and dexterity decline with age, and they opt to act more cautiously for their own safety. Young people are enthusiastic and frequently irresponsible.

The improvement of employees' safety behaviours is also significantly influenced by their knowledge of safety (Idirimanna and Jayawardena, 2011; Fang, Chen, and Louisa, 2006; Masood and Choudhry, 2012). Additionally, professionals made it clear that there is a greater likelihood that workers may act unsafely while on the job if they don't understand why or, worse yet, if they don't want to. Therefore, developing safety behaviours on-site requires a great deal of safety information.

Drinking habits might also have an impact on worker safety behaviour. Drinking alcohol while at work increases the risk of harm to both the drinker and those around them, particularly in settings where heavy machinery is used (Frone, 2009). Twenty to twenty-five percent of workplace accidents are estimated to be caused by alcohol consumption (Henderson, Hutcheson, and Davies, 1996). The scientists claim that a person's drinking habits can change how they perceive risk and affect how they feel about safety.

When their societal duties are greater, workers also seem to be more cautious in what they do (Fang, Chen, and Louisa, 2006; Choudhry and Fang, 2008). As per experts, people who are married and have larger families tend to follow safety protocols and guidelines while working on a job site. However, they emphasized that a thorough poll is required to determine precisely how much, as the results can be unexpected when dealing with people.

According to Hinze (1997), education does have a favourable effect on employees' safety behaviour. Experts concurred that having a workforce with people who have solid educational backgrounds makes it easier to meet safety standards. Experts claim that people with good education understand the significance of adhering to workplace safety regulations. People with junior high school diplomas and advanced level (A/L) secondary school education make up most of their workforces. As per Manjula and De silva (2014), interviewers found that individuals with a secondary education are easier to manage and convince to adhere to safety procedures than those with only a primary education.

An individual's attitude, defined as their inclination to respond positively or negatively to specific individuals, objects, or situations, is usually formed via experience. However, everyone's perception of risk and willingness to accept it differ. Safety programs can be more successful if employees' positive attitudes toward safety are reinforced (Johnson, 2003; Schultz, 2004; Tam et al., 2001; Fang et al., 2006).

Efficient communication is essential for maintaining safety since it is the only way to properly comprehend safety procedures and human factors principles. For this reason, communication is very important. Communication within the team increases knowledge of potential risks and the consequences of safety violations, which could result in losses (Fritzsche et al., 2014; Kaminski, 2001; Goncalves et al., 2010). Senior employees must be conscious of how their attitudes affect the opinions of their colleagues, and managers and supervisors who actively communicate their expectations and ideas to the workforce must be mindful of any possible conflicts between safety and productivity objectives. Insufficient channels for bidirectional communication can lead to heightened job demands and a less clear understanding of work objectives and priorities. These factors are linked to dangerous behaviours and an uncomfortable work environment (Clarke, 2006)

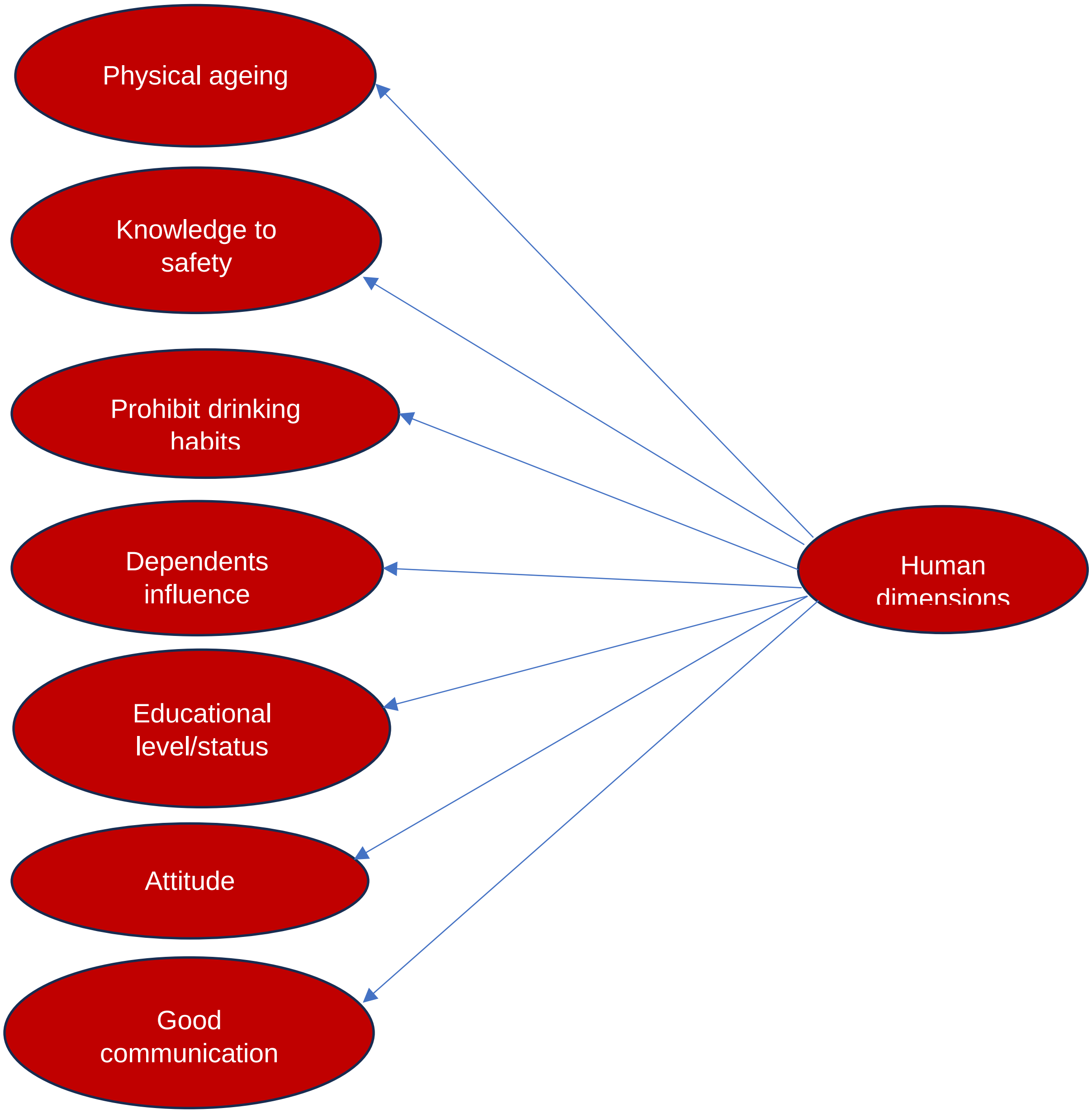

Fig 1: Human dimension conceptual framework.

6. CONCLUSION

In conclusion, the person dimension construct provides a thorough understanding of how individual traits and experiences affect safe working conditions in the construction industry. This is because it considers factors like age, marital status, educational attainment, working experience, work-related pressure, workmate safety behaviour, prior exposure to occupational safety health accidents, awareness of safety, and safety attitude. By addressing these problems, the construction industry may significantly improve worker safety through inclusive practices, which leads to a practical solution to the industry's hazardous nature either on on-site or off-site operation(s). When it comes to offsite construction, human dimensions are vital to maintaining safe working conditions, which have a big impact on safety results and project success. Prospective studies can tackle the difficulties faced by the human dimension during the offsite construction process and production.

7. REFERENCES

Ahasan, A. (2002). Human adaptation to shift work in improving health, safety, and productivity - some recommendations. Work Study 51:9-16.

Alvarenga, M.A.B. (2014). Frutuoso e Melo, P.F.; Fonseca, R.A. A critical review of methods and models for evaluating organizational factors in Human Reliability Analysis. Progr. Nucl. Energ. 75, 25–41.

Aneziris, O.N.; Topali, E.; Papazoglou, I.A. (2012). Occupational risk of building construction. Reliab. Eng. Syst. Saf. 105, 36–46.

Asilian-Mahabadi, H.; Khosravi, Y.; Hassanzadeh-Rangi, N.; Hajizadeh, E.; Behzadan, A.H. (2018). Factors affecting unsafe behaviour in construction projects: Development and validation of a new questionnaire. Int. J. Occup. Saf. Ergon. 1–8.

Bahari SF. (2013). An investigation of safety training and safety outcome in a manufacturing plant. J Teknol 64:59-65.

Carrillo-Castrillo, J.A.; Trillo-Cabello, A.F.; Rubio-Romero, J.C. (2017). Construction accidents: Identification of the main associations between causes, mechanisms, and stages of the construction process. Int. J. Occup. Saf. Ergon. 23, 240–250.

Cheyne C, Oliver A, Tomas JM, Cox S. (2002). The architecture of employee attitudes to safety in the manufacturing sector. Personnel Rev 31:649-70.

Choudhry, R.M. (2014). Behaviour-based safety on construction sites: A case study. Accid. Anal. Prev. 70, 14–23.

Choudhry, R.M., and Fang, D., (2008). Why operatives engage in unsafe work behaviour: Investigating factors on construction sites. Safety Science, 46, 566–584.

Clarke S. (2006). Safety climate in an automobile manufacturing plant: The effects of work environment, job communication and safety attitudes on accidents and unsafe behaviour. Personnel Rev 35:413-30.

Cheng, C.W.; Leu, S.S.; Lin, C.C.; Fan, C. (2010). Characteristic analysis of occupational accidents at small construction enterprises. Saf. Sci. 48, 698–707.

Dekker S. (2011). Drift into failure: from hunting broken components to understanding complex systems. Farnham (UK): Ashgate.

Dekker S. (2013). Production and safety. Hindsight 17:8-9

Denkowski, M. R., Kelly, B. G., and Garvin, M. (2016, March). A paradigm shift in well control training and assessment. In SPE/IADC Drilling Conference and Exhibition (p. D021S010R001). SPE.

Di Pasquale, V.; Miranda, S.; Iannone, R.; Riemma, S. (2015). A simulator for human error probability analysis (SHERPA). Reliab. Eng. Syst. Saf. 139, 17–32.

Dode P, Greig M, Zolfaghari S, Neumann WP. (2016). Integrating human factors into discrete event simulation: a proactive approach to simultaneously design for system performance and employees' wellbeing. Int J Prod Res 54:3105-17

Dumrak, J.; Mostafa, S.; Kamardeen, I.; Rameezdeen, R. (2013). Factors associated with the severity of construction accidents: The case of South Australia. Constr. Econ. Build. 13, 32–49.

Dekker S. (2013). Production and safety. Hindsight 17:8-9

Embrey, D. (2004). Qualitative and quantitative evaluation of human error in risk assessment. In Human Factors for Engineers; Sandom, C., Harvey, R.S., Eds.; IET: Hearts, UK, pp. 151–202, ISBN 0863413293.

Fang, D.P., Chen, Y., Louisa, W., (2006). Safety climate in construction industry: a case study in Hong Kong. Journal of Construction Engineering and Management, 132(6), 573–584.

Fargnoli, M.; Lombardi, M.; Haber, N.; Guadagno, F. (2018). Hazard Function Deployment: A QFD based tool for the assessment of working tasks—A practical study in the construction industry. Int. J. Occup. Saf. Ergon. 1–53.

Fargnoli, M.; Lombardi, M.; Haber, N.; Puri, D. (2018). The Impact of Human Error in the Use of Agricultural Tractors: A Case Study Research in Vineyard Cultivation in Italy. Agriculture 8, 82.

Fritzsche L, Wegge J, Schmauder M, Kliegel M, Schmidt KH. (2014). Good ergonomics and team diversity reduce absenteeism and errors in car manufacturing. Ergonomics. 57:148-61.

Frone, M. R., (2009). Does a permissive workplace substance use climate affect employees who do not use alcohol and drugs at work? A U.S. national study. PsycholAddictBehav, 23(2), 386-390.

Goncalves R, Lancmana S, Trudeb L, Jarbimb TA, Sznelwarz LI, Santosa MC, Freeman A. (2010). An ergonomic approach to reorganize parking inspection agents' work productivity, health and safety in Sao Paulo, Brazil.Work;36:345-53.

Griffin MA, Neal A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. J Occup Health Psychol 5:347-58.

Guo, B.H.; Goh, Y.M.; Wong, K.L.X. (2018). A system dynamics view of a behaviour-based safety program in the construction industry. Saf. Sci. 104, 202–215.

Guo, B.H.; Yiu, T.W.; González, V.A. (2018). Does company size matter? Validation of an integrative model of safety behaviour across small and large construction companies. J. Saf. Res. 64, 73–81.

Guz, A.N. and Rushchitsky, J.J., 2009. Scopus: A system for the evaluation of scientific journals. International Applied Mechanics, 45(4), p.351.

Harvey, E.J.; Waterson, P.; Dainty, A.R. (2018). Beyond ConCA: Rethinking causality and construction accidents. Appl. Ergon. 73, 108–121.

Håvold JI. (2005). Safety-culture in a Norwegian shipping company. J Saf Res 36: 441-58.

Hollnagel E. (2009). The ETTO principle: efficiency-thoroughness trade off. Farnham (UK): Ashgate.

Hinze, J.W., (1997). Construction safety. New Jersey: Prentice-Hall, Inc.

Henderson, M., Hutcheson, G., and Davies, J., (1996). Alcohol and the workplace. WHO Reg Publ Eur Ser, 67, 1- 100.

Idirimanna, I.A.S.D., and Jayawardena, L.N.A.C., (2011). Factors affecting the health and safety behaviour of factory workers. In: 11th Global Conference on Business and Economics. ISBN: 978-0-9830452-1-2

Islam, R.; Yu, H.; Abbassi, R.; Garaniya, V.; Khan, F. (2017). Development of a monograph for human error likelihood assessment in marine operations. Saf. Sci. 91, 33–39.

Johnson, S.E., (2003). Behavioural safety theory: understanding the theoretical foundation. Professional Safety 48 (10), 39–44.

KaminskiM. (2001). Unintended consequences: organizational practices and their impact on workplace safety and productivity. J Occup Health Psychol 6:127-38.

Kirwan, B. (1992). Human error identification in human reliability assessment. Part 1: Overview of approaches. Appl. Ergon. 23, 299–318.

Kramer W. (2013). The battle between production & safety: safety in the modern do-more-with-less economy. Prof Saf 14-15.

Kunlun, S.; Yan, L.; Ming, X. (2011). A safety approach to predict human error in critical flight tasks. Proc. Eng. 17, 52–62.

Luria G, Yagil D. (2010). Safety perception referents of permanent and temporary employees: safety climate boundaries in the industrial workplace. Accid Anal Prev 42:1423-30

Li, H.; Lu, M.; Hsu, S.C.; Gray, M.; Huang, T. (2015). Proactive behaviour-based safety management for construction safety improvement. Saf. Sci. 75, 107–117.

Mahfuth, K.; Loulizi, A.; Al Hallaq, K.; Tayeh, B.A. (2019). Implementation Phase Safety System for Minimising Construction Project Waste. Buildings, 9, 25.

Manjula, N.H.C., and Nayanthara De Silva, (2014). Factors influencing safety behaviours of construction workers. The 3rd World Construction Symposium 2014: Sustainability and Development in Built Environment 20 – 22 June 2014, Colombo, Sri Lanka.

Marhavilas, P.K.; Koulouriotis, D.; Gemeni, V. (2011) Risk analysis and assessment methodologies in the work sites: On a review, classification, and comparative study of the scientific literature of the period 2000–2009. J. Loss Prev. Process. Ind. 24, 477–523.

Masood, R., and Choudhry, R.M., (2012). Investigation of demographic factors relationship with safety climate. 48th ASC Annual International Conference Proceedings.

Mitropoulos, P.; Cupido, G.; Namboodiri, M. (2009). Cognitive approach to construction safety: Task demand-capability model. J. Constr. Eng. Manag. 135, 881–889.

Mittal, A.; Sharma, H.K.; Mittal, K. (2013). Ergonomic risk controls in construction industry–A literature review. Int. J. Emerg. Res. Manag. Technol. 2, 28–33.

Moaveni, S.; Banihashemi, S.Y.; Mojtahedi, M.A. (2019). Conceptual Model for a Safety-Based Theory of Lean Construction. Buildings 9, 23.

Nathanael D, Tsagkas V, Marmaras N. (2016). Trade-offs among factors shaping operators' decision-making: the case of aircraft maintenance technicians. Cogn Technol Work 18:807-20.
Nesheim T, Gressgård LJ. (2014). Knowledge sharing in a complex organization: Antecedents and safety effects. Saf Sci. 62:28-36.
Schultz, D., (2004). Employee attitudes: a must have. Occupational Health and Safety 73 (6), 66–71.
Seo, J.; Han, S.; Lee, S.; Kim, H. (2015). Computer vision techniques for construction safety and health monitoring. Adv. Eng. Inform. 29, 239–251.
Siu, O.L., Phillips, D.R., and Leung, T. W., (2004). Safety climate and safety performance among construction workers in Hong Kong: the role of psychological strains as mediators, Accident Analysis and Prevention, 36, 359-66.
Sousa, V.; Almeida, N.M.; Dias, L.A. (2014). Risk-based management of occupational safety and health in the construction industry–Part 1: Background knowledge. Saf. Sci. 66, 75–86.
Strand, G.O.; Haskins, C. (2018). On Linking of Task Analysis in the HRA Procedure: The Case of HRA in Offshore Drilling Activities. Safety 4, 39.
Su, X.; Pan, J.; Grinter, M. (2015). Improving construction equipment operation safety from a human-centered perspective. Proced. Eng. 118, 290–295.
Tam, C.M., Fung, I.W.H., Chan, A.P.C., (2001). Study of attitude changes in people after the implementation of a new safety management system: the supervision plan. Construction Management and Economics 19, 393–403.
Thevendran, V.; Mawdesley, M.J. (2004). Perception of human risk factors in construction projects: An exploratory study. Int. J. Proj. Manag. 22, 131–137.
Wu, X.; Li, Y.; Yao, Y.; Luo, X.; He, X.; Yin, W. (2018). Development of construction workers job stress scale to study and the relationship between job stress and safety behaviour: An empirical study in Beijing. Int. J. Environ. Res. Public Health 15, 2409.
Ye, G.; Tan, Q.; Gong, X.; Xiang, Q.; Wang, Y.; Liu, Q. (2018). Improved HFACS on Human Factors of Construction Accidents: A China Perspective. Adv. Civ. Eng. 1–15.
Zaira, M.M.; Hadikusumo, B.H. (2017). Structural equation model of integrated safety intervention practices affecting the safety behaviour of workers in the construction industry. Saf. Sci. 98, 124–135.
Zhao, D.; Thabet, W.; McCoy, A.; Kleiner, B. (2014). Electrical deaths in the US construction: An analysis of fatality investigations. Int. J. Inj. Control. Saf. Prev. 21, 278–288.
Zhou, Z.; Goh, Y.M.; Li, Q. (2015). Overview and analysis of safety management studies in the construction industry. Saf. Sci. 72, 337–350.
Zhou, Z.; Irizarry, J.; Li, Q. (2013) Applying advanced technology to improve safety management in the construction industry: A literature review. Constr. Manag. Econ., 31, 606–622.