Occupational Safety among Women Engineers

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A company must motivate its employees through various methods to foster a safe and healthy Work Environment (WEN). To ensure these safety requirements, Occupational Safety (OCS) programs are the most helpful when it comes to making a secure and healthy workplace where safety is the main priority. The OCS system includes Occupational and Nonoccupational Safety management, which benefits individuals, organizations and employee motivation, which ultimately enhances positive outcomes. Against this background, construction industries are significant in that workers often experience the risk of death when carrying out their duties.

work environment (WEN) | safety commitment (SCT) | personal protection | safety measures | construction industry | women engineers

1. Safety-Related Factors

1.1. Work Environment

In the organizational safety climates, employee attitudes regarding the maintenance of safety protocols in the Work Environment (WEN) significantly reduce workplace hazards. Additionally, individual accountability is also favorable and crucial to maintain safety levels to eliminate maximum workplace danger in organizations [1]. In fulfilling the WEN, smart technology has the potential role to boost worker productivity with minimal workplace accidents [2]. The enablers, such as workplace discipline and the WEN, positively and significantly influence occupational health and safety [3]. From the industrial health and safety perspective, calculating workplace risks is better for organizations. These risks occur due to electricity and related hazards in the workplace [4]. This risk elimination is possible through an advantageous WEN [5].

1.2. Safety Equipment

In terms of safety equipment, Personal Protection (PP) ensures health and safety [6]. There is a clear correlation between firefighter safety and safety-specific revolutionary leadership and a positive correlation between the use of PP equipment and the motivation to be safe [7]. The favorable effects of the safety climate and risk perceptions substantially affect attitudes towards wearing PP equipment [8]. A good safety environment influences the perceived use of PP. Sensitivity to noise significantly influences how healthy employees perceive the effects of noise and how they behave towards their physical protection. In addition, the safety environment can substantially benefit employees' perceptions of risk, and their expectations and values and can also directly affect PP behavior. At the same time, perceptions of risk, anticipation and valuation are different mediating factors that do not interfere with

one another [9]. During the COVID-19 pandemic, PP equipment, such as masks and sanitizer, has remained effective at resisting COVID-19 [10]. The organizational risks and emotional fatigue are associated with workplace satisfaction, whereas psychosocial risks are significant predictors of burnout. Nevertheless, by initiating PP steps, these impacts are reduced [11].

1.3. Safety Training and Knowledge

Safety instruction is the most significant factor that influences success in terms of safety. A safety mindset and understanding are the best ways to mediate this relationship. Effective safety instruction is another safety management technique that can help to create a successful safety strategy [12]. Training in safety skills reduces the chances of individual injuries from organizational incidents [13].

1.4. Need of Women

The top four viable tactics in construction are recognized to provide women with adequate sanitary facilities in the workplace [14]. Given the demanding positions and opportunities for their professional development, there is a need to provide women, as role models, with a flexible organizational culture. However, women face several existing workplace challenges due to their nature, organizational structures and surroundings. In addition, women encounter sexual harassment, stress and gender discrimination. Additionally, the absence of daycare services, paid absences and flexible work arrangements (such as maternity leave) create unnoticed difficulties that limit women's professional potential. Often, these are acknowledged as the major obstacles facing women in the construction industry [15]. Similarly, the findings of [16]'s review confirm that the USA, South Africa, Australia and Japan are leading the advancement of research in women's health and safety. In addition, biologically associated dangers were found to be the main stresses or hazards encountered by women in the construction industry. In many countries, the construction industry is faced with skill shortages. When compared to men, women experience lower incidence rates in both professional and manual or trade occupations. Women who work in construction and plumbing and operate earthmoving equipment are more likely to sustain injuries that leave them permanently disabled. Among female employees, fractures, soft tissue injuries, deafness, anxiety, stress and depression cause permanent incapacities. Finally, falls from the same height, muscle strain from handling items, prolonged sound exposure, job stress, workplace harassment and bullying lead to incapacitating injuries that cannot be cured [17]. When working in sweltering weather, employees with a medical problem such as hypertension are more likely to experience adverse effects on their health. Female workers have more heat-related illnesses [18]. Attracting women into a profession that emphasizes conflict and aggression is difficult [19]. Consequently, the construction industry is working hard to alter its reputation and culture and professional organizations, and labor unions and colleges are supporting their efforts. In the construction industry, an accident happens when electrical systems are not de-energized, safe distances are not maintained, PP equipment are inappropriately used, poor work practices lead to unintentional contact with exposed electrical parts, broken tools and equipment are used, there is a lack of functional safety devices or a hazardous environment, and preventative actions (safe work practices, insulation, guarding, grounding and electrical protective devices) are not taken [20]. Due to their character, organizational

structure, and surroundings, women engineers, in particular, encounter several employment problems. They face many difficulties, including sexual harassment, stress and gender discrimination, particularly in construction sites.

1.5. Occupational Safety of Women Engineers

The behavior factor is more effective when preventing rather than setting habitual risk taking and making repetitive warnings. In addition, it is essential to determine the ideal intensity of intervention (such as scheduling and regularity) that will reduce or delay the development of hazardous behaviors [21]. Designs, which include safety measures, significantly improve construction Occupational Safety (OCS) and workers' health and create a favorable environment for safe learning, continuous engagement in education and training, and designs for lifelong organizational safety [22]. The factors presenting the most significant barriers are the expense of adopting COVID-19 pandemic safety precautions, a lack of cooperation and misinformation [23]. However, fewer respondents mentioned superstitions, a shortage of PP equipment and loss of COVID-19 materials [24]. To ensure the safety management system, several industries possess legal safety management system standards that emphasize a safety culture, and their work includes safety culture components such as reporting/a just culture, continuous development and involvement [25][26][27]. Although there have been significant advancements in workplace Occupational Safety and health regulations throughout the years, there continues to be many injuries, deaths and incidents of health and safety illnesses [28].

1.6. Safety Culture and Commitment

Safety Commitment (SCT) is a crucial factor when determining the stability of miners' safe behaviors. The thoughtful leaders mirror the workgroup's dedication to safety. However, when opinion leaders and group chiefs are different, opinion leaders rather than group chiefs prove to have a more outstanding commitment to safety. There are consistent correlations between cluster subgroups' safety traits and the overall workgroup's degree of dedication to safety [29]. While the SCT attributes of the employees' calculative leader relate only to reducing levels of employee compliance, the SCT attributes of the emotional leader are linked to employee safety behaviors. However, there is no association between employees' self-reported safety behaviors and the conventional SCT attributes of their boss [30]. A lower perceived SCT relates to reduced involvement and compliance with safety measures [31]. A safety culture focusing on managers' and workers' commitment to safety means having leaders and managers foster a secure workplace environment by demonstrating their dedication to safety [25]. They have greater power to ensure all activities are carried out safely within the company [32].

1.7. Safety Sustainability

A program that uses safety as a starting point to operationalize sustainability should ideally place stress equally on the advantages of safety for people and the business aspects of pursuing safety measures [33] through mediators and social-sustainability practices, such as the work settings, working conditions, health and safety education and training, and the benefit of the couriers' employment satisfaction during the COVID-19 pandemic (psychological safety and perceived fairness) [34]. Programs for OCS and health help lure in and keep talent, which enhances the

effectiveness of these organizations' internal operations. Total quality management practices positively and significantly impact the OCS and health performance of organizations [35].

1.8. Knowledge Gaps

Consequently, there remains significant gaps in the existing literature mentioned above, which need to be filled. First, several scholars tested factors such as working conditions, health and safety, education, training, employment happiness, psychological safety, perceived fairness, total quality management practices, PP, health performance, FSR, workers' commitment, SCT, TESS and managerial dedication. They examined the OCS, safety measures and health occupation [25][32][33][34][35]. However, the literature does not include a model to investigate the integrated contribution made by the WEN, PP, TESS, FSR and SCT towards OCS. Second, particularly among women in the construction industry as units of analysis and, more specifically, in the construction industry, there remains a massive gap in the literature. Finally, the literature contains no similar findings about investigations on Egypt's construction sites [13][36][37][38]. After considering these existing gaps and the positive associations in the literature, the researchers developed a model (see **Figure 1**) to investigate women engineers working on Egypt's construction sites.

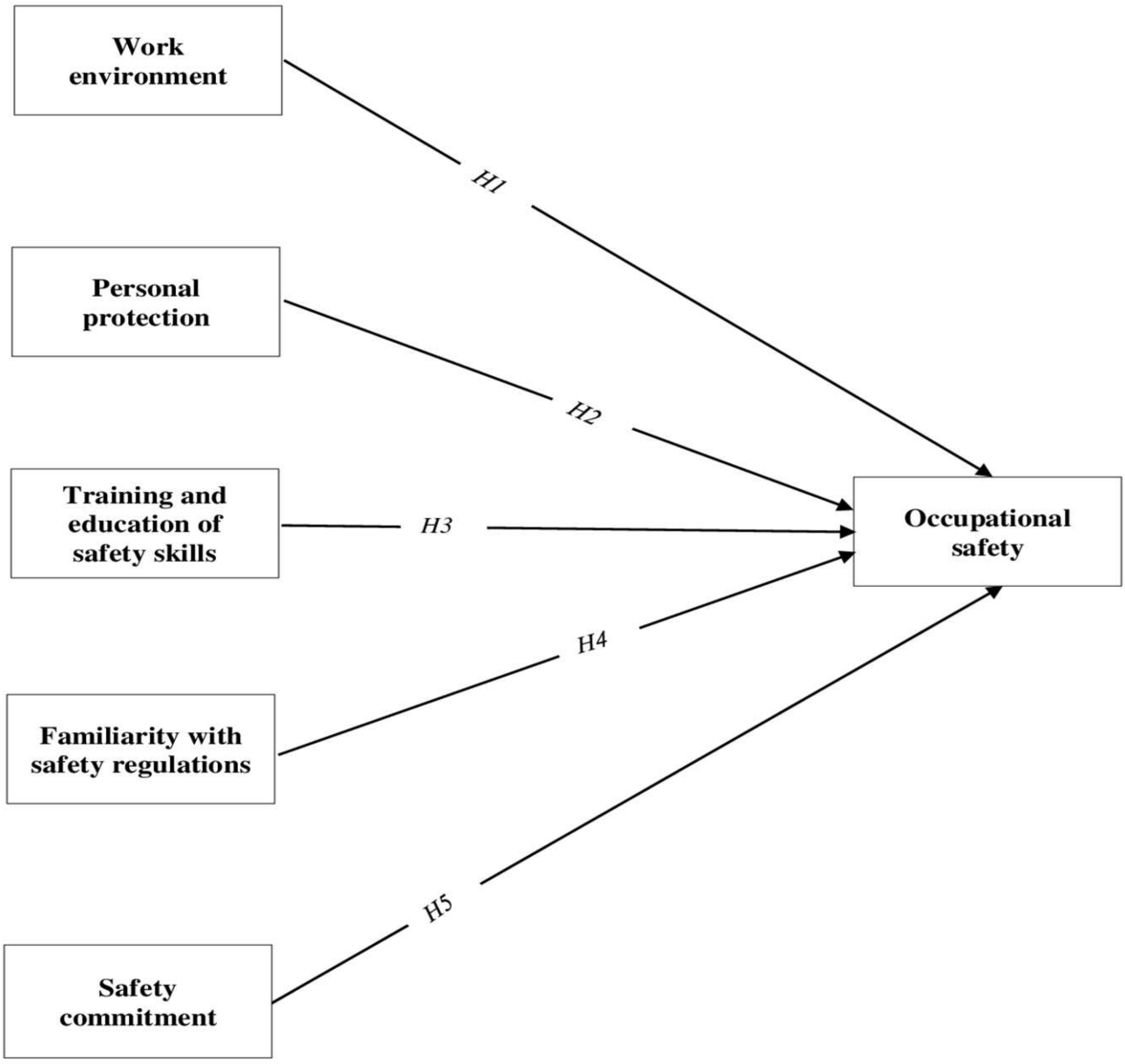

Figure 1. Conceptual model of the study. Source: authors' own conceptualization.

2. Work Environment (WEN) and Occupational Safety (OCS)

Workplace safety, health, the environment and sustainable development represent the key unifying factors of the highly divisive ideas. However, these ideas are connected [39]. According to review-based research, the WEN and work ethics impact OCS and health. In comparison, occupational wellness impacts OCS [3]. Monitoring nurses' working circumstances enhances the hospital culture which, in turn, improves employee safety and increases hospital revenue through better system results (such as a lower turnover of employees) [40]. A changing work setting impacts safety and workplace accidents. This suggests an underlying mechanism based on organizational variables to further understand these impacts and the effect of a disability attributed to a workplace accident on an individual's lifespan [41]. The job processes connected to infrastructure and construction significantly impact the WEN [42]. There is a need to learn how nurses view their WEN and workplace safety and the sociodemographic

factors and employment requirements that affect these factors. Their workplace is of average standard, with inadequate job safety [43]. Ref. [44]'s findings indicate that the effect on the Spanish industry will improve working conditions. From an academic perspective, workplace health and safety integrate environmental, societal and corporate variables. Healthy workers, a safer workplace, lower costs due to fewer accidents, a controlled atmosphere, managed workplace incidents and enhanced workplace safety information contribute to sustainable development [45]. Water utility sector workers are subject to dangers and hazards. Workplace safety and health risks affect this sector's working conditions [46]. Ref. [47]'s findings show that innovation is crucial for any country's long-term growth. Workplace innovation drastically alters the employees' WEN. In a similar dimension, the quality of the WEN predicts the OCS [48]. Safety communications, management's dedication to safety, and workplace safety training are the variables that affect if workers are successful in terms of safety. An improvement in safety efficiency is linked to a reduction in workplace accidents. When reducing the number of accidents and near misses, safety communications are the most critical aspect of a safe WEN [49]. It is essential to prioritize workplace safety to motivate a company's workers in various ways. A secure, safe and healthy work setting, non-OCS and safety for tasks performed outside of the workplace are all goals of the OCS system [50].

3. Personal Protection (PP) and Occupational Safety (OCS)

Human behaviors make a tremendously significant contribution to restricting OCS. With the employees' involvement and a specific pattern of behavior as crucial criteria required to alter employees' behaviors, the safety problem can be addressed effectively [51]. Using PP equipment in such a way is more helpful in reducing accident rates [52]. Due to the deficient use of PP equipment, employees in small-scale businesses are subjected to a wide range of physical, chemical and accidental dangers [53]. PP equipment effectively reduces work illnesses, accidents and other hazards that would otherwise cause significant losses in human capital and resources in small-scale industries. To ensure a safe and healthy WEN, there is a need to provide employees with appropriate and timely safety training and sophisticated safety equipment for everyday activities [54]. Ref. [55]'s findings demonstrate that preserving and safeguarding employees' health and safety helps avoid illnesses and injuries and improves workers' living standards. Additionally, it helps to engage in "low awareness activities" such as training and development, human resource management and environmental concerns. The pollution-avoidance techniques used by employees of the Mexican car refinishing industry affect the communities, the WEN and public health [56]. More particularly, working in elevated areas without safety precautions, losing equilibrium while moving, failing to use safety equipment, having bad experiences and meeting unsafe structures can all lead to accidents [57]. The development of workplace safety and health in the production sector includes exposure to physical and chemical factors, technical controls use and working medical services [58]. Consequently, the PP's role in the workplace remains both robust and constructive.

4. Training and Education of Safety Skills (TESS) and Occupational Safety (OCS)

The use of training is one such intervention used in the industrial and building sectors to address the issue of construction-related workplace health and safety. It provides a better understanding of the human factors affecting the actions of those responsible for accidents on building sites. The inadequate training and education given to new employees on building sites, inappropriate behaviors and a lack of communication make it difficult for project managers to encourage “learning by doing.” [59]. While most of the questioned contractors offered health and safety training, few quantified their programs’ effectiveness in reducing risky behaviors or exposures, elevating work satisfaction or improving productivity [60]. The prevalence of occupational illnesses and injuries has dropped since the advent of health and safety management systems. However, these systems are only effective with a strong workplace safety ethic [61]. It is essential to note that the following information is based on the most recent available data [12]. Practical safety training helps to develop a well-functioning safety policy. Likewise, in construction projects, the accident rate is higher than the average of other industries. OCS and health standards must catch up to enable developing countries’ economies to grow. The authors of [62] demonstrated that the new feedback safety measures, based on goal setting and collaborative follow up, appear to increase the safety and progress of building work significantly. The experts claim that improving safety performance is possible through education/training [63].

Similarly, more than ever before, employees can benefit from comprehensive workplace health and safety training due to national skill requirements [64]. These offer safety educators and industry experts helpful information on creating efficient indicators of danger and receptor training programs to enhance the safety performance of building sites. Based on the vigorous review of the literature, ref. [65]’s findings showed that, as crucial elements of successful training programs, adult-learning cognitive processes are needed to create a solid foundation for the instruction and dissemination of safety information. There is also a need to use the socioecological paradigm in education and develop novel strategies to avoid workplace injuries in young employees. Youth-related incidents decline as workplace health and safety programs and career training programs improve [66][67]. Consequently, TESS is meaningful at ensuring health and safety precautions are taken.

5. Familiarity with Safety Regulations (FSR) and Occupational Safety (OCS)

The researchers identified the variables that included the improper use of PP, a lack of stringent safety regulations, incentives and insufficient management support [68]. The cognitive sign characteristics of familiarity, concreteness, simplicity and meaningfulness have an anticipated influence on understanding ratings. A lack of adherence to health and safety work regulations has led to a disproportionately higher rate of building accidents in developing countries such as Pakistan. According to the findings of previous studies, the two most neglected factors are employees’ participation and the absence of OCS and health instruction in contract papers [69]. Safety awareness and citizenship behaviors among Chinese building employees are important constructs that can significantly improve personnel safety [70]. A lack of knowledge and carelessness or intentional breaches improve attitudes towards using safety precautions. The beliefs about mistakes, taking risks, accidents and how they interact with rules and regulations eventually promote the use of workplace safety measures [71]. At the organizational level, a positive and significant association exists between high-performance work systems and OCS [72]. The formulation,

implementation and monitoring of safety rules and laws are subject to lax procedures, and most building sites need to employ safety-management systems [73]. Effective safety regulation remains an indefinable goal for many industrializing countries. FSR ensures fewer incidents [74]. Management system certification impacts the connection between the chemical industry's safety management and safety performance and has resulted in significant levels of accidents. The safety management methods anticipate safety behaviors. However, safety policies and protocols have become frequent indicators of specific behaviors [75]. Similarly, Ref. [22]'s findings demonstrated that the design of safety measures improves the construction industry's OCS. Although usually regarded as practical, the partnership between service providers and clients regarding safety measures relies on the partner. The provision of safety cooperation includes, among other things, instruction, direction and risk analysis [76].

6. Safety Commitment (SCT) and Occupational Safety (OCS)

There is a positive and strong correlation between employee safety behaviors and a perceived corporate dedication to supporting safety measures. Employees' safety behaviors are more susceptible to perceived corporate commitment and support for safety in general industries and developed regions rather than in high-risk sectors and emerging areas [77]. There is a positive and significant correlation between OCS management and emotional, normative and continual dedication. In addition, workplace health and safety impact favorably on continued behaviors and normative commitment [78]. Healthy workers, a safer workplace, lower costs due to fewer accidents, a controlled atmosphere, managed workplace incidents and enhanced workplace safety information contribute to sustainable development [45]. Ref. [79]'s findings showed that health and safety results can be improved only if systems satisfy strict requirements for top management commitment, efficient workforce participation and program integration. There are negative correlations between workplace health and safety management dimensions and attributed purpose, safety leadership, oversight, safety buildings and equipment and safety processes. The safety leadership and building strongly predict the desire to leave. In addition, the dedication of safety leadership to ensuring the successful formulation of policies and the oversight of occupational health and safety in the workplace positively impacts the employees' desires to leave their jobs [80].

References

1. Cheyne, A.; Oliver, A.; Tomás, J.; Cox, S. The architecture of employee attitudes to safety in the manufacturing sector. Pers. Rev. 2002, 31, 649–670.
2. Khakurel, J.; Melkas, H.; Porras, J. Tapping into the wearable device revolution in the work environment: A systematic review. Inf. Technol. People 2018, 31, 791–818.
3. Saputra, F.; Mahaputra, M.R. Building Occupational Safety and Health (K3): Analysis of the Work Environment and Work Discipline. J. Law Politic Humanit. 2022, 2, 105–114.

4. Ak, M.F.; Yucesan, M.; Gul, M. Occupational health, safety and environmental risk assessment in textile production industry through a Bayesian BWM-VIKOR approach. Stoch. Environ. Res. Risk Assess. 2022, 36, 629–642.
5. Tegor, T.; Thasimmim, S.N.; Dianasari, E.L.; Yusmalina, Y. The influence of work discipline in mediating work environment relationships on job satisfaction. J. Cafe. 2023, 4, 106–112.
6. Nath, N.D.; Behzadan, A.H.; Paal, S.G. Deep learning for site safety: Real-time detection of personal protective equipment. Autom. Constr. 2020, 112, 103085.
7. Smith, T.D.; DeJoy, D.M.; Dyal, M.-A. Safety specific transformational leadership, safety motivation and personal protective equipment use among firefighters. Saf. Sci. 2020, 131, 104930.
8. Man, S.S.; Alabdulkarim, S.; Chan AH, S.; Zhang, T. The acceptance of personal protective equipment among Hong Kong construction workers: An integration of technology acceptance model and theory of planned behavior with risk perception and safety climate. J. Saf. Res. 2021, 79, 329–340.
9. Chong, D.; Chen, L.; Peng, Y.; Yu, A. Occupational noise-related perception and personal protection behavior among Chinese construction workers. Saf. Sci. 2022, 147, 105629.
10. Turgeon, N.; Pagé, M.; Robillard, J.; Goulet, V.; Bahloul, A.; Brochot, C.; Saidi, M.N.; Dumont-Leblond, N.; Duchaine, C. Filtration performance, fit test and side effects of respiratory personal protective equipment following decontamination: Observations for user safety and comfort. PLoS ONE 2023, 18, e0280426.
11. Adamopoulos, I.; Syrou, N.; Lamnisos, D.; Boustras, G. Cross-sectional nationwide study in occupational safety & health: Inspection of job risks context, burn out syndrome and job satisfaction of public health Inspectors in the period of the COVID-19 pandemic in Greece. Saf. Sci. 2023, 158, 105960.
12. Ofori, E.K.; Aram, S.A.; Saalidong, B.M.; Gyimah, J.; Niyonzima, P.; Mintah, C.; Ahakwa, I. Exploring new ante-cedent metrics for safety performance in Ghana’s oil and gas industry using partial least squares structural equation modelling (PLS-SEM). Resour. Policy 2023, 81, 103368.
13. Baruni, R.R.; Miltenberger, R.G. Teaching Safety Skills to Children: A Discussion of Critical Features and Practice Recommendations. Behav. Anal. Pract. 2022, 15, 938–950.
14. Pamidimukkala, A.; Kermanshachi, S. Occupational health and safety challenges in construction industry: A gender-based analysis. In Construction Research Congress; ASCE Press: Reston, VA, USA, 2022; pp. 491–500.
15. Pamidimukkala, A.; Kermanshachi, S. Development of strategies to improve health and safety of women in construction industry: A Delphi method. In Construction Research Congress; ASCE Press: Reston, VA, USA, 2022; pp. 314–323.

16. Mariam, A.T.; Olalusi, O.B.; Haupt, T.C. A scientometric review and meta-analysis of the health and safety of women in construction: Structure and research trends. J. Eng. Des. Technol. 2021, 19, 446–466.
17. Hasan, A.; Kamardeen, I. Occupational Health and Safety Barriers for Gender Diversity in the Australian Construction Industry. J. Constr. Eng. Manag. 2022, 148, 4022100.
18. Karthick, S.; Kermanshachi, S.; Ramaji, I. Health and Safety of Construction Field Workforce Active in Extreme Weather Conditions. In Construction Research Congress; ASCE Press: Reston, VA, USA, 2022; pp. 737–747.
19. Menches, C.L.; Abraham, D.M. Women in construction—Tapping the untapped resource to meet future demands. J. Constr. Eng. Manag. 2007, 133, 701–707.
20. Chi, C.F.; Yang, C.C.; Chen, Z.L. In-depth accident analysis of electrical fatalities in the construction industry. Int. J. Ind. Ergon. 2009, 39, 635–644.
21. Lee, B.; Kim, H. Measuring effects of safety-reminding interventions against risk habituation. Saf. Sci. 2022, 154, 105857.
22. Ibrahim, C.K.I.C.; Belayutham, S.; Manu, P.; Mahamadu, A.-M.; Cheung, C.M. Knowledge, attitude and practices of design for safety (DfS): A dynamic insight between academics and practitioners in Malaysia. Saf. Sci. 2021, 146, 105576.
23. Rahman, T.; Dey, K.; Pyrialakou, V.D.; Das, S. Factors influencing safety perceptions of sharing roadways with autonomous vehicles among vulnerable roadway users. J. Saf. Res. 2023; in press.
24. Simpeh, F.; Bamfo-Agyei, E.; Amoah, C. Barriers to the implementation of COVID-19 safety regulations: Insight from Ghanaian construction sites. J. Eng. Des. Technol. 2022, 20, 47–65.
25. Nævestad, T.-O.; Phillips, R.O. The limits of soft safety regulation: Does successful work with safety culture require SMS implementation? Transp. Res. Interdiscip. Perspect. 2023, 17, 100733.
26. Qian, C.; Balaji, P.; Crilly, D.; Liu, Y. Better Safe Than Sorry: CEO Regulatory Focus and Workplace Safety. J. Manag. 2023, 48.
27. Karwowski, W. Human factors and prevention of falls from height at construction sites. In International Encyclopedia of Ergonomics and Human Factors—3 Volume Set; CRC Press: Boca Raton, FL, USA, 2006; pp. 2699–2703.
28. Karwowski, W. (Ed.) International Encyclopedia of Ergonomics and Human Factors—3 Volume Set; CRC Press: Boca Raton, FL, USA, 2006.
29. Han, S.; Chen, H.; Long, R.; Jiskani, I.M. Can miners' social networks affect their safety commitment? A case study of Chinese coal mining enterprises. Resour. Policy 2022, 75, 102535.

30. Fruhen, L.S.; Andrei, D.M.; Griffin, M.A. Leaders as motivators and meaning makers: How perceived leader behaviors and leader safety commitment attributions shape employees' safety behaviors. Saf. Sci. 2022, 152, 105775.
31. Li, K.; Griffin, M.A. Safety behaviors and job satisfaction during the pandemic: The mediating roles of uncertainty and managerial commitment. J. Saf. Res. 2022, 82, 166–175.
32. Timbang, A.; Prasad, D.M.R.; Azri, M.H. The perspective of leadership and management commitment in process safety management. Indian Chem. Eng. 2023, 74, 1–14.
33. Gilding, P.; Hogarth, M.; Humphries, R. Safe companies: An alternative approach to operationalizing sustainability. Corp. Environ. Strategy 2002, 9, 390–397.
34. Pang, Q.; Fang, M.; Wang, L.; Mi, K.; Su, M. Increasing Couriers' Job Satisfaction through Social-Sustainability Practices: Perceived Fairness and Psychological-Safety Perspectives. Behav. Sci. 2023, 13, 125.
35. Aichouni, M.; Touahmia, M.; Alshammari, S.; Said, M.A.; Aichouni AB, E.; Almudayries, M.; Aljohani, H. An empirical study of the contribution of total quality management to occupational safety and health performance in Saudi organizations. Int. J. Environ. Res. Public Health 2023, 20, 1495.
36. Morosohk, E.; Miltenberger, R. Using Generalization-Enhanced Behavioral Skills Training to Teach Poison Safety Skills to Children with Autism. J. Autism Dev. Disord. 2022, 52, 283–290.
37. Abbas, A.; Seo, J.; Ahn, S.; Luo, Y.; Wyllie, M.J.; Lee, G.; Billinghurst, M. How Immersive Virtual Reality Safety Training System Features Impact Learning Outcomes: An Experimental Study of Forklift Training. J. Manag. Eng. 2023, 39, 4022068.
38. Shayesteh, S.; Ojha, A.; Liu, Y.; Jebelli, H. Human-robot teaming in construction: Evaluative safety training through the integration of immersive technologies and wearable physiological sensing. Saf. Sci. 2023, 159, 106019.
39. Molamohamadi, Z.; Ismail, N. The relationship between occupational safety, health, and environment, and sustainable development: A review and critique. Int. J. Innov. Manag. Technol. 2014, 5, 198–222.
40. Stone, P.W.; Gershon, R.R.M. Nurse Work Environments and Occupational Safety in Intensive Care Units. Policy Politics Nurs. Pract. 2006, 7, 240–247.
41. Koukoulaki, T. New trends in work environment–New effects on safety. Saf. Sci. 2010, 48, 936–942.
42. Scanlon, K.A.; Lloyd, S.M.; Gray, G.M.; Francis, R.A.; LaPuma, P. An Approach to Integrating Occupational Safety and Health into Life Cycle Assessment: Development and Application of Work Environment Characterization Factors. J. Ind. Ecol. 2015, 19, 27–37.

43. Samur, M.; Intepeler, S.S. Factors influencing nurses' perceptions of occupational safety. Arch. Environ. Occup. Health 2017, 72, 45–52.
44. Sesé, A.; Palmer, A.L.; Cajal, B.; Montaño, J.J.; Jiménez, R.; Llorens, N. Occupational safety and health in Spain. J. Saf. Res. 2002, 33, 511–525.
45. Jilcha, K.; Kitaw, D. Industrial occupational safety and health innovation for sustainable development. Eng. Sci. Technol. Int. J. 2017, 20, 372–380.
46. Oluoch, I.; Njogu, P.; Ndeda, J.O.H. Effects of Occupational Safety and Health Hazards' Exposure on Work Environment in the Water Service Industry within Kisumu County—Kenya. IOSR J. Environ. Sci. Toxicol. Food Technol. 2017, 11, 46–51.
47. Jilcha, K.; Kitaw, D.; Beshah, B. Workplace innovation influence on occupational safety and health. Afr. J. Sci. Technol. Innov. Dev. 2016, 8, 33–42.
48. Mattila, M.; Rantanen, E.; Hyttinen, M. The quality of work environment, supervision and safety in building construction. Saf. Sci. 1994, 17, 257–268.
49. Gümüş, R.; Ayhan, M.; Gümüş, B. Safety climate in marble industry and its influence on safety performance and occupational accidents. Arch. Environ. Occup. Health 2023, 78, 48–59.
50. Muthuviknesh, R.; Kumar, K.A. The effect of occupational health and safety management on work environment: A prospective study. Int. J. Adv. Res. Comput. Sci. Manag. Stud. 2014, 2, 63–70.
51. Zin, S.M.; Ismail, F. Employers' behavioural safety compliance factors toward occupational, safety and health improvement in the construction industry. Procedia Soc. Behav. Sci. 2012, 36, 742–751.
52. Rajendran, S.D.; Wahab, S.N.; Yeap, S.P. Design of a Smart Safety Vest Incorporated with Metal Detector Kits for Enhanced Personal Protection. Saf. Health Work. 2020, 11, 537–542.
53. Balkhyour, M.A.; Ahmad, I.; Rehan, M. Assessment of personal protective equipment use and occupational expo-sures in small industries in Jeddah: Health implications for workers. Saudi J. Biol. Sci. 2019, 26, 653–659.
54. Singh, A.; Misra, S.C.; Kumar, V.; Kumar, U. Identification and ordering of safety performance indicators using fuzzy TOPSIS: A case study in Indian construction company. Int. J. Qual. Reliab. Manag. 2022, 39, 77–114.
55. Moore, A.; Parahoo, K.; Fleming, P. Workplace health promotion within small and medium-sized enterprises. Health Educ. 2010, 110, 61–76.
56. Munguía, N.; Zavala, A.; Marin, A.; Moure-Eraso, R.; Velazquez, L. Identifying pollution prevention opportunities in the Mexican auto refinishing industry. Manag. Environ. Qual. Int. J. 2010, 21, 324–335.

57. Cheng, C.-W.; Lin, C.-C.; Leu, S.-S. Use of association rules to explore cause–effect relationships in occupational accidents in the Taiwan construction industry. Saf. Sci. 2010, 48, 436–444.
58. Noweir, M.H.; Alidrisi, M.M.; Al-Darrab, I.A.; Zytoon, M.A. Occupational safety and health performance of the manufacturing sector in Jeddah Industrial Estate, Saudi Arabia: A 20-years follow-up study. Saf. Sci. 2013, 53, 11–24.
59. Mollo, L.G.; Emuze, F.; Smallwood, J. Improving occupational health and safety (OHS) in construction using Training-Within-Industry method. J. Financ. Manag. Prop. Constr. 2019, 24, 655–671.
60. Goldenhar, L.M.; Moran, S.K.; Colligan, M. Health and safety training in a sample of open-shop construction companies. J. Saf. Res. 2001, 32, 237–252.
61. Kim, Y.; Park, J.; Park, M. Creating a Culture of Prevention in Occupational Safety and Health Practice. Saf. Health Work. 2016, 7, 89–96.
62. Laukkanen, T. Construction work and education: Occupational health and safety reviewed. Constr. Manag. Econ. 1999, 17, 53–62.
63. Endroyo, B.; Yuwono, B.E.; Mardapi, D. Soenarto Model of Learning/Training of Occupational Safety & Health (OSH) Based on Industry in the Construction Industry. Procedia Eng. 2015, 125, 83–88.
64. Palassis, J.; Schulte, P.A.; Sweeney, M.H.; Okun, A.H. Enhancing Occupational Safety and Health through Use of the National Skill Standards. Int. J. Occup. Environ. Health 2004, 10, 90–98.
65. Albert, A.; Hallowel, M.R. Revamping occupational safety and health training: Integrating andragogical principles for the adult learner. Constr. Econ. Build. 2013, 13, 128–140.
66. Laberge, M.; MacEachen, E.; Calvet, B. Why are occupational health and safety training approaches not effective? Understanding young worker learning processes using an ergonomic lens. Saf. Sci. 2014, 68, 250–257.
67. Yılmaz, F. Analysis of the interaction between safety measures and workers' safety awareness from the construction workers' perspective. Eng. Constr. Arch. Manag. 2023, 30, 41–55.
68. Debela, M.B.; Deyessa, N.; Begosew, A.M.; Azage, M. Occupational health and safety practices and associated factors among workers in Ethiopia's Metehara and Wonji sugar industries: A convergent parallel mixed design. BMJ Open 2023, 13, e065382.
69. Zahoor, H.; Chan, A.P.; Masood, R.; Choudhry, R.M.; Javed, A.A.; Utama, W.P. Occupational safety and health performance in the Pakistani construction industry: Stakeholders' perspective. Int. J. Constr. Manag. 2016, 16, 209–219.
70. Meng, X.; Chan, A.H. Demographic influences on safety consciousness and safety citizenship behavior of construction workers. Saf. Sci. 2020, 129, 104835.

71. Laurence, D. Safety rules and regulations on mine sites—The problem and a solution. J. Saf. Res. 2005, 36, 39–50.
72. Zacharatos, A.; Barling, J.; Iverson, R.D. High-Performance Work Systems and Occupational Safety. J. Appl. Psychol. 2005, 90, 77–93.
73. Azhar, S.; Choudhry, R. Capacity building in construction health and safety research, education, and practice in Pakistan. Built Environ. Proj. Asset Manag. 2016, 6, 92–105.
74. Haines, F. Regulatory Reform in Light of Regulatory Character: Assessing Industrial Safety Change in the Aftermath of the Kader Toy Factory Fire in Bangkok, Thailand. Soc. Leg. Stud. 2003, 12, 461–487.
75. Vinodkumar, M.N.; Bhasi, M. A study on the impact of management system certification on safety management. Saf. Sci. 2011, 49, 498–507.
76. Nenonen, S.; Vasara, J. Safety Management in Multiemployer Worksites in the Manufacturing Industry: Opinions on Co-Operation and Problems Encountered. Int. J. Occup. Saf. Ergon. 2013, 19, 168–183.
77. Liu, S.; Yang, X.; Mei, Q. The effect of perceived organizational support for safety and organizational commitment on employee safety behavior: A meta-analysis. Int. J. Occup. Saf. Ergon. 2021, 27, 1154–1165.
78. Amponsah-Tawiah, K.; Mensah, J. Occupational Health and Safety and Organizational Commitment: Evidence from the Ghanaian Mining Industry. Saf. Health Work. 2016, 7, 225–230.
79. Gallagher, C.; Underhill, E.; Rimmer, M. Occupational safety and health management systems in Australia: Barriers to success. Policy Pract. Health Saf. 2003, 1, 67–81.
80. Amponsah-Tawiah, K.; Ntow, M.A.O.; Mensah, J. Occupational Health and Safety Management and Turnover Intention in the Ghanaian Mining Sector. Saf. Health Work. 2016, 7, 12–17.