Business & Social Science
IJRBS

Research in Business & Social Science

IJRBS VOL 11 NO 3 (2022) ISSN: 2147-4478

Available online at www.ssbfnet.com
Journal homepage: https://www.ssbfnet.com/ojs/index.php/ijrbs

The effect of safety knowledge and workplace safety climate on safety performance with safety behavior as a mediator: A study on operations worker of Pindad

Pungki Sukmana Putra [(a)*] *Risna Wijayanti* [(b)] *Djumilah Hadiwidjojo* [(c)]

[(a)]*Faculty of Economic and Business, University of Brawijaya, Kyai Parseh Jaya street, Bumiayu, Kedungkandang, 65135 Malang, Indonesia.*
[(b)]*Ph.D., Faculty of Economics and Business, University of Brawijaya, Kembang Sepatu street, 65141, Malang, Indonesia.*
[(c)] *Profesor, Faculty of Economics and Business, University of Brawijaya, Cimahi street, 65113, Malang, Indonesia.*

ARTICLE INFO

Article history:

Received 26 February 2022
Received in rev. form 18 April 2022
Accepted 23 April 2022

Keywords:

Safety knowledge, workplace safety climate, safety behavior, safety performance

JEL Classification:
O15; L25; D23

ABSTRACT

This research examines the effect of safety knowledge and Workplace Safety Climate on safety performance mediated by worker safety behavior in the defense product manufacturing industry in Indonesia using PT Pindad as research site. Occupational health and safety (K3) are one of the most important aspects of a company's production operations. No matter how good the quality or productivity of a company, it will be meaningless if there are problems regarding the value of K3 in its operations so that the K3 aspect cannot be ruled out. Safety knowledge of workers and creating a safety climate is able to achieve good safety performance. This study also measures the mediating effect of safety behavior in the causal relationship between safety knowledge and safety climate on safety performance. Questionnaires were distributed to 160 permanent employees. Then, Partial Least Squares are used to test the proposed hypothesis. The results showed that the safety knowledge variable was significantly related to the safety performance variable, with a count of 2.097, and the safety climate variable was significantly related to the safety performance variable, with account of 2.243. The safety behavior variable mediates the effect of the safety knowledge variable on the safety performance variable, with a count of 2,607, and the safety behavior variable mediates the effect of the safety climate variable on the safety performance variable, with an account value of 2.094.

Introduction

Every company wants its Occupational Safety and Health (K3) system to run well. Company management will incur considerable human and social costs due to poor OSH system performance (Dillard, 1998; ILO, 2012). The decreasing number of work accidents can directly reduce operational costs caused by work accidents. Work safety issues have an impact on the company's sustainability (Berry, 2016), the company's image declines (OIT, 2011), and becomes a consumer consideration regarding business ethics (Krajewski, Ritzman, and Malhotra, 2013). This is a special concern in the discussion of operational management considering that almost all K3 problems are in the company's operational activities.

Managers from various companies, in the manufacturing or service sectors, continue to make efforts to prevent work accidents so that workers can work safely, comfortably, and healthily. The fact is that K3 problems still exist. The International Labor Organization (ILO) reveals that there are more than 250 work accidents every year and 160 million workers get sick because of hazards in the workplace and 1.6 million of them die (ILO, 2009). Data from the Ministry of Manpower (Kemenaker) states that there has been a decrease in the number of work accidents in Indonesia between 2015 and 2017, but there has been an increase in the period 2018 and 2019 at 114,000 cases per year. In 2020 there was a spike of up to 55.26% in the figure of 177,000 work accident

* *Corresponding author. ORCID ID: 0000-0002-0654-3554*

https://doi.org/10.20525/ijrbs.v11i3.1705

cases. This data shows that K3 problems in Indonesia have not yet received the right solution and need attention from company management.

Work accidents occur due to unsafe behavior (unsafe act) and unsafe working conditions (unsafe conditions). Cooper (2009) argues that unsafe acts are the cause of 80-95% of work accidents. Then it is also supported by the US National Safety Council (NSC) (2011) which states that 88% of work accidents are caused by unsafe acts (unsafe behavior), unsafe conditions (unsafe conditions) cause 10% of work accidents, and 2% of unknown causes. Unsafe conditions and unsafe behavior occur as a failure to create a good Workplace Safety Climate (Zohar, 2010).

There is a link between Human Resources (HR) management and operational management in creating a work environment that meets K3 values. Management needs to consider the conditions of workers, the environment, the layout and also the sequence of the production process in order to create a good job design. In the work design planning process, a good and measurable environmental analysis is needed to produce good and quality products (Bhat, 2011; Taylor and Russell, 2011). Environmental factors refer to the physical location of the work in a production/service facility. These conditions include things like the right temperature, lighting, ventilation, job site, production process location, vibration, material supply flow, and noise. Production sites require a very clean and climate-controlled closed environment. Detail work requires proper lighting; some jobs that generate high levels of dust require good ventilation. Ergonomics factors also need to be considered considering that each employee's physical condition is different (Heizer and Render, 2011). Young and old workers, as well as male and female gender, will have different levels of ergonomics so that the comfort and safety factor needs to be paid attention to by management in designing the workplace. Inappropriately designed work can destroy the potential of a process to meet its objectives, no matter how appropriate the layout or technology of the process (Slack and Jones, 2018).

Workers need to know and understand the aims and objectives of an organization so that it is necessary to provide knowledge to workers by company management. Employees are expected to experience a systematic change of skills and talents that result in increased employee performance in thinking and working so that it is easy to get new ideas and achieve company goals and objectives. Increased knowledge to improve the skills and talents of workers also needs to be followed by knowledge of K3 values. A worker who has K3 knowledge through training is able to make risky decisions faster (Kahneman, D. 1993) and the results are satisfactory (Siebert, Kunz and Rolf, 2021).

K3 knowledge is very important, especially for educating employees about safety practices and compliance. This will provide accident prevention and control. (Cooper, 2009; Elsebaei et al., 2020). The greater level of knowledge workers in K3, so that less likely the risk of work accidents to occur. However, there are studies that state that OSH knowledge is not significantly related to OSH performance (Komaki, Heinzmann and Lawson, 1980; Ali, Azimah Chew Abdullah and Subramaniam, 2009; De Koster, Stam and Balk, 2011) and further research is needed to determine the factors the cause.

Safety climate has been suggested to be an antecedent to actual safety behavior as well as the potential for accidents and injuries to occur (Barlow and Iverson, 2005). Therefore, a valid and reliable assessment of an organization's workplace climate is important to enabling accurate and continuous monitoring of safety factors, which in turn can prevent workplace accidents. Safety climate has been associated with increased motivation to work safely, engage in safer behaviors and fewer adverse safety outcomes such as accidents and injuries (Kalteh et al., 2021). The better safety climate that is built so greater chance that work accidents can be avoided. Safety climate has a significant effect on efforts to avoid work accidents (Zohar and Luria, 2005; Olak et al., 2021).

The high number of work accidents, it is possible that there is a factor that bridges the K3 knowledge variable and the workplace safety climate towards the prevention of work accidents. Problems about K3 can come from the side of the organization or individual workers. This study carries the safety behavior variable as a mediating variable. Worker safety behavior is quite influential on the prevention of work accidents. The better safety behavior of workers, so the greater the chance of success in preventing work accidents. The actual safety behavior that individuals perform in the workplace can be classified into safety compliance and safety participation' (Griffin and Neal, 2000). Both are used to differentiate safety behavior in the workplace.

Previous researchers conducted research that stated that the K3 knowledge variable significantly affected OSH performance (Subramaniam et al., 2016; Taufek, Zulkifle and Kadir, 2016; Olak et al., 2021), but several studies stated otherwise (Vredenburgh, 2002; Ali, Azimah Chew Abdullah and Subramaniam, 2009; Sarita et al., 2019). The inconsistency in the K3 knowledge variable becomes a research gap in this research.

The results of previous studies on the workplace safety climate variable stated that the workplace safety climate was significantly related to OSH performance (Zohar, 2003; Brondino, Silva and Pasini, 2012; Liu et al., 2015; Kalteh et al., 2021), while There are several studies that state inconsistency. The workplace safety climate does not significantly affect OSH performance (Huang et al., 2006; Smith et al., 2006).

Previous researchers conducted research on OSH knowledge and workplace safety climates in various industrial and service fields. These studies were carried out on subway transportation (Deng et al., 2020), chemical industry (Renecle et al., 2021), shipping (Lu and Tsai, 2008), construction (Zhang, Boukamp and Teizer, 2015; Sang et al., 2020; Chen et al., 2021), hospital operations (Singer et al., 2009) and so on. Research in the industrial sector of the military product sector is almost never used as an object of research both in Indonesia and abroad so that researchers feel like knowing and need to do research in this industry.

This study aims at examining the effect of safety knowledge and Workplace Safety Climate on safety performance mediated by worker safety behavior in the defense product manufacturing industry in Indonesia using PT Pindad as research site. This study also measures the mediating effect of safety behavior in the causal relationship between safety knowledge and safety climate on safety performance. In the following section, empirical studies have been reviewed. This study continues with research and methodology part and finally concludes with key points, implications and recommendations.

Literature Review

Conceptual Background

Knowledge based on the type and level of difficulty in delivery is divided into 2 dimensions, explicit and implicit knowledge (Smith, 2001; Ni et al., 2020; Olak et al., 2021). Explicit knowledge is knowledge obtained through facts, is formal, scientific and documented through data, reports, and books. While implicit knowledge is knowledge that is subjective, based on experience and is informal and not documented in data.

Workplace Safety Climate is defined as a shared perception of safety policies, procedures and practices (Zohar, 2008). There are 6 factors that influence the safety climate (Glendon and Litherland, 2001), namely: (1) Communication and support Good communication and mutual support in terms of safety will be able to encourage a good safety climate from employees. (2) Adequacy of procedure Procedures that are clear and quite understandable by employees will make the employee feels comfortable at work. So that their opinion of their work tends to be positive. (3) Work pressure Work pressure is the workload determined by the company for its employees. Pressure that is too big will make workers tired, while if it is too small it will make workers too careless at work. (4) Personal Protective Equipment − When wearing PPE, employees will feel safe and comfortable at work. PPE is provided by the company for the needs of its employees. (5) Relationship is the relationship between employees and their co-workers as well as their superiors or subordinates. Good relationships will make employees feel protected by their colleagues when working. (6)Safety Rules Rules − regarding safety are usually already stated in the work agreement between the company and its employees, so that they can understand the limitations of their safety when working.

Safety behavior is a combination of safety compliance (compliance) and safety participation (participation) (Neal, Griffin and Hart, 2000). Compliance with K3 is demonstrated by compliance with K3 regulations and carrying out work in a safe manner in accordance with regulations. Participation in OSH is shown as helping colleagues, actively promoting safety programs in the workplace, implementing initiatives, and improving safety in the workplace (Neal, Griffin and Hart, 2000; Vinodkumar and Bhasi, 2010; Christina, Ludfi and Thoyib, 2012).

Safety performance is an activity to provide information about the progress and current status of the strategies, processes and activities used by the organization to control risks to health and safety (Health and Safety Executive, 2001). Among the most widely used criteria are measuring the rate of accidents (Liu et al., 2015), the frequency of occurrences, such as the number of injuries, illnesses, and deaths. Another indicator is the amount of actual damage caused by work accidents such as lost hours and damage to equipment or buildings.

Conceptual Framework of the Research

This research investigates four main constructs consisting of two independent variables (safety knowledge and workplace safety climate) and one dependent variable (safety performance). In addition, this study also adds one mediating variable safety behavior). For more details, see Figure 1 below:

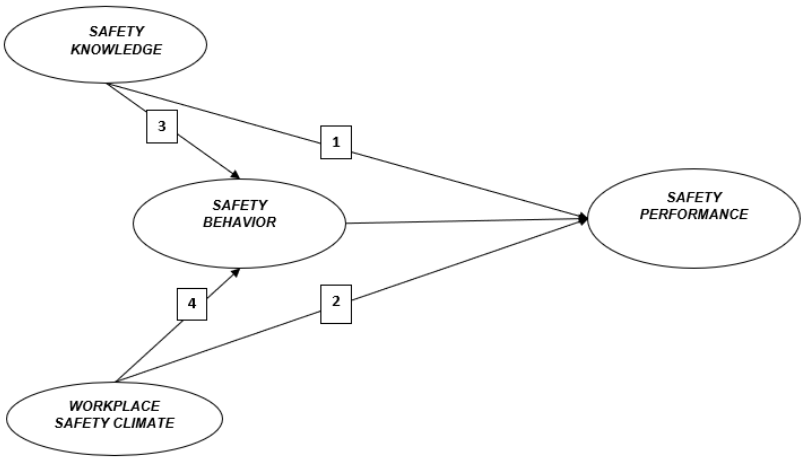

Figure 1: Research Framework and Hypothesis

The hypotheses of this study are:

H1: Safety knowledge has a significant effect on safety performance
H2: Workplace safety climate has a significant effect safety performance
H3: The effect of safety knowledge on safety performance is mediated by safety behaviour
H4: The effect of workplace safety climate on safety performance is mediated by safety behaviour.

Research and Methodology

Participants and Data Collection

Production operational line workers (operators) at PT Pindad (Persero) with a minimum working period of 1 year. The method used is proportional random sampling with 160 respondents. The technique of data collection in this research used a questionnaire. This research was conducted from January to February 2022.

Data Analysis

The method of data analysis uses SEM (Structural Equation Modeling) based on Partial Least Square (PLS) that uses SmartPLS 3.3 software application.

Measurements

All indicators to measure the four variables were adopted from several previous studies. Indicators of safety knowledge variables were adapted from Smith, (2001), Ni *et al.*, (2020) dan Olak *et al.*, (2021) study which consisted of 2 indicators. Safety climate variables were measured through 6 indicators from Glendon and Litherland, (2001). Safety behaviour variables were measured through 2 indicators from Neal, Griffin and Hart, (2000), Vinodkumar and Bhasi, (2010). Safety performance variables were measured through 2 indicators from Liu *et al.*, (2015).

Analysis and Findings

Based on the results of processing respondent data, it is known that from 160 respondents there are 136 respondents with male gender (85%) and 24 respondents with female sex (15%). Based on age, there were no respondents aged < 20 years (0%), respondents aged between 21-30 years were 37 people (23%), aged 31-40 years were 46 people (29%), aged 41-50 years amounted to 45 people (28%), and age > 51 years amounted to 32 people (20%).

Based on education, respondents with the last education of high school/equivalent amounted to 152 people (95%), then respondents with the last education of diploma were 3 people (2%) and respondents with the last education degree were 5 people (3%). Based on years of service, respondents with tenures 1 - 5 are 23 people (14%), respondents with tenures 6 - 10 are 83 people (52%), there are no respondents with tenures 11 - 20, and respondents with tenure > 20 totaled 54 people (34%).

Table 1: Composite Reliability, Cronbach Alpha, AVE

Variabels	Composite Reliability	Cronbach Alpha	AVE
Safety Knowledge	0.891	0.836	0.672
Safety Climate	0.951	0.944	0.621
Safety Behavior	0.921	0.899	0.625
Safety Performance	0.859	0.754	0.671

Source: Primary data processed, 2021

Table 1 indicates that the scale, magnitude, and statistical concordance have been accepted. The average variance extracted (AVE) value of all latent variables shows a score of 0.672 for the Safety Knowledge variable, 0.621 for the Safety Climate variable, 0.625 for the Safety Behavior variable, and 0.671 for the Safety Performance variable. The AVE value for the four constructs is greater than 0.5 so it can be concluded that the evaluation of the measurement model has good discriminant validity.

The cronbach alpha value for the Safety Knowledge variable has a cronbach alpha value of 0.836, the Safety Climate variable was 0.944, the Safety Behavior variable was 0.899, and the Safety Performance variable was 0.754. Constructs are declared reliable if the value of composite reliability and Cronbach's alpha was above 0.70. So it can be concluded that the construct has good reliability.

Composite reliability value for variable safety knowledge has a composite reliability value of 0.891, the safety climate variablw was 0.951, safety behavior variable was 0.921, and safety performance variable was 0.859. So it can be conclude that the composite reliability or Cronbach alpha is reliable.

The R-square value of the safety behavior variable is 0.567 and the safety performance variable is 0.629. Goodness of Fit (GoF) in this study is calculated using the equation $Q^2 = 1 – (1-R_1^2) \times (1 – R_2^2) = 1 – (1-0.567) \times (1-0.629) = 0.8394$. Skor 0.8394 the Q-Square calculation shows that the model in this study can be said to have a good goodness of fit.

Table 2: Hypothesis Testing Results

Hypothesis	Relationship Between Variable	Path Coefficient	t-statistics	p-values	Results	
H1	Safety Knowledge → Safety Performance	0.306	2.097	0.036	Significant	Accepted
H2	Safety Climate → Safety Performance	0.259	2.243	0.025	Significant	Accepted
H3	Safety Knowledge → Safety Behavior → Safety Performance	0.168	2.607	0.009	Significant	Accepted
H4	Safety Knowledge → Safety Behavior → Safety Performance	0.120	2.094	0.037	Significant	Accepted

Source: Primary Data Processed, 2022

The composite reliability value for the Safety Knowledge variable has a composite reliability value of 0.891, the Safety Climate variable is 0.951, the Safety Behavior variable is 0.921, and the Safety Performance variable is 0.859. It can be concluded that all constructs are reliable, both according to composite reliability and Cronbach's alpha.

The R-square value of the Safety Behavior variable is 0.567 and the Safety Performance variable is 0.629. Goodness of Fit (GoF) in this study is calculated using the equation Q2= 1 – (1-R12) x (1 – R22) = 1 – (1-0.567) x (1-0.629) = 0.8394. A score of 0.8394 on the Q-Square calculation shows that the model in this study can be said to have a good goodness of fit.

Based on these findings, the Safety Knowledge variable has a significant influence on the Safety Performance variable, with a path coefficient of 0.306 and a p-value of 0.036 (under the critical value of 0.05), so that hypothesis 1 was accepted. The Safety Climate variable has a significant influence on the Safety Performance variable, with a path coefficient of 0.259 and a p-value of 0.025 (under the critical value of 0.05), so that hypothesis 2 was accepted. The Safety Behavior variable mediates significantly between the Safety Knowledge variable and the Safety Performance variable, with a path coefficient of 0.168 and a p-value of 0.009 (under the critical value of 0.05), so that hypothesis 3 was accepted. The Safety Behavior variable mediates significantly between the Safety Knowledge variable and the Safety Performance variable, with a path coefficient of 0.120 and a p-value of 0.037 (under the critical value of 0.05), so that hypothesis 4 was accepted.

Discussion

The Effect of Safety Knowledge on Safety Performance

This research resulted in the finding that safety knowledge has a significant effect on safety performance. It means that safety knowledge can directly prevent work accidents in the company. The more information about the K3 value received by the Worker, the more the Worker will be able to know the sources of danger that are at risk of causing work accidents. This information can be in the form of training or an experience mentoring process regarding the value of K3 among workers. This is an effective way to share implicit knowledge because experienced workers can check and ensure that knowledge passed on to new workers is clearly assimilated. This is very effective in avoiding work accidents (Tietze et al., 2015).

This study is in accordance with the results of previous studies conducted by Subramaniam et al., (2016), Taufek, Zulkifle and Kadir, (2016), Olak et al., (2021) which showed that safety knowledge had a significant effect on safety performance. These studies show that the higher the safety knowledge possessed by workers, the higher the safety performance produced.

The Effect of Safety Climate on Safety Performance

This research resulted in the finding that safety climate has a significant effect on safety performance. This means that the better the safety climate created in the Company, the greater the safety performance in the company's operational lines. Workers feel they can work safely and comfortably when the safety climate is well established through good communication and mutual support in terms of safety between workers, clear procedures and quite understandable by workers, workloads that are set in accordance with the provisions, personal protective equipment (PPE). PPE) is complete, the relationship between employees is good, and the enforcement of regulations on K3 is consistent. The results of this study are also in accordance with research conducted by Zohar, (2003b), Brondino, Silva and Pasini, (2012), Liu et al., (2015), Kalteh et al., (2021) where the results of their research explain the significant effect of safety climate towards work accident prevention efforts.

The Effect of Safety Knowledge on Safety Performance is mediated by Safety Behavior

The results show that safety performance has a significant impact on safety performance through safety behavior. Workers who have good safety knowledge will understand the impact experienced if a work accident occurs both for themselves and for others. For

example, injuries suffered, costs incurred by the company, or even sanctions given by the company and parties who feel harmed to workers as a result of negligence or non-compliance with existing K3 values. Awareness of the importance of implementing K3 values fosters good safety behavior in workers.

The results of this researh are also in accordance with research conducted by Brown, Willis and Prussia, (2000), Choudhry and Fang, (2008), De Koster, Stam and Balk, (2011), Chen and Tian, (2012) where safety behavior plays an important role. Important in creating good safety performance so that good knowledge of K3 requires good safety behavior as well in order to achieve the expected safety performance. In this researh, safety behavior is included in the variable that partially mediates the relationship between safety knowledge and safety performance, because the safety knowledge variable has a direct significant effect on safety performance.

The Effect of Safety Climate on Safety Performance Mediated by Safety Bahavior

The results show that the safety climate has a significant impact on safety performance through safety behavior. The safety climate built by the company aims to ensure that the company's activities can run well without any incidents of work accidents, so that workers can work safely, comfortably and in a healthy manner. This results in workers understanding the importance of the values and objectives of the safety climate, and the need for a safety behavior in implementing it. The results of this study are also in accordance with research conducted by neal, griffin and hart, (2000), chen and tian, (2012), and guo, yiu and gonzález, (2016). In this study, safety behavior is included in the variable that partially mediates the relationship between safety climate and safety performance, because the safety climate variable has a direct significant effect on safety performance.

Conclusion

The results of this research can be concluded that (i) Knowledge of workers' K3 affects the creation of a healthy and safe work environment; (ii) companies can improve K3 performance by creating a good workplace security climate through good communication and support between workers, relevant work guidelines and procedures, appropriate workloads, complete personal protective equipment (PPE) facilities, relationships good relations between workers, as well as regulations on K3 that are always enforced, and (iii)Knowledge of K3 and workplace safety climate is able to influence and change worker behavior regarding K3 through a good level of compliance and participation so as to reduce the number of work accidents.

Finally, this paper provides recommendations for future research as (i) further research can be carried out in other companies, especially those with a high risk of work accidents, (ii) it is expected that the company can maintain and improve K3 performance and evaluate if there are technological developments in the future that require changes to company policies in the field of K3, and (iii) given that the independent variables in this study are very important in influencing Safety Performance, it is hoped that the results of this study can be used as a reference for further researchers to develop this research by considering other variables such as management commitment and safety culture which are other variables outside of the variable that have been included in this research.

Acknowledgement

Author Contributions: Conceptualization, PSP., RW., DH.; Methodology, PSP., RW., DH.; Data Collection, PSP., RW., DH.; Formal Analysis, PSP., RW., DH.; Writing—Original Draft Preparation, PSP., RW., DH.; Writing—Review And Editing, PSP., RW., DH. All authors have read and agreed to the published the final version of the manuscript.

Institutional Review Board Statement: Ethical review and approval were waived for this study, due to that the research does not deal with vulnerable groups or sensitive issues.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

Conflicts of Interest: The authors declare no conflict of interest.

References

Ali, H., Abdullah, N. A. C., & Subramaniam, C. (2009). Management practice in safety culture and its influence on workplace injury: An industrial study in Malaysia. Disaster Prevention and Management: An International Journal. 18(5), 470–477. https://doi.org/10.1108/09653560911003660.

Berry, R. (2016) Operations management, Solutions: Business Problem Solving. https://doi.org/10.1201/9781420065541.ch22.

Bhat, K. S. (2011). Production and Operations Management, Himalaya Publishing House Pvt. Ltd., 1–38.

Brondino, M., Silva, S. A. and Pasini, M. (2012). Multilevel approach to organizational and group safety climate and safety performance: Co-workers as the missing link, Safety Science, 50(9), 1847–1856. https://doi.org/10.1016/j.ssci.2012.04.010.

Brown, K. A., Willis, P. G. and Prussia, G. E. (2000). Predicting safe employee behavior in the steel industry: Development and test of a sociotechnical model, Journal of Operations Management, 18(4), 445–465. https://doi.org/10.1016/S0272-6963(00)00033-4.

Chen, D. and Tian, H. (2012). Behavior based safety for accidents prevention and positive study in China construction project, Procedia Engineering, 43, 528–534. https://doi.org/10.1016/j.proeng.2012.08.092.

Chen, W. T. et al. (2021). Exploring the relationship between safety climate and worker safety behavior on building construction sites in Taiwan, Sustainability (Switzerland) MDPI, 13(6), 1–21. https://doi.org/10.3390/su13063326.

Choudhry, R. M. and Fang, D. (2008). Why operatives engage in unsafe work behavior: Investigating factors on construction sites, Safety Science, 46(4), 566–584. https://doi.org/10.1016/j.ssci.2007.06.027.

Christina, W. Y., Ludfi, D. and Thoyib, A. (2012). Pengaruh Budaya Keselamatan Dan Kesehatan Kerja (K3) Terhadap Kinerja Proyek Konstruksi, Jurnal Rekayasa Sipil, 6(1), 83–95.

Cooper, M. D. (2009). Towards a model of Safety Culture Towards a model of Safety Culture, Behavioural Sciences Ltd, 36, 111–136.

Deng, Y. et al. (2020). Exploring the effects of safety climate on worker's safety behavior in subway operation, Sustainability (Switzerland), 12(20), 1–23. https://doi.org/10.3390/su12208310.

Dillard, B. G. (1998). Employee involvement: an effective strategy for reducing workers' compensation costs, Journal of Fashion Marketing and Management, 2(4), 318–328. https://doi.org/10.1108/eb022537.

Elsebaei, M. et al. (2020). Elements of safety management system in the construction industry and measuring safety performance – A brief, IOP Conference Series: Materials Science and Engineering, 974(1). https://doi.org/10.1088/1757-899X/974/1/012013.

Glendon, A. I. and Litherland, D. K. (2001). Safety Climate Factors, Group Differences and Safety Behaviour in Road Construction A.I.Land Development: Risk, Return and Risk Management, Journal of Real Estate Finance and Economics, 36(1), 81–102.

Griffin, M. A. and Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation., Journal of occupational health psychology, 5(3), 347–358. https://doi.org/10.1037/1076-8998.5.3.347.

Guo, B. H. W., Yiu, T. W. and González, V. A. (2016). Predicting safety behavior in the construction industry: Development and test of an integrative model, Safety Science, 84, 1–11. https://doi.org/10.1016/j.ssci.2015.11.020.

Health and Safety Executive (2001). A Guide To Measuring Health & Safety, Hse, (December), 1–30. Available at: http://www.hse.gov.uk/opsunit/perfmeas.pdf.

Heizer, J. and Render, B. (2011). Operations Management 10th ed - Jay Heizer, Barry Render (Pearson, 2011)'.

Huang, Y.-H. et al. (2006). Safety climate and self-reported injury: Assessing the mediating role of employee safety control, Accident Analysis and Prevention 38 (2006) 425–433, 102(3), 425–431. https://doi.org/10.1016/j.aap.2005.07.002.

ILO (2012) ILO Training Package on Development of a National Programme of Occupational Safety and Health.

Jensen, P. A., Rasmussen, H. L. and Chatzilazarou, S. (2019). Knowledge transfer between building operation and building projects, Journal of Facilities Management, 17(2), 208–219. https://doi.org/10.1108/JFM-05-2018-0030.

Kalteh, H. O. et al. (2021). The relationship between safety culture and safety climate and safety performance: a systematic review, International Journal of Occupational Safety and Ergonomics, 27(1), 206–216. https://doi.org/10.1080/10803548.2018.1556976.

Komaki, J., Heinzmann, A. T. and Lawson, L. (1980). Effect of training and feedback: Component analysis of a behavioral safety program., Journal of Applied Psychology, 65(3), 261–270. https://doi.org/10.1037//0021-9010.65.3.261.

De Koster, R. B. M., Stam, D. and Balk, B. M. (2011). Accidents happen: The influence of safety-specific transformational leadership, safety consciousness, and hazard reducing systems on warehouse accidents, Journal of Operations Management, 29(7–8), 753–765. https://doi.org/10.1016/j.jom.2011.06.005.

Krajewski, L. J., Ritzman, L. P. and Malhotra, M. K. (2013) Operations Management 10th Edition. Pearson.

Liu, X. et al. (2015). Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry, Safety Science, 78, 173–178. https://doi.org/10.1016/j.ssci.2015.04.023.

Lu, C. S. and Tsai, C. L. (2008). The effects of safety climate on vessel accidents in the container shipping context, Accident Analysis and Prevention, 40(2), 594–601. https://doi.org/10.1016/j.aap.2007.08.015.

Neal, A., Griffin, M. A. and Hart, P. M. (2000). The impact of organizational climate on safety climate and individual behavior, Safety Science, 34(1–3), 99–109. https://doi.org/10.1016/S0925-7535(00)00008-4.

Ni, G. et al. (2020). Influencing mechanism of job satisfaction on safety behavior of new generation of construction workers based on Chinese context: The mediating roles of work engagement and safety knowledge sharing, International Journal of Environmental Research and Public Health, 17(22), 1–24. https://doi.org/10.3390/ijerph17228361.

OIT (2011). Cost of accidents and diseases to business, (1).

Olak, A. J. et al. (2021). The relationships between the use of smart mobile technology, safety knowledge and propensity to follow safe practices at work, International Journal of Occupational Safety and Ergonomics, 27(3), 911–920. https://doi.org/10.1080/10803548.2019.1658398.

Ostroff, C., Kinicki, A. J. and Muhammad, R. S. (2012) Organizational Culture and Climate, Handbook of Psychology, Second Edition. https://doi.org/10.1002/9781118133880.hop212024.

Renecle, M. et al. (2021). Enhancing safety in high-risk operations: A multilevel analysis of the role of mindful organising in translating safety climate into individual safety behaviours, Safety Science, 138(August 2020). https://doi.org/10.1016/j.ssci.2021.105197.

Sang, L. et al. (2020). Influence mechanism of job satisfaction and positive affect on knowledge sharing among project members: Moderator role of organizational commitment, Engineering, Construction and Architectural Management, 27(1), 245–269. https://doi.org/10.1108/ECAM-10-2018-0463.

Shin, D. P., Gwak, H. S. and Lee, D. E. (2015) Modeling the predictors of safety behavior in construction workers, International Journal of Occupational Safety and Ergonomics. https://doi.org/10.1080/10803548.2015.1085164.

Siebert, J. U., Kunz, R. E. and Rolf, P. (2021). Effects of decision training on individuals' decision-making proactivity, European Journal of Operational Research, (xxxx). https://doi.org/10.1016/j.ejor.2021.01.010.

Singer, S. et al. (2009). Relationship of safety climate and safety performance in hospitals, Health Services Research, 44(2P1), 399–421. https://doi.org/10.1111/j.1475-6773.2008.00918.x.

Slack, N. and Jones, A. B. (2018) operations and Process Management.

Smith, E. A. (2001). The role of tacit and explicit knowledge in the workplace, Journal of Knowledge Management, 5(4), 311–321. https://doi.org/10.1108/13673270110411733.

Smith, G. S. et al. (2006). The relationship between safety climate and injury rates across industries: The need to adjust for injury hazards, Accident Analysis and Prevention, 38(3), 556–562. https://doi.org/10.1016/j.aap.2005.11.013.

Subramaniam, C. et al. (2016). Safety management practices and safety compliance in small medium enterprises, Asia-Pacific Journal of Business Administration, 8(3), 226–244. https://doi.org/10.1108/APJBA-02-2016-0029.

Taufek, F. H. B. M., Zulkifle, Z. B. and Kadir, S. Z. B. A. (2016). Safety and Health Practices and Injury Management in Manufacturing Industry, Procedia Economics and Finance, 35(October 2015), 705–712. https://doi.org/10.1016/s2212-5671(16)00088-5.

Taylor, B. W. and Russell, R. S. (2011) Operation management 7th Editions.

Tietze, S. et al. (2015). Using tacit knowledge in training and accident prevention, Proceedings of the ICE - Management, Procurement and Law, (June). https://doi.org/10.1680/mpal.1400027.

Vinodkumar, M. N. and Bhasi, M. (2010). Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation, Accident Analysis and Prevention, 42(6), 2082–2093. https://doi.org/10.1016/j.aap.2010.06.021.

Zhang, S., Boukamp, F. and Teizer, J. (2015). Ontology-based semantic modeling of construction safety knowledge: Towards automated safety planning for job hazard analysis (JHA), Automation in Construction, 52, 29–41. https://doi.org/10.1016/j.autcon.2015.02.005.

Zohar, D. (2003). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups, Journal of Organizational Behavior, 23(1), 75–92. https://doi.org/10.1002/job.130.

Zohar, D. (2008). Safety climate and beyond: A multi-level multi-climate framework, Safety Science, 46(3), 376–387. https://doi.org/10.1016/j.ssci.2007.03.006.

Zohar, D. (2010). Thirty years of safety climate research: Reflections and future directions, Accident Analysis and Prevention, 42(5), 1517–1522. https://doi.org/10.1016/j.aap.2009.12.019.

Zohar, D. and Luria, G. (2005). A multilevel model of safety climate: Cross-level relationships between organization and group-level climates, Journal of Applied Psychology, 90(4), 616–628. https://doi.org/10.1037/0021-9010.90.4.616.

Publisher's Note: SSBFNET stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.