

Developing crew's safety behavior based on safety culture and safety motivation**Solikin^a, Muhammad Thamrin^b, Suharto Abdul Majid^b**^aDoctoral Program of Institut Transportasi dan Logistik
Trisakti^bLecturer of Institut Transportasi dan Logistik
Trisakti✉ corresponding author: captsolikin@gmail.com

Abstract: Safety behavior is very important and determines individual and organizational performance. For shipping companies, safety behavior can help achieve company goals, including increasing competitiveness and organizational performance. Therefore, it is essential to investigate crew safety behavior from the perspective of other relevant variables. Based on this urgency, this research aims to investigate crew safety behavior based on safety culture and safety motivation and find a relevant model regarding the influence of safety culture on crew safety behavior through safety motivation. A Likert scale questionnaire collected research data from 122 crew. Research data analysis in the form of descriptive and correlational analysis is used to support Structural Equation Modeling-Partial Least Square (SEM-PLS). The research results show that safety culture significantly influences the crew's safety motivation and safety behavior. In addition, safety motivation mediates the influence of safety culture on crew safety behavior.

Keywords: *safety culture, safety motivation, safety behavior.*

1. Introduction

Ship accidents continue to occur, including in Indonesia. The human error factor accounts for 80% of these accidents. It is because the ship crew does not pay attention to the environment, is careless, does not make plans before sailing, does not assess the situation, does not immediately take action on board the ship, does not communicate, does not understand the ship's specifications well, and does not send/receive signals (Harahap, 2012). One example of human error is safety behavior that is not maintained properly. According to Neal and Griffin (2006), safety behavior has an impact on accidents. Safety behavior refers to every action or deed carried out by a person in an effort to comply with, support, and be involved in all activities related to safety in the workplace. Safety behavior is activity that promotes workplace safety procedures and initiatives, which workers must acknowledge as necessary to prevent workplace accidents (Zin et al., 2012). Safety behavior is related to work behavior relevant to safety, which can be conceptualized in the same way as other work behaviors that form work behavior. The output of negative work safety behavior is called safety outcomes, in the form of injuries or careless behavior that almost injures oneself, material damage, or harm to others. Neal and Griffin (2006) identified two indicators of safety behavior, namely, safety compliance, which refers to maintaining work safety by carrying out basic safety activities determined by the job, and safety participation, which refers to facilitating the development of an environment that supports safety. Safety behavior can be influenced by inadequate safety culture and safety motivation. This is proven in the studies of Aytac and Dursun (2018) and Asmani (2020) that safety culture has a significant effect on safety behavior. The study of Ansori et al. (2021), Subramaniam et al. (2022), and Agustin and Dwiyantri (2023). also shows that safety motivation has an effect on safety behavior. In addition, Al-Bayati's study (2021) proves that safety culture can influence safety motivation. However, another study by Ekong et al. (2021) shows inconsistent results, where safety culture does not affect safety motivation. This circumstance generates a research void that needs to be filled by science. Given this urgency, the goal of this

study is to examine how safety motivation acts as a mediator between safety culture and safety behaviour.

2. Literature review

2.1. Safety culture and safety behavior

The safety culture inside an organisation is one facet that addresses personal, professional, and organisational traits that impact workers' health and well-being. Organisational culture is described as the common values and beliefs of a group within an organisation by McShane and Von Glinow (2020). Organisational culture is defined by Robbins and Judge (2020) as a common meaning system that unites and sets apart the group. Moreover, organisational culture also includes the common values, beliefs, practises, norms, and artefacts among its members, as noted by Pilch and Turska (2015) and Hogan & Coote (2014). One very good goal of safety culture is to create an environment where employees are aware of the risks they face at work and are always aware of them (Ostrom et al., 1993). It follows that safety culture is a vital management tool that helps control workers' attitudes, convictions, and behaviours related to safety (Beck & Woolfson, 1999). Research conducted by Aytac and Dursun (2018) and Asmani (2020) shows that safety culture has a significant effect on safety behavior. It shows that an outstanding safety culture can improve safety behavior. Employee perceptions of organisational and environmental safety features that influence safety performance are known as safety culture. Safety culture can be interpreted as a construction that is used to explain how the social environment in the internal organization directly affects the risk of organizational practices that can cause personal injury or a process of safety disaster (Antonsen, 2017). Various indicators are needed to measure safety culture, which includes engineering, enforcement, education, emotion, empathy, empowerment, and engagement (Lutchman et al., 2012). When the safety culture in the company is well-conditioned (healthy and adequate), it can improve safety behavior. Thus, the first hypothesis (H_1) can be formulated: Safety culture has a direct influence on safety behavior.

2.2. Safety motivation and safety behavior

Besides being influenced by safety culture, safety behavior is also influenced by safety motivation. Scholars claimed that safety motivation influences safety behavior (Shin et al., 2015; Amponsah-Tawaih & Adu, 2016; Panuwatwanich et al., 2016; Baser et al., 2017; Adjekum, 2017; Mohammadfam et al., 2017; Ansori et al., 2021; Subramaniam et al., 2022). Motivation is the willingness of individuals to expend high-level efforts to achieve organizational goals to meet their needs (Robbins & Judge, 2020). Motivation, as it relates to safety, is the willingness of an individual to put forth effort in order to execute safety behaviour and the valence associated with that behaviour. If people believe there is a positive safety climate at work, they should be encouraged to follow safe work practises and take part in safety initiatives (Neal & Gryphon, 2006). The readiness of employees to adopt safe behaviours and their perception of the benefits of doing so are referred to as safety motivation. (Kalteh et al., 2022). Safety motivation aims to prevent accidents and injuries at a desired level of safety using scientific principles and procedures (Pordanjani & Ebrahimi, 2015). Safety motivation includes doing work safely, using equipment safely, improving health and safety, reducing the risk of accidents, health and safety issues, maintaining personal safety, the importance of maintaining safety, the importance of reducing the risk of accidents (Neal & Griffin, 2006). If conditioned well (adequately), these indicators have the potential to encourage increased safety behavior. Thus, the second hypothesis (H_2) can be proposed: Safety motivation has a direct influence on safety behavior.

2.3. Safety culture and safety motivation

In addition to impacting safety behaviour, safety culture also has an impact on safety motivation. A research project by Al-Bayati (2021) proves that safety culture can influence safety motivation. It means that if the safety culture condition is excellent, it can increase safety motivation. Paying attention to safety culture is vital because this can benefit the company. Companies can gain benefits by having a strong safety culture and maintaining their good name. Many people have defined and evaluated numerous organisations as a result of the realisation that safety cultures are crucial in preventing work-related incidents (Glendon, 2008). This condition shows that safety culture is a predictor of safety motivation. If the company's safety culture is in excellent condition, it can stimulate high safety motivation. Thus, the third hypothesis (H₃) can be formulated: Safety culture has a direct influence on safety motivation.

2.4. Safety motivation mediation

The results of the previous research above show that safety culture influences safety motivation (Al-Bayati, 2021), while Adjekum (2017) and Subramaniam et al. (2022) proved that safety motivation affects safety behavior. This suggests that safety motivation can act as a mediator for the influence of safety culture on safety behavior. When a safety culture is conducive, it can stimulate safety motivation and have implications for safety behavior. Thus, the fourth hypothesis (H₄) can be proposed: Safety culture has an indirect effect on safety behavior by mediating safety motivation.

3. Materials and Methods**3.1. Participants**

122 Indonesian ferry crew members who were willing to fully complete and reply to all statement items on the questionnaire at the time the research was conducted were selected as participants in this study using Accidental Sampling (Widodo, 2021). Table 1 shows that 82.79% of participants were men, 52.46% were in their 30s and 40s, 43.44% had ANT III education, 88.52% were married, and 46.72% had worked for 10 to 15 years.

Table 1. Profile of the Research Participant

Profile	Amount	Percentage
Gender		
1. Male	101	82.79
2. Female	21	17.21
Age		
1. ≤ 30 years	10	8.20
2. 30 – 40 years	64	52.46
3. 40 – 50 years	40	32.79
4. > 50 years	8	6.56
Education		
1. ANT I	22	18.03
2. ANT II	46	37.70
3. ANT III	53	43.44
4. ANT IV	1	.82
Status		
1. Married	108	88.52
2. Unmarried	14	11.48
Length of Work		
1. ≤ 5 years	26	21.31

2. 5 – 10 years	11	9.02
3. 10 – 15 years	57	46.72
4. 15 – 20 years	27	22.13
5. > 20 years	1	.82

3.2. Procedure and Materials

This study employs a quantitative methodology and is carried out via a survey with a questionnaire serving as the instrument. The Likert scale used in the questionnaire's design had five response possibilities, ranging from strongly disagree (score = 1) to strongly agree (scoring = 5). The questionnaire was made by the researchers themselves based on theoretical indicators from the experts available in kinds of literature. The safety culture's indicators are engineering (X.1), enforcement (X.2), education (X.3), emotion (X.4), empathy (X.5), empowerment (X.6), and engagement (X.7) (Lutchman et al., 2012). Safety motivation's indicators consist of doing work safely (Y1.1), using equipment safely (Y1.2), improving health and safety (Y1.3), reducing the risk of accidents (Y1.4), important health and safety issues (Y1.5), maintaining personal safety (Y1.6), the importance of maintaining safety (Y1.7), and the importance of reducing the risk of accidents (Y1.8) (Neal & Griffin, 2006). Safety behavior indicators comprise safety compliance (Y2.1) and safety participation (Y2.2) (Neal & Griffin (2006).

The result of the construct reliability and validity test is presented in Table 2. Cronbach's alpha (CA) test for safety culture = .975, safety motivation = .925, and safety behavior = .794. Rho_A (RA) test for safety culture = .985, safety motivation = .931, and safety behavior = .800. Composite reliability (CR) test for safety culture = .979, safety motivation = .940, and safety behavior = .906. Average variance extracted (AVE) test for safety culture = .870; safety motivation = .663; and safety behavior = .829. The value of CA, RA, and CR > .7 and AVE > .5 indicates good reliability and acceptable convergence (Hair et al., 2018).

Table 2. Construct Reliability and Validity

Variables	CA	Rho_A	CR	AVE
Safety culture	.975	.985	.979	.870
Safety motivation	.925	.931	.940	.663
Safety behavior	.794	.800	.906	.829

3.3. Data Analysis

This study's data analysis starts with descriptive and correlational analysis. While correlational analysis establishes the association between research variables, descriptive analysis explains the state of each research variable. Using SPSS version 22, descriptive and correlational analysis was carried out. Furthermore, the study hypothesis was tested using structural equation modelling – Partial Least Square (SEM-PLS). SmartPLS 4 software is used for SEM-PLS analysis.

4. Result and Discussion

The standard deviation (SD) values within the range of 1.046 to 2.236 were obtained through the application of descriptive and correlation studies conducted with SPSS. These SD values, which were less than the mean and were found to be between 8.41 and 11.88, created a unique data pattern that needed more research. Furthermore, the correlation study showed coefficient values ranging from .27 to .75. The significance of the data, which included all constructs (variables), was determined to be $p < .01$, indicating that the indicators were dependent on each other. The correlation coefficient that was produced was less than 0.8,

indicating that there were no traits that would be used to characterize multicollinearity despite this mutual dependency.

The result of cross-loading discriminant validity is present in Table 3. Discriminant validity indicates that different constructs of manifest variables should not have a high correlation. How to test this validity with a reflection indicator that looks at the cross-loading value for each variable must be $> .60$. Each variable has a cross-loading value of above $.60$. Thus, the different constructs are not highly correlated.

Table 3. Cross loadings

	Safety Behavior (Y2)	Safety Culture (X)	Safety Motivation (Y1)
X.1	.644	.980	.665
X.2	.764	.915	.715
X.3	.491	.929	.629
X.4	.473	.936	.563
X.5	.500	.905	.574
X.6	.751	.905	.767
X.7	.509	.955	.611
Y1.1	.624	.470	.695
Y1.2	.579	.633	.748
Y1.3	.541	.552	.881
Y1.4	.451	.465	.828
Y1.5	.563	.708	.896
Y1.6	.474	.474	.704
Y1.7	.706	.564	.889
Y1.8	.595	.656	.841
Y2.1	.900	.501	.644
Y2.2	.920	.678	.639

All tested hypotheses were shown to be supported by empirical data (t value $> t$ table at $p = .01$), according to the SmartPLS output, which is displayed in Figures 1 and 2 and summarised in Table 4. As a result, safety motivation ($\gamma = .705$, $p < .01$) and safety behaviour ($\gamma = .310$, $p < .01$) are significantly impacted directly by safety culture. Safety behaviour is significantly impacted by safety motivation ($\gamma = .486$, $p < .01$). Furthermore, safety motivation mediates a noteworthy indirect impact of safety culture on safety behaviour ($\beta = .342$, $p < .01$).

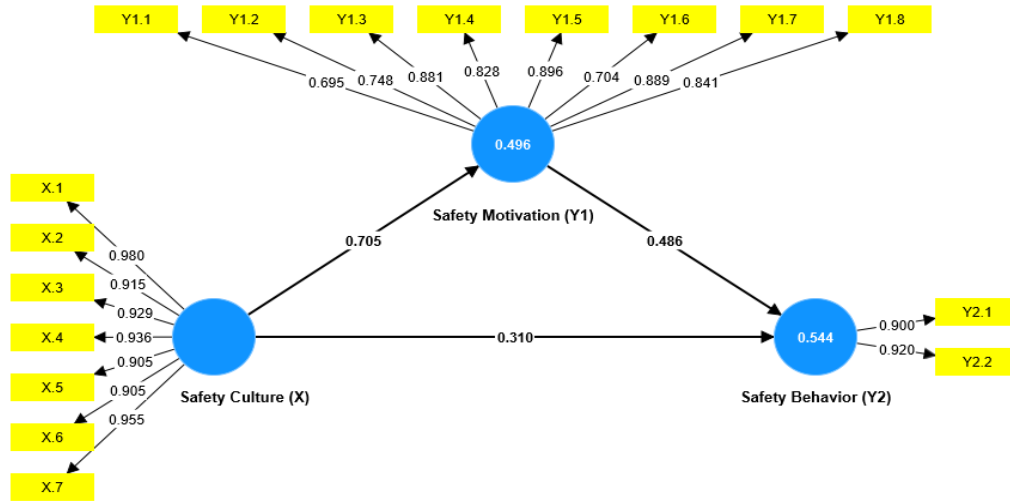


Figure 1. Standardized Structural Model

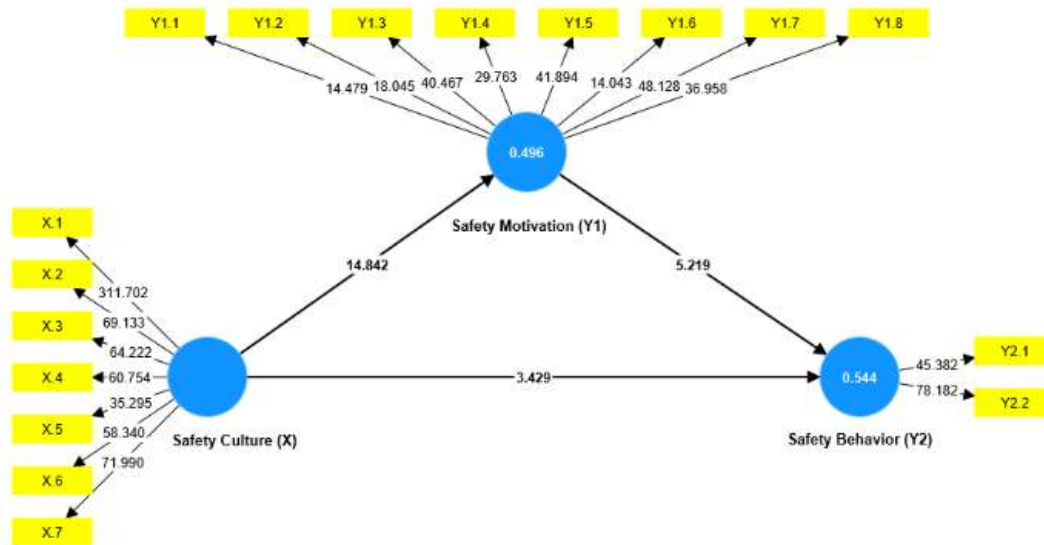


Figure 2. T value Structural Model

Table 5. Result of Hypothesis Testing

Hypothesis	γ/β	T value	Decision
H ₁ : Safety culture (X) on safety behavior (Y ₂)	.310**	3.429	Supported
H ₂ : Safety motivation (Y ₁) on safety behavior (Y ₂)	.486**	5.219	Supported
H ₃ : Safety culture (X) on safety motivation (Y ₁)	.705**	14.842	Supported
H ₄ : Safety culture (X) on safety behavior (Y ₂) mediated by safety motivation (Y ₁)	.342**	4.469	Supported

** p < .01

This study discovered that through mediating safety motivation, safety culture has a major impact on crew safety behaviour. As a result, this study develops an appropriate research model using actual data from Indonesian ship personnel. It demonstrates that safety motivation and

safety culture play a significant role in influencing crew safety behaviour. The influence of safety culture on crew safety behaviour is also mediated by safety motivation.

In specifics, crew safety behaviour is directly impacted by safety culture. It demonstrates how safety behaviour is significantly influenced by safety culture. As a result, improving safety culture may help crew members behave more safely. Shipping businesses, for instance, can promote safety participation and compliance if they can ensure a culture that is supportive of safety. This conclusion supports and validates the findings of earlier studies showing that safety culture affects safety behaviour (Aytac & Dursun, 2018; Asmani, 2020).

Additionally, this study demonstrates that crew safety behaviour is directly impacted by safety motivation in a major way. It demonstrates that a critical precursor to crew safety behaviour is safety motivation. Consequently, boosting safety incentive can promote improved crew safety practises. For instance, personnel can be encouraged to follow safety laws if they operate safely, wear safety equipment, prioritise health and safety, and attempt to lower the chance of accidents. Researchers assert that safety behaviour is greatly influenced by safety motivation, and our data supports their claims (Adjekum, 2017; Subramaniam et al., 2022; Dhani et al., 2022; Andi et al., 2022).

Furthermore, this study shows that crew safety motivation is influenced by safety culture. It demonstrates that safety culture can influence crew safety motivation, which is demonstrated by actions like performing activities safely, utilising safety gear, enhancing health, lowering the likelihood of accidents, and upholding safety. Thus, enhancing safety culture can raise crew members' motivation to be safe. For instance, shipping companies that regularly implement safety-related engineering, enforcement, education, emotion, empathy, empowerment, and engagement tend to encourage crews to perform tasks safely, use safety gear, pay attention to health and safety, and attempt to lower the likelihood of workplace accidents. These results support and validate the findings of Al-Bayati's (2021) earlier study, which found a relationship between safety motivation and safety culture.

Lastly, this study discovered that safety motivation plays a critical role in moderating the impact of safety culture on crew safety behaviour. This result is consistent with studies (Adjekum, 2017; Subramaniam et al., 2022) that demonstrate the positive relationship between safety motivation and safety behaviour, as well as research by Al-Bayati (2021) that demonstrates the important influence of safety culture on safety motivation. As a result, this study generates a novel empirical model about how safety motivation mediates the indirect impact of safety culture on safety behaviour. It implies that enhancing crew safety behaviour will be enhanced by enhancing safety culture and motivated by safety.

5. Conclusion

In order to improve safety and decrease accidents, safety behaviour is crucial. This study demonstrates how safety motivation is mediated by safety culture, which in turn affects crew safety behaviour. As a result, this study supports a novel empirical model of safety culture, which links crew safety behaviour to the safety motivation of Indonesian Perry ship personnel. Researchers and practitioners can use this model as discussion material to enhance safety behaviour. By incorporating participants from additional data sources, such as ship captains or coworkers, using a different locus, or including new variables and indicators, researchers can further extend the model into a new research design. In the meanwhile, practitioners can utilise this model to create plans for enhancing crew safety behaviour by looking at safety motivation and safety culture. Safety behaviour has the potential to lower accidents and raise ship safety, which makes it essential.

6. Implication

The results of this study provide two critical implications. First, it provides theoretical contributions to developing marine transportation management studies, especially relating to developing crew safety behavior from the perspective of safety culture and safety motivation. Second, it encourages shipping company management to increase crew safety behavior by improving safety culture and safety motivation. Accordingly, company management needs to develop a more massive safety culture and revitalize the safety motivation of the ship's crew.

7. Research limitations

This study has several limitations that require improvement in the future. First, it only accommodates some theoretical indicators in the literature so that other researchers can complete it in the future. Second, it only uses a quantitative approach, so it cannot reveal the motives underlying the case relationships between research variables. For that, future studies need to consider mixed methods, both quantitative and qualitative.

References

- Adjekum, D. K. (2017). An evaluation of the relationships between collegiate aviation safety management system initiative, self-efficacy, transformational safety leadership and safety behavior mediated by safety motivation. *International Journal of Aviation, Aeronautics, and Aerospace*, 4(2), 1-38. <https://doi.org/10.15394/ijaa.2017.1169>
- Agustin, C., & Dwiyanti, E. (2023). The correlation between awareness, motivation, and perception with safe behavior at Ngadiredjo Sugar Factory. *The Indonesian Journal of Occupational Safety and Health*, 12(1), 30-41. <http://doi.org/10.20473/ijosh.v12i1.2023.30-41>
- Al-Bayati, A.J. (2021). Impact of construction safety culture and construction safety climate on safety behavior and safety motivation. *Safety*, 7, 41. <https://doi.org/10.3390/safety7020041>
- Amponsah-Tawaih, K., & Adu, M. A. (2016). Work pressure and safety behaviors among health workers in Ghana: The moderating role of management commitment to safety. *Safety and Health at Work*, 7(4), 340-346. <https://doi.org/10.1016/j.shaw.2016.05.00>
- Andi, A., Sumali, S. H. ., & Limansantoso, G. F. (2022). The impact of contractor safety leadership on workers safety behavior. *Civil Engineering Dimension*, 24(2), 93-100. <https://doi.org/10.9744/ced.24.2.93-100>
- Ansori, N., Widyanti, A., & Yassierli. (2021). The influence of safety climate, motivation, and knowledge on worker compliance and participation: An empirical study of indonesian SMEs. *Ingeniería e Investigación*, 41(3), e83763. <https://doi.org/10.15446/ing.investig.v41n3.83763>
- Antonsen, S. (2017). *Safety Culture: Theory, Method and Improvement* (1st ed.) London: CRC Press.
- Asmani, L. (2020). Promote safety culture and enhance safety performance through safety behaviour. *EJBMR, European Journal of Business and Management Research*, 5(4), 1-11. <http://dx.doi.org/10.24018/ejbmr.2020.5.4.405>
- Aytac, S., & Dursun, S. (2018). The effect on the safety culture of occupational accidents and safety behavior: The case of Turkey. *11 June 2018, 38th International Academic Conference, Prague*, 20-28. <https://doi.org/10.20472/IAC.2018.038.005>
- Baser, F., Ture, H., Abubakirova, A., Sanlier, N., and Cil, B. (2016). Structural modeling of the relationship among food safety knowledge, attitude, and behavior of Hotel Staff in Turkey. *Food Control*, 73(B), 438-444. <https://doi.org/10.1016/j.foodcont.2016.08.032>

- Beck, M., & Woolfson, C. (1999). Safety culture one concept too many-Matthias Beck and Charles Woolfson with a contentious viewpoint on a vogue item on the safety menu. *Safety and Health Practitioner*, 17(1), 14-18.
- Dhani, S.R.A., Paskarini, I., & Silehu, S. (2022). Safety Motivation sebagai Determinan dari Safety Performance Pekerja PT X Sidoarjo. *Jurnal Penelitian Kesehatan Suara Forikes*, 13(3), 823-827.
- Ekong, A. E., Ugbebor, J. N., & Brown, B. K. (2021). Influence of safety culture on employee safety motivation and error behaviour in Selected Petroleum Industries in Niger-Delta. *Asian Journal of Advanced Research and Reports*, 15(4), 49-62.
- Glendon, I. (2008). Safety culture and safety climate: How far have we come and where could we be heading?. *Journal of Occupational Health and Safety-Australia and New Zealand*, 24(3), 249-271.
- Hair, J. F., Babin, B. J., Anderson, R. E., & Black, W. C. (2018). *Multivariate data analysis* (8th ed.). India: Cengage India.
- Harahap, F. A. (2012). Reliability Assessment Sebagai Upaya Pengurangan Human Error Dalam Penerapan Kesehatan dan Keselamatan Kerja. Skripsi Universitas Indonesia Depok.
- Hogan, S. J., & Coote, L. V. (2014). Organizational culture innovation, and performance: A test of Schein's model. *J. Bus. Res.*, 67, 1609-1621.
- Kalteh, H. O., Salesi, M., & Mokarami, H. (2022). The mediator role of safety motivation and knowledge between safety culture and safety performance: The results of a sociotechnical and macroergonomics approach. *Work IOS Press*, 1-11. <https://doi.org/10.3233/WOR-205085>.
- Lutchman, C., Rohanie, & Ghanem, W. (2012). *Safety Management A Comprehensive Approach to Developing A Sustainable System*. Boca Raton: CRC Press Taylor & Francis Group.
- McShane, S. L., & Von Glinow, M. A. (2020). *Organizational behavior: Emerging knowledge, global reality* (9th ed.). New York: McGraw-Hill Education
- Mohammadfam, I., Ghasemi, F., Kalatpour, O., & Moghimbeigi, A. (2017). Constructing a bayesian network model for improving safety behavior of employees at workplaces. *Applied Ergonomics*, 58, 35-47. <https://doi.org/10.1016/j.apergo.2016.05.006>
- Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology*, 91(4), 946-953.
- Ostrom, L., Wilhelmsen, C., & Kaplan, B. (1993). Assessing safety culture. *Nuclear Safety*, 34(2), 163-172.
- Panuwatwanich, K., Al-Haadir, S., & Stewart, R.A. (2016). Influence of safety motivation and climate on safety behavior and outcomes: Evidence form the Saudi Arabian Construction Industry. *International Journal of Occupational Safety and Ergonomics*, 23(1), 60-75. <https://doi.org/10.1080/10803548.2016.1235424>
- Pilch, I., & Turska, E. (2015). Relationships between Machiavellianism, organizational culture, and workplace bullying: Emotional abuse from the target's and the perpetrator's perspective. *J Bus Ethics*, 128(1), 83-93.
- Pordanjani, T. H., & Ebrahimi, A. M. (2015). Safety motivation and work pressure as predictors of occupational accidents in the petrochemical industry. *Health Scope*, 4(4), e26492. <https://doi.org/10.17795/jhealthscope-26492>.
- Robbins, S. P., & Judge, T. A. (2020). *Organizational behavior* (18th ed.). Essex: Pearson Education Limited.

- Shin, D., Gwak, H., & Lee, D. (2015). Modeling the predictors of safety behavior in construction workers. *International Journal of Occupational Safety and Ergonomics*, 21(3), 298-311. <https://doi.org/10.1080/10803548.2015.1085164>
- Subramaniam, C., Johari, J., Mashi, M.S., & Mohamad, R. (2022). The influence of safety leadership on nurses' safety behavior: The mediating role of safety knowledge and motivation. *Journal of Safety Research*, In Press. <https://doi.org/10.1016/j.jsr.2022.10.013>
- Widodo, W. (2021). *Metodologi penelitian populer & praktis*. [Popular & practical research methodologies]. In Indonesian. Depok: Rajawali Pers.
- Zin, S. M., & Ismail, F. (2012). Employers' behavioural safety compliance factors toward occupational, safety and health improvement in the construction industry. *Procedia - Social and Behavioral Sciences*. 36, 742-751. <https://doi.org/10.1016/j.sbspro.2012.03.081>.