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ORIGINAL ARTICLE

Comparative Analysis Research of Safety Climate Assessment in the Jababeka Manufacturing Industry

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ABSTRACT

Introduction: The manufacturing industry transforms various materials, substances, or components into new products using mechanical, physical, or chemical forces. Safety climate refers to the perception of workers of prioritizing safety over organizational goals in the workplace. PT A, B, and C are manufacturing companies located in the Jababeka area. This study aims to identify the main factors that influence the perception of workers of safety climate in PT A, B, and C. **Methods:** A quantitative study with a cross-sectional design was conducted in August 2021 to analyze the safety climate of three companies. This study focused on various factors, such as leadership, risk management, implementation of occupational health and safety management system (OHSMS), regulation, management commitment, worker engagement, and worker competence. The sample size consisted of 330 workers selected from the three companies using the Lemeshow formula from a total of 1500 workers using the cluster sampling technique with the analysis of variance (ANOVA) test. **Results:** The results showed that risk management had the lowest score among the safety climate sub-variable for the three companies. **Conclusion:** The ANOVA test revealed a significant relationship among the safety climate variables. Furthermore, it is necessary to prioritize management in terms of policy and administration by involving all departments.

Keywords: manufacturing, safety climate, safety climate assessment

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INTRODUCTION

The manufacturing industry transforms various materials, substances, or components into new products using mechanical, physical, or chemical forces (U.S Bureau of Labor Statistics, 2022). The work processes are continuous, with each stage playing an essential role in the production flow and quality of the final product (Yang *et al*., 2021). Manufacturing processes have varying degrees of complexity, determined by specific criteria associated with different types of products (Wu *et al*., 2021). To achieve increased safety performance and reduce the risk of accidents, it is necessary to improve the quality of human resources through the implementation of work safety (Abidin *et al*., 2021; Syed-Yahya, Idris and Noblet, 2022; Yang *et al*., 2023).

The development of science and technology and the complexity of manufacturing production have made occupational safety and health (OHS) as an essential reference and obligation for the implementation of strategies related to regulatory compliance, early design analysis, and work process concepts. The implementation of OHS is a shared responsibility among all company stakeholders and the government. The strategies must be designed and enforced according to specific guidelines, with the collaboration of all company stakeholders, particularly management (Singh, Singh, and Khamba, 2021; Mofidi Naeini and Nadeau, 2022). This partnership ensures effective implementation of the strategies and contributes to the safety and health of employees.

Safety climate is defined as the values, perceptions, and attitudes of individuals and groups

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toward OHS within an organization, considering safety and health aspects of workers (Ghasemi *et al*., 2018; Memarbashi *et al*., 2021). Its implementation is closely related to the compliance and participation of all elements of management in the workplace (Ghasemi *et al*., 2020). Furthermore, a positive safety climate can improve worker performance, as evidenced by a decrease in the rate of occupational accident (Ghasemi *et al*., 2020; Memarbashi *et al*., 2021).

Within organizations, safety climate refers to the perception of workers of prioritizing safety over organizational goals in the workplace. Workers form perceptions of workplace safety climate by reflecting on various policies, procedures, and behaviors of stakeholders that affect the outcomes of the work process (Abidin *et al*., 2021; Mes, Peker, and Do 2022). Safety climate is an important positive predictor of compliance with regulations, safety procedures, and contributions to organizational safety improvement initiatives. Monitoring safety climate through validated and tested assessment methods can help identify safety problems in the workplace before accidents occur (Mes, Peker, and Do, 2022; Summers *et al*., 2022; Hon *et al*., 2023).

Jababeka manufacturing industry is the first modern eco-industry area, which is established through a technical cooperation program between the Ministry of Environment of Indonesia and the Republic of Germany. The area is home to several manufacturing companies, including those producing inorganic chemicals, paints, and related products for buildings and infrastructure, as well as food and beverages.

Based on observations and interviews conducted in several companies, it was found that risk management was not optimal, resulting in low worker engagement and leadership commitment in safety. The results showed that safety climate analysis has not been carried out in several companies in this area. Therefore, further research is necessary to analyze the relationship between individual factors and safety climate in this area.

This study aims to identify the main factors that shape the perceptions of workers regarding safety climate in manufacturing companies located in the Jababeka area of Bekasi, West Java. This study is significant because previous research has shown a lack of comprehensive analysis due to the theoretical conception of safety climate as a distinct subculture.

METHODS

This quantitative study with a cross-sectional design was conducted to analyze safety climate in three manufacturing companies in the Jababeka area in August 2021. The sample size consisted of 330 workers selected using the Lemeshow formula from a total of 1500 workers. The safety climate variables were selected based on the conceptual framework of workplace safety climate (Luo, 2020).

This study used a self-constructed questionnaire comprising 135 items to collect sociodemograpic data and measure seven variables, namely leadership, risk management, implementation of occupational health and safety management system (OHSMS), regulation, management commitment, worker engagement, and worker competence. A seven-point Likert scale was used to indicate the level of agreement, ranging from strongly disagree to strongly agree. The validity and reliability of the questionnaire were tested using Cronbach's alpha of more than 0.60.

Furthermore, univariate and bivariate analyses were performed and the results were compared to Hudson's (2010) safety maturity scale to determine the gap between the strength of the correlations. The collected data were also statistically tested using the analysis of variance (ANOVA) test with the Statistical Package for the Social Sciences (SPSS) version 25.0. This study received ethical approval with a certificate number Ket-539/UN2.F10. D11/ PPM.00.02/2023.

RESULTS

Sociodemography of Workers

Univariate Analysis

Table 1 shows that the workers of PT A, B, and C were predominantly males. PT A had 48 male workers (83%) and 10 female workers (17%), while PT B had 89 male workers (89%) and 11 female workers (11%). Additionally, PT C had 135 male workers (78%) and 37 female workers (22%).

The majority of workers at PT A, B, and C fell within the 19-29 and 30-39 age groups. Specifically, 132 workers (40%) were aged between 19 and 29 years and 107 workers (32.42%) were aged between 30 and 39 years. Additionally, 72 workers (21.82%) were aged between 40 and 49 years, and 19 workers (5.76%) were aged between 50 and 59 years.

Safety Climate

Figure 1 shows that PT A has an average total score of 5.72 out of 7. The regulation variable has the highest score compared to the other six with an average of 5.98 out of 7, while risk management has the lowest score of 5.37.

Figure 2 shows that PT B has an average total score of 5.39 out of 7, which is the lowest score compared to the other companies. The risk management variable also has the lowest score compared to the others six.

The implementation of OHSMS, regulation, management commitment, worker participation, and worker competence variables have a score of 5.37, 5.47, 5.41, 5.37, and 5.38, respectively. The regulation variable has the highest score compared to the other six variables.

Figure 3 shows that PT C has an average total score of 6.02 out of 7, which is the highest score compared to the other two companies. The

Table 1. Sociodemographic Data of Workers of PT A, B, and C

Characteristics	PT A		PT B		PT C	
	n	%	n	%	n	%
Sex						
Male	48	83	89	89	135	78
Female	10	17	11	11	37	22
Age (years)						
19-29	21	36	8	8	103	60
30-39	22	38	37	37	48	28
40-49	11	19	46	46	15	9
50-59	4	7	9	9	6	3
≥60	0	0	0	0	0	0

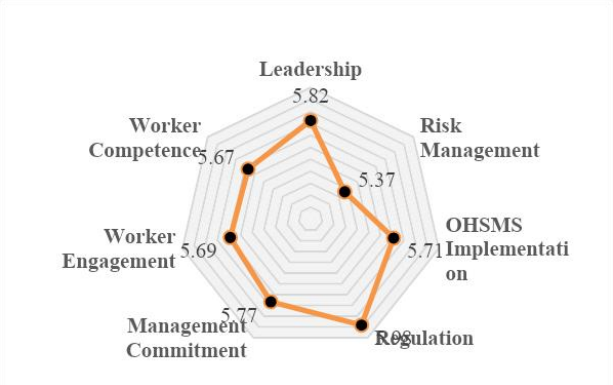

Figure 1. Safety Climate Mesh Diagram of PT A

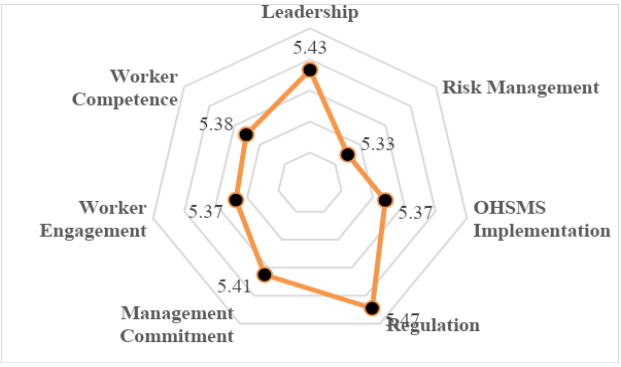

Figure 2. Safety Climate Mesh Diagram of PT B

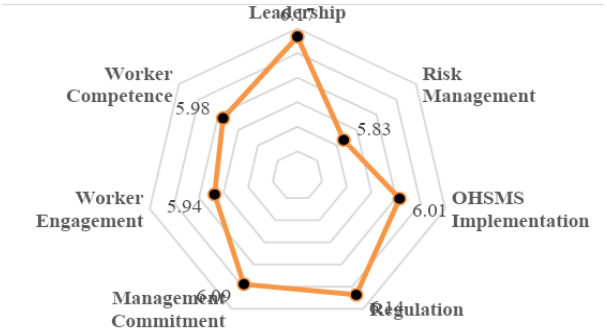

Figure 3. Safety Climate Mesh Diagram of PT C

Table 2. ANOVA Test Results of Safety Climate Research Variables

Variables	Mean			F	One-Way ANOVA (Sig.)
	PT A	PT B	PT C		
Leadership	5.824	5.533	6.167	9.226	0.000
Risk Management	5.366	5.325	5.834	6.428	0.002
OHSMS Implementation	5.719	5.376	6.019	9.700	0.000
Regulation	5.998	5.485	6.149	9.884	0.000
Management Commitment	5.741	5.431	6.097	11.339	0.000
Worker Engagement	5.629	5.420	5.960	7.553	0.001
Worker Competence	5.572	5.344	5.941	8.473	0.000
Safety Climate	5.692	5.416	6.023	9.628	0.000

highest score is the leadership variable, which has an average score of 6.17 out of 7, while the risk management variable has the lowest score compared to the other six.

Bivariate Analysis

An analysis of variance (ANOVA) was performed to determine statistically significant differences between the research variables in each company. The proposed hypotheses were as follows.

- H0: There is no significant statistical difference between each research variable in each company.
- H1: There is a significant statistical difference between each research variable in each company.

Table 2 shows significant average differences between the three companies ($p < 0.05$) in terms of leadership, risk management, and implementation of OHSMS, with p-values of 0.000, 0.002, and 0.000, respectively.

Meanwhile, the p-values of regulation, management commitment, worker engagement, and worker competence are 0.000, 0.000, 0.001, and 0.000, respectively, indicating significant differences between the variables in PT A, B, and C.

DISCUSSION

According to the results, risk management has the lowest value compared to other variables. This is due to the differing views on risk tolerance, which is the level of readiness of employees to accept risks (Wang *et al*., 2016; Bhandari *et al*., 2021). Research has shown that a positive safety climate leads to favorable risk tolerance among workers (Bhandari and Hallowell, 2022).

Accurate perception and evaluation of safety risks by workers is crucial for maintaining a safe work environment. However, recent research shows that workers are not proficient in identifying risks in their work environment (Albert *et al*., 2017). Safety risks are often underestimated even when hazards are identified, leading to poor implementation of safety measures and failure to follow established work procedures (Arefin *et al*., 2022; Hon *et al*., 2023). Lack of training which results in the limited knowledge and skills of workers can influence the perception of safety among workers (Todaro *et al*., 2023). Therefore, regular assessments of skills and knowledge of the work environment should be conducted (Comberti and Demichela, 2022).

In practice, safety climate is a precursor to proactive risk management, which influences the safety knowledge and motivation of workers. This leads to the development of competencies that comply with procedures and promote safety (Oah, Na and Moon, 2018).

This study found a significant negative correlation between safety climate and risk-taking decisions in the workplace. This suggested that safety climate might reduce risk tolerance and promote more risk-averse decision-making in the workplace, regardless of the risk tolerance of workers. The correlation was statistically significant accross different datasets and was not influenced by demographic factors, occupational risk tolerance, and personal risk tolerance. In this context, safety professionals can use safety climate to mitigate the risk decision-making tendencies of construction workers despite the risk tolerance of their jobs (Bhandari and Hallowell, 2022).

A study found that workload and accident experience had a significant positive correlation with accident risk perception. Meanwhile, safety leadership and climate of an organization had a negative correlation (Rahlin *et al*., 2022). This study highlighted the importance of leadership aspect in establishing a consistent safety climate in a company. The results also indicated variations among PT A, B, and C, which may be attributed to differences in leadership.

Furthermore, PT C achieved the highest audit scores for management systems and policies. This suggested that the roles of management systems and leadership concerning safety played a crucial role in promoting a positive safety climate in the workplace (Rahlin *et al*., 2022). Therefore, organizations should prioritize embedding transformational leadership to foster the development of safety climate in their organizational culture. These results are particularly important because they contribute to the reduction of occupational accidents (Draghici *et al*., 2022).

This study was conducted to understand the factors that contribute to safety climate. Further research could investigate the dominant factors in three companies to identify areas for improvement and promote a positive safety climate. Additionally, further research could explore the role of stakeholders, particularly management, in implementing effective OHSMS. Companies can

also establish a culture of safety and health that benefits both employees and the organization by involving stakeholders in the development and implementation of OHSMS.

CONCLUSION

In conclusion, risk management and safety leadership contributed to a favorable safety climate in PT A, B, and C. Transformational leadership and proactive risk management influenced the knowledge of safe work practices among workers in the workplace. Prioritization in terms of policy and administration was necessary for effective preparation of risk management. The commitment of each department head to invite their workers to participate in every safety program was also key to creating a positive safety climate in the workplace.

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