JOURNAL LA SOCIALE

VOL. 06, ISSUE 04 (1267-1279), 2025
DOI:10.37899/journal-la-sociale.v6i4.1962

Analysis of the Effect of Management Commitment, Safety Compliance and Safety Awareness on Safety Culture

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Article Info

Article history:
Received 22 January 2025
Received in revised form 6 March 2025
Accepted 27 June 2025

Keywords:
Management Commitment
Safety Awareness
Safety Compliance
Safety Culture
Workplace Safety

Abstract

This study investigates the influence of Management Commitment, Safety Compliance, and Safety Awareness on Safety Culture at PT XYZ, a heavy equipment manufacturing company. The research aims to address the rising workplace accidents, as indicated by increasing LTIFR and TRIFR rates, by identifying factors critical to improving safety culture. Data were collected from 116 respondents using a structured questionnaire and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The analysis confirmed that Management Commitment has the most significant effect on Safety Culture, with a path coefficient of 0.437 and a large effect size of 0.963, highlighting the importance of leadership and consistent safety policies. Safety Compliance, with a path coefficient of 0.375 and an effect size of 0.712, underscores the role of adherence to safety regulations in fostering accountability and reducing accidents. Safety Awareness, with a path coefficient of 0.333 and an effect size of 0.632, emphasizes the need for employee understanding of safety risks to encourage proactive behaviors. These findings underline the importance of integrating these variables into organizational strategies to enhance safety culture. The study concludes that fostering a robust safety culture requires collective efforts across all organizational levels, emphasizing management leadership, compliance enforcement, and safety awareness initiatives to ensure a safer and more productive workplace.

Introduction

Indonesia as a developing country has a heavy equipment manufacturing sector which plays a vital role in supporting the national economy. This sector is not only the main driver in creating added economic value but also provides employment opportunities for thousands of people (Achmad & Hamzani, 2015; Turkyilmaz et al., 2021). Heavy equipment manufacturing products are widely used, especially in the mining industry which requires advanced technology and skilled human resources. However, in the midst of this growth, work safety risks have become a significant challenge. The use of heavy equipment, operation of large machines, and demanding working conditions often increase the potential for work accidents (Duarte et al., 2021; Bedi et al., 2021; Mehmood et al., 20230.

The high number of work accidents in the manufacturing sector reflects the importance of improving safety culture in the workplace. Based on data from BPJS Employment, the number of work accidents continues to increase from year to year, especially during the pandemic period. In 2020, 221,740 work accident cases were recorded, which then jumped to 370,747 cases in 2023. This significant increase shows that the efforts made to reduce the number of accidents are still not optimal. The main causes of this high number can be attributed to a lack

ISSN 2721-0960 (Print), ISSN 2721-0847 (online)

of safety awareness, low compliance with safety standards, and limited supervision of the implementation of safety procedures in the workplace (Basahel, 2021; Ullah et al., 2021).

PT XYZ as a heavy equipment manufacturing company has attempted to improve safety culture through various programs. As a company engaged in heavy equipment fabrication, PT XYZ realizes the importance of work safety in its operations. This company routinely holds work safety outreach programs every month to increase employee awareness regarding the importance of safety protocols. Apart from that, the company also carries out annual health checks as a preventive measure to maintain employee health and productivity. However, survey results show that there is unsafe behavior among some employees, such as not using personal protective equipment (PPE) or carrying out high-risk activities without paying attention to safety procedures. This indicates that even though the company has a good program, there is still room to improve compliance with safety culture among workers (Rasmussen & Ahsan, 2022; Kalteh et al., 2021).

Based on data available at PT XYZ, TRIFR (Total Recordable Injury Frequency Rate), which previously decreased from 2021 to 2023, increased again in 2024 with a figure reaching 9.6. An increase in LTIFR indicates the need for increased monitoring and treatment of risk factors that cause serious injuries, while an increase in TRIFR indicates that the overall number of recorded injuries, whether mild, moderate or severe, is also increasing. This trend emphasizes the importance of in-depth evaluation of existing work safety programs and the need for more systematic strategic steps to reduce LTIFR and TRIFR figures so that they do not continue to increase in the future.

Improving work safety culture requires a holistic and evidence-based approach to overcome various challenges in the field. In this context, analysis using the Structural Equation Modeling (SEM) method can be an effective tool for identifying factors that influence work safety culture in companies. With this method, the relationship between safety behavior, management commitment, safety leadership and other components can be understood in more depth. It is hoped that the results of this research will provide valuable insight for companies in designing more effective strategies to create a safe and productive work environment. This evidence-based approach is also expected to be able to improve the quality of safety program implementation at PT XYZ, as well as make a real contribution to reducing the number of work accidents in the manufacturing sector.

Safety Culture

Safety Culture is a concept encompassing safety behavior, environment, and attitudes within an organization. It involves interactions between these elements, encompassing employees' values, beliefs, and attitudes, influencing behavior and societal norms (Mohd Ariff et al., 2022). Tear and Reader highlight that culture influences safety by shaping risk recognition frames and influencing individual values, attitudes, perceptions, skills, and behavior patterns, ultimately determining an organization's health and safety management style (Amirah et al., 2024). Safety culture is a set of shared values and beliefs that interact with organizational structures and control systems to create norms or behavior. Other factors used to measure safety culture include work rules, communication, competence, work environment, and employee involvement (Islami & Sudiarno, 2022).

Management Commitment

Management commitment is a term often used to define management involvement and participation in an organization's safety program. In the earliest safety investigations, researchers found that management's commitment to workplace safety was an important example of influencing the effectiveness of an organization's safety initiative program. A safety

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policy statement is one strong example of management's commitment to safety (Hassan et al., 2020). Management's commitment to safety can be proven for organizations to reduce work accidents in various forms of work safety training (Ajmal et al., 2021). The success of the K3 program is determined by the commitment of management. Commitment to safety is divided into three dimensions, namely safety commitment which is related to attitude/affective, safety commitment which follows applicable/normative rules and ongoing safety commitment. (Setiadi et al., 2023).

Safety Compliance

Safety compliance refers to the attitude of adhering to safety procedures and performing safe work, originating from safety management practices and personal protective equipment. It involves role clarity, appropriate security expectations, and behaviors like voluntarily improving workplace safety (Omidi et al., 2023). Safety compliance refers to employees adhering to organizational rules and procedures, including safe operational procedures and personal protective equipment. It is crucial in high-risk industries like gas, oil, manufacturing, and construction. Studies show a positive correlation between compliance and accident and injury rates, with violations often being the main cause. (Hu et al., 2020).

Safety Awareness

Safety awareness refers to a person's awareness of safety issues, impacting cognitive and behavioral aspects. It drives job-related safety and operational safety behaviors. Businesses strive to increase worker safety awareness, as per Kiani and Khodabakhsh (Prasetiawan et al., 2024). Research indicates that communication of safety information significantly influences employees' safety awareness and behavior, leading to more complex safety issues. Organizations are focusing on increasing safety awareness, aiming for three types: self-safety awareness, safety responsibility awareness, and safety management and supervision awareness. Employees can receive attitude and knowledge education to enhance safety awareness (Fu et al., 2020).

SEM (Structural Equations Model)

Structural Equation Modeling (SEM) is a data analysis technique used to study relationships between variables in research. It is a multivariate approach that considers the relationship between independent and dependent variables. SEM is confirmatory as it tests hypotheses from existing theories and ideas. It allows modeling complex relationships between variables that cannot be measured directly but can be assessed through indicator variables. This exploratory research aims to develop theory using SEM based on partial least squares structural equation modeling (PLS-SEM), with a minimum sample size of 10 times the number of independent variables (Tay & Zamore, 2024).

H1: *Management Commitment has a positive and significant effect on Safety Culture at PT. XYZ*

The findings of the study (N. N. H. Ismail, 2020) show that safety performance has a significant relationship with management commitment. This confirms our argument that management commitment to safety is a key factor associated with a positive safety culture, positive employee safety behavior, and positive employee safety attitudes. This statement is supported by previous research that shows the importance of managerial commitment in creating a safe culture (Jaselskis et al., 1996). Ye et al. (2020) claim that top management's dedication to management systems, processes and procedures promotes employees' understanding of the value of maintaining safety on construction sites. Meanwhile, Hong et al. (2018) have examined the efficacy of management commitment through safety management and planning.

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This is in line with the successful management of safety management management in the manufacturing sector (Fadhilah et al., 2023).

H2: *Safety Compliance has a positive and significant effect on Safety Culture at PT. XYZ*

The findings show the significance of safety compliance in building a safety culture. The positive relationship between safety compliance and safety culture is in line with previous studies by Ramayah and Subramanian (2023; 2018), which emphasized the importance of prioritizing safety compliance to improve safety culture in the workplace (Amirah et al., 2024). Safety compliance significantly influences safety culture in the construction industry, guiding compliance with workplace regulations and reducing workplace accident problems. High compliance helps establish a clean image and reduces accidents. Abdullah et al. (2021) also corroborate the research findings, showing that safety compliance can be used to implement safety culture practices, enhancing safe work practices and reducing occupational accident hazards, thus improving project efficiency. (Fadhilah et al., 2023).

H3: *Safety Awareness has a positive and significant effect on Safety Culture at PT. XYZ*

The findings of the study by Song et al. (2019) show that safety awareness is significantly influenced by safety culture. Safety culture has a positive impact on safety awareness, which is significantly influenced by safety culture. Safety culture, reflected in engineering, enforcement, education, emotion, empathy, empowerment, and engagement, is a concept to explain how an organization's internal social environment can influence risky practices within the organization. When an organization's safety culture is favorable, it will affect safety awareness, which is the state in which a person knows his or her rights and responsibilities regarding potential risks in the workplace and safety difficulties. (Prasetiawan et al., 2024).

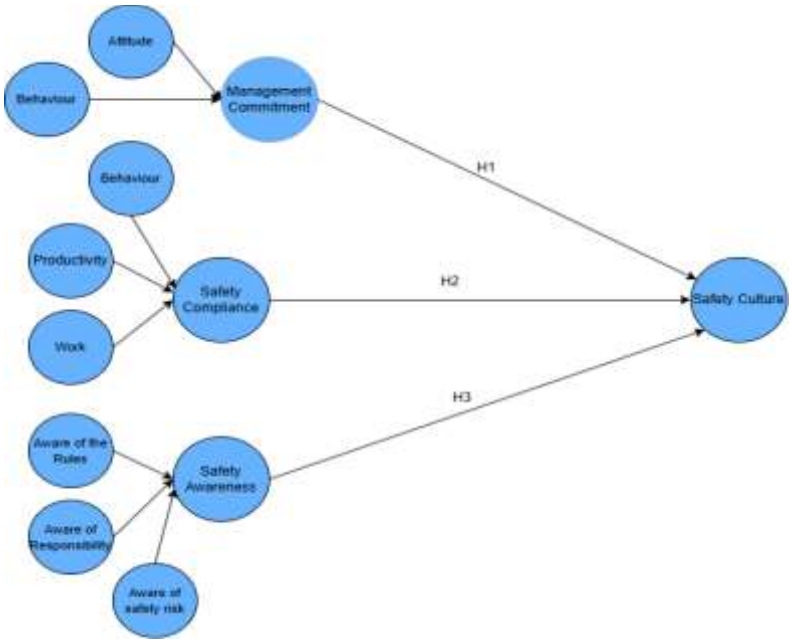

Figure 1. The research model and hypotheses developed

Methods

This research was conducted at a mining heavy equipment manufacturing company. The study involved employees working in the production division of the company, including welders, fitters, grinders, and painters. The study aims to explore the relationship between Management Commitment, Safety Compliance and Safety Awareness and Safety Culture, utilizing data collected from July 2023 onward.

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This study examines key variables and their respective dimensions, focusing on their influence on safety culture within PT XYZ. Safety awareness is analyzed through dimensions such as awareness of rules, responsibility, and recognition of safety risks, emphasizing employees' understanding and proactive behavior toward safety protocols. Safety compliance is measured by evaluating the relationship between adherence to safety regulations and workplace productivity, as well as the effectiveness of regulatory frameworks in ensuring compliance. Management commitment, a critical factor in shaping safety behavior, is assessed through dimensions such as managerial attitudes, actions promoting safety, and consistent leadership practices like coaching and ongoing supervision. Finally, safety culture, the dependent variable, is explored through dimensions including employee responsibility for following safety procedures, personal accountability in preventing workplace injuries, and active participation in safety training and initiatives. Together, these variables and their dimensions provide a comprehensive framework for understanding and enhancing safety practices in the workplace.

Table 1. Description of operationalization

Variable	Dimensions
Management Commitment	- Attitude: Management's attitude toward safety
	- Behavior: Management behavior in maintaining safety
Safety Compliance	- Productivity: The relationship between safety compliance and work productivity.
	- Regulation: Regulatory capability to maintain safety compliance.
Safety Awareness	- Aware of the rules
	- Aware of responsibility
	- Aware of safety risks

This research was conducted on a population of 163 workers, consisting of several main positions in the production process at PT XYZ, namely Welder, Fitter, Grinder, and Painter. Of the total population of 163 workers, Welder and Fitter have the largest number of workers, 67 people (41%) and 72 people (44%) respectively, which indicates that these two positions play a dominant role in production activities. Meanwhile, Grinder and Painter have a smaller workforce of 10 (6%) and 14 (9%) respectively, but still play an important role in the overall manufacturing process.

The research employed a proportional stratified random sampling method to ensure fair representation across different employee categories. The total sample size was calculated using Slovin's formula, with a 5% margin of error. The selection of a 5% error rate in this study was based on a balance between the accuracy of the results and the efficiency of data collection, as well as its suitability for the Proportional Stratified Random Sampling method. Smaller error rates, such as 1% or 2%, will increase the number of samples required, thus requiring more time, costs and resources. Conversely, a larger error rate, such as 10%, may reduce the sample size but increase the risk of errors in the research results. With an error rate of 5%, the study still has a 95% confidence level, which ensures the results remain representative of the population. In addition, in Proportional Stratified Random Sampling, this error rate helps maintain a balanced proportion of each stratum in the sample, so that the distribution of population characteristics is maintained and the research results can be well generalized and unbiased.

$$n = \frac{N}{1+N(e^2)} \quad \text{.....(2.1) Slovin Formula}$$

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Based on the population data mentioned above, with a total of 163 workers, this research applies the proportional stratified random sampling method to determine the number of samples representing each job group. By using the Slovin formula with a margin of error of 5%, a sample size of 116 respondents was obtained, which was then distributed proportionally according to the percentage of the population of each position using the formula listed above. The calculation results showed that the sample consisted of 48 welders, 51 fitters, 7 grinders, and 10 painters, which reflected the composition of the workforce population proportionally and ensured each job group had sufficient representation in the research analysis.

The study uses proportional stratified random sampling to analyze the heterogeneity of the workforce in PT XYZ, focusing on differences in wages, safety risks, and safety procedures. The stratification method is used to ensure that each worker category (welder, fitter, grinder, painter) has a representative representation in the research. Welders and fitters have more workers, higher production costs, and higher safety risks, while grinders and painters have lower wages but higher safety risks. This approach allows for a more accurate understanding of safety culture in all workplaces. The smaller sample sizes for grinders and painters may lead to limitations in generalizing the findings and increase the possibility of higher variation in the data. In addition, although the proportional stratified random sampling method was applied to ensure representation of each occupational group, there is still potential bias in the results. Bias from workers who are reluctant to provide honest answers regarding safety culture may affect the validity of the results, which is a limitation of the study.

Data collection was conducted using a structured questionnaire designed to measure variables such as safety awareness, compliance, management commitment. The questionnaire included closed-ended questions based on a 4-point Likert scale. Likert scale is a scale used to measure the perceptions, attitudes or opinions of a person or group regarding an event or social phenomenon (Pranatawijaya et al., 2019). The use of a questionnaire instrument that uses a four-scale Likert scale has advantages, namely that it can collect research data more accurately because the undecided answer category has multiple meanings or it can be interpreted that the respondent cannot decide or give an answer.

The study distributed an instrument both in-person and digitally via platforms like WhatsApp and Google Forms to ensure convenience and reach. However, the study faced challenges in ensuring the independence and authenticity of responses due to external influences, distractions, and careless responses. To address these issues, the questionnaire was designed with straightforward wording to reduce misinterpretations. In-person data collection was conducted with uniform instructions from trained facilitators, while digital respondents were provided with detailed explanations to select answers and avoid mistakes before they answer the questions. To increase reliability, respondents were encouraged to complete the questionnaire independently in a distraction-free environment with a 1-month time limit. However, external factors affecting digital responses cannot be completely eliminated, remaining a potential limitation of the study.

To analyze the collected data, the study employed Partial Least Squares Structural Equation Modeling (PLS-SEM), a powerful analytical tool well-suited for small sample sizes and non-normal data distributions. This method allows the researcher to explore complex relationships between variables, such as Management Commitment, Safety Compliance and Safety Awareness and Safety Culture. The analysis included the assessment of outer models for validity and reliability and inner models to determine structural relationships (Rahadi, 2023). The findings are expected to provide valuable insights into the critical factors influencing safety culture in a manufacturing setting. By identifying the impact of variables such as Management Commitment, Safety Compliance and Safety Awareness and Safety Culture, the study seeks to

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contribute to the development of strategies to improve workplace safety practices at PT XYZ, ultimately reducing workplace accidents and fostering a safer work environment.

Results and Discussion

Based on the demographic data of respondents, from 116 respondents, the majority of workers are in the age range of 36-45 years with a percentage of 37.1%, followed by 26-35 years old (25.9%), 46-55 years old (22.4%), 17-25 years old (11.2%), and over 55 years old (3.4%). Based on job position, most respondents are Fitters with a percentage of 44%, followed by Welder at 41.4%, Painter at 8.6%, and Grinder at 6%. In terms of work experience, the majority of respondents have 11-15 years of work experience with a percentage of 37.1%, followed by 6-10 years (26.7%), more than 15 years (20.7%), and less than 5 years (15.5%). This data shows a distribution that reflects variations in age, job position, and work experience in the company's work environment. The data presented in the figure 2 includes outer loadings for each indicator. the outer loadings represent the strength of the relationship between each indicator and its respective latent variable. Most outer loading values are above 0.7, signifying that the indicators strongly contribute to the constructs they measure, thereby confirming their reliability and validity within the model.

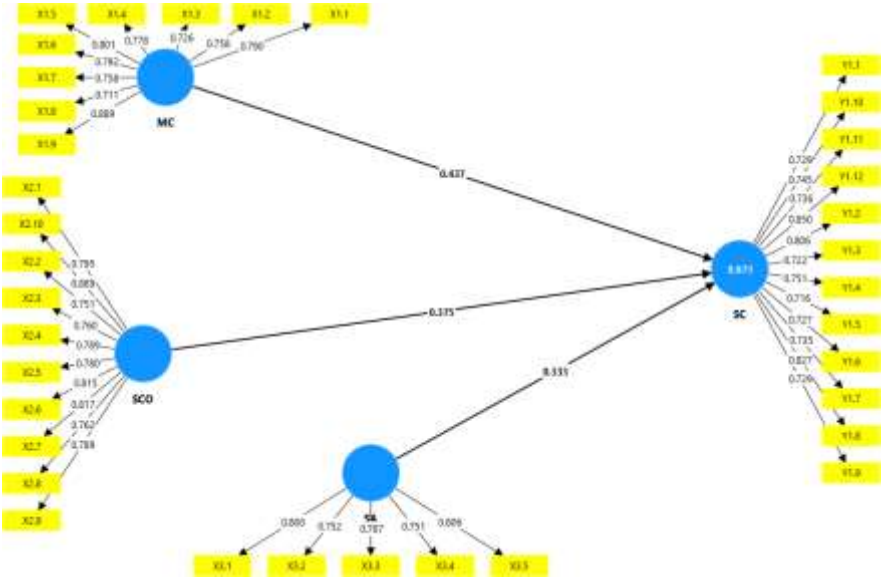

Figure 2. outer loadings value

Source: SmartPLS 4, 2024

The table demonstrates the validity and reliability of the variables measured in the study, including Management Commitment, Safety Compliance, Safety Awareness, and Safety Culture. Convergent validity is confirmed, as all constructs have AVE values greater than 0.50, ranging from 0.573 to 0.633, indicating that more than 50% of the variance in the indicators is explained by their respective constructs. Discriminant validity is also supported, as the square root of AVE ($\sqrt{AVE}$) for all constructs exceeds 0.75, ensuring that each construct is distinct from the others. Reliability analysis shows excellent results, with Cronbach's Alpha values between 0.835 and 0.935 and Composite Reliability (CR) values ranging from 0.883 to 0.945, both exceeding the recommended threshold of 0.70. These results confirm that the measurement model is both valid and reliable, making it robust for further analysis.

Table 2. The results of the measurement model

Variable	AVE	$\sqrt{AVE}$	CA	CR

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Management Commitment	0.608	0.779	0.919	0.933
Safety Compliance	0.633	0.775	0.935	0.945
Safety Awareness	0.601	0.757	0.835	0.883
Safety Culture	0.573	0.796	0.932	0.941

Source: SmartPLS 4, 2024

The R^2 value of 0.873 indicates that 87.3% of the variance in Safety Culture is explained collectively by the independent variables: Management Commitment (MC), Safety Compliance (SCO), and Safety Awareness (SA). This suggests that these variables play a critical role in shaping Safety Culture within the observed context. Additionally, the adjusted R^2 value of 0.870, which accounts for the number of predictors in the model, is only slightly lower than the R^2, implying that the model does not suffer from overfitting. The high values of both R^2 and adjusted R^2 demonstrate the model's strong ability to explain the variation in Safety Culture effectively.

Table 3. The results of R-Square

Variable	R^2	R^2 Adj.	Result
Safety Culture	0.873	0.870	Strong

Source: SmartPLS 4, 2024

The table evaluates the predictive relevance of the model using the Q^2 metric, calculated as$Q^2 = 1 - \frac{SSE}{SSO}$. For Safety Culture, the Q^2 value is 0.487, which exceeds the threshold of 0, indicating that the model has strong predictive relevance. This result confirms that the independent variables (MC, SCO, SA) not only explain a significant portion of the variance in Safety Culture but also have substantial predictive capability. This strengthens the confidence in the model's ability to provide meaningful insights and forecasts regarding Safety Culture.

Table 4. The results of Q-Square

	SSO	SSE	Q^2 (=1-SSE/SSO)
SC	1392.000	714.403	0.487

Source: SmartPLS 4, 2024

The table focuses on the effect sizes (F^2) of the independent variables, which indicate the magnitude of their individual contributions to Safety Culture. Management Commitment has the highest effect size at 0.963, signifying its critical importance in driving changes in Safety Culture. Safety Compliance follows with an effect size of 0.712, which also represents a significant impact. Finally, Safety Awareness has an effect size of 0.632, demonstrating its meaningful but slightly lesser influence compared to the other two variables. According to the guidelines for interpreting effect size (F^2), all three values are categorized as large effects, confirming that each variable significantly contributes to the model's explanation of Safety Culture.

Table 5. The results of effect size

Variable	Safety Culture	Result
Management Commitment	0.963	Large Effect
Safety Compliance	0.712	Large Effect
Safety Awareness	0.632	Large Effect

Source: SmartPLS 4, 2024

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The table outlines the relationships between the predictor variables and Safety Culture using path coefficients and T-statistics. The path coefficient for Management Commitment is 0.437, indicating a moderate positive influence on Safety Culture, supported by a T-statistic of 7.514, which exceeds the critical threshold of 1.96, confirming statistical significance. Similarly, Safety Awareness has a path coefficient of 0.333, reflecting a positive but slightly weaker impact, with a T-statistic of 5.677, also statistically significant. Lastly, Safety Compliance has a path coefficient of 0.375, showing a moderate positive influence, with a T-statistic of 7.171. These results confirm that all three independent variables significantly and positively contribute to Safety Culture. The T-statistics validate that these relationships are robust and reliable within the observed dataset.

Table 6. Structural Model

	Original sample (O)	**T statistics (|O/STDEV|)**
MC -> SC	0.437	7.514
SA -> SC	0.333	5.677
SCO -> SC	0.375	7.171

Source: SmartPLS 4, 2024

H1: Management Commitment has a positive and significant effect on Safety Culture at PT. XYZ

The results strongly support Hypothesis 1, which posits that Management Commitment has a positive and significant effect on Safety Culture at PT. XYZ. This is evident from the path coefficient of 0.437, which reflects a moderately strong positive relationship. Furthermore, the T-statistic of 7.514 exceeds the critical threshold of 1.96, confirming that the effect is statistically significant. Additionally, the large effect size (f^2) of 0.963 further highlights the substantial influence of Management Commitment on shaping Safety Culture. These findings indicate that managerial actions, policies, and consistent dedication to safety play a crucial role in fostering a positive safety culture within the organization. Strengthening management commitment will enhance trust and communication between employees and leaders, leading to a more engaged workforce and safer working conditions. According to Huang et al. (2012), a key aspect of safety culture is the contribution of managerial commitment. This is supported by Zohar's (2008) discussion of management commitment as a fundamental element in the theoretical or empirical development of safety culture constructs. (Fadhilah et al., 2023).

H2: *Safety Compliance has a positive and significant effect on Safety Culture at PT. XYZ*

The analysis also validates Hypothesis 2, which suggests that Safety Compliance positively and significantly affects Safety Culture at PT. XYZ. The path coefficient for this relationship is 0.375, signifying a moderate positive impact of employees adhering to safety standards and regulations on the overall safety culture. With a T-statistic of 7.171, this relationship is statistically significant. The effect size (f^2) of 0.712 is categorized as large, indicating that safety compliance has a meaningful and critical role in shaping Safety Culture. These results underscore the importance of employee compliance with safety guidelines in promoting a strong and reliable safety culture. Enhancing safety compliance through training, clear communication, and consistent enforcement of rules can significantly reduce accidents and improve operational efficiency within the company. Analysis of the findings from the research also shows that safety compliance influences safety culture well. This is because safety compliance is an important component as a guideline for compliance with safety regulations in the workplace. (Fadhilah et al., 2023).

ISSN 2721-0960 (Print), ISSN 2721-0847 (online)

H3: Safety Awareness has a positive and significant effect on Safety Culture at PT. XYZ

Hypothesis 3 is also supported, affirming that Safety Awareness has a positive and significant effect on Safety Culture at PT. XYZ. The path coefficient of 0.333 shows a positive relationship, albeit slightly weaker compared to the other predictors. The T-statistic of 5.677 exceeds the critical threshold of 1.96, confirming statistical significance. The effect size (f^2) of 0.632, though slightly lower than the other variables, is still categorized as large, demonstrating that safety awareness meaningfully contributes to the overall safety culture. These findings emphasize that increasing employees' understanding and consciousness about safety risks and practices significantly enhances the organization's safety culture. Improving safety awareness through educational programs, campaigns, and regular safety reminders can create a proactive environment where employees prioritize safety in every aspect of their work. Safety awareness measures how well management and staff are aware of the risks to their safety and the safety of others associated with business operations. Safety awareness enables employees to recognize the various hazards and impacts of individual actions in the workplace (Adzivor et al., 2024).

PT. XYZ has demonstrated strong Management Commitment through their HSE program, and regularly reports on the effectiveness of their Risk Management Program. They maintain their knowledge, skills, and environment to ensure safe work by providing efficient facilities and collaborations, ensuring safety and workplace health, and ensuring management commitment to safety and workplace health. To improve efficiency, the company should communicate a more effective safety vision, allowing employees to understand safety as a top priority. PT. XYZ has a strong safety compliance record, focusing on safety regulations, using personal protective equipment (APD), and safe work practices. However, some employees still don't use APD and may not follow safety guidelines. To improve efficiency, the company provides training, continuous improvement, and a consistent work environment, ensuring not only safer work but also a healthier and more productive work environment. PT. XYZ is focusing on increasing safety awareness among employees regarding workplace safety, including using personal protective equipment. This is a crucial foundation for promoting proactive safety practices. The company is working on an interactive safety training program, such as risk simulation and personal protective equipment. Research by Ismail Noraishah Ismail, Azizan Ramli, and Hanida Abdul Aziz suggests that good safety training and education can improve safety between employees and the workplace (S. N. Ismail et al., 2021).

Conclusion

The study underscores the critical role of safety culture in reducing workplace accidents and fostering a safer, more productive work environment, particularly in the heavy equipment manufacturing sector at PT XYZ. The increasing trend of workplace accidents, reflected in the rise of LTIFR and TRIFR, highlights the urgent need for effective strategies to enhance safety practices. The research identifies Management Commitment, Safety Compliance, and Safety Awareness as pivotal factors shaping a robust safety culture. Among these, Management Commitment is the most influential, with a path coefficient of 0.437 and a large effect size of 0.963, demonstrating that visible leadership, consistent policies, and prioritization of safety significantly impact safety culture development. Safety Compliance, with a path coefficient of 0.375 and a large effect size of 0.712, emphasizes the importance of adhering to safety regulations and fostering employee accountability. Safety Awareness, with a path coefficient of 0.333 and a large effect size of 0.632, highlights the necessity of enhancing employees' understanding of safety risks to promote proactive behaviors and mitigate hazards. Collectively, these findings emphasize the need for PT XYZ to integrate these factors into its organizational strategies, continuously evaluate and improve safety programs, and align these

ISSN 2721-0960 (Print), ISSN 2721-0847 (online)

efforts with long-term goals to ensure a safe and productive workplace for all employees. Future studies should consider analyzing whether response mode influences the quality and reliability of data A comparative statistical analysis could be employed to determine if significant differences exist between in-person and digital responses.

Acknowledgment

I would like to express my deepest gratitude to PT XYZ for providing the opportunity and support to conduct this research within their organization. My heartfelt thanks also go to my academic mentor, and my lecturers, for their invaluable guidance, encouragement, and insights throughout the research process. Additionally, I am immensely grateful to my family and friends for their unwavering support and motivation, which have been instrumental in completing this study. Finally, I extend my sincere appreciation to all respondents and colleagues who contributed their time and knowledge to make this research possible.

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