

The Determinants of Occupational Safety Culture at PT. Bridgestone Sumatra Rubber Estate In 2024

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ABSTRACT

The research employs a quantitative design using the Partial Least Square-Structural Equation Modeling (PLS-SEM) method and involves 244 workers selected through proportional stratified sampling from a population of 623 workers. Data were collected using a Likert scale-based questionnaire that had been tested for validity and reliability. Factors such as management commitment, employee perception, safety implementation, safety participation, emergency response, as well as the culture of information, reporting, learning, and flexibility significantly impact the occupational safety culture. The study results show that a strong occupational safety culture can reduce workplace accidents and improve operational efficiency. Implementing an effective safety culture requires management support, employee involvement, and strengthening safety culture dimensions. Recommendations are provided for the company to continuously enhance its occupational safety programs.

INTRODUCTION

Industrialization in modern Indonesia is progressing rapidly. To meet consumer demands, industries must continually improve product and service quality. However, increased production often leads to higher risks of workplace hazards and accidents. Proper implementation of occupational safety programs is essential to safeguard company assets. Workplace accidents are a recurring issue in Indonesia, with annual increases. Identifying potential risks in the work environment, equipment, materials, and workers is critical for prevention (Alsefwin, 2021).

A safety culture encompasses norms, attitudes, roles, and technological practices aimed at minimizing exposure to hazards for workers, management, consumers, and the community. A total safety culture requires continuous engagement, particularly from operational workers. These employees are familiar with the placement of safety equipment and can identify unsafe behaviors (Rahman et al., 2021).

Safety culture reflects an organization's commitment, demonstrated through values, attitudes, perceptions, competencies, and behavior patterns in managing health and safety. Effective implementation of a safety culture reduces workplace accidents. Strong commitment and leadership from top management are essential to embed safety culture within an organization. However, management approaches often fail due to neglecting the interplay between worker behaviors, values, perceptions, and the work environment. Motivating workers to consistently adopt safe behaviors is crucial (Wagner et al., 2018).

Maintaining a robust safety culture depends on management and employee commitment. Supervisors, coworkers, and top management significantly influence workers' safety behavior (Newaz et al., 2019). Decreasing workplace accidents is linked to implementing and monitoring occupational health and safety (OHS) programs. Risk control requires ongoing efforts, including modern system-based approaches or simple measures like safety signage and promoting safety-conscious worker behavior. Safety culture is shaped by factors such as management commitment, OHS regulations, communication, worker involvement, workplace environment, and worker competence (Hermawan, 2019).

At PT Bridgestone Sumatra Rubber Estate, a subsidiary of Bridgestone Corporation headquartered in Tokyo, Japan, safety culture is measurable through Safety Culture Maturity Levels. As a major natural rubber producer, the company is committed to OHS, with policies aligned with Government Regulation No. 50/2012 and global safety standards like Bridgestone's Fundamental Activities, including 3S (Seiri, Seiton, Seiso), risk assessment, and safety rules (Bridgestone, 2020).

Employees play a crucial role in achieving company objectives, with performance reflecting compliance, discipline, and effective task execution. Incorporating OHS programs ensures safe production processes (Gea, 2021). Awareness of safety's importance influences personnel, community, and environmental well-being. Regular evaluations of safety culture maturity and workers' attitudes are necessary to improve OHS implementation.

Research highlights the influence of safety climate, safety management systems, and safety behavior on safety culture (Palendeng & Bernarto, 2022). Factors like safety compliance and participation are key indicators, involving adherence to procedures and fostering a safe work environment. PT Bridgestone's efforts include addressing near-miss incidents, with rubber tapping accounting for 30% of 500 near-miss reports in 2023. Field department data also revealed high risks for tappers, emphasizing the need for proper safety measures and worker training.

Preliminary surveys at PT Bridgestone Sumatra Rubber Estate identified six safety culture dimensions: management commitment, regulations and procedures, communication, worker involvement, competence, and workplace environment. Observations revealed SOP violations, such as improper use of personal protective equipment (PPE) due to discomfort or complacency. Interviews with field assistants indicated 18 minor accidents in 2024, including cuts, equipment mishaps, and slips. This study aims to analyze the determinants of occupational safety culture at PT Bridgestone Sumatra Rubber Estate.

LITERATURE REVIEW

Workplace accidents are a recurring issue in Indonesia, with annual increases. Identifying potential risks in the work environment, equipment, materials, and workers is critical for prevention (Alsefwin, 2021). As a major natural rubber producer, the company is committed to OHS, with policies aligned with Government Regulation No. 50/2012 and global safety standards like Bridgestone's Fundamental Activities, including 3S (Seiri, Seiton, Seiso), risk assessment, and safety rules (Bridgestone, 2020).

METHODOLOGY

This research aims to examine the role of safety climate, safety behavior, and safety culture among workers at PT Bridgestone Sumatra Rubber Estate in 2024. It also seeks to determine how safety climate and safety behavior influence the formation of workers' safety culture. The study uses a quantitative approach with a survey method, involving the collection of primary data through systematically and structurally designed research instruments to test predefined hypotheses. Data analysis will be conducted using the SEM-PLS (Partial Least Square-Structural Equation Modeling) method with the SmartPLS software.

The research will be conducted at PT Bridgestone Sumatra Rubber Estate, Dolok Merangir, Serbalawan – 21155, starting in November 2024 until the completion of the study. The study population consists of 623 tappers working in Sub-Division II of PT Bridgestone Sumatra Rubber Estate. The sample size is determined using Slovin's formula, resulting in 244 participants. The sampling method used is proportionate stratified random sampling, ensuring that every department within the population has an equal chance of being included. This approach determines the number of samples from each sub-division proportionally to represent the population adequately. Targeted samples will be selected using an applicator machine, which randomly generates names. The names of all 623 workers will be entered, and the first 244 names will be used as

the sample, distributed across the sub-divisions according to the calculated proportions.

To test the hypotheses, the study uses questionnaires as the primary tool for data collection. Respondents are asked to answer structured, closed-ended questions and provide feedback on specific queries. The questionnaire employs a Likert scale ranging from 1 to 4, with 1 representing "strongly disagree" and 4 representing "strongly agree." Once all the data from the questionnaires have been collected, quality testing will be performed to ensure the validity, reliability, and consistency of the questions, making them suitable for further analysis. The study uses a Likert scale to assess respondents' attitudes, opinions, and perceptions, as it is commonly applied to measure agreement levels. Respondents will indicate their level of agreement or disagreement with statements related to the research variables. The scale includes four categories, with 1 as the minimum score and 4 as the maximum score.

Data analysis in this research involves descriptive and quantitative methods. The descriptive analysis provides an overview of the variables being studied, such as safety climate, safety behavior, and safety culture, by presenting the data as it is without generalization. The quantitative analysis employs the SEM-PLS method, which is preferred for its flexibility in handling non-parametric data, smaller sample sizes, and complex model structures. SEM-PLS allows researchers to examine both first-order constructs (reflective dimensions measured by their indicators) and second-order constructs (latent variables formed by multiple dimensions). The SEM-PLS approach involves evaluating both the measurement model and the structural model. The measurement model ensures that the indicators used are valid and reliable by assessing convergent validity, discriminant validity, and composite reliability. Meanwhile, the structural model evaluates relationships between latent variables through measures such as R-square, predictive relevance (Q-square), and the significance of path coefficients. SEM-PLS is advantageous because it accommodates non-normally distributed data, small sample sizes, and models with multiple independent and dependent variables. However, its limitations include challenges in interpreting cross-product relationships and reliance on bootstrapping for significance testing. Through this methodological approach, the study aims to provide insights into the dynamics of safety climate, safety behavior, and safety culture within the workplace, contributing to a deeper understanding of their interrelationships and implications for improving safety practices at PT Bridgestone Sumatra Rubber Estate.

RESEARCH RESULT

PT Bridgestone Sumatra Rubber Estate (BSRE) is a subsidiary of Bridgestone Corporation, headquartered in Tokyo, Japan. The company operates in rubber plantation and crumb rubber processing, exporting its processed rubber to Japan as raw material for tire production. Bridgestone tires are then marketed across Asia, Africa, and America. The estate is located in Dolok Merangir 1, Serbelawan, Simalungun Regency, North Sumatra Province, approximately 108 km from Medan and 20 km from Pematang Siantar. The plantation and factory sit at an altitude of ± 42 meters above sea level, with a

predominantly hilly topography. The total area managed by BSRE Dolok Merangir spans 18,000.03 hectares, encompassing buildings, roads, swamps, rivers, and forests.

As one of the largest natural rubber companies, PT BSRE is committed to occupational safety and health (OSH) by implementing a corporate policy signed by the company's leadership. Its core principles include *Seijitsu-Kyochō* (Integrity and Cooperation), *Shinshu-Dokuso* (Creative Pioneer), *Genbutsu-Genba* (On-site Observation), and *Jukuryō-Dankō* (Deliberation and Decisiveness). BSRE adheres to global safety missions applied across all Bridgestone subsidiaries, following OSH management systems regulated under Government Regulation No. 50 of 2012 and ISO 45001. Bridgestone's fundamental safety activities focus on four key elements: 3S (*Seiri, Seiton, Seiso*), *Kiken Yochi* (Hazard Prediction), Risk Assessment, and Safety Rules.

However, the implementation of these safety frameworks requires continuous assessment and evaluation, particularly regarding the safety culture and workers' attitudes and behaviors at all levels. These efforts aim to foster a safe and sustainable work environment. The workforce at BSRE primarily consists of individuals aged 36-46 years (69.7%). The majority hold a high school education (80.3%), with only a small percentage having elementary education. Most workers (68%) have more than 15 years of service, while 32% have less than 15 years.

Table.1 The Characteristics of Workers at PT. Bridgestone Sumatra Rubber Estate

Variable	n	%
Ages		
26-35 years	31	12,7
36-45 years	170	69,7
46-55 years	43	17,6
Education		
Elementary School	8	3,3
Junior High School	40	16,4
Senior High School	196	80,3
Masa Kerja		
<5 years	78	32,0
>5 years	166	68,0

The analysis of structural model coefficients is used to test hypotheses by identifying which relationships significantly influence the variables in the path coefficients through the bootstrapping procedure. If the p-value is less than 0.05, the relationship is considered significant; conversely, if the p-value is greater than 0.05, the relationship is deemed insignificant.

Table.2 Hypotheses of the Research Model

Hypot heses	Path Coefficient		Orig inal Sample (O)	T Statistics (O/STD EV)	P Values	Explan ation
H1	Safety Climate Safety Culture ->	4	0,35	4,755	0, 000	Accept ed
H2	Safety Climate Safety Behavior ->	2	0,59	14,03 6	0, 000	Accept ed
H3	Safety Behavior -> Safety Culture	6	0,45	6,287	0, 000	Accept ed

Based on the table, the relationship between safety climate and safety culture shows an Original Sample (O) value of 0.354 with a P-Value of 0.000, which is less than 0.05. This indicates that safety climate has a significant positive influence on safety culture. A strong safety climate serves as a primary factor for employee success in achieving optimal performance. Management commitment significantly contributes to adherence to safety protocols and strengthens the safety culture. Furthermore, employee involvement in decision-making and a comprehensive understanding of risks substantially enhance safe behaviors in the workplace.

The relationship between safety climate and safety behavior has an Original Sample (O) value of 0.592 with a P-Value of 0.000, which is also less than 0.05. This suggests that safety climate has a significant positive influence on safety behavior. Safety behavior can include compliance and participation. Compliance refers to individual actions to maintain workplace safety, such as adhering to work procedures. Participation involves efforts to enhance safety, such as engaging in activities that foster a safe working environment.

The relationship between safety behavior and safety culture shows an Original Sample (O) value of 0.456 with a P-Value of 0.000, which is less than 0.05. This indicates that safety behavior significantly and positively impacts safety culture. By prioritizing safety culture, organizations can enhance safety behavior, reduce the likelihood of accidents and injuries, and improve overall organizational performance. In a strong safety culture, flexibility is a key strength. Employees become more adaptable to change and work collaboratively to create relevant and effective solutions in various situations.

The results of this study indicate a positive and significant influence of safety climate on safety culture and safety behavior at PT Bridgestone Sumatra Rubber Estate. The path coefficient between safety climate and safety culture is 0.354 with a p-value of 0.000, which is less than 0.05, confirming a significant effect. Safety climate plays a crucial role in optimizing employee performance, as it serves as a primary factor for achieving optimal work outcomes. This is supported by the observation that both company commitment and employee involvement are integral to shaping a positive safety climate within the organization. In other words, a company should foster a positive safety climate to motivate employees and enhance their work enthusiasm, thus contributing to the overall success of the organization.

The role of management commitment to safety is a topic of considerable importance, highlighting the need for strong leadership and employee dedication to create a safe working environment. Management commitment, as well as employee involvement, plays a crucial role in establishing and improving the safety culture within an organization. The effectiveness of management's commitment is illustrated by studies across various sectors, such as the healthcare industry, where management commitment to implementing health and safety management systems (OHSMS) is critical (Darmastuti, 2024). Similarly, in high-risk industries like oil and gas, management commitment acts as a mediator between safety management practices and safety outcomes, contributing to the development of a robust safety culture (Ajmal et al., 2022).

Employee commitment to safety is equally important and serves as a mediator between safety practices and safety performance. Research in the manufacturing sector shows that a safety-focused environment increases employee commitment, which in turn enhances safety performance and strengthens the safety culture (Yamoah and Nsowah, 2024). Active employee participation in decision-making regarding safety and the implementation of incentive systems are effective strategies for raising safety awareness and promoting health and safety behavior (Ghofur et al., 2024). These efforts lead to a positive safety culture and motivate employees to engage in safe practices, thereby minimizing workplace risks and accidents.

Safety climate also significantly impacts safety behavior, with a path coefficient of 0.592 and a p-value of 0.000, confirming a significant relationship. Safety behavior involves adherence to safety protocols and participation in safety activities aimed at minimizing workplace accidents. According to Huda et al. (2016), a significant cause of workplace accidents in Indonesia is the lack of proper safety behavior. Safety behavior can be categorized into compliance and participation, where compliance refers to an individual's adherence to safety procedures, while participation involves actively engaging in activities that promote a safer work environment. Implementing effective health and safety practices (K3) is vital for creating a safer work environment and cultivating a culture of safety among employees. This approach, which includes identifying, assessing, and controlling potential hazards, contributes to reducing accidents and improving employee health and productivity (Prastoto et al., 2024; Mayasari et al., 2024). The effective implementation of safety management systems, such

as OHSMS, is shown to positively affect the overall safety culture within organizations, leading to improved safety performance and reduced workplace accidents (Abdul Rahim et al., 2023).

Furthermore, safety behavior is influenced by management's commitment to safety, which, when perceived as strong by employees, leads to improved safety performance and fewer workplace accidents (Nana et al., 2020; Nawi et al., 2022). This reinforces the idea that management's commitment to safety plays a pivotal role in shaping safety behavior and, by extension, the overall safety culture. In addition, flexible work arrangements contribute positively to safety culture by ensuring that employees are safe both physically and psychologically. These flexible and inclusive work practices accommodate the unique needs of individuals, including those at higher risk of exposure to hazards. By promoting a supportive and safe environment, organizations can enhance employee well-being, which in turn strengthens the overall safety culture, leading to greater productivity and healthier work-life integration for employees (Mishra, 2024). This combination of factors management commitment, employee involvement, effective safety practices, and flexible work arrangements creates a holistic approach that ensures the continuous improvement of safety culture and behavior in the workplace, ultimately resulting in better safety outcomes and organizational performance.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this study indicate that safety climate has a positive and significant impact on both safety culture and safety behavior at PT Bridgestone Sumatra Rubber Estate. Specifically, safety climate influences safety culture with a path coefficient of 0.354 and a p-value of 0.000, highlighting its role as a crucial factor in achieving optimal employee performance. Management commitment contributes to adherence to safety protocols and strengthens the safety culture, while employee involvement in decision-making and risk awareness significantly enhances safe behavior in the workplace. Additionally, safety climate positively impacts safety behavior with a path coefficient of 0.592 and a p-value of 0.000. This relationship is characterized by compliance with safety procedures and active participation in safety-enhancing activities. Lastly, safety behavior positively influences safety culture with a path coefficient of 0.456 and a p-value of 0.000. By prioritizing safety culture, organizations can reduce accidents and injuries, boost performance, and foster flexibility among employees, enabling them to adapt to changes and collaborate effectively in various situations.

ADVANCED RESEARCH

Still conducting further research to find out more about the Determinants of Occupational Safety Culture at PT. Bridgestone Sumatra Rubber Estate In 2024.

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