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The Influence of Safety Knowledge, Safety Climate, Safety Motivation on Safety Performance

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Abstract

The ILO estimates that around 2.3 million people die every year due to work accidents or illnesses. In Indonesia, claims for Work Accident Insurance and Death Benefit increased from 2019 to November 2023, especially in the construction services industry. During the Lombok Power Plant FTP 2 construction project throughout 2023, has occurred near misses, property damage, first aid and fire were found. Safety performance is a general method for determining the effectiveness and adequacy of work management safety systems. This research aims to analyze the relationship between safety performance and several variables that have been studied previously, including safety knowledge, safety climate, safety motivation in the Lombok Steam Power Plant FTP 2 construction workers. This research uses a quantitative research approach which emphasizes data in the form of numbers and processing it using the Structural Equation Modeling (SEM) method. The population in this study was 278 Lombok Power Plant FTP 2 Construction workers for the March 2024 period with a sample of 165 workers. The research results show that (1) safety knowledge has a significant effect on safety performance, (2) safety climate has an insignificant effect on safety performance, (3) safety motivation has a significant effect on safety performance

Keywords: *Safety Performance, safety knowledge, safety climate, safety motivation*

INTRODUCTION

In an article published on the ILO (International Labour Organization) website (ilo.org), entitled "The enormous burden of poor working conditions," the organization estimates that approximately 2.3 million women and men worldwide die from occupational accidents or diseases annually. This equates to over 6,000 deaths per day. Globally, approximately 340 million workplace accidents and 160 million victims of occupational diseases occur annually. A principal finding of the

ILO's most recent data on occupational accidents and diseases is that the construction industry exhibits a markedly elevated accident rate.

In Indonesia, the number of claims for Work Accident Insurance (JKK) and Death Insurance (JKM) from the social employment program has continued to increase, according to data from BPJS Ketenagakerjaan. These figures are for the period from 2019 to November 2023. In 2019, there were 182,835 claims for Work Accident Insurance (JKK) and Death Insurance (JKM) from the social employment program. By 2022, this figure had risen to 297,725 claims. A significant proportion of work accident cases are concentrated within the construction service industry, particularly in the context of national strategic projects, including toll road infrastructure, steel and power plants.

The enactment of Law No. 1 of 1970 on Occupational Health and Safety (OHS) regulations represents a significant milestone in the Indonesian government's efforts to prevent occupational accidents. The legislation encourages the development of robust safety systems in the workplace, with a primary focus on the protection of employees from the hazards and risks associated with their work. The OHS Law establishes rigorous safety standards, which organizations are obliged to adhere to. These include the use of personal protective equipment, employee training and the provision of adequate supervision of the work environment. Compliance with these laws allows companies to markedly enhance their safety performance, reducing the probability of accidents and worker injuries. This, in turn, contributes to the creation of a safer and more productive work environment.

Safety performance represents one of the most common methods for evaluating the effectiveness and adequacy of safety management systems (Arto Kuusisto, 2000:19). Safety performance can be quantified by lagging and leading indicators pertaining to the incidence of accidents, injuries, and near misses (Evan A Nadhim et al., 2018). Lagging indicators are associated with the consequences of a work accident, whereas lead indicators are related to preventive actions and the improvement of performance. The improvement of lead indicators related to safety can, in turn, lead to an improvement in overall safety performance (Nevhage & Lindahl, 2008: 11).

Previous studies, including research by Dewi Syarifah and Rosatyani Puspita Adiati (2018), have demonstrated that safety knowledge has a significant positive effect on safety performance. Individuals with greater knowledge and motivation to engage in safe behavior tend to demonstrate higher levels of compliance, as evidenced by their adherence to safe work procedures. (Kuo-Yang Kao et al., 2019) demonstrates that there is a significant positive correlation between workers' safety knowledge and their safety attitudes.

The term 'safety climate' is frequently employed in academic literature to denote the character of an organization’s policies and the attitudes of its employees with regard to safety matters (Intan Suraya Noor Arzahan et al., 2022). Some previous research findings, including those of several researchers. (Evan A Nadhim et.al, 2018) found that safety climate has a significant effect on safety performance.

There is a strong relationship between safety climate and safety performance, as indicated by the level of compliance and increased worker participation.

In a study conducted by Phil Hughes and Ed Farrett in 2007, it was found that: Safety motivation can be defined as the level of encouragement or desire exhibited by individuals to engage in safe behaviors and adhere to established safety procedures. Some previous research findings, including those of a number of previous researchers. (Syazwan Syah Zulkifly et. al., 2021) demonstrates that an individual's perception of safety motivation has a significant impact on their safety performance, attention to safety and adherence to safety policies. Furthermore, it increases employee safety motivation, which in turn has a considerable influence on the company's safety performance.

In light of the above, further research is required to gain a deeper understanding of the factors influencing project safety performance. It is imperative that previous research influenced by factors such as safety knowledge, safety climate and safety motivation. This is because such factors have an impact on safety performance, which in turn affects the level of productivity, quality of work and, most importantly, the safety of workers. It can be argued that nothing is more important than the human soul and returning home in one piece (complete, healthy and safe for the family at home).

In light of the aforementioned description, this research was conducted to investigate the relationship between safety knowledge, safety climate, safety motivation and safety performance, within the context of the Lombok Power Plant FTP 2 construction project on Lombok Island, West Nusa Tenggara Province, Indonesia.

Safety Knowledge

As posited by Machado and Davim (2021: 51-52), knowledge can be defined as the understanding or awareness that an individual gains through experience, learning, or critical thinking. An increase in safety knowledge should result in an increase in safety behavior, due to an increase in awareness and understanding of the reality of safety at work and the workplace. Consequently, the risk of injury is lower (Kuo-Yang Kao et al., 2019). As posited by Gias Oktaruly Sinaga and Clariza Vioito Sinaga (2021), an individual's safety knowledge is likely to impact the overall performance of an organization. In the event that an individual's safety practices align with the established standards set forth by the company, the organization is likely to demonstrate favorable performance outcomes. The term "safety knowledge indicator," as defined by Bunner, Prem, and Korunka (2018), pertains to an individual's comprehension of the requisite procedures and activities for ensuring personal safety.

Knowledge serves as the foundation for action at work, fostering awareness of potential hazards, compliance with safety procedures, and rational decision-making (Gias Oktaruly Sinaga & Clariza Vioito Sinaga, 2021). (Ummu Kamila et. al., 2021) The implementation of effective safety management practices has been observed to enhance workers' knowledge, which subsequently contributes to the improvement of safety performance. Individuals with greater knowledge and motivation to engage in safe behaviors demonstrate higher levels of compliance,

manifested in their adherence to safe work procedures (Dewi Syarifah & Rosatyani Puspita Adiati, 2018). In light of the aforementioned findings, it can be posited that there is a correlation between workers' safety knowledge and their subsequent safety behavior and performance.

Hipotesis 1: Safety knowledge has significant effect on safety performance of Lombok Power Plant FTP-2 construction workers.

Safety Climate

Safety Climate is the fulfilment and participation of individuals in safeguard activities in the workplace (Griffin and Neal, 2000); (Benny Agus Setiono, 2019). Safety climate increases workers' commitment to health and safety, emphasizing that deviation from company safety goals, at any level, is unacceptable, (Evan A Nadhim et.al, 2018). The definition of safety climate according to (Darius Tandiabang et.al, 2023) relates to shared perceptions related to the priority of safety policies, procedures, practices, and the extent to which safety compliance or improved behavior is supported and valued in the work environment. Schneider (2009): "Occupational safety climate is defined as the perception of employee concerns about practices, procedures and similar behaviors that are provided, supported and expected in a setting". The concept of safety climate was first introduced by Zohar in 1980. Safety climate refers to workers' perceptions of safety and affects workers' motivation to behave safely. Safety climate depends on time and place and reflects the current organizational situation; therefore, it is relatively unstable and changes based on the organizational situation, (Hamed Aghaei, 2020).

Safety climate is defined as how individuals perceive safety rules, procedures and practices in the workplace. There is currently no consensus regarding the dimensions of the safety climate, (Intan Suraya Noor Arzahan et.al, 2022). Safety climate indicators according to Griffin and Neal (2006) consist of five which include: value management, safety communication, safety practice, safety training, safety equipment.

Research conducted by (Beni Agus Setiono et.al, 2018), revealed that safety climate has a positive and significant influence on employee performance at PT Pelindo III East Java Province. Evan A Nadhim et.al, (2018), proved on retrofit workers that there is a strong relationship between safety climate and safety performance as indicated by the level of compliance and increased worker participation. (Hamed Aghaei et.al, 2020), safety climate and safety performance are closely correlated, an increase in safety climate can lead to an increase in nurse safety performance. Research findings from (Fatma Lestari et.al, 2023) confirm that safety climate has a positive influence on safety performance at 129 petrol stations in Indonesia. Therefore, the findings of previous studies provide reasons that explain why and how workers' safety climate is related to safety behavior and safety performance, so we hypothesis as follows:

Hipotesis 2: Safety climate has a significant effect on the safety performance of Lombok Power Plant FTP-2 construction workers

Safety Motivation

The primary objective of safety motivation is to ascertain the relationship between the collective exertion and the strength of motivation to work safely and the subsequent safety outcomes (Darius Tandiabang et al., 2023). Safety motivation can be defined as the motivation to engage in safety-related activities and adhere to established work practices with the aim of fostering a safe working environment (Griffin & Curcurato, 2016). Safety motivation is associated with the inclination of individuals to engage in safety-related behaviors and activities (Fariz Septian & Budhi Haryanto, 2023). The perception of risk in the workplace exerts a significant influence on safety motivation, prompting individuals to take action in a manner that ensures their safety and further encouraging the adoption of safe behaviors (Vinodkumar and Bhasi, 2010). The indicators of safety motivation, as outlined by Bunner et al. (2018), encompass the motivation to comply with safety regulations, the motivation to minimize accidents, the motivation to create safe situations, and the motivation to implement safety programs.

Safety motivation provides a combined impact of employee and employer obligations towards safety, thereby indicating the existence of a psychological safety contract. Furthermore, it increases existing knowledge about organizational social interactions that affect safety performance (Sanaz Vatankhah, 2021). The findings of the study conducted by Syazwan Syah Zulkifly et al. (2021) also indicated that safety motivation exerts a significant influence on the safety performance of manufacturing SMEs in Selangor, Malaysia. In light of the findings of previous research, which provide reasons that explain why and how worker safety motivation is related to safety behavior and safety performance, we put forward the following hypothesis:

Hipotesis 3: Safety motivation has a significant effect on the safety performance of Lombok Power Plant FTP-2 construction workers.

METHOD

This research employs a quantitative methodology, which is a research approach that prioritizes the analysis of numerical data and the testing of relationships between variables. The research proposed here is of an explanatory nature. As outlined by Sugiyono (2017: 6), explanatory research is a method of inquiry that seeks to elucidate the position of the variables under study and the influence exerted by one variable upon another.

Population and Sample

The population under investigation comprised all construction workers engaged in the Lombok Power Plant FTP-2 development project up until the March 2024 period, with a total of 278 workers. The sampling technique employed in this study is proportionate random sampling. This is a form of random sampling whereby the proportion or percentage of each subpopulation in the population is

proportionally represented in the sample taken. The sample size was determined using the Slovin formula (1960), resulting in a total of 165 respondents.

Research Instruments

A Likert scale was employed, with scores ranging from 1 (indicating strong disagreement) to 5 (indicating strong agreement). The data employed in this study are both primary and quantitative. Primary data is defined as data obtained or collected directly in the field by researchers from the person concerned. The data were collected using a questionnaire distributed to respondents via Google Form.

Data Analysis

Descriptive analysis is employed to elucidate respondents' responses to research variables, with quantitative techniques utilizing the SEM (Structural Equation Modelling) model via the AMOS version 29 program. SEM enables the modelling of intricate relationships between variables within a unified framework, the measurement of latent variables that are not directly observable, and the simultaneous testing of hypotheses regarding causal relationships. This approach enhances the accuracy and reliability of the analysis. AMOS offers users a user-friendly interface, the capacity to visualize path diagrams, and advanced statistical analysis capabilities, including multigroup, mediation, and moderation analysis. The extensive use of AMOS in previous research provides a substantial body of literature and technical support for users.

RESULTS AND DISCUSSION

Respondent Characteristics

The majority of respondents were male (91.5%), with an age distribution that was concentrated in the 31-40 years age bracket (55.8%). The majority of respondents indicated that they are employed by subcontractors, representing 70.3% of the total sample. Additionally, the highest level of education attained by the respondents was at the secondary level, with 50.3% of the sample having completed secondary education. The majority of respondents have between five and ten years of experience in their field (33.9%), although the experience of between 11 and 15 years is also not significantly different (32.7%). It can thus be concluded that the profile of workers is predominantly male, with a level of education that remains at the intermediate level but with sufficient work experience of between five and fifteen years, and a productive age range of between twenty and forty years.

Measurement Model Analysis

The objective of measurement model analysis is to assess the appropriateness of construct measurement and to ascertain the validity and reliability of indicators in reflecting the construct. Measurement model analysis is also referred to as a Confirmatory Factor Analysis (CFA) test, which is conducted in three stages: firstly, the measurement model fit is tested; secondly, construct validity is evaluated; and thirdly, construct reliability is assessed.

Table 1. Fit Measure on Measurement Model

Fit Measure		*Critical Value*	*Measurement Model*	
			Index value	*Remark*
Absolute Fit Indices	Prob. χ^2	> 0,05	0,000	*Even a good fit*
	Cmin/df	δ 3,00	2,229	*Good fit*
	GFI	ε 0,90	0,882	*Marginal fit*
	RMSEA	δ 0,08	0,087	*Marginal fit*
	SRMR	δ 0,08	0,060	*Good fit*
Incremental Fit Indices	CFI	ε 0,95	0,941	*Marginal fit*
	TLI	ε 0,95	0,916	*Marginal fit*
	NFI	ε 0,90	0,899	*Marginal fit*
	RFI	ε 0,90	0,857	*Marginal fit*
Parsimony Fit Indices	AGFI	ε 0,90	0,807	*Marginal fit*
Note: GFI, CFI, TLI, NFI, RFI, & AGFI: *result* ≥0,80 *marginal fit*; *result*<0,80 *poor fit*. RMSEA: *result* 0,08-0,12 *marginal fit*; *result* >0,12 *poor fit*.				

Structural Model Analysis

The objective of structural model analysis in SEM is to test the fit model, which assesses the degree of correspondence between the hypothesized structural model and the empirical data. A model that is deemed to be of a satisfactory quality will demonstrate satisfactory fit values in accordance with the predetermined criteria. A valid structural model provides robust empirical evidence of the causal relationships between latent constructs, thereby enabling researchers to draw meaningful inferences about the relationships between variables within the context of the conceptual model developed.

Table 2. Fit Measure on Structural Model

Fit Measure		*Critical Value*	Model Struktural	
			Index value	Keputusan
Absolute Fit Indices	Prob. χ^2 [(a)]	> 0,05	0,000	*Even a good fit*
	Cmin/DF	δ 3,00	2,229	*Good fit*
	GFI	ε 0,90	0,882	*Marginal fit*
	RMSEA	δ 0,08	0,087	*Marginal fit*
	SRMR	δ 0,08	0,060	*Good fit*
Incremental Fit Indices	CFI	ε 0,95	0,941	*Marginal fit*
	TLI	ε 0,95	0,916	*Marginal fit*
	NFI	ε 0,90	0,899	*Marginal fit*
	RFI	ε 0,90	0,857	*Marginal fit*

Fit Measure		*Critical Value*	Model Struktural	
			Index value	Keputusan
Parsimony Fit Indices	AGFI	ε 0,90	0,807	*Marginal fit*

Good fit : the model has a good fit
Marginal fit : the model has a good fit within acceptable limits
Poor fit : the model has poor fit
[a] In a model with a sample size of n>250 or many indicators m>30, the model is still fit even though the probability value is below 0.05 or even a good fit. (Hair *et al*., 2019:642).

After the measurement model analysis stage is fulfilled, the next stage is the structural model analysis. The structural model stage begins with an evaluation of the structural model fit (goodness of fit), which serves to ensure that the developed model is appropriate for the data (fit).

Hypothesis Testing

Table 3. Hypothesis Testing

Direct Effect			*Std. Estimate*	*S.E. bootstrap*	*C.R.*	*P-value*	Hypothesis Decisions
X1	□	Y	0,280	0,072	2,250	0,036	H_2 Accepted
X2	□	Y	0,035	0,100	0,360	0,525	H_4 Rejected
X3	□	Y	0,284	0,153	2,340	0,038	H_6 Accepted

Note:
X1: *Safety Knowledge*
X2: *Safety Climate* Y: *Safety Performance*
X3: *Safety Motivation*
SE, CR, & p-values based on bootstrapping bias-corrected percentile method

The relationship between safety knowledge and safety performance is as follows: The significant effect with CR 2.250 and p-value 0.036 indicates that elevated levels of safety knowledge are associated with enhanced safety performance. The positive effect coefficient of 0.280 indicates a positive relationship, thereby supporting the hypothesis that H1 is valid.

The relationship between safety climate and safety performance is examined. The insignificant effect (CR 0.360, p-value 0.525) indicates that a good safety climate does not necessarily lead to improved safety performance. The effect coefficient of 0.035 indicates a very small impact, which leads to the rejection of hypothesis H2. This discrepancy may be attributed to inconsistencies in the implementation of safety policies in the field.

The relationship between safety motivation and safety performance is as follows: The notable effect, with a CR of 2.340 and a p-value of 0.038, suggests that elevated levels of safety motivation are associated with enhanced safety performance. The positive influence coefficient of 0.284 indicates a positive relationship, thereby supporting the acceptance of hypothesis H3.

Discussion

The findings indicate that safety knowledge has a considerable impact on the safety performance of workers in the Lombok Power Plant FTP 2 construction project. These findings corroborate the hypothesis put forth by Machado and Davim (2021) that safety knowledge serves as the foundation for action at work, fostering awareness of potential hazards, compliance with safety procedures, and rational decision-making. The results of the study align with those previously reported by Gias Oktaruly Sinaga and Clariza Vioito Sinaga (2021), Ummu Kamila et al. (2021), and Dewi Syarifah and Rosatyani Puspita Adiati (2018). A high level of safety knowledge enables workers to identify and avoid potential hazards, thereby reducing the likelihood of accidents. A comprehensive understanding of safety procedures enables workers to perform their duties in a safe and efficient manner, thereby directly improving safety performance.

This result does not corroborate the theory put forth by Zohar (2003), which posits that a positive safety climate fosters a work environment that encourages commitment, concern, and safety practices among workers, thereby markedly enhancing their safety performance through a reduction in accidents and work-related incidents. The findings of this study diverge from those of previous research conducted by Evan A Nadhim et al. (2018), Hamed Aghaei et al. (2020), Beni Agus Setiono et al. (2018) and Fatma Lestari et al. (2023). Despite the presence of a favorable safety climate, the implementation and application of safety policies frequently exhibit inconsistencies in practice. The efficacy of safety policies is contingent upon the support of management and the consistent implementation by workers. In the absence of these conditions, the impact on safety performance is likely to be minimal. The communication of safety information was rated the lowest in terms of the safety climate, indicating that workers perceive deficiencies in the manner in which management conveys such information. The two items that were rated lowest by respondents were management's accuracy in delivering messages and management's ability to deliver information in a pleasant atmosphere. The age of the workers, the majority of whom are entering the productive age range of 20-40 years (millennials and Z generation), with 5-15 years of work experience, is considered to require a more engaging and innovative approach to communication.

The findings of this study corroborate the hypothesis proposed by Phil Hughes & Ed Farrett (2007), namely that elevated levels of safety motivation prompt workers to adhere consistently to safety procedures and engage in safe practices (thereby reducing the incidence of accidents and injuries), thereby enhancing overall safety performance in the workplace. The results of the study align with those previously reported by Sanaz Vatankhah (2021) and Syazwan Syah Zulkifly et al. (2021). The presence of high safety motivation will encourage workers to engage more actively in safety programs and adhere more closely to safety procedures, which in turn will lead to an improvement in safety performance. Those with high levels of motivation are more likely to exercise caution and take a proactive approach to maintaining a safe working environment, which can ultimately lead to a reduction in the number of accidents and incidents that occur.

CONCLUSION

The findings of this study indicate safety knowledge and safety motivation have a significant effect on safety performance among workers on the Lombok Power Plant FTP 2 construction project. The skills of workers in implementing safety procedures, motivation for the importance of safety in the workplace, compliance and participation of workers in safety programs have a positive effect on the prevention of workplace accidents. The influence of safety climate on safety performance among workers in the Lombok Power Plant FTP 2 construction project is found to be insignificant. In the absence of effective communication and consistent implementation of safety policies, the impact on safety performance is likely to be minimal.

In further research, it should be carried out on different objects, where the objects in this research are construction project workers and more sampling, which can allow different research results. The results in this study should be a source of ideas and input for future research development. In future research, it can be considered to examine more deeply the relationship between safety climate variables and safety performance, where the findings in this study produce an insignificant effect on safety climate on safety performance, but with safety behavior mediation, safety climate can increase safety performance. The results in this study can be a consideration and input for the management of the Lombok Power Plant FTP 2 Development project implementers in improving safety training and communication to workers.

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