

Analysis of Factors Affecting Safety Behavior in Electrical Distribution Network Maintenance and Operation Officers

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Abstract

Workplace accident data at PT PLN (Persero) shows that the distribution sector still contributes the highest number of incidents compared to other sectors. This study aims to analyze the effect of Safety Leadership and Safety Training on Safety Behavior with Safety Awareness as a mediating variable in electricity distribution, network maintenance and operation personnel. This study uses a quantitative approach with the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. The research sample consisted of 117 respondents from technical workers of the PT Cita Yasa Perdana distribution network at PLN UP3 Situbondo. Data collection was carried out through a structured questionnaire. The results showed that Safety Training had a positive and significant effect on Safety Awareness ($\beta = 0.826$; $t = 8.049$; $p < 0.001$), and Safety Awareness had a positive and significant effect on Safety Behavior ($\beta = 0.583$; $t = 3.592$; $p < 0.001$). In contrast, Safety Leadership did not significantly influence Safety Awareness ($\beta = 0.057$; $p = 0.617$) or Safety Behavior ($\beta = -0.048$; $p = 0.745$). Safety Training also did not significantly influence Safety Behavior at the 5% significance level ($\beta = 0.364$; $p = 0.067$). In addition, Safety Awareness was proven to mediate the influence of Safety Training on Safety Behavior, but did not mediate the influence of Safety Leadership on Safety Behavior. Practically, the results of this study indicate that improving worker safety behavior is more effective through strengthening the quality of Safety Training that can increase Safety Awareness, compared to a direct leadership approach. These findings are expected to be input for PLN in designing strategies to strengthen safety training programs and developing policies to support the zero accident target.

INTRODUCTION

Occupational Safety and Health (K3) is a fundamental aspect in PT PLN (Persero's operations), especially for distribution network technical workers who face high risks such as exposure to electricity, work at heights, and dynamic field conditions. The implementation of K3 is a must to prevent work accidents, maintain productivity, protect the company's image, and ensure the reliability of electricity supply for the community. This is in line with the Minister of Energy and Mineral Resources Regulation No. 38 of 2018 concerning Electricity Safety, which emphasizes the importance of safety for workers, the community, and state assets. Through SMK3, Safety Training, and the INSPEKTA digital application, PLN seeks to strengthen hazard reporting, risk mapping, and follow-up on safety findings on an ongoing basis.

However, work accident data in 2020-2024 shows that the distribution business process is the largest contributor to accidents, namely 95.45%, with the majority of victims coming from outsourced workers and the main cause is electric shock. This condition shows that prevention efforts still need to be strengthened, especially since most incidents are not only caused by unsafe conditions, but also unsafe actions, such as not using complete PPE, ignoring SOPs, not following safety briefings, and working in a hurry for operational targets. Therefore, improving safety culture, leadership that cares about K3, field supervision, and compliance with PPE and SOPs need to be the top priority in reducing the number of work accidents in the PLN distribution environment.

The occurrence of non-conformities that are *unsafe action* and *unsafe conditions* are also found in the work environment of PLN UP3 Situbondo where, according to the data that has been recorded on the inspection application, there are still unsafe behaviors and conditions that are far from the safety aspect, both carried out deliberately by the maintenance and operation officers of the distribution network and those derived from external factors. Based on this background, this research will focus on conducting research on the maintenance and operation of the distribution network at PLN UP3 Situbondo where it has the status of outsourced personnel (TAD) under the auspices of PT Cita Yasa Perdana.

In the literature on Occupational Safety and Health (K3), *Safety Behavior* is seen as a key factor in its achievement *Zero accidents* (Ali et al., 2025). (Reason, 1990) through *Swiss Cheese Model* emphasizing that accidents are not simply the result of individual actions, but a combination of system weaknesses, dangerous conditions, and human behavior. Therefore, accident prevention strategies should be focused on the formation of safe worker behavior (*safe behavior*). Some studies support this view. From showing that Niu & Liu (2022) *Safety Leadership* and *Safety Climate* has a significant effect on safe behavior in the energy sector. affirms that (J. Zhang, Zhang, Liu, & Zhou, 2024) *Safety Behavior* is the result of a complex interaction between leadership, training, and individual awareness of risk. Two main factors influencing *Safety Behavior* is safety leadership (*Safety Leadership*) and *Safety Training*. *Safety Leadership* defined as a leader's ability to influence and direct team members in creating a safe work environment through behaviors, values, and communication that support safety. (Robson et al., 2012) *Safety Leadership* It includes the leader's ability to inspire, lead by example, and ensure that safety is a top priority in every work activity. Thus, *Safety Leadership* It is not just in the form of formal instructions, but it is a leadership style that instills the value of safety as an organizational culture.

Research shows that Moon (2024) *Safety Leadership Training Including Coaching* (SLTC) significantly improves *safety behavior and safety climate* in the wood processing industry. found that in the power generation sector, Conclusion Goddess (2024) *Safety Leadership* has a positive effect on safety culture, although it does not always have a direct effect on behavior without *Safety Culture* intermediaries. Similar findings from PT Kereta Api Indonesia (Persero), that Mila Hikmatul Ulawia & Adithya Sweat (2025) *Safety Leadership* and *safety knowledge* affect *safety citizenship behavior* through *safety attitude*.

In addition, research in the tourism sector shows that Squirt Syafitri & Faidal (2024) *Safety Leadership* has a positive influence on *Safety Awareness* and *Safety Behavior* through *Safety Culture*. The study added that in the context of manufacturing (PT XYZ), Faradico (2024) *Safety Leadership* has a direct influence on the reduction of work accidents.

In the context of electricity, PLN distribution workers face high risks such as exposure to electric current, working at heights, and extreme field conditions. Field leaders who demonstrated safe behaviors (adhering to SOPs, wearing PPE, and providing positive feedback) were shown to increase subordinates' adherence to safety procedures. (S. Zhang, Hua, Huang, & Shi, 2022)

On the other hand, *Safety Training* is the main means to improve workers' skills and knowledge. Through training, workers are introduced to specific risks in the field, safe work procedures, and emergency management skills. A study of public training institutions (TVET) found that the frequency and quality of training have a direct effect on Zulkifly, Hasan, & Zain (2023) the Safety Awareness of instructors. However, some other studies show different results. Research suggests that the effect of training on behavior will only be effective when combined with consistent feedback and supervision. Elost - Alzubi (2024)

In this context, *Safety Awareness* is an important variable that mediates the influence of leadership and training on *Safety Behavior*. *Safety Awareness* is defined as an individual's awareness of potential dangers and mental readiness to act safely. Workers with a high level (Alshammari, Rabi, Al-Kheetan, & Alkherret, 2025) of awareness will be more compliant with procedures, use PPE completely, and be able to recognize and stop dangerous conditions. emphasized that (Ramadhani, Nasrul, Syaifuddin, Maharani, & Putera, 2024) *Safety Awareness* is an important mediating variable between *Safety Leadership* and *Safety Behavior* in the energy industry sector. also found that Ayu Syafitri & Faidal (2024) *Safety Awareness* strengthened the relationship between *Safety Culture* and *Safety Behavior*. These findings are reinforced by researching health workers in Turkey, where Uzuntarla, Kucukali & Uzuntarla (2020) *Safety Awareness* has been shown to be a mediating factor between *Safety Training* and *Safety Behavior*. Meanwhile, it found that Li et al (2022) *Safety Awareness* plays a significant mediator between training and worker compliance in the construction sector.

However, the results of previous research show that *Safety Leadership* and *Safety Training* play an important role in shaping *Safety Behavior*, but the results still show inconsistencies. Some studies such as, found significant direct influences, while other studies, showed indirect influences through mediating variables such as Robson (2012) Moon (2024) Faradico (2024) Niu & Liu (2022) Conclusion Goddess (2024) Squirt Syafitri & Faidal (2024) *Safety Culture* or *Safety Awareness*.

On the other hand, *Safety Training* has been shown to increase risk awareness and worker compliance (Kao 2019), but the effects are not always consistent without strong leadership support. This creates C. Li et al (2022) *an empirical gap*, which is the difference in results between studies regarding the direct and indirect relationship between variables. In addition, there is still a *conceptual gap*, where the role of *Safety Awareness* as a mediating variable has not been comprehensively tested, even though research such as and Syafitri (2024) shows its important role in bridging the influence of leadership and training on safe behavior. Ramadhani et al (2024)

Contextually, most of the research has been conducted in the construction, manufacturing, and transportation sectors, while the electric power distribution sector has not been widely studied where the sector has different work characteristics involving high risk, extreme environmental conditions, and dynamic fieldwork patterns. Methodologically, some

studies still use simple regression without considering complex mediating relationships. Therefore, further research with *the Structural Equation Modeling–Partial Least Squares* (SEM-PLS) method is needed to validate the direct and indirect relationships between variables.

Based on global, national, and PLN contexts, this study is important to analyze the influence of *Safety Leadership* and *Safety Training* on *Safety Behavior* with *Safety Awareness* as a mediator in electricity distribution network workers. The results of the research are expected to make a theoretical contribution to the development of K3 science as well as a practical contribution in supporting PLN's *zero accident* policy and improving national occupational safety.

The formulation of the problem in this study is how the influence of *Safety Leadership*, *Safety Training*, and *Safety Awareness* on *Safety Behavior* in maintenance and operation officers of electricity distribution networks. This issue is important to study because the work safety behavior of field officers is greatly influenced by safety leadership, the quality of safety training, and the level of individual awareness of the occupational risks faced in the maintenance and operation of the distribution network.

The purpose of this study is to identify and analyze the factors that affect *Safety Behavior* in maintenance and operation personnel of distribution networks. In addition, this study aims to analyze the relationship between *Safety Leadership*, *Safety Training*, and *Safety Awareness* in influencing *Safety Behavior* in maintenance and operation officers of electricity distribution networks. This study also aims to measure the influence of each factor on *Safety Behavior* through the *Structural Equation Modeling–Partial Least Squares* (SEM-PLS) approach. Based on the results of the empirical analysis, this study is expected to provide strategic recommendations to strengthen the effective and sustainable implementation of Occupational Safety and Health (K3), especially in improving *Safety Behavior* in maintenance and operation of electricity distribution networks.

The scope of this research includes the limitations and assumptions used to make the research more directed and focused on the problem being studied. The limitations of this study include the location and subject of the research, namely the operational unit of PLN UP3 Situbondo with respondents who are workers implementing the maintenance and operation of the distribution network of PT Cita Yasa Perdana. This study does not include non-technical workers or employees in the administrative department. In addition, this study only focuses on the variables of *Safety Leadership*, *Safety Training*, *Safety Awareness*, and *Safety Behavior*, so it does not discuss other variables outside the research model, such as intrinsic motivation, overall organizational culture, physical work environment factors, such as temperature, weather, equipment conditions, and individual personality factors of workers. Data collection in this study was carried out from December 2025 to January 2026.

The assumptions in this study refer to statements that are considered true and accepted as the basis for conducting research, although they cannot always be directly proven. This research assumes that the company has been fully committed to fulfilling the K3 aspect based on government regulations and company regulations. In addition, during the data collection process, it is assumed that there will be no changes in the company's policies that can affect the results of the research.

RESEARCH METHODS

Problem Identification

The initial stage of the research is to identify the problem determined based on the background of the basis of this research. The Occupational Safety and Health (K3) aspect is a top priority that is not only related to compliance with regulations, but also directly related to the reliability of electricity supply and the safety of workers in the field. Electrical distribution network technical workers are faced with various potential hazards every day such as exposure to medium-voltage electric current, work at heights, extreme weather conditions, and risks due to work procedure errors. Although the company has implemented the K3 policy, there are still incidents of work accidents in several implementation units involving partner workers, especially in the maintenance and operation of distribution networks. The results of PLN's internal investigation show that most of these incidents were caused by *unsafe actions* such as ignoring work procedures, not using complete personal protective equipment (PPE), and lack of supervision and leadership in the field. Some of the factors that are suspected to contribute to the still occurrence of unsafe behavior include *Safety Leadership*, *Safety Training* in influencing *Safety Behavior*, and *Safety Awareness* as a *Mediator of Safety Leadership* and *Safety Training* in influencing *Safety Behavior*.

These problems show that the formation of worker *Safety Behavior* is not only influenced by the company's formal policies, but also by the leadership role, the effectiveness of training, and the level of individual safety awareness. Therefore, a more in-depth study is needed to identify the relationship between *Safety Leadership*, *Safety Training*, *Safety Awareness*, and *Safety Behavior* in order to obtain an empirical picture of the extent to which each of these factors has a direct or indirect influence on *Safety Behavior* distribution network workers at PT PLN (Persero) UP3 Situbondo using analysis through *Structural Equation Modeling - Partial Least Squares* (SEM-PLS).

Defining Variables

Based on the background, problem identification, and theoretical foundation that has been described, this study focuses on the influence of *Safety Leadership* and *Safety Training* on *Safety Behavior* with *Safety Awareness* as a mediating variable. These variables are identified and categorized as follows:

1. Independent Variables

Independent variables are variables that affect or cause changes in other variables in the research model. In this study, there are two independent variables, namely:

a. *Safety Leadership* (X1)

It is a leadership style that emphasizes the importance of work safety through example, effective communication, motivation, and supervision of the implementation of K3 in the work environment. Safety-oriented leaders serve as role models, providing feedback on safe behaviors, and ensuring that safety is a top priority in every work activity.

b. *Safety Training* (X2)

It is a systematic process to improve the knowledge, skills, and attitudes of workers in applying the principles of occupational safety. *Safety Training* includes debriefing safe work procedures, the use of PPE, identification of potential hazards, and handling emergencies. Effective training is expected to increase the awareness and *safety behavior* of workers in the field. In the implementation of the *Safety Training* program carried out by PLN UP3 Situbondo

is carried out twice in 1 year through the Alkademi Yantek program where in the program learning and training are carried out to improve the understanding and competence of technical service officers, both soft skills and hard skills in the implementation of K3 culture in daily work.

2. Intervening Variables

The mediating variable is a variable that describes the mechanism of the relationship between independent and dependent variables. In this study, the mediation variables used were:

a. *Safety Awareness (Z)*

It is the level of individual awareness of the importance of occupational safety as well as an understanding of potential hazards that can arise in work activities. *Safety Awareness* reflects the extent to which workers are aware of risks, understand safety procedures, and have a proactive attitude in preventing accidents. This variable functions as a liaison (mediator) between *Safety Leadership* and *Safety Training* to the formation of *Safety Behavior*.

3. Dependent Variable

Dependent variables are variables that are influenced by other variables and are the main focus of the research. In this study, the dependent variables are:

a. *Safety Behavior (Y)*

It is a real action of workers in applying the principles of occupational safety, both in the form of compliance with the rules (*safety compliance*) and active participation in safety activities (*safety participation*). *Safety Behavior* includes the use of PPE, reporting unsafe conditions, involvement in the K3 program, and compliance with standard operating procedures (SOPs).

Conceptual Model

The conceptual model is prepared based on relevant theories, previous research results, and the logic of the cause-and-effect relationship between the research variables with the aim of describing the causal relationship between the variables tested. The conceptual model of the research is as follows:

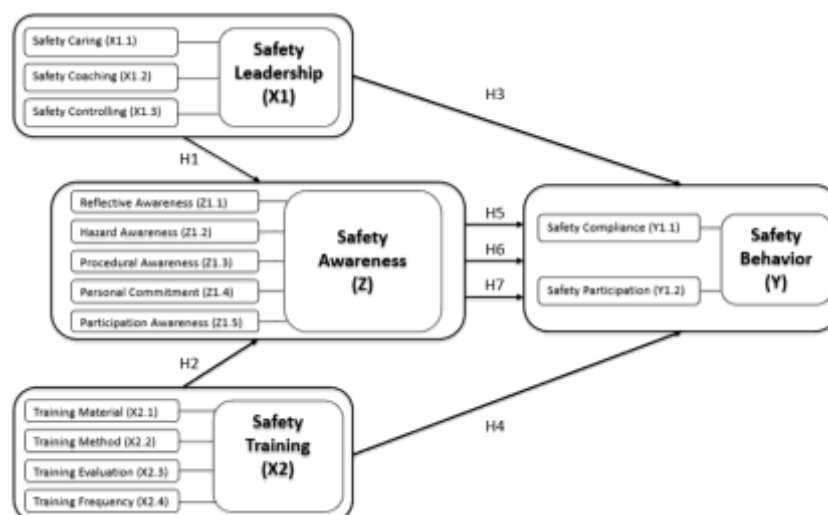


Figure 1 Research Conceptual Model

The hypothesis of the conceptual model used in this study takes into account previous studies:

H1 states that Safety Leadership has a positive effect on Safety Awareness. Based on Social Learning Theory, workers learn through the example of leaders in applying safety values (Ott, 2024). Consistent leadership in communication, supervision, and examples of safe behaviors has been shown to increase worker safety awareness (Robson et al., 2012; Sadili & Faidal, 2024; Stuart & Scott, 2024).

H2 states that Safety Training has a positive effect on Safety Awareness. Referring to Human Capital Theory, safety training increases workers' knowledge, skills, and awareness (Elosta & Alzubi, 2024). Research by Moon (2024), Zulkifly et al. (2023), and Ayu Syafitri & Faidal (2024) shows that sustainable, interactive, and relevant safety training is able to increase Safety Awareness.

H3 states that Safety Leadership has a positive effect on Safety Behavior. Based on Behavioral Safety Theory, the safe behavior of workers is influenced by the policies, directions, rewards, and assertiveness of leaders against unsafe actions (Cooper, 2002). The findings of Mila Hikmatul Ulawia & Adithya Sudiarno (2025) and Pamungkas & Dewi (2024) support that safety leadership encourages safe behavior and safety culture.

H4 states that Safety Training has a positive effect on Safety Behavior. Safety Training equips workers with the ability to recognize hazards and act safely. The Safety Training Effectiveness Model asserts that the effectiveness of training can be seen from changes in work behavior towards safer practices (Beś & Strzałkowski, 2024). Faradico (2024) and Moon (2024) prove that safety training and coaching improve compliance and safe behavior of workers.

H5 states that Safety Awareness has a positive effect on Safety Behavior. Based on the Theory of Planned Behavior, an individual's behavior is influenced by awareness and intention of the consequences of his actions (Elosta & Alzubi, 2024). Employees with high Safety Awareness are more careful and compliant with safety procedures, as emphasized by Zulkifly et al. (2023), Ayu Syafitri & Faidal (2024), and Sadili & Faidal (2024).

H6 states that Safety Awareness mediates the influence of Safety Leadership on Safety Behavior. Safety leadership not only influences safe behavior directly, but also through increased safety awareness. The findings of Mila Hikmatul Ulawia & Adithya Sudiarno (2025), Sadili & Faidal (2024), and Pamungkas & Dewi (2024) show that Safety Awareness strengthens the relationship between Safety Leadership and Safety Behavior.

H7 states that Safety Awareness mediates the influence of Safety Training on Safety Behavior. Safety Training improves technical capabilities while building worker awareness, which then encourages safe work behavior. Ayu Syafitri & Faidal (2024) and Moon (2024) emphasized that Safety Awareness is an important mechanism that bridges the influence of Safety Training on Safety Behavior.

RESULTS AND DISCUSSION

Description of Research Variables

1. Variable *Safety Leadership* (X1)

Variable *Safety Leadership* divided into 3 groups of indicators, namely *Safety Caring*, *Safety Coaching*, and *Safety Controlling* with the highest average value in the indicator *Safety Coaching* namely 4,826 with very good criteria. Overall, the total score on all indicators is 4,806 with very good criteria which means that comprehensively the participants agree with the questions on the variable *Safety Leadership*.

2. Variable *Safety Training* (X2)

The *Safety Training variables* are divided into 4 groups of indicators, namely *training materials*, *training methods*, *training evaluations* and *safety frequencies* with the highest average score in the *safety evaluation* indicator, which is 4,751 with very good criteria. Overall, the total score on all indicators is 4,731 with very good criteria which means that comprehensively participants agree with the questions on the *Safety Training* variable.

3. *Safety Awareness* Variable (Z)

The *Safety Awareness variable* is divided into 5 groups of indicators, namely *hazard awareness*, *procedural awareness*, *personal commitment*, *participation awareness* and *reflective awareness* with the highest average score in the *reflective awareness* indicator namely 4,783 with very good criteria. Overall, the total score on all indicators is 4,751 with very good criteria which means that comprehensively participants agree with the questions on the *Safety Awareness variable*.

4. *Safety Behavior* Variable (Y)

The *Safety Behavior variable* is divided into 2 groups of indicators, namely *safety compliance* and *safety participation* with the highest average score in the *safety participation* indicator, which is 4,782 with very good criteria. Overall, the total value of all indicators is 4,771 with very good criteria which means that comprehensively participants agree with the questions on the *Safety Behavior variable*.

Discussion of Hypothesis Testing

Table 1 Hypothesis Testing Results

Hypothesis	Relationships	Coefficient (β)	t-statistic	p-value	Verdict
H1	SL $\rightarrow$ SA	0.057	0.500	0.617	Rejected
H2	ST $\rightarrow$ SA	0.826	8.049	0.000	Accepted
H3	SL $\rightarrow$ SB	-0.048	0.325	0.745	Rejected
H4	ST $\rightarrow$ SB	0.364	1.833	0.067	Rejected
H5	IN $\rightarrow$ SB	0.583	3.592	0.000	Accepted

The test results showed that Safety Leadership had not had a significant effect on Safety Awareness and Safety Behavior, so H1 and H3 were rejected. These findings indicate that safety leadership in the field has not been effective enough to shape worker safety awareness and behavior, likely because it is still formal-administrative, lacking in real-time through real examples, coaching, effective communication, and consistent supervision. These results are not entirely in line with (Chen, Wang, & Hung, 2015), (Robson et al., 2012), (Moon, 2024), and (Faradico, 2024), but support the existence of an empirical gap as stated by (Niu & Liu, 2022) and (Pamungkas & Dewi, 2024). In addition, Safety Awareness does not mediate the influence

of Safety Leadership on Safety Behavior, so H6 is rejected. This shows that the influence of safety leadership is highly dependent on the organizational context, work culture, work characteristics, and the strength of safety culture as affirmed by (Zohar, 2002).

On the other hand, Safety Training has been proven to have a positive and significant effect on Safety Awareness, so H2 is accepted. Safety training is a dominant factor in increasing worker awareness because it provides hands-on experience, simulation, practice, and understanding of occupational risks, in accordance with the experiential learning theory of (Kolb, 1984). These findings are also supported by (Burke et al., 2006), (Benson et al., 2024), (Zulkifly et al., 2023), and (K. Li & Griffin, 2022) who affirm that active, participatory, relevant, and ongoing training is able to strengthen risk understanding and safety awareness. However, Safety Training did not have a significant direct effect on Safety Behavior, so H4 was rejected. This means that training does not necessarily directly change behavior if it is not accompanied by reinforcement, supervision, support for the work environment, and internalization of safety values, as explained by (Burke et al., 2006), (Elosta & Alzubi, 2024), and (K. Li & Griffin, 2022b).

The results of the study also showed that Safety Awareness had a positive and significant effect on Safety Behavior, so H5 was accepted. Safety awareness is a key factor that encourages workers to understand risks, evaluate hazards, use PPE, adhere to work procedures, and make safe decisions in risky working conditions. These findings are in line with (K. Li & Griffin, 2022a), (Alshammari et al., 2025), (Zulkifly et al., 2023), and (Dian et al., 2025), and support Social Learning Theory (Chen et al., 2015), which emphasizes that behaviors are formed through the process of learning and internalization of values. In addition, Safety Awareness has been proven to mediate the influence of Safety Training on Safety Behavior, so H7 is accepted. Thus, safety training is more effective in shaping safe behaviors if it first succeeds in increasing worker awareness, as supported by (K. Li & Griffin, 2022b), (Dian et al., 2025), and (Moon, 2024).

In-Depth Interview Findings

In-Depth *Interviews* were conducted to strengthen and validate the results of quantitative hypothesis testing, especially related to the phenomenon of insignificance of *Safety Leadership* and the role of *Safety Training* and *Safety Awareness* in shaping *Safety Behavior*. The selected informants are representatives of technical workers of the distribution network and structural levels within the scope of UP3 who have work experience and direct involvement in operational activities in the field.

1. Informant 1 (MULP Panarukan)

The informant said that in policy, the management has placed safety as a top priority. This is reflected in the existence of work procedures, safety briefings, and the use of monitoring applications such as Inspekta.

However, in its implementation in the field, there is still a gap between policy and practice. The informant stated:

"From the management side, actually the commitment to safety is very clear. Every job always begins with directions, SOPs are also available, and the use of PPE is also always emphasized. However, in practice in the field, it cannot always be carried out ideally, especially when work conditions are urgent or there is a disturbance."

This statement shows that *Safety Leadership* at the managerial level has been running structurally and normatively, but its effectiveness in shaping worker behavior still faces implementation obstacles. This indicates a gap between policy and practice on the ground, which is generally caused by operational pressures and dynamic working conditions.

Regarding *Safety Training*, the informant stated:

"The training provided is quite good and routine, both internal and programs such as the Yantek Academy. The material is also in accordance with the work in the field."

This shows that organizationally, the training program has been well designed and relevant, and contributes to improving the knowledge of workers.

Meanwhile, regarding *Safety Awareness*, the informant explained:

"The level of awareness of workers is still different. Some are already disciplined and aware of the importance of safety, but there are also those who still need to be reminded and supervised."

This statement emphasizes that *Safety Awareness* is an individual factor that is not uniform, so it is the main challenge in the implementation of occupational safety.

2. Informant 2 (TL Distribution Operations)

The informant explained that safety supervision and briefing have been carried out regularly, especially through pre-work briefings and field supervision. Regarding *Safety Leadership*, the informant said:

"Under normal conditions, supervision and direction can still run well. But if there is a disturbance or emergency work, usually the main focus is on accelerating normalization, so that the safety aspect sometimes becomes less than optimal."

This statement shows that the effectiveness of *Safety Leadership* is situational, where in high-pressure conditions, work priorities can shift attention to safety. This is one of the reasons why the influence of *Safety Leadership* is not directly significant. Imbang also added that the closeness that has been built between leaders and officers is still not effective.

"The approach to officers so far has been more through briefings and formal directions. But not all of them can be directly touched, especially in daily activities."

This shows that *the Safety Leadership* approach is still formal, such as through briefings and work instructions. While important, this approach is not enough to build worker emotional engagement. The lack of direct interaction outside of the formal context causes the safety message to not be fully internalized.

Regarding *Safety Training*, the informant stated:

"Training does help improve understanding, but in practice not everything is immediately implemented if there is no supervision or reminder."

This indicates that training is not strong enough to shape behavior directly, but rather requires other supporting factors such as supervision and individual awareness.

Regarding *Safety Awareness*, the informant explained:

"If the worker has high awareness, usually continue to work according to the procedure, even though there is no supervision."

This statement reinforces that *Safety Awareness* is the dominant factor in determining safe behavior.

3. Informant 3 (TL K3L)

As the person in charge of K3, the informant explained that the *Safety Leadership* that has been running for a long time is:

"The safety program and policies from the management are actually quite complete, starting from SOPs, inspections, to evaluations. But the challenge is how to make sure all of that is carried out consistently on the field."

This shows that the main problem is not policy, but consistency of implementation, which is a weakness in the effectiveness of *Safety Leadership*.

"Supervision has been carried out, but it is not optimal. We can't keep an eye on it all the time, so it goes back to each worker."

This statement confirms that limited supervision is one of the main obstacles in the effectiveness of *Safety Leadership*. This indicates that the safety system cannot rely solely on external controls, but requires reinforcement from within the worker.

Regarding *Safety Training*, the informant emphasized that safety programs, including training and socialization, have been running well.

"Training is very influential in improving workers' understanding, especially related to work risks and safety procedures. Especially if the training is practice-based, the impact is more pronounced."

However, the informant also acknowledged that:

"Not all workers immediately apply the results of the training in the field."

This shows that *Safety Training* is effective in increasing knowledge, but it is not yet fully able to change behavior in the absence of other factors such as individual awareness.

Regarding *Safety Awareness*, the informant explained:

"Awareness is the most important, because if the worker is conscious, he will take care of himself without having to be supervised."

This statement emphasizes that *Safety Awareness* is the main key in shaping *Safety Behavior*, because it is internal and *self-driven*.

4. Informant 4 (K3L Yantek Supervisor)

Regarding *Safety Leadership*, the Informant said that supervision of safety aspects has been actively carried out, including inspection and enforcement of the use of PPE. However, it was found that:

"Supervision and enforcement of rules have been carried out regularly, but indeed not all workers comply immediately just because they are supervised."

This suggests that external supervision has limitations in shaping behavior, so it is not always effective in the long run. The informant also added that:

"If we only rely on supervision, the results will not be optimal. What is more important is how to build closeness with workers so that they are aware of themselves."

Regarding *Safety Training*, the informant stated:

"Training helps improve understanding, but it must be supported by supervision and evaluation so that it is truly implemented in the field."

This indicates that training requires reinforcement, both through supervision and organizational culture.

Regarding *Safety Awareness*, the informant explained:

"Usually obedient workers are because they already have their own awareness, not because they are afraid of being supervised."

This statement emphasizes that *Safety Awareness* is more influential than external controls, so it is a major factor in shaping safe behavior.

5. Informant 5 (Technical Implementer)

As a field implementer, the informant provides a practical perspective that:

"If the job is pursued by the target, sometimes someone takes a fast path, especially if they feel experienced."

This shows the phenomenon of *Risk normalization* (risk is considered normal) and the influence of experience on the decrease in alertness. However, the informant also added that workers who understand the risks tend to be more disciplined in the use of PPE.

Regarding *Safety Leadership*, the informant said:

"In the field, sometimes when the work is pursued by the target, there are those who take the fast route, even though it is not actually according to the procedure."

This shows that the pressure of job targets is a factor that weakens the effectiveness of *Safety Leadership*, especially at the operational level. In addition, the absence of leaders in ensuring a safety culture for officers both in the implementation of work and outside activities. "Sometimes we feel that our superiors are only present during briefings or when there are problems. If we go down more often directly and communicate casually, maybe we will also be more open."

This statement illustrates that from the perspective of the executive, the interaction of the boss is still limited to formal moments, so the working relationship has not been built strongly. Workers expect more frequent boss attendance and more flexible interaction in daily activities.

Regarding *Safety Training*, the informant stated:

"Training is very helpful, especially if you practice right away, so we have a better understanding of how to work safely."

This confirms that practice-based training is more effective than theory, especially for high-risk jobs.

Regarding *Safety Awareness*, the informant explained:

"If we are aware that the risk is great, we will be more careful and not dare to violate."

This statement shows that risk awareness has a direct influence on workers' safe behavior.

6. Informant 6 (Technical Implementer)

Regarding *Safety Leadership*, the informant said:

"Supervision is not always there in every condition, so it ultimately comes back to individual workers in carrying out safety."

This shows that dependence on supervision has limitations, so an internal factor in the form of awareness is needed.

"If the boss is closer, not just when it's formal, we are usually more reluctant to violate and more self-aware."

This statement shows that the interpersonal closeness between the boss and the worker has a significant influence on safety behavior. Closer relationships create a higher sense of responsibility and awareness than just formal instruction.

Regarding *Safety Training*, the informant stated:

"Training is quite effective, especially if there is a simulation or hands-on practice, so it is easier to understand."

This reinforces that interactive training methods increase the effectiveness of safety learning.

Regarding *Safety Awareness*, the informant explained:

That the experience of seeing or knowing a work accident greatly influences behavior: "If you have seen the incident, you will be more careful and do not dare to violate."

This shows that *Safety Awareness* formed from real experience is very strong in shaping *Safety Behavior*. In addition, the informant also emphasized the importance of the control function or reminder of colleagues and the culture of reminding each other in the work environment.

A. Safety Leadership Phenomenon That Has No Significant Effect

The results of the *in-depth interview* show that in general, *Safety Leadership* has been implemented in the form of policies, work directions, and supervision of safety implementation. The leader routinely provides briefings before work, establishes standard operating procedures (SOPs), and supervises the use of personal protective equipment (PPE) and compliance with work procedures. However, the phenomenon that has emerged in the field shows that the effectiveness of *Safety Leadership* in shaping worker safety behavior has not run optimally and consistently. One of the main findings is that supervision carried out by superiors has not been fully effective, because it cannot be carried out continuously on all work activities in the field. This limitation causes workers' compliance with safety to be situational, which increases when supervision is present and tends to decrease when supervision is not carried out directly.

In addition, the leadership approach applied is still dominated by formal approaches, such as briefings, work instructions, and performance evaluations. While this approach is important in maintaining operational standards, it is not effective enough in building emotional attachment between superiors and workers. Some informants said that interaction with superiors is still limited to the context of formal work, so two-way communication and openness have not been fully built. On the other hand, workers expect a more intense closeness from their superiors, both in formal and informal contexts. The presence of direct superiors in the field, more open communication, and informal interaction in daily activities are considered to be able to increase worker trust and involvement. This closeness is also believed to encourage compliance with safety not only because of obligations, but because of awareness and internal responsibility.

Thus, it can be concluded that *Safety Leadership* plays more of an *enabler* role in the safety system, but has not been able to become the main driving factor (*driver*) that directly shapes the *Safety Behavior* of workers. Its effectiveness is still heavily influenced by the leadership approach and the quality of the relationship between superiors and subordinates.

B. Safety Training Phenomenon That Has No Direct Effect

Based on the results of the interviews, *Safety Training* in the work environment has been carried out regularly and structured, both through internal training and competency development programs such as the Yantek Academy. The training material is considered relevant to working conditions in the field, including technical aspects, safety procedures, and handling work risks. The informant also said that practical and simulation training had higher

effectiveness than the lecture method. This is because workers can directly understand the actual working conditions and the risks that may occur. This experience-based approach proves to be easier to remember and apply in everyday work. However, the phenomenon found shows that *Safety Training* has not been directly able to form safe behavior consistently. Although the training has improved workers' knowledge and understanding, not all workers automatically implement the results of the training in the field. Under certain conditions, especially when there is work pressure or operational targets, workers tend to revert to old habits that are not in accordance with safety procedures.

In addition, the effectiveness of training is highly dependent on reinforcement through supervision, evaluation, and a work culture that supports safety. Without such reinforcement, the knowledge gained from training is not fully internalized into behavior. This shows that training plays more of a role as a means of increasing knowledge and awareness, but is not strong enough to change behavior directly.

Thus, it can be concluded that *Safety Training* plays a role as a factor in forming knowledge and *Safety Awareness*, but requires support from other factors in order to make a real contribution to *Safety Behavior*.

C. *Safety Awareness* as the Main Determining Factor

The results of the interviews showed that *Safety Awareness* was the most dominant variable in influencing the *Safety Behavior* of workers. The level of worker safety awareness was found to be uneven, where there were workers who had a high level of awareness and consistently worked according to procedures, and there were also workers who still needed supervision and reminders. A prominent phenomenon is that workers with a high *level of Safety Awareness* remain safe even when not under supervision. They have a good understanding of work risks as well as internal awareness to protect themselves and their colleagues. In contrast, workers with low levels of awareness tend to only obey the rules when supervised.

In addition, the results of the interviews showed that *Safety Awareness* was greatly influenced by work experience, both personal experience and experience of seeing work accidents. These experiences form a stronger perception of risk, thus encouraging workers to be more careful and disciplined in their work. This shows that there is an *experiential learning* process in the formation of safety awareness. Furthermore, *Safety Awareness* is also influenced by work environment factors and social interaction between workers. A culture of mutual reminding among colleagues and open communication can increase collective awareness of safety. Thus, *Safety Awareness* is not only individual, but also influenced by social dynamics in the work team.

Thus, it can be concluded that *Safety Awareness* is the main factor (*core driver*) in forming *Safety Behavior*, because it is internal, based on understanding and experience, and does not depend on external supervision.

D. The Influence of Work Culture and Operational Pressures

Some of the interview results also revealed that *workers' safety behavior* is not only influenced by individual factors, but also by social and organizational dynamics in the work environment. The growing work culture in the field shows a tendency to use shortcuts to speed up job completion, especially when workers are facing pressure on operational targets. In addition, the influence of senior colleagues and group norms (*peer influence*) are important

factors in shaping worker behavior patterns, where new workers tend to imitate work practices that have become habits in teams.

The phenomenon reflects a strong *social learning* process in organizations, where safety behaviors are learned through social interaction and shared experiences. An organizational climate that emphasizes more on achieving operational targets than safety also has the potential to undermine the consistency of implementing safe work procedures. Therefore, the formation of *Safety Behavior* requires an approach that focuses not only on the individual, but also on strengthening the safety culture and managing operational pressures in a balanced manner.

Synthesis and Integration of Results

Based on the overall interview results, it can be concluded that there is a pattern of relationships between variables as follows:

- a. *Safety Leadership* has not been able to directly affect *Safety Behavior*, because its effectiveness is influenced by limited supervision and approaches that are still formal.
- b. *Safety Training* plays a role in increasing knowledge and *Safety Awareness*, but does not directly shape behavior without further reinforcement.
- c. *Safety Awareness* is the main factor that determines the formation of *Safety Behavior*, because it is internal and influenced by individual experience and risk perception.

Phenomenologically, it can be explained that workers' *safety behavior* is more influenced by the internalization of safety awareness than external interventions such as leadership and training. This shows that *behavior-based and psychological approaches* are becoming more relevant in improving occupational safety than approaches that focus only on formal control and compliance.

These findings also reinforce the results of previous quantitative analyses, where *Safety Awareness* plays a significant mediating variable, while *Safety Leadership* does not show a significant direct influence on *Safety Behavior*.

Practical Implications

Based on the results of quantitative analysis using SEM-PLS and in-depth interviews, improving *Safety Behavior* in PT PLN (Persero) UP3 Situbondo electricity distribution network workers cannot be achieved only through structural, administrative, or formal compliance approaches. The results of the study show that *Safety Awareness* is the most dominant factor in shaping safety behavior, while *Safety Training* plays a role in increasing knowledge and awareness, and *Safety Leadership* serves as a guide that needs to be strengthened through a more humanistic, participatory, and direct involvement approach in the field.

Practically, safety strategies need to be directed from *compliance-based safety* to *awareness-based* and *behavior-based safety*. This can be done through the transformation of safety leadership, more applicable and contextual training, strengthening safety culture, risk communication, experiential programs, and reward systems for safe behavior. The synergy between *Safety Leadership*, *Safety Training*, and *Safety Awareness* is expected to be able to create sustainable safe work behaviors, reduce *unsafe actions*, and support the achievement of *zero accident targets* in the electricity distribution work environment.

CONCLUSION

Based on the results of the SEM-PLS analysis and in-depth interviews, it can be concluded that the Safety Behavior of electricity distribution network workers is more influenced by internal factors, especially Safety Awareness, than by external factors such as Safety Leadership. Safety Leadership does not have a significant effect on Safety Awareness or Safety Behavior because the approach still tends to be formal and supervision is not optimal, so it has not been able to internalize safety messages to workers. Meanwhile, Safety Training has been shown to increase Safety Awareness, but it does not directly change Safety Behavior without a strong internalization process. Safety Awareness is the most dominant variable because it is able to encourage workers to be more disciplined in complying with procedures, using PPE, and avoiding risky actions. In addition, Safety Awareness mediates the relationship between Safety Training and Safety Behavior, but does not mediate the relationship between Safety Leadership and Safety Behavior. Thus, the formation of Safety Behavior is not enough only through instruction, compliance, or technical training, but must be focused on strengthening the safety awareness of individual workers.

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