Journal of Business and Information Systems
Vol. 5, No. 2, December (2023)
www.thejbis.org
DOI:10.36067/jbis.v5i2.219
ISSN:2685-2543

Accepted, October 2023
Revised, November 2023
Published, December 2023

Manufacturing Companies' Risk Perception Based on the Influence of Safety Leadership, Safety Knowledge, and Safety Attitudes

Latifah Putranti*,
Arista Yesi Saputri,
Pradita Nindya Aryandha,
Hapsari Dyah Herdiany

Universitas PGRI Yogyakarta
Corresponding Author: latifah@upy.ac.id

Abstract: *The growth and development of the manufacturing industry certainly has a positive impact because it increases employment, but it is directly proportional to the increase in work accidents. Most of the causes of work accidents are unsafe behavior. Unsafe behavior is caused by several factors and risk perception is an important part of it. Risk perception is relevant to safety because it can influence behavior that can influence the likelihood of accidents. This study aims to determine the effect of safety leadership, safety knowledge, and safety attitudes on perceived risk probability and perceived risk severity. This research was conducted at PT Linggarjati Mahardika Mulia in 2022. The sample used in this study was 315 respondents and used non-probability sampling techniques through a purposive sampling approach. The data analysis technique in this study used structural equation modeling with SEM-PLS and WarpPLS 8.0. The results confirmed that safety leadership has a positive effect on perceived risk probability and perceived risk severity. Safety knowledge has a positive effect on perceived risk probability and perceived risk severity. Safety attitude has a positive effect on perceived risk probability and perceived risk severity.*

Keywords: *Perceived risk probability; Safety leadership; Safety knowledge; Safety attitudes*

1. Introduction

In 2021, the manufacturing sector was the main contributor to Indonesia's economic growth of 7.07% in the second quarter, with growth of 6.91% despite the pressure of the covid-19 pandemic. Meanwhile, manufacturing grew 3.68% in the third quarter, contributing 0.75% to Indonesia's economic growth (BPKM, 2021). One of the manufacturing sectors is the wood industry, where the export volume of the wood industry increased by 21.88% to 5.98 million tons in 2021 compared to the previous year of only 4.9 million tons. Similarly, export value rose 31.89% last year to $4.78 billion, compared to $3.62 billion a year earlier. The growth and development of the industry will have a positive impact because the industry is one of the jobs that requires a lot of labor to increase employment. However, this is directly proportional to the increase in work accidents, because the higher the productivity to achieve good product quality, the greater the danger or risk to workers (Holcroft & Punnett, 2009).

One of the manufacturing sectors, the plywood industry, is the strategic industries related to the agro-industrial system. Some of the negative impacts or risks include air

pollution, ergonomic hazards, pinched conveyors, scratched hands, coughing, punctured wood, cutting dust, aches, fires, and hot room temperatures that make workers not use personal protective equipment (Varonen & Mattila, 2002). PT Linggarjati Mahardika Mulia is a semi-finished plywood processing company or plywood factory located on Jl. Pacitan-Lorok km 7.5 Wonogondo, Kebonagung, Pacitan, with a total of 317 workers in the production section. It is known that workers in the production section are in direct contact with dangerous tools, putting them at the greatest risk of occupational accidents (Wang et al., 2016).

Based on observations, there were 28 work accidents in 2020 (7.6%), while in January-June 2021 there were 9 work accidents (2.4%). The most cases occurred in February 2020, there were 9 work accidents, while in 2021 until June there were no more than 3 work accidents per month. Some of the work accidents at PT Linggarjati Mahardika Mulia include abrasions, lacerations, narrow and deep wounds due to skin punctured with sharp tools, nails pulled out, cuts or slashes, and electric shock. Work accidents are not only caused by machinery or the work environment, but can also be caused by human error, which is an accident caused by a lack of caution and skill. Where accidents involving injury are directly caused by unsafe behavior and potential mechanical or physical hazards (Holcroft & Punnett, 2009).

Work accidents are not only caused by machinery or the work environment, but can also be caused by human error, which is an accident caused by a lack of caution and skill. Where accidents involving injury are directly caused by unsafe behavior and potential mechanical or physical hazards (Holcroft & Punnett, 2009). Unsafe behavior is caused by several factors, and risk perception is an important internal factor (Wang et al., 2016). Risk perception is related to safety, as it can influence worker behavior which also has an influence on the likelihood of accidents. Risk perception is an individual's feeling and understanding of the various objective risks around them (Van der Velde et al., 1992). Risk is assessed based on the likelihood of occurrence of risk probability and consequences of risk severity (Weyman & Kelly, 1999).

Companies should seek intervention strategies from personal and institutional factors of the company to adjust workers' risk perception. Corporate safety performance can be improved by safety culture and safety climate (Tholén et al., 2013). Pandit et al. (2019) workplaces with a more positive safety climate show higher levels of hazard recognition and safety risk perception. Safety climate is divided into four dimensions: management safety prioritization, management safety commitment, safety communication, and work group safety involvement (Tholén et al., 2013). When dividing the dimensions of safety climate measurement, many dimensions emphasize communication between workers and leaders including safety commitment, safety communication, and supervisor support, which can be referred to as safety leadership.

Safety leadership is a process in which leaders influence their subordinates with their roles to achieve organizational safety goals and emphasize the process of safe interaction between leaders and subordinates (Wu et al., 2008). Safety leadership is effective

communication that can regulate risk perception (Zhang et al., 2017). Consequently, in an emergency, the leader's position is needed to decide on the actions to be taken to survive in handling or preventing risks (Slovic & Weber, 2002). The cognitive dimension, which is related to a person's knowledge and understanding of the hazard at hand, is another factor that influences how much risk a person perceives about the hazard (Peak & Hove, 2017). Safety knowledge is the understanding that ensures one's safety in the workplace, maintenance and safe use of tools, technology, and information. With great safety knowledge, workers can know the potential hazards that exist in the workplace, so that they are more aware of accidents and can be prevented systematically and continuously in accordance with applicable procedures.

Furthermore, safety attitudes are attitudes that reflect employees' beliefs and feelings about safety policies and actions that are connected to fields such as safety science, psychology, and management science (Wu et al., 2017). Workers' attitudes also affect a person's perception (Walgito, 2010). Attitudes can determine behavior because they have a relationship to perception, personality, feelings, and motivation (Robbins, 2015). The attitude of everyone is different, but the direction of the relationship is the same where the better the attitude of the individual, the better the perception of something and vice versa (Ajzen, 2008).

2. Literature Review & Hypotheses development

2.1. Prospect Theory

Daniel Kahneman and Amos Tversky created prospect theory, which mainly focuses on two fields of study, namely psychology and economics. Prospect theory shows individual behavior when faced with uncertainty and risk situations (Anum & Ameer, 2017). When a person is faced with a decision-making situation, the person will look for sources of information and then make several choices as a final decision. According to prospect theory, individuals with irrational tendencies are more risk averse with gains rather than losses, when a person is in a favorable situation, they tend to avoid risk, whereas a person in a loss position tends to take risks, be exposed to risks, or seek risks.

According to prospect theory, individual decision tendencies are based on a decision weighting function. Where these decisions are not necessarily related to the size or frequency of occurrence of events. Events with low probability are usually overweight, events with medium or high probability are underweight. The phenomenon described above occurs when events occur that cause large losses. In addition, prospect theory assumes that options without risk will be chosen more often than options containing risk, even if the probability of risk is very low. Because a person tries to eliminate the risk completely, not reduce or minimize the existing risk (Kahneman & Tversky, 2013).

2.2. Risk Perception

Risk perception is an individual's feeling and understanding of various objective risks that exist outside related to the influence of experience from individual intuitive judgment and subjective feelings to analyze, control and manage risks (Zhang et al., 2017). Risk

perception is related to safety, as it can influence worker behavior which also has an influence on the likelihood of accidents. Risk perception is an individual's feeling and understanding of the various objective risks around them (Van der Velde et al., 1992). Risk is assessed based on the likelihood of an incident occurring (risk probability) and the consequences of an incident risk severity (Weyman & Kelly, 1999). Therefore, the measurement of workers' risk perception is divided into two: perceived risk probability and perceived risk severity. Perceived risk probability is an individual's perception and understanding of the possibility of various objective risks that exist in the outside world. Meanwhile, the perception of risk severity is an individual's perception and understanding of the severity of the consequences of various objective risks in the outside world. (Weyman & Kelly, 1999).

2.3. Safety Leadership

According to the National Safety Counchil, there are factors that cause the perception of occupational accident risk, namely macro-level factors related to the culture of perception and explain the environment around the individual. Factors at the macro level can be shown in workplace safety leadership, trust in the organization and risk, which shows commitment to the workplace safety management system thereby reducing risky behavior and work accidents (Inouye, 2014). Safety leadership is the ability of superiors to motivate all members of the organization to carry out the creation of a work safety culture to achieve organizational goals (Gunawan, 2013). Building a strong safety culture in high-risk areas requires safety leadership, as this culture is developed from the top down by the company's management team (Astuti, 2010).

Safety leadership affects risk perception, where there is communication between leaders and workers so that there is a process where leaders influence subordinates with their roles to achieve company goals. Safety leadership emphasizes the process of safe interaction between leaders and subordinates through effective communication to regulate risk perception. This is proven by Zhao et al. (2021) which states that safety leadership has a direct positive impact on perceived risk probability and perceived risk severity. Then, greater safety leadership will lead to good safety behavior thereby reducing the incidence of accidents (Lu & Yang, 2010). Then, research Zhang et al. (2017) shows that effective communication between superiors and subordinates affects risk perception. Research Flin & Yule (2004) shows that effective leadership influences improving safety performance in high-hazard and complex work. Finally, research O'Dea & Flin (2001) shows that leadership affects safety. Based on some of these descriptions, the first and second hypotheses of this study are:

H_1: Safety leadership has a positive effect on the perception of risk probability.
H_2: Safety leadership has a positive effect on perceived risk severity.

2.4. Safety Knowledge

There is a cognitive dimension associated with a person's knowledge and understanding of the hazard at hand, which is another factor that influences how much risk a person perceives about the hazard (Peak & Hove, 2017). Safety knowledge is an understanding that ensures

one's safety in the workplace, maintenance and safe use of tools, technology, and information (Zhao et al., 2021).

Safety knowledge affects risk perception, there are many trainings conducted by companies to improve safety knowledge. So that workers have an understanding that will ensure their safety at work, maintain, and use knowledge and technology sources safely. This is proven by Zhao et al. (2021) which states that safety knowledge has a direct positive impact on perceived risk probability and perceived risk severity. Then, there is a relationship between knowledge and the perception of occupational safety and health risks (Hartono & Sutopo, 2018). Then, research from Thepaksorn et al. (2018) states that safety knowledge most effectively improves workers' risk perception. Similarly, research from Stemn et al. (2019) states that safety knowledge has a positive effect on safety performance, where risk perception is part of the safety outcome. Then, research from Hasanzadeh et al. (2017) states that safety knowledge can significantly improve worker hazard detection. Based on some of these descriptions, the third and fourth hypotheses of this study are:
H_3: Safety knowledge has a positive effect on perceived risk probability.
H_4: Safety knowledge has a positive effect on perceived risk severity.

2.5. Safety Attitude

One aspect of perception that individuals have according to Woodworth and Marquis, namely the conative aspect includes behavior that is not only directly observed, but also behavior that is a tendency to react or act on the observed object. Regarding work accidents, it can be shown how a person's behavior reacts to the risk of work accidents that exist in the workplace, whether it is calmly accepted or accepted as something that is ignored (Walgito, 2010).

A person's behavior is determined by attitude because both have a relationship to perception, personality, feelings, and motivation (Robbins, 2015). Safety attitudes are attitudes that reflect employees' beliefs and feelings about safety policies and actions that are connected to fields such as safety science, psychology, and management science (Wu et al., 2017). Metropolitan Life Insurance Company states that the risks faced by employees, such as work accidents, are caused by errors in attitude. Attitudes that can lead to work accidents are carelessness, irresponsibility, and lack of cooperation (Winarsunu, 2008).

Safety attitudes affect risk perception, where companies can determine safety measures to reduce reckless actions, to guide workers to have beliefs and feelings towards safety policies and actions that are connected to fields such as safety science, psychology, and management science. This is proven by Zhao et al. (2021) which state that safety attitudes have a direct positive impact on perceived risk probability and perceived risk severity. Then, there is a relationship between attitudes and perceptions about the implementation of the Work Safety System. Similarly, research from Wu et al. (2017) states that safety attitudes have a positive effect on safety performance. Then, research Tholén et al. (2013) states that one of the safety attitude items, namely safety behavior, has a positive impact on risk perception. Finally, research Neto et al. (2021) states that safety

values, attitudes, and behaviors affect the level of safety maturity and risk perception of workers. Based on some of these descriptions, the fifth and sixth hypotheses of this study are:

H_5: Safety attitudes have a positive effect on the perception of risk probability.

H_6: Safety attitudes have a positive effect on perceived risk severity.

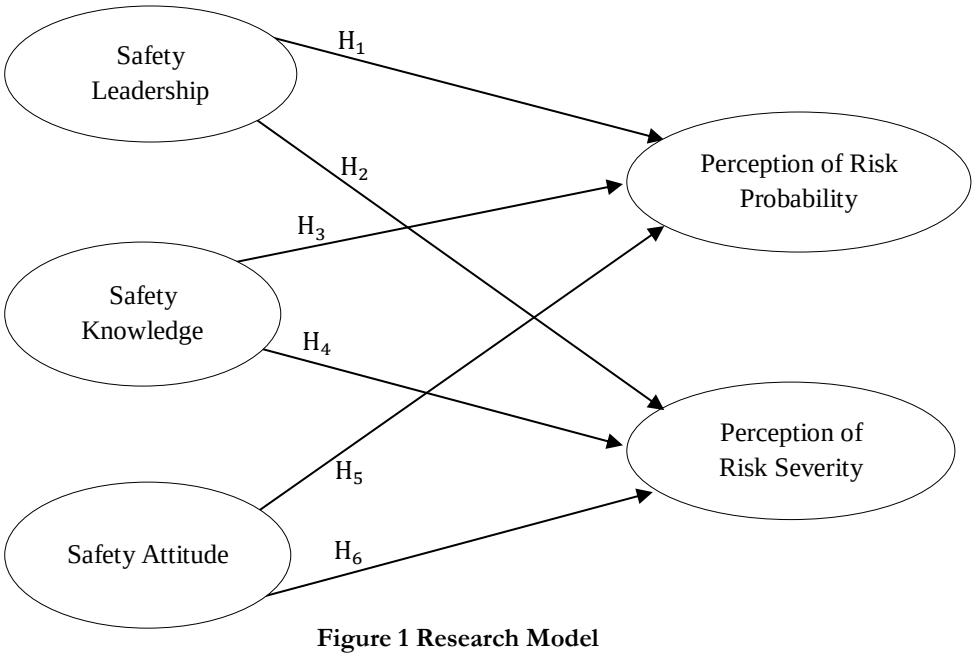

Figure 1 Research Model

3. Method

The population in this study were all workers at PT Linggarjati Mahardika Mulia in Pacitan. Guidelines for determining the sample size for SEM-PLS should be 100 or greater, between 100 - 400 (Hair, 2010). From the results of distributing the questionnaires, there were 315 respondents who responded, so they met the sample size requirements. The questionnaire used in this study consists of five research variables, namely safety leadership, safety knowledge, safety attitudes, perceived risk probability, perceived risk severity. Safety leadership consists of 3 indicators, namely, safety motivation, safety policy, and safety issues (Slovic & Weber, 2002). Safety knowledge includes indicators of understanding related to accident risks, use of safety equipment, and how to handle risks (Peak & Hove, 2017). Safety attitude consists of 3 indicators, namely, safety affective, safety cognitive attitude, and safety behavior attitude (Robbins, 2015). Perceived risk probability includes consideration of the possibility of work accidents (Zhao et al., 2021). Finally, perceived risk severity includes consideration of the severity of the consequences of work accidents (Zhao et al., 2021). The questionnaire used a Likert scale of 1 to 5. The data collected was then analyzed using the SEM-PLS method with WarpPLS 8.0 software.

Table 1. Research Instrument

Variables		Instrument
Safety Leadership		**Safety Motivation**
(Zhao et al., 2021)	1.	My supervisors reward those who set an example in safety behavior.
	2.	My supervisors praise the workers' safety behavior.

Variables	Instrument
	3. My supervisors have set up a safety incentive system. 4. My supervisors encourage workers to report risk and hazard. 5. My supervisors encourage workers to provide safety suggestions. 6. My supervisors trust workers. 7. My supervisors encourage workers' participation in safety decision-making. 8. My supervisors will give workers a serious punishment when workers violate the safe operating procedures. **Safety Policy** 9. My supervisors have established sound safety policies. 10. My supervisors explain the safety policy clearly. 11. My supervisors enforce the safety policy strictly. 12. My supervisors have established a safety responsibility system. 13. My supervisors establish clear safety goals. **Safety Concern** 14. My supervisors show consideration for workers' safety. 15. Even if work has a deadline, my supervisors will stop working and solve the safety problem first when the working conditions are not safe. 16. My supervisors believe that safety is more important than production. 17. My supervisors coordinate with other departments to solve safety issues. 18. My supervisors stress the importance of wearing personal protective equipment. 19. My supervisors often emphasize adherence to safe operating procedures. 20. My supervisors are concerned about safety improvement. 21. My supervisors are very happy to comply with the safety policy. 22. My supervisors pay great attention to workers safety education. 23. My supervisors invest in safety heavily.
Safety Knowledge (Zhao et al., 2021)	1. I know how to use safety equipment and standard work procedures. 2. I know the objects involved in my work, such as whether they are flammable, whether they are toxic, etc. 3. I know how to maintain or improve workplace safety. 4. I know what the hazards/risks are associated with my job and what are the necessary precautions to be taken when performing my job. 5. I know how to handle the risk of accidents and incidents in the workplace. 6. I know what to do and who to report if a potential hazard is spotted in my workplace.
Safety Attitude (Zhao et al., 2021)	1. The safety officers are too picky and always like to find fault in everything. 2. I don't think it is necessary to set up a safety department in the company because it costs too much. 3. The safety measures mentioned by the officer are very old-fashioned and unworkable. 4. I can do the work of a security officer. 5. It is very troublesome and time-consuming to attend safety meetings and safety training. 6. Safety work is the security officer's business, and it has nothing to do with me. 7. Some people have accidents just because of their bad luck. 8. I ensure my own safety, but my coworkers' safety is not related to me. 9. Workplace hazards/risks are unavoidable. 10. Safety is just wearing a safety helmet, wearing a seat belt and nothing else. 11. Safe operating procedures at work are cumbersome, and time to complete work is delayed. 12. I will immediately notify the safety officer when I see that my coworkers are unsafe. 13. I will correct and remind when I see that my coworkers are unsafe. 14. To get the job done, even though I know that some behaviors are unsafe, I still do them.

Variables	Instrument
	15. I will still report to my supervisor when I am injured because I violated operating procedures. 16. I will refuse work when safety precautions are not perfect, for example, the leader does not give me a seat belt when I work at heights.
Risk Perception (Zhao et al., 2021)	1. Started work without checking the readiness of the machine and without lubricating it before operation. 2. Started work without checking that the control equipment was properly installed and working properly. 3. Started work without personal protective equipment. 4. Started work without clearing flammable and explosive materials. 5. Started work without supervision from a supervisor. 6. Start work without ensuring all materials used have information on potential hazards (health, fire, reactivity, and environment). 7. Starting work without evaluating work environment conditions. 8. Performing work without stretching muscles for repetitive work. 9. After work is completed, leaving without cleaning the work site.

4. Result & Discussion

The subjects in this study were workers of PT Linggarjati Mahardika Mulia, totaling 315 respondents. Respondents in this study are people who work at PT Linggarjati Mahardika Mulia. From the results of the questionnaire distributed to workers of PT Linggarjati Mahardika Mulia, it is known that a general description of the respondents who have filled in contains information on the demographic characteristics of respondents such as age, gender, work experience, education, and monthly income.

Based on the respondent demographic data in table 1, the demographics of respondents are dominated by respondents who are 20-30 years old, female, have 6-10 years of work experience, have the last education of SMA / SMK, and have an income of <Rp. 1,000,000. It can be concluded that these respondents are employees of PT Linggarjati Mahardika Mulia.

Table 2. Respondent Characteristic

Profile of respondent		Total	Percentage (%)
Age	20-30 year	123	39.2
	31-40 year	111	35.2
	41-50 year	74	23.4
	>50 year	7	2.2
Gender	Male	153	48.5
	Female	162	51.5
Work Experience	1 – 5 year	99	31.4
	6 – 10 year	111	35.3
	11 – 15 year	85	26.9
	>15 year	20	6.4
Income	< Rp. 1.000.000	167	53.1
	Rp. 1.000.001- Rp. 2.000.000	143	45.4
	Rp. 2.000.001- Rp. 3.000.000	5	1.5

Table 3. Discriminant Validity Test Results

	Safety Leadership	Safety Knowledge	Safety Attitude	Perception of Risk Probability	Perception of Risk Severity
Safety Leadership	**(0.660)**	-0.112	0.290	0.146	0.075
Safety Knowledge	-0.112	**(0.932)**	-0.119	0.462	0.658
Safety Attitude	0.290	-0.119	**(0.698)**	0.116	0.082
Perception of Risk Probability	0.146	0.462	0.116	**(0.826)**	0.772
Perception of Risk Severity	0.075	0.658	0.082	0.772	**(0.868)**

Table 4. Reliability Test Results

Variable	Composite Reliability (CR)	Cronbach's Alpha
Safety Leadership (SL)	0.936	0.928
Safety Knowledge (SK)	0.975	0.970
Safety Attitude (SA)	0.937	0.928
Perception of Risk Probability (PRP)	0.950	0.939
Perception of Risk Severity (PRS)	0.965	0.958

The convergent validity test shows the degree to which an indicator correlates positively with alternative indicators for the same construct. To reveal convergent validity using outer loading of each indicator. Where the indicator used to measure a construct is considered significant if its value is greater than 0.50 (Ghozali & Latan, 2015). The following are the results of the convergent validity test for each questionnaire item in this study. From the convergent validity test results, for the safety leadership variable out of 23 statements, 19 statements are valid. Then, the safety knowledge variable from 5 statements, all statements are valid. Then, the safety attitude variable from 16 statements, all statements are valid. Furthermore, the risk probability perception variable of 9 statements, all statements are valid. Finally, the risk intensity perception variable of 9 statements, all statements are valid.

The discriminant validity test is tested from the square root value of AVE The square root of the AVE value must be greater than the highest correlation with other constructs when compared to the latent variable correlation (Ringle & Sarstedt, 2022). The findings show that all variables have achieved discriminant validity because the square root AVE value for each variable is higher than the relationship between latent variables in the same column and row.

The instrument can meet the reliability requirements if the Composite Reliability (CR) and Cronbach's Alpha values are more than 0.60 - 0.70 so that all items meet the reliability requirements or are consistent (Ringle & Sarstedt, 2022). The results show that the Composite Reliability (CR) and Cronbach's Alpha values are more than 0.60 - 0.70, meaning that each statement item can be used for further research to examine the same group.

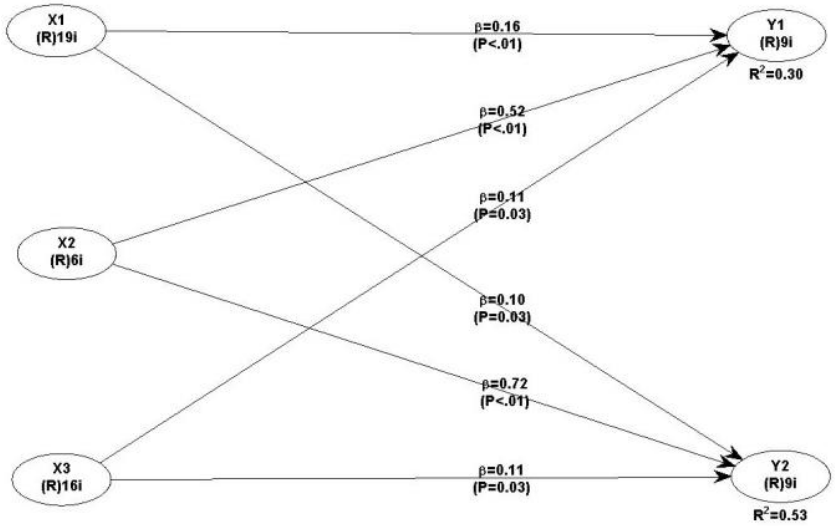

Figure 2. Path Coefficient Test Model and P Values

Table 4. Results of Path Coefficient and P Values

Variable	Path Coefficient Value	P Value	Result
SL → PRP	0.158	0.002*	Accepted
SK→ PRP	0.522	0.001*	Accepted
SA→ PRP	0.106	0.029*	Accepted
SL→ PRS	0.103	0.032*	Accepted
SK→ PRS	0.724	0.001*	Accepted
SA→ PRS	0.108	0.027*	Accepted

* Sig < 5%

Safety leadership has a positive effect on perceived risk probability, this shows that safety leadership has a positive and significant effect on perceived risk probability, so that the higher or stronger the safety leadership, the higher the level of risk probability perception of employees, which means that the supervisor's concern for worker safety will make it possible for employees to recognize risks proactively which makes workers' risk probability perception increase. The results of this first hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety leadership which has three measurement items, namely, safety motivation, safety policies, and safety issues has a direct positive impact on risk probability perception. Then, research Lu & Yang (2010) which states that safety leadership has a positive effect on safety performance. Then, research Wu et al. (2008) which shows that safety leadership has a major influence on commitment and safety actions in the safety climate. Similarly, research Zhang et al. (2017) showed that effective communication between superiors and subordinates influences risk perception. Then, research Flin & Yule (2004) shows that effective leadership influences improving safety performance in high hazard and complex work. Finally, research O'Dea & Flin (2001) shows that leadership influences safety by developing good quality participative and open relationships with subordinates. The results of this study indicate that safety leadership influences the perception of risk probability. Where strong leadership can influence employees to report and take initiative for any hazards or risks that occur which results in an increased level of worker risk perception.

The analysis shown that safety leadership has a positive and significant effect on perceived risk severity, so that the higher or stronger the safety leadership, the higher the level of employee risk severity perception, which means that the supervisor's concern for worker safety will make it possible for employees to recognize risks proactively which makes the perception of worker risk severity increase. The results of this second hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety leadership which has three measurement items, namely, safety motivation, safety policies, and safety issues has a direct positive impact on perceived risk severity. Then, research Reid et al. (2008) which states that safety leadership affects the level of safety to achieve good safety performance in the organization. Then, research Oah et al. (2018) which shows that safety leadership has an influence on risk perception. Similarly, research from Eid et al. (2012) shows that safety leadership directly influences safety outcomes through increasing perceptions of a positive safety climate. Furthermore, research from Fernández-Muñiz et al. (2017) showed that safety leadership has a direct, positive relationship on safety participation. Finally, research from Clarke & Ward (2006) showed that transformational leadership style has a significant relationship with safety participation partially mediated by safety climate. The results of this study suggest that safety leadership influences perceptions of risk severity. Where strong leadership can influence employees to report and take initiative for any hazards or risks that occur which results in an increased level of worker risk perception.

The analysis in table 3, show that safety knowledge has a positive and significant effect on the perception of risk probability, so that the higher the safety knowledge of workers, the higher the level of risk probability perception of workers, which means that workers who apply more safety knowledge in the process of possible risks can understand risks more scientifically. The results of this third hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety knowledge has a direct positive impact on risk probability perception. Then, research from Stemn et al. (2019) states that safety knowledge has a positive effect on safety performance, where risk perception is part of the safety outcome. Then, research from Vinodkumar & Bhasi (2010) which states that perceived safety management practices affect safety performance through safety knowledge and safety motivation as mediators. Similarly, research from Rajabi et al. (2022) states that locus of control affects safety performance which is mediated by safety knowledge and safety motivation. Then, research from Griffin & Neal (2000) which states that knowledge and motivation mediate the impact of safety climate on individual safety behavior. Finally, research from Khaleghinejad & Ziaaldini (2015) which states that safety motivation and safety knowledge have a mediating role in the relationship between safety climate and safety performance. The results of this study indicate that safety knowledge affects the perception of risk probability. Where workers who want to make efforts to prevent work accidents as a form of vigilance against accidents, should understand (know) the potential hazards that exist in the workplace, so that prevention can be carried out systematically and continuously in accordance with applicable procedures which results in an increased level of risk perception of workers.

Based on the analysis shown in table 3, shows that safety knowledge has a positive and significant effect on perceived risk severity, so that the higher the worker's safety knowledge, the higher the worker's risk severity perception, which means that workers who apply more safety knowledge in the risk recognition process can understand how severe the risk is. The results of this fourth hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety knowledge has a direct positive impact on perceived risk severity. Thepaksorn et al. (2018) states that safety knowledge related to HPD-based interventions is the most effective intervention in utilizing and improving workers' risk perception. Similarly, research from Sarita et al. (2019) states that safety knowledge and safety motivation have a positive and significant effect on work compliance. Then, research from Hasanzadeh et al. (2017) which states that safety knowledge can significantly improve worker hazard detection. Finally, research from Basahel (2021) states that safety motivation and safety knowledge have a positive impact on worker participation and compliance. The results of this study indicate that safety knowledge affects the perception of risk severity. Where workers who want to make efforts to prevent work accidents as a form of vigilance against accidents, should understand (know) the potential hazards that exist in the workplace, so that prevention can be carried out systematically and continuously in accordance with applicable procedures which results in an increased level of risk perception of workers.

Hypothesis 5 is that safety attitude has a positive effect on perceived risk probability. This shows that safety attitudes have a positive and significant effect on the perception of risk probability, so that the higher the safety attitude of workers, the higher the level of risk probability perception of workers, which means that workers who have a good safety affective attitude will make workers more sensitive to the possibility of risk. The results of this fifth hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety attitudes which have three measurement items, namely, safety affective attitudes, safety cognitive attitudes, and safety behavioral attitudes have a direct positive impact on perceived risk probability. Then there is research from Wu et al. (2017) which states that safety attitudes have a positive effect on safety performance. Then, research Tholén et al. (2013) which states that one of the safety attitude items, namely safety behavior, influences the safety climate so that it has a positive impact on risk perception. Similarly, research Vinodkumar & Bhasi (2010) states that safety management practices that have a positive effect on employee attitudes are directly related to safety management. Then, research Tao et al. (2021) which states that safety attitudes affect awareness of safety behavior. Finally, research Neto et al. (2021) states that safety values, attitudes, and behaviors affect the level of safety maturity and risk perception of workers. The results of this study indicate that safety attitudes affect the perception of risk probability. Where workers can determine safety measures to reduce rash actions, so that they have confidence and feelings towards safety policies and actions which result in an increased level of worker risk perception.

Safety attitudes have a positive effect on perceived risk severity. This shows that safety attitudes have a positive and significant effect on perceived risk severity, so that the

higher the worker's safety attitude, the higher the level of perception of the worker's risk probability, which means that workers who have a good safety affective attitude will make workers more sensitive and understand how severe the risk is. The results of this sixth hypothesis test are in line with previous research, namely research from Zhao et al. (2021) which states that safety attitudes which have three measurement items, namely, safety affective attitudes, safety cognitive attitudes, and safety behavioral attitudes have a direct positive impact on perceptions of risk severity. Then there is research from Loosemore & Malouf (2019) which states that safety attitudes have a positive effect on safety performance. Then, research Biggs et al. (2007) states that safety attitudes increase safety behavior in a consistent manner to create good safety. Similarly, research Hung et al. (2011) states that effective safety attitudes can reduce injury rates. Then, research from Tam & Fung (2012) which states that safety attitudes have a positive effect on safety culture. Finally, Al Faqeeh et al. (2019) which states that the mediating role of safety attitudes in the relationship between safety climate and safety behavior. The results of this study indicate that safety attitudes affect the perception of risk severity. Where workers can determine safety measures to reduce rash actions, so that they have confidence and feelings towards safety policies and actions which result in an increased level of worker risk perception.

5. Conclusion, Limitation & Suggestion

Unsafe behavior is caused by several factors, and risk perception is an important internal factor. Risk perception is related to safety because it can influence worker behavior which also influences the possibility of accidents. Risk is assessed based on the probability of the risk occurring and the consequences of a risk severity level (Weyman & Kelly, 1999). To adjust workers' risk perceptions, companies must seek intervention strategies from personal factors and company institutions. Where, company safety performance can be improved with safety culture and safety climate (Tholén et al., 2013).

Safety leadership is a process in which leaders influence their subordinates with their roles to achieve organizational safety goals and emphasize safe interaction processes between leaders and subordinates. Where, in safety leadership, there is effective communication that can regulate risk perceptions (Zhang et al., 2017). As a result, in an emergency, a leadership position is needed to decide what actions must be taken to survive in handling or preventing risks (Slovic & Weber, 2002). Safety knowledge is the understanding that ensures a person's safety at work, maintenance and safe use of tools, technology and information. With greater safety knowledge, workers can understand (know) the potential dangers that exist in the workplace, so that they are more alert to accidents and prevention can be carried out systematically and continuously in accordance with applicable procedures.The provides suggestions for future researchers, it is hoped that they can consider other variables that can influence and improve risk perception besides safety leadership, safety knowledge, and safety attitudes, such as the work environment or factors outside the company, namely government policies.

References

Ajzen, I. (2008). *Attitude & Attitude Change*. Psychology Press.

Al Faqeeh, F., Khalid, K., & Osman, A. (2019). Integrating safety attitudes and safety

stressors into safety climate and safety behavior relations: the case of healthcare professionals in Abu Dhabi. *Oman medical journal*, *34*(6), 504-513. https://doi.org/10.5001/omj.2019.93

Anum, & Ameer, B. (2017). Behavioral factors and their impact on individual investors' decision making and investment performance: Empirical investigation from Pakistani Stock Market. *Global Journal of Management and Business Research*, *17*(1), 1–12.

Astuti, Y. H. N. (2010, November). Peran safety leadership dalam membangun budaya keselamatan yang kuat. In *Seminar Nasional VI SDM Teknologi Nuklir. Yogyakarta*.

Basahel, A. M. (2021). Safety leadership, safety attitudes, safety knowledge and motivation toward safety-related behaviors in electrical substation construction projects. *International Journal of Environmental Research and Public Health*, *18*(8) 4196. https://doi.org/10.3390/ijerph18084196

Biggs, H. C., Sheahan, V. L., & Dingsdag, D. P. (2007). Risk management and injury prevention: Competencies, behaviours, and attitudes to safety in the construction industry. *The Australian Journal of Rehabilitation Counselling*, *13*(2), 63-67. https://doi.org/10.1375/jrc.13.2.63

BPKM (Badan Koordinasi Penanaman Modal). (2021). *Industri Manufaktur untuk Percepatan Pertumbuhan Ekonomi Indonesia*. https://www.bkpm.go.id/id/publikasi/detail/berita/industri-manufaktur-untuk-percepatan-pertumbuhan-ekonomi-indonesia#:~:text=Industri manufaktur berkontribusi besar dalam,75%25 terhadap pertumbuhan ekonomi Indonesia.

Clarke, S., & Ward, K. (2006). The role of leader influence tactics and safety climate in engaging employees' safety participation. *Risk analysis*, *26*(5), 1175-1185. https://doi.org/10.1111/j.1539-6924.2006.00824.x

Eid, J., Mearns, K., Larsson, G., Laberg, J. C., & Johnsen, B. H. (2012). Leadership, psychological capital and safety research: Conceptual issues and future research questions. *Safety science*, *50*(1), 55-61. https://doi.org/10.1016/j.ssci.2011.07.001

Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2017). The role of safety leadership and working conditions in safety performance in process industries. *Journal of Loss Prevention in the Process Industries*, *50*, 403-415. https://doi.org/10.1016/j.jlp.2017.11.001

Flin, R., & Yule, S. (2004). Leadership for safety: industrial experience. *BMJ Quality & Safety*, *13*(suppl 2), ii45-ii51. https://doi.org/10.1136/qshc.2003.009555

Ghozali, I., & Latan, H. (2015). Partial least squares konsep, teknik dan aplikasi menggunakan program smartpls 3.0 untuk penelitian empiris. *Semarang: Badan Penerbit UNDIP*.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of occupational health psychology*, *5*(3), 347-358. https://doi.org/10.1037/1076-8998.5.3.347

Gunawan, F. (2013). Safety Leadership: Building Excellent Operation (pertama). *PT. Dian Rakyat*.

Hair Joseph, F, et al. (2010). Multivariate Data Analysis. New Jersey: Prentice Hall Published.

Hartono, A., & Sutopo, S. (2018). Pengaruh pengetahuan, sikap dan kondisi lingkungan kerja terhadap persepsi penerapan keselamatan dan kesehatan kerja. *Jurnal Dinamika Vokasional Teknik Mesin*, *3*(2), 76-81. https://doi.org/10.21831/dinamika.v3i2.21402

Hasanzadeh, S., Esmaeili, B., & Dodd, M. D. (2017). Measuring the impacts of safety knowledge on construction workers' attentional allocation and hazard detection using

remote eye-tracking technology. *Journal of management in engineering*, *33*(5), 04017024. https://doi.org/10.1061/(asce)me.1943-5479.0000526

Holcroft, C. A., & Punnett, L. (2009). Work environment risk factors for injuries in wood processing. *Journal of Safety Research*, *40*(4), 247-255. https://doi.org/10.1016/j.jsr.2009.05.001

Hung, Y. H., Smith-Jackson, T., & Winchester, W. (2011). Use of attitude congruence to identify safety interventions for small residential builders. *Construction Management and Economics*, *29*(2), 113-130. https://doi.org/10.1080/01446193.2010.521758

Inouye, N. S. (2014). *Risk Perception : Theories, Strategies, dan Next Steps*. The Campbell Institute.

Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision making: Part I* (pp. 99-127). https://doi.org/10.1142/9789814417358_0006

Khaleghinejad, A., & Ziaaldini, M. (2015). Relationship between employees' safety climate and safety performance with respect to mediating effect of safety knowledge and safety motivation in Sarcheshmeh copper complex. *Journal of Health and Safety at Work*, *5*(4), 69-86.

Loosemore, M., & Malouf, N. (2019). Safety training and positive safety attitude formation in the Australian construction industry. *Safety science*, *113*, 233-243. https://doi.org/10.1016/j.ssci.2018.11.029

Lu, C. S., & Yang, C. S. (2010). Safety leadership and safety behavior in container terminal operations. *Safety science*, *48*(2), 123-134. https://doi.org/10.1016/j.ssci.2009.05.003

O'Dea, A., & Flin, R. (2001). Site managers and safety leadership in the offshore oil and gas industry. *Safety science*, *37*(1), 39-57. https://doi.org/10.1016/S09257535(00)00049-7

Neto, H. V., Arezes, P., & Junior, B. B. (2021). Safety values, attitudes and behaviours in workers of a waste collection and sanitation company. *Safety science*, *144*, 105471. http://doi.org/https://doi.org/10.1016/j.ssci.2021.105471

Oah, S., Na, R., & Moon, K. (2018). The influence of safety climate, safety leadership, workload, and accident experiences on risk perception: A study of Korean manufacturing workers. *Safety and health at work*, *9*(4), 427-433. https://doi.org/10.1016/j.shaw.2018.01.008

Pandit, B., Albert, A., Patil, Y., & Al-Bayati, A. J. (2019). Impact of safety climate on hazard recognition and safety risk perception. *Safety science*, *113*, 44-53. https://doi.org/10.1016/j.ssci.2018.11.020

Peak, H. J., & Hove, T. (2017). *Risk perceptions and risk characteristics.* Oxford Research Encyclopedia of Communication. https://doi.org/10.1093/acrefore/9780190228613.013.283

Rajabi, F., Mokarami, H., Cousins, R., & Jahangiri, M. (2022). Structural equation modeling of safety performance based on personality traits, job and organizational-related factors. *International journal of occupational safety and ergonomics*, *28*(1), 644-658. https://doi.org/10.1080/10803548.2020.1814566

Reid, H., Flin, R., Mearns, K., & Bryden, R. (2008). Influence from the top: Senior managers and safety leadership. In *SPE International Conference and Exhibition on Health, Safety, Environment, and Sustainability?* (SPE-111762). SPE. https://doi.org/10.2118/111762-MS

Ringle, C. M., & Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (Issue September 2021).

Robbins, P. (2015). *Perilaku Organisasi: Konsep, Kontroversi, Aplikasi*. Salemba Medika.

Sarita, F. F., Sadalia, I., Silalahi, A. S., & Rossanty, Y. (2019). The effect of safety knowledge and safety motivation to work accident with work compliance as intervening variable at PT. Wijaya Karya Project Division 1, Indonesia. *International Journal of Science and Business*, *3*(2), 22-31.

Slovic, P., & Weber, E. U. (2002). Perception of risk posed by extreme events. *Risk Management Strategies in an Uncertain World*, 1–21.

Stemn, E., Bofinger, C., Cliff, D., & Hassall, M. E. (2019). Examining the relationship between safety culture maturity and safety performance of the mining industry. *Safety science*, *113*, 345-355. https://doi.org/10.1016/j.ssci.2018.12.008

Tam, V. W., & Fung, I. W. (2012). Behavior, attitude, and perception toward safety culture from mandatory safety training course. *Journal of Professional Issues in Engineering Education and Practice*, *138*(3), 207-213. https://doi.org/10.1061/(ASCE)EI.1943-5541.0000104

Tao, D., Liu, Z., Diao, X., Tan, H., Qu, X., & Zhang, T. (2021). Antecedents of self-reported safety behaviors among commissioning workers in nuclear power plants: The roles of demographics, personality traits and safety attitudes. *Nuclear Engineering and Technology*, *53*(5), 1454-1463. https://doi.org/10.1016/j.net.2020.11.012

Thepaksorn, P., Siriwong, W., Neitzel, R. L., Somrongthong, R., & Techasrivichien, T. (2018). Relationship between noise-related risk perception, knowledge, and the use of hearing protection devices among para rubber wood sawmill workers. *Safety and health at work*, *9*(1), 25-29. https://doi.org/10.1016/j.shaw.2017.06.002

Tholén, S. L., Pousette, A., & Törner, M. (2013). Causal relations between psychosocial conditions, safety climate and safety behaviour - A multi-level investigation. *Safety Science*, *55*, 62–69. https://doi.org/10.1016/j.ssci.2012.12.013

Van der Velde, F. W., Hooykaas, C., & Van der Joop, P. (1992). Risk perception and behavior: Pessimism, realism, and optimism about AIDS-related health behavior. *Psychology and Health*, *6*(1-2), 23-38. https://doi.org/10.1080/08870449208402018

Varonen, U., & Mattila, M. (2002). Effects of the work environment and safety activities on occupational accidents in eight wood-processing companies. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *12*(1), 1-15. https://doi.org/10.1002/hfm.10002

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation. *Accident Analysis & Prevention*, *42*(6), 2082-2093. https://doi.org/10.1016/j.aap.2010.06.021

Walgito, B. (2010). *Pengantar Psikologi Umum*. C.V Andi.

Wang, J., Zou, P. X., & Li, P. P. (2016). Critical factors and paths influencing construction workers' safety risk tolerances. *Accident analysis & prevention*, *93*, 267-279. https://doi.org/10.1016/j.aap.2015.11.027

Weyman, A., & Kelly, C. J. (1999). Risk perception and risk communication: A review of literature. In *HSE Contract Research Report* (pp. 1–79).

Winarsunu. (2008). *Psikologi Keselamatan Kerja. Malang: Universitas Muhammadiyah Malang.* (U. Press (Ed.)

Wu, T. C., Chen, C. H., & Li, C. C. (2008). A correlation among safety leadership, safety climate and safety performance. *Journal of loss prevention in the process industries*, *21*(3), 307-318. https://doi.org/10.1016/j.jlp.2007.11.001

Wu, X., Yin, W., Wu, C., & Li, Y. (2017). Development and validation of a safety attitude

scale for coal miners in China. *Sustainability*, *9*(12), 2165. https://doi.org/10.3390/su9122165

Zhang, M., Wang, X., Mannan, M. S., Qian, C., & Wang, J. (2017). A system dynamics model for risk perception of lay people in communication regarding risk of chemical incident. *Journal of Loss Prevention in the Process Industries*, *50*, 101–111. https://doi.org/10.1016/j.jlp.2017.09.005

Zhao, Y., Zhang, M., Liu, T., & Mebarki, A. (2021). Impact of safety attitude, safety knowledge and safety leadership on chemical industry workers' risk perception based on structural equation modelling and system dynamics. *Journal of Loss Prevention in the Process Industries*, *72*. https://doi.org/10.1016/j.jlp.2021.104542