International Journal of Integrative Research (IJIR)
Vol.3, No.4, 2025: 303-318

Psychological Capital as a Mediator the Relationship Between Safety Culture and Safety Behavior of Coal Mine Workers

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A R T I C L E I N F O

Keywords: Safety Culture, Safety Behaviour, Pyschological Capital

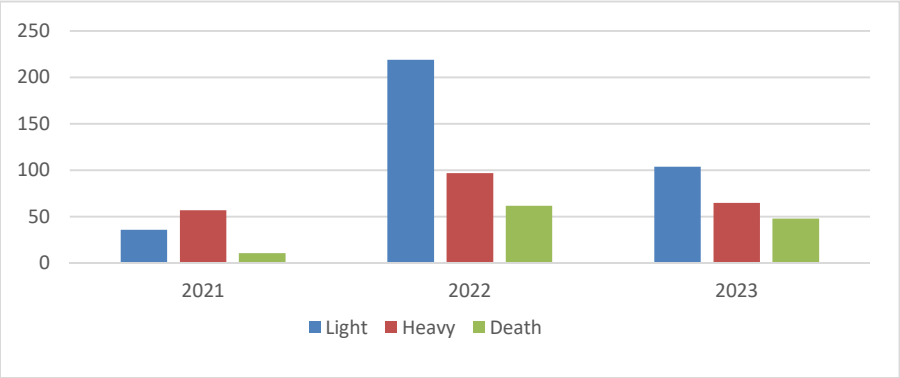
Received : 14 February
Revised : 27 March
Accepted: 30 April

A B S T R A C T

This study aims to analyze the relationship between safety culture and safety behavior of coal mine workers by considering the mediating role of psychological capital. The method used was a quantitative approach with a cross-sectional design using a questionnaire distributed to 412 respondents of coal mine employees of PT. Cipta Kridatama of Tapin Regency in South Kalimantan Province. The data was analyzed using Structural Equation Modeling (SEM) with WarpPLS software version 8.0. The results of the study show that safety culture and psychological capital have a significant positive relationship with safety behavior. Safety culture also has a significant positive relationship with psychological capital. The study also found that psychological capital is able to mediate the relationship between safety culture and safety behavior. The R-Square for psychological capital and safety behavior variables were 64.9% and 25.8%, respectively, indicating that the model had a fairly good predictive ability

INTRODUCTION

The mining sector is classified as one of the most dangerous occupations in the world. This happens because this work involves the operation of heavy equipment machinery for transporting overburden (OB) and coal materials, drilling, blasting, and welding. Workers in the mining sector may be exposed to various hazards and risks in the workplace, including respiratory diseases, exposure to noise, falls, explosions, fires, landslides, collisions, and being hit by heavy equipment vehicles (Baraza et al., 2023). The Ministry of Energy and Mineral Resources (2024) stated that there are three categories of accidents experienced by workers in the mining sector, namely minor accidents, serious accidents, and accidents that result in death (Kementerian Energi dan Sumber Daya Mineral, 2024). The following is data on work accidents in the mining sector that occurred in Indonesia in 2021-2023.



Source: Ministry of Energy and Mineral Resources, 2024

Figure 1. Data on Work Accidents in the Mining Sector in Indonesia in 2021-2023

Based on this data, it can be seen that the number of accidents that occur in the mining sector tends to increase every year. This increase indicates a serious problem in terms of occupational safety and health in the mining industry. Data from the Indonesian Ministry of Energy and Mineral Resources recorded that in 2021 there were 104 cases of mining accidents with 11 cases causing deaths. In 2022, there were 378 cases with 62 incidents causing casualties and in 2023 there were 48 incidents.

BPJS Employment data explains that the number of work accident claims is 234,730 cases in 2021, 297,725 cases in 2022 and 347,855 cases in 2023. The increase in the number of work accidents is certainly a special concern for the government, mining companies, and all related stakeholders.

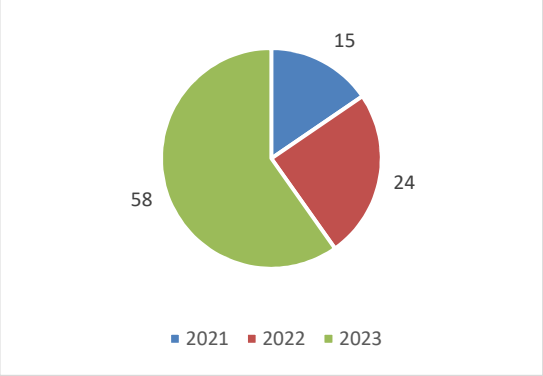
According to the Ministry of Industry (2019), work accidents can be caused by various factors, namely; 3% of accidents are caused by aspects that cannot be avoided such as natural disasters; 24% of accidents occur due to work environments or equipment that do not meet safety standards and 73% of work accidents are caused by unsafe behavior of the workers themselves (Kementerian Perindustrian, 2019). The high percentage of accidents caused by unsafe behavior factors from workers themselves shows that efforts to improve occupational

safety must be more focused on changing worker behavior and increasing awareness of the importance of working safely.

There are two factors that can affect safety behavior, namely organizational factors (external factors) and individual factors (internal factors) (Cooper, 2000). Organizational factors such as culture and safety climate are external factors that provide an environment and encouragement for individuals to behave safely. Individual factors, such as workers' awareness, attitudes, motivations, and knowledge of safety, are internal factors that influence how a person responds to hazards in the workplace. On the other hand, this integration between internal (individual) and external (organizational) factors determines how well safety is practiced in the workplace (Pradewa & Mahardayani, 2023).

Individual factors in safety behavior consist of psychological capital and personality. The psychological capital factor is very influential in determining work safety behavior because it is closely related to the mental and emotional aspects of employees. Employees with high psychological capital are more likely to comply with safety procedures, are able to deal with stress at work, and are less easily affected by risky situations because mental and emotional stability will make a person more likely to make wise decisions in dangerous situations and play a more active role in maintaining a safe work environment (Saleem et al., 2022).

Indonesia has land rich in mining resources, one of which is in South Kalimantan. However, behind the large economic contribution, the mining sector in South Kalimantan is also faced with serious challenges, one of which is the high number of work accidents. This is shown based on work accident data in South Kalimantan Province:



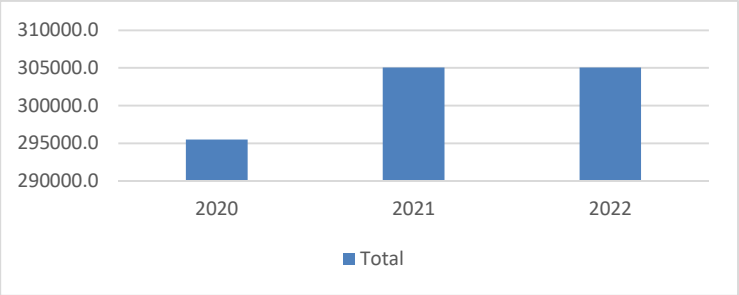
Source: South Kalimantan Provincial Communication and Information Service, 2023

Figure 2. Work Accident Data in South Kalimantan Province

The data on work accidents in South Kalimantan Province displayed on the graph shows an increasing trend from 2020 to 2022.

One of the mining companies operating in South Kalimantan is PT Cipta Kridatama. Mining companies in South Kalimantan, including PT Cipta Kridatama, have implemented occupational safety principles to protect

employees and ensure operations run safely. The following is data on incidents that occurred from 2021 to 2023 at PT Cipta Kridatama:



Source: PT Cipta Kridatama, 2023
Figure 3. Data Total Incident PT Cipta Kridatama

An increase in the number of incidents indicates the presence of a developing problem or a significant change in the environment. Data obtained from PT Cipta Kridatama shows that in 2023 there will be one incident requiring medical treatment and one first aid case incident in 2021 and 2022. There has been a significant increase in the number of incidents with losses above $10,000, from none in 2021 to seven in 2023. The number of incidents with losses under $10,000 is increasing every year, from nine in 2021 to twenty in 2023. This shows an increasing trend of incidents with lower but still significant financial losses.

Based on the above and the absence of studies that specifically examine the relationship between safety culture and safety behavior with the role of psychological capital as a mediator between the two, research related to the relationship between safety culture and safety behavior mediated by psychological capital needs to be conducted. Another novelty of this study is its holistic approach in analyzing factors that have a relationship withsafety behavior. This approach allows the identification of more effective strategies to improve safety behaviors through the integration of the two aspects. Thus, the researcher is interested in taking the title of the study with titled "**Psychological Capital as a Mediator of the Relationship between Safety Culture and Safety Behavior of Coal Mine Workers".**

LITERATURE REVIEW

The main dimensions of psychological capital and the key aspects of safety behavior become the conceptual foundation of this study. Psychological capital is measured through indicators such is: self-efficacy, optimism, hope, and resilience. Meanwhile, safety behavior is assessed through several behavioral indicators, including compliance with safety procedures, the proper use of personal protective tools, and active participation in safety training and the development of safety protocols. This explanation provides a solid conceptual helps to clarify the theoretical relationship between the variables in this research.

The relationship between safety culture and safety behavior has been examined in previous research. A strong safety culture encourages workers to prioritize safety in their job activities. In the context of coal mining, which is characterized by a high level of occupational risk, a robust safety culture have a

critical role in fostering workers' awareness and commitment to accident prevention.This culture is reflected through in strict obedience to safety procedures, consistent use of personal protective tools, and active participation in safety training programs.

Safety culture not only has a direct influence on safety behavior but also through psychological capital. Workers who work in environments with strong and consistent safety culture tend to feel more supported by their organization and will improve their psychological capital. Psychological capital plays a crucial role in forming workers' attitudes and actions, particularly in relation to safety. Psychological capital also has a direct relationship with safety behavior in the workplace. Workers who has high levels of psychological capital are able to cope with pressures in workplace, make good decisions that prioritize safety, and adopt a proactive approach to risk prevention.

The relationship between safety culture, psychological capital, and safety behavior can be explained through a mediation mechanism. A well-established safety culture contributes to improve workers' psychological capital, which in turn encourages them to engage in safer behaviors in the workplace. When employees perceive that safety is a organizational priority, they tend to develop a more optimistic vision regarding their ability to maintain personal and collective safety.

Based on the explanation that have been described above, the following hypothesis are proposed in this study:

- H1: There is a significant relationship between Safety Culture and Safety Behavior of Coal Mine Workers.
- H2: There is a significant relationship between Safety Culture and the Psychological Capital of Coal Mine Workers.
- H3: There is a significant relationship between Psychological Capital and the Safety Behavior of Coal Mine Workers.
- H4: Psychological Capital mediates the relationship between Safety Culture and the Safety Behavior of Coal Mine Workers.

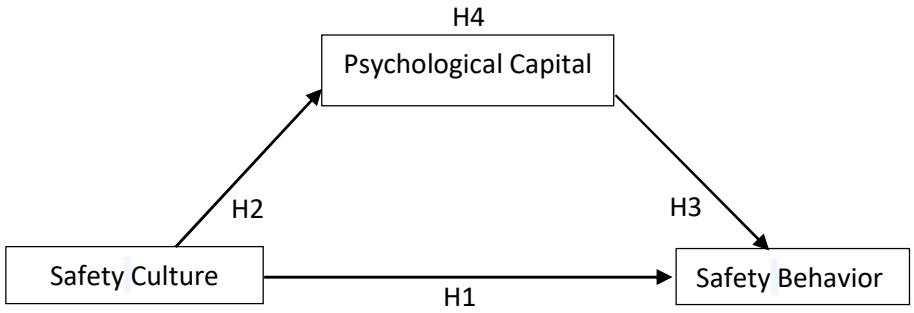


Figure 4. Conceptual Framework

METHODOLOGY

This study uses a quantitative approach with a type of correlational research, which is research that asks about the relationship between two or more variables (Sugiyono, 2019). The purpose of this study is to determine whether or not there is a relationship between variables or to make predictions based on correlations between variables. In this study, there are three types of variables, including; The dependent variable is safety behavior, the independent variable is safety culture and the mediation variable is psychological capital.

Data Collection

The sampling technique in this study is a non-probability sampling technique with the purposive sampling method which is a sampling technique by determining certain criteria that describe the actual population state (Sugiyono, 2018b).

The data was distributed with a Google Form questionnaire sent to respondents via WhatsApp application and email and then processed using the Structural Equation Model (SEM) method with WarpPLS software version 8.0.

The respondents in this study were all workers from PT. Cipta Kridatama who is in charge of Tapin Regency with data collected as many as 412 respondents while the respondents planned for this study are 337 respondents according to the calculation of the formula developed from Isaac and Michael (Sekaran & Bougie 2017a). Respondents were grouped based on age, gender, position, length of work and last education.

Variable Operational Definition

Safety Culture

The safety culture variable in this study refers to the values, norms, and beliefs that govern safety-related attitudes and actions in the workplace. From a psychological perspective, safety culture includes three main dimensions, namely psychological, situational, and behavioral dimensions. The psychological dimension involves workers' perceptions, beliefs, and motivations towards safety, which affects their awareness of complying with safety rules. The situational dimension includes external factors, such as organizational policies, management support, and safety work environment conditions. The behavioral dimension reflects the worker's apparent actions, such as complying with procedures, using personal protective equipment, and reporting potential hazards. The interaction of these three dimensions forms a safety culture that promotes a safe and healthy work environment.

Safety Behavior

Safety behavior variables in the study refer to workers' actions and attitudes related to efforts to maintain safety in the workplace. This includes specific behaviors such as following safety procedures, using personal protective equipment (PPE) correctly, reporting dangerous working conditions, and complying with safety regulations set by the company PT Cipta Kridatama.

Psychological Capital

The psychological capital variable in this study refers to positive psychological attributes that support individual performance and well-being in the workplace. This includes the individual's belief in his or her ability to achieve goals, a positive attitude toward the future, the ability to plan for and overcome

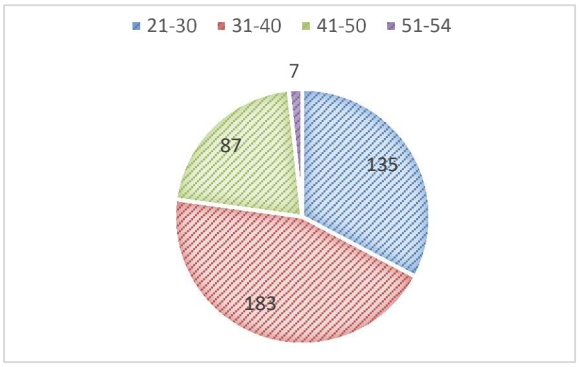
obstacles, and the ability to recover from failure and stress in a constructive way. This psychological capital contributes to increased motivation, adaptability, and job satisfaction.

RESULTS

Respondent Profile Analysis

1) Respondent Profiles by Age

Respondents aged 31-40 years were 183 people (44.4%). The age group of 21-30 includes 135 respondents (32.8%). Respondents aged 41-50 years were 87 people (21.1%) while the age group of 51-54 years was 7 people (1.7%). This reflects that most of the workforce is in a professionally active and stable phase, which usually contributes significantly to the company's productivity.

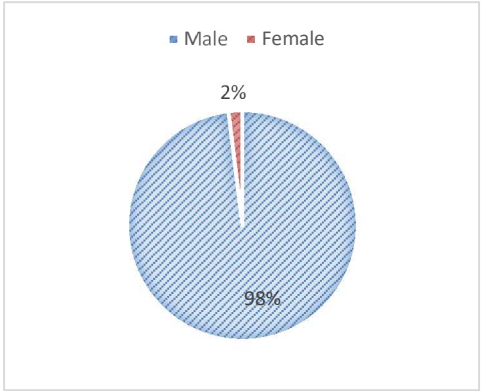


Source: Data Processed (2024)

Figure 5. Respondent Profiles by Age

2) Respondent Profiles by Gender

The characteristics of the respondents in this study showed as many as 404 male respondents (98%) and 8 female respondents (2%). This distribution suggests that the majority of the workforce is made up of men, which is most likely in line with the characteristics of the jobs in the sector. The very small proportion of female respondents may reflect their more limited or specific roles in the company's work environment.

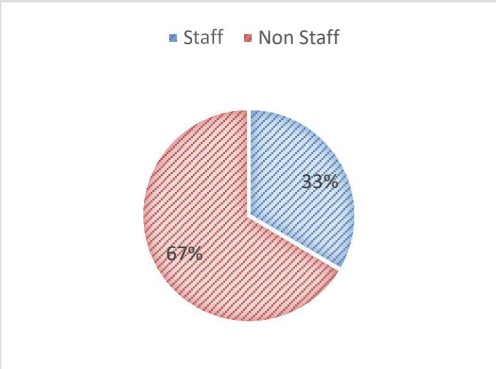


Source: Data processed (2024)

Figure 6. Respondent Profiles by Gender

3) Respondent Profile by Position

The characteristics of the respondents in this study showed that the distribution of positions was dominated by Non-Staff as many as 274 respondents (67%) and Staff 138 respondents (33%). This distribution shows that the majority of the workforce consists of Non-Staff, which can include operational workers and a smaller proportion of Staff reflects a more limited number of managerial or administrative positions compared to operational positions.

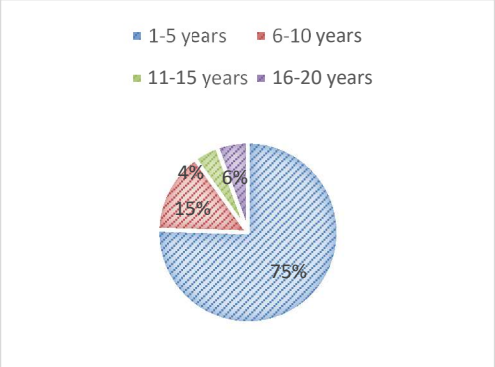


Source: Data Processed (2024)

Figure 7. Respondent Profile by Position

4) Respondent Profile Based on Length of Work

The characteristics of the respondents in this study showed that the distribution of working time of 1-5 years was 75%, respondents with a working period of 6-10 years were 15%, respondents with a working period of 16-20 years were 6%, and respondents with a working period of 11-15 years were 4%. This distribution shows that the dominance of the young workforce in terms of work experience, which has the potential to bring new dynamics to the work environment, although it requires attention to long-term development and retention.



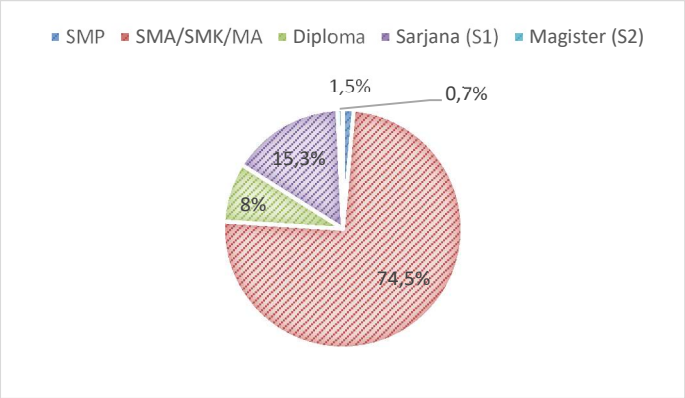
Source: Data Processed (2024)

Figure 8. Respondent Profile Based on Length of Work

5) Respondent Profile Based on Last Education

The characteristics of the respondents in this study showed that the last education of SMA/SMK/MA was 307 people (74.5%), the group with

Bachelor education (S1) amounted to 63 people (15.3%), Diploma amounted to 33 people (8%), respondents with junior high school education amounted to 6 people (1.5%) and Master's Degree (S2) amounted to 3 people (0.7%). This distribution shows that workers with a high school/vocational/MA education background make up most of the operational workforce. This reflects that this type of work in the company is likely to require both practical and technical skills. The group with Bachelor's education (S1) shows that there are a number of workers who occupy managerial or administrative positions, where higher education is more needed. Meanwhile, the Diploma education group reflects the existence of workers who have specific skills in a particular field, which is relevant to the needs of the company.



Source: Data Processed (2024)
Figure 9. Respondent Profile Based on Last Education

Analysis and Research Results

1. Descriptive Statistical Analysis

Descriptive statistical analysis aims to provide a detailed picture of the research data used. In this study, the psychological capital variable had an average of 4.211, indicating that the respondents had a good level of psychological capital, which included elements such as optimism, resilience, hope, and efficacy. The second variable is occupational safety behavior, with a value of 4,050 indicating that most respondents show compliance and positive behavior in implementing occupational safety.

Meanwhile, safety culture has a lower average of 3,886 which indicates that there is room for improvement in aspects of safety culture in the work environment, as can be seen in the following table:

Table 1. Descriptive Statistics of Safety Behavior Variables (Y)

Variable	Average
Safety Behavior	4,050
Safety Culture	3,886
Psychological Capital	4,211

Source: Data Processed (2024)

2. Outer Model Analysis Testing

Outer model analysis testing of the structural model is carried out to test the hypothesis proposed. The evaluation of the structural model was carried out by looking at the R-Square value and conducting a hypothesis test.

R-Square

Table 2. R-Square Results

	Psychological Capital	**Safety Behavior**
R-Squared	0,649	0,258
Adj. R-Squared	0,648	0,254

Source: Data Processed (2024)

Based on the table above, it can be seen that the R-Squared value of the Psychological Capital variable is 64.9% (0.649) of variation in the variable can be explained by safety culture, while the remaining 35.1% is explained by other factors that are not included in the study.

The Adj. R-Squared value on the Psychological Capital variable of 0.648 showed almost the same results, which indicates that the model used in this study is quite good at explaining the variation in these variables.

The R-Squared value of the Safety Behavior variable was 25.8% (0.258), the variation in these variables could be explained by Safety Culture and Psychological Capital, while the remaining 74.2% was explained by other variables that were not included in the study.

The Adj. R-Squared value of the Safety Behavior variable of 0.254 showed similar results, indicating that although this model explains some of the variation in the Y variable, most of the variation is still influenced by other factors that were not measured in this study.

Model Fit and Quality Index

The fit model and the quality of the index are used to assess the feasibility of the model built by the researcher. This measurement is important to know whether the research model is appropriate and can be used to test the hypothesis that has been formulated.

The following is presented the results of the Fit Model and Index Quality measurements

Table 3. Fit Model Results and Index Quality

No.	Fit Model Results and Index Quality	Fit Criteria	Result
1.	Average Path Coefficients (APC)	Accepted if p < 0.05	< 0,001
2.	Average R-squared (ARS)	Accepted if p < 0.05	< 0,001
3.	Average adjusted R-squared (AARS)	Accepted if p < 0.05	< 0,001
4.	Average block VIF (AVIF)	Accepted if p ≤ 5	2,437
5.	Average full collinearuty (VIF)	Accepted if p ≤ 5	2,339
6.	Tenenhaus GoF (GoF)	Small > 0.1 Medium > 0.25 Big > 0.36	0,515
7.	Symphson's Paradox ratio	Accepted if ≥ 0.7	1,000
8.	R squared contribution ratio	Accepted if ≥ 0.9	1,000
9.	Statistical suppression ratio	Accepted if ≥ 0.7	1,000
10.	Nonlinear bi-variate causality direction ratio (NLBCDR)	Accepted if ≥ 0.7	1,000

Source: Data processed (2024)

1. APC is the mean of the path coefficients in the model. The APC value indicates the strength of the relationship between variables in the model. The P value < 0.001 indicates that the path coefficient is statistically significant.
2. ARS is the average of the R-squared values of all dependent variables in the model. The R-squared value indicates the extent to which variations in dependent variables can be explained by independent variables. An ARS of 0.453 indicates that 45.3% of the variation of dependent variables can be explained by the model, and a P value < 0.001 indicates its statistical significance.
3. AARS is an average of R-squared values that have been adjusted to account for the number of predictors in the model. A slightly lower value than the ARS (0.451) indicates that the model is quite good, with a correction for the complexity of the model.
4. AVIF is the average of the Variance Inflation Factor (VIF) for all independent variable blocks. VIF measures the colrepancies between predictors in the model. An AVIF score of < 5 is considered acceptable, but ideally < 3.3. With an AVIF value = 2.437, collinearity is still within acceptable limits.
5. AFVIF is a VIF for the entire model, which includes all independent and dependent variables. An AFVIF score of < 5 is acceptable, but ideally < 3.3. With an AFVIF value = 2.339, the collinearity is still within acceptable limits.
6. The GoF is a global measure for assessing the overall fit of a model. A GoF value of ≥ 0.1 is considered small, ≥ 0.25 is considered moderate, and ≥ 0.36

is considered large. With a value of 0.515, this indicates that the model has an excellent (large) fit.

7. SPR measures the proportion of pathways that are not affected by the Simpson paradox, which is a situation in which the relationship between an independent and dependent variable changes direction when the third variable is taken into account. An SPR value of ≥ 0.7 is acceptable, ideally 1. An SPR value = 1,000 indicates that most paths are unaffected by this paradox.
8. The RSCR measures the proportion of positive contribution to R-squared in the model. An RSCR value of ≥ 0.9 is considered good, ideally 1. The value of RSCR = 1,000 indicates an excellent contribution to R-squared in the model.
9. SSR measures the proportion of pathways that are not affected by the statistical suppression effect, where the independent variable can negatively reduce the effect of the other independent variable. An SSR value of ≥ of 0.7 is considered good, and a value of 1,000 indicates that there is no damaging suppression effect in the model.
10. NLBCDR measures the proportion of causality direction consistent with expectations in non-linear bivariate relationships. An NLBCDR value of ≥ of 0.7 is acceptable, and a value of 1,000 indicates that most causal relationships in the model are in line with the expected direction.

Hypothesis Test

1. Direct Hypothesis Test

Table 4. Direct Hypothesis Test Results

Hypothesis		Coefficient	P-values	Information
H1	Safety Culture → Safety Behavior	0,805	<0,001	Significant
H2	Safety Culture → Psychological Capital	0,390	<0,001	Significant
H3	Psychological Capital → Safety Behavior	0,142	0,002	Significant

Source: Data Processed (2024)

It is known that H1 shows that Safety Culture has a positive and significant relationship with Safety Behavior. A coefficient of 0.805 indicates a strong relationship, and a P-value of <0.001 indicates that this relationship is statistically significant.

Furthermore, H2 shows that Safety Culture also has a positive and significant relationship with Psychological Capital. A coefficient of 0.390 indicates a moderate relationship, and a P-value of <0.001 indicates that this relationship is statistically significant.

Meanwhile, H3 shows that Psychological Capital has a positive and significant relationship with Safety Behavior. A coefficient of 0.142 indicates a small but positive relationship, and a P-value of 0.002 indicates that this relationship is statistically significant.

2. Indirect Hypothesis Test (Mediation)

Table 5. Indirect Hypothesis Test (Mediation)

	Hypothesis	Coefficient	P-values	Information
H4	Safety Culture → Psychological Capital → Safety Behavior	0,115	<0,001	Significant

Source: Data Processed (2024)

Based on the table above, H4 shows that Safety Culture indirectly through Psychological Capital has a positive and significant relationship with Safety Behavior. A coefficient of 0.115 indicates a small but positive relationship, and a P-value of <0.001 indicates that this relationship is statistically significant.

Thus, based on the direct and indirect relationship test table above, it can be concluded that all the hypotheses proposed in this study are supported by data. A positive and significant relationship was found in the relationship between Safety Culture and Safety Behavior through Psychological Capital. All supporting hypothesis suggest that these relationships have strong statistical significance.

DISCUSSION

Hypothesis 1 of this study is that safety culture has a positive effect on the occupational safety behavior of coal mine workers. The test results showed that there was a positive and significant relationship between safety culture and the work behavior of coal mine workers. This is indicated by a p-value of <0.001, which means that the relationship is statistically significant. These results show that the stronger the safety culture implemented in the work environment, the better the work behavior shown by coal mine workers.

Based on the description above, the results of this study show that a strong safety culture is an important factor in shaping positive occupational safety behaviors, especially in high-risk work environments such as coal mines. Therefore, organizations need to continue to strengthen safety culture through training, effective communication, and leadership that supports occupational safety. Based on the above description, it can be concluded that safety culture has a significant positive relationship with occupational safety behavior, and the first hypothesis is accepted.

Hypothesis 2 of this study is that safety culture has a positive effect on the psychological capital of coal mine workers. Hypothesis testing shows that there is a positive and significant relationship between safety culture and the psychological capital of coal mine workers. This is indicated by a p-value of <0.001, which means that the relationship is statistically significant. These results show that the stronger the safety culture implemented in the work environment, the better the psychological capital of coal mine workers.

Thus, the implementation of a good safety culture has a positive impact on the psychological condition of workers, which contributes to increased

productivity and overall well-being. Based on the above description, it can be concluded that safety culture has a significant positive relationship with psychological capital, and the second hypothesis is accepted.

The 3 hypotheses of this study are that psychological capital has a positive effect on the occupational safety behavior of coal mine workers. Hypothesis testing shows that there is a positive and significant relationship between psychological capital and the safety behavior of coal mine workers. This is indicated by a p-value of 0.002, which means that the relationship is very statistically significant. These results show that the stronger the psychological capital applied in the work environment, the better the safety behavior shown by coal mine workers. In other words, workers who have strong psychological capital tend to be more motivated to maintain the safety of themselves and colleagues, so that the risk of work accidents can be minimized.

Based on the above description, it can be concluded that psychological capital has a significant positive relationship with occupational safety behavior, and the third hypothesis is accepted.

The 4 hypotheses of this study are that psychological capital is able to mediate the positive relationship between safety culture and occupational safety behavior of coal mine workers. Hypothesis testing shows that safety culture has a positive and significant relationship with the occupational safety behavior of coal mine workers mediated by psychological capital. This result is indicated by a p-value of <0.001, which indicates that this relationship is statistically significant. The results of this study confirm that a strong safety culture not only directly affects occupational safety behavior, but also has an indirect impact through increasing workers' psychological capital. Psychological capital, which includes optimism, hope, self-efficacy, and resilience, plays a mediating role that strengthens the relationship between safety culture and occupational safety behavior. In other words, a good safety culture encourages the development of workers' psychological capital, which then motivates them to demonstrate better occupational safety behaviors.

Based on the above description, it can be concluded that the safety culture with the work safety behavior of coal mine workers mediated by psychological capital, and the fourth hypothesis is accepted

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of data processing and discussion that have been explained above, the conclusions that can be drawn include:

1. There is a positive relationship between safety culture and the occupational safety behavior of coal mine workers. The results showed a significant relationship with a p-value of <0.001. This indicates that a strong safety culture directly influences occupational safety behavior.
2. There is a positive relationship between safety culture and the psychological capital of coal mine workers. This relationship was also significant with a p-value of <0.001, indicating that a good safety culture was able to increase workers' psychological capital.
3. There is a positive relationship between psychological capital and the occupational safety behavior of coal mine workers. The results showed that

there was a significant relationship with a p-value of 0.002, indicating that psychological capital plays an important role in influencing occupational safety behavior. Workers with strong psychological capital are more disciplined and motivated to maintain the safety of themselves and their colleagues, thereby reducing the risk of accidents..

ACKNOWLEDGMENT

Alhamdulillah praise be to Allah Subhanahuwata'ala with gratitude to His divine will, blessings and favors, so that researcher successfully complete this study. The researchers acknowledge that that the completion of this research was made possible through the collective prayers, assistance, support, encouragement and motivation from diverse components.

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