THE EFFECT OF FARMING RISK PERCEPTION AND MITIGATION STRATEGIES ON RICE FARMING PERFORMANCE IN TEBAS DISTRICT

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Abstract

Background: Rice farming in Tebas District faces various risks, such as drought, pest/disease attacks (blasts and fungal diseases), and price fluctuations that threaten farmers' productivity and income. Therefore, mitigation strategies are implemented to overcome these risks. However, the performance of farming, such as productivity, still fluctuates.
Purpose: This study aimed to analyze the influence of farming risk perception and mitigation strategies on rice farming performance in Tebas District.
Design/methodology/approach: Data were collected through interviews and questionnaires from September to October 2025, involving 91 respondents. The data were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS 3.0 software. The variables studied included risk perception (X1), benefits of mitigation strategies (X2), and farming performance (Y).
Findings/Results: The results show that risk perception encourages farmers to implement risk mitigation strategies. However, risk perception does not directly improve farming performance. In contrast, risk mitigation strategies have proven to play an important role in increasing the productivity and efficiency of rice farming. These findings show that improvements in farming performance are more influenced by mitigation actions taken by farmers than by the perception of risk itself.
Conclusion: The performance of rice farming in Tebas District is determined more by the implementation of effective mitigation strategies than by the perception of farmers' risks. Mitigation strategies act as full mediation variables that transform risk awareness into actual performance improvements. This study contributes to enriching the study of agricultural risk management by showing that the improvement of farming performance does not occur directly through risk perception, but through the application of adaptive mitigation strategies.
Originality/value (State of the art): This study confirms the mediating role of mitigation strategies using the SEM-PLS approach in the context of rice farming on risk-prone rainfed land. In practical terms, these findings imply that extension programs not only build risk awareness but also equip farmers with technical skills to implement adaptive mitigation strategies.

Keywords: risk perception, mitigation strategy, farming performance, sem-pls, rice

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INTRODUCTION

Agriculture, especially rice farming, is a vital sector in the Indonesian economy, as evidenced by its contribution of approximately 12.66% to the national GDP (BPS Indonesia, 2025). However, the sector faces high vulnerability to various risks, both natural, such as floods, droughts, pest/disease attacks, and economic risks, such as fluctuations in input and output prices. Data from the Central Statistics Agency in 2024 noted that the three main problems faced by farmers are pest/disease attacks (55.03%), difficulties in accessing agricultural inputs (46.39%), and natural factors (41.38%) (BPS Indonesia, 2024). In West Kalimantan, rice production experienced significant fluctuations during the 2020-2024 period, with the highest production of 778,170.36 tons in 2020 and 700,290.80 tons in 2023 (BPS Provinsi Kalimantan Barat, 2024). These fluctuations are more influenced by changes in crop area than by productivity, which is relatively stable in the range of 30-32 ku/ha. As the main rice-producing area in West Kalimantan, Sambas Regency has a harvest area of 64,122.30 ha in 2024, but has a relatively low productivity of 30.45 ku/ha and is vulnerable to floods and droughts, which cause a decrease in productivity and require government intervention in the form of seed assistance (BPSIP Kalimantan Barat (2025). In addition, among farmers, the price of grain has also experienced significant fluctuations, ranging from Rp 5,000-7,000 per kg in a year, thus increasing the uncertainty of farmers' incomes (BPS Provinsi Kalimantan Barat, 2024). Rice production data in Sambas District for the 2020-2023 period shows a trend of increasing productivity, but harvest and production areas are still fluctuating, reflecting the high risks and uncertainties in rice farming (Open Data Sambas, 2023).

These risks threaten not only productivity but also the income and sustainability of farming. Therefore, understanding farmers' perceptions of risks and the mitigation strategies they implement is important for improving resilience and farming performance (Febriansyah et al. 2021). Theoretically, the relationship between risk perception and farmer decision-making can be explained by the Prospect Theory proposed by Kahneman and Tversky (1979). This theory states that individuals tend to make decisions based on perceptions of potential losses and gains that they may face rather than on actual objective conditions. In the context of rice farming, farmers who have a high perception of production risks, such as drought, pest and disease attacks, and price fluctuations, will be more motivated to take actions that can reduce potential losses. Therefore, risk perception is an important factor that influences farmers' behavior in determining farming risk management strategies. In addition, the relationship between risk perception and the implementation of mitigation strategies can be explained through Protection Motivation Theory (PMT), proposed by Rogers (1975). PMT explains that individuals will be motivated to take protective measures if they view a threat as serious and believe that the actions taken can reduce its impact. In farming activities, farmers who are aware of the high production risk tend to implement various mitigation strategies, such as adjusting planting times, controlling plant pest organisms, using superior varieties, and applying more adaptive cultivation technologies. In addition, the Expected Utility Theory (EUT), developed by von Neumann et al. (1944), assumes that individuals are rational decision-makers who choose between various alternatives by maximizing the expected utility (satisfaction or benefit). In the context of agriculture, EUT describes farmer behavior as the process of comparing the costs and benefits of various management strategies. Farmers adopt mitigation strategies, such as adjusting planting times or using pest-resistant varieties, if they perceive that the expected benefits of such strategies (e.g., increased yields or income stability) outweigh the costs incurred (e.g., input or labor costs).

Based on these three theories, it can be understood that risk perception does not directly result in an increase in farming performance but first influences farmers' decisions to implement risk mitigation strategies. Strategies that are implemented effectively have the potential to increase the productivity and efficiency of farming, thereby improving the performance of farming as a whole. Therefore, this study examines the influence of risk perception on farming performance by considering the role of risk mitigation strategies as a mediating variable in rice farming in Tebas District.

The ideal condition for rice farming in Tebas District is that farmers are able to achieve stable productivity despite their exposure to drought, pests, disease attacks, and price fluctuations. However, Field findings indicate that rice productivity continues to fluctuate significantly despite farmers' high perception of risk. This indicates a gap between risk awareness and actual farming performance, suggesting that risk perception alone is insufficient to improve farming performance without appropriate mitigation strategies. This problem is particularly relevant for small-scale farmers, as 72% of the respondents manage less than 0.5 hectares of land. Therefore, examining the role of mitigation in understanding how risk perception can be translated into improved farming performance is important.

Previous research has separately examined many risk aspects, mitigation strategies, and rice farming performance. Previous studies have examined agricultural risk, mitigation strategies, and rice farming performance from various perspectives. Hikarim et al. (2022) examined the risk in rice farming, while Lawolo and Waruwu (2022) analyzed risk and risk management in rice farming in Gido District, Nias Regency, North Sumatra Province. Maliano et al. (2022) examined the performance of rainfed rice farming in Sungai Kakap District, Kubu Raya Regency, but did not integrate risk perception and mitigation strategies into anlysis. Komarek et al. (2020) provided a comprehensive review of agricultural risk but did not empirically examine the mediating mechanism linking risk perception and farming performance. Nugraha and Heryanto (2024), Ni and Aris Sasongko (2025), and Pertama et al. (2024) discussed climate-smart agriculture and climate adaptation strategies but did not specifically examine the mediating role of mitigation strategies in linking risk perception to farming performance.

Previous studies have generally examined one or two aspects of the relationship between risk perception, mitigation strategies, and farming performance. Consequently, empirical evidence on how risk perception is translated into farming performance through mitigation strategies remains limited. None of the previous studies have comprehensively addressed the simultaneous relationship between risk perception, mitigation strategies, and performance within a single structural analysis framework. Research specifically examining the relationship among risk perception, mitigation strategies, and farming performance in Tebas District of Sambas Regency remains limited. Although previous studies have examined agricultural risk, mitigation strategies, and farming performance, most have focused on only one or two aspects of these relationships. Consequently, empirical evidence on how risk perception translates into farming performance through mitigation strategies remains limited. Research specifically examining these relationships in Tebas District, Sambas Regency, is also limited. Therefore, this study addresses this gap by simultaneously examining the relationships among risk perception, mitigation strategies, and farming performance and by assessing the mediating role of mitigation strategies using SEM-PLS.

Field findings indicate that rice productivity continues to fluctuate significantly despite farmers' high perception of risk. This indicates a gap between awareness and actual farming performance, suggesting that risk perception alone is insufficient to improve farming performance without appropriate mitigation strategies. The impact of this gap is that small-scale farmers (72% who own less than 0.5 hectares of land) continue to suffer losses due to crop failure, while local governments have to allocate seed aid budgets annually due to unstable production. This problem is specific and measurable; therefore, it can be researched using the SEM-PLS method on 91 rice farmers in Tebas District Thus, the novelty of this study lies in: (1) the integrity of three main variables (risk perception, mitigation strategy, and farming performance) in one structural analysis model; (2) testing the mediating role of mitigation strategies in the relationship between risk perception and farming performance; (3) the specific context of rice farming in rainfed land in Tebas District, which is still rarely researched; and (4) the application of the SEM-PLS approach that allows simultaneous testing of causal relationships.

To address the research problem, this study was designed quantitatively using the SEM-PLS method. All primary data were collected through survey activities involving 91 rice farmers as respondents in two villages in Tebas District, Sambas Regency, namely Mensere Village and Tebas Sungai Village, which were purposively selected as rice production centers with high risk levels. The research variables included risk perception (X1), benefits of mitigation strategies (X2), and farming performance (Y).

The SEM-PLS method was chosen as the primary analytical tool because of the complexity of the model, sample size, and data characteristics. This study involved a relatively complex structural model with mediating relationships that required simultaneous testing of various causal pathways. SEM-PLS is specifically designed to handle complex models with many latent variables and their indicators, making it more suitable than traditional regression techniques that cannot accommodate mediation analysis within a single framework (Wardhana, 2024). In addition, SEM-

PLS is more suitable for exploratory research aimed at developing theories and maximizing dependent variance predictions, in contrast to covariance-based SEM, which is more suitable for theoretical testing with large samples (Nasution et al. 2020; Savitri et al. 2021). Compared to alternative methods such as multiple regression analysis, SEM-PLS allows for the simultaneous testing of measurement and structural models, thus providing more comprehensive and reliable results (Savitri et al. 2021).

The second analysis was conducted in two main stages. The first stage was the testing of the measurement model (outer model), which ensured the validity and reliability of the research instrument. The second stage is structural model testing (inner model), which aims to test the causal relationship between variables and the significance of the hypothesis established by Jugiyono and Abdilah in Evi and Rachbini (2022). This approach allows researchers to observe direct and indirect influences through mediating variables.

This study aimed to analyze the influence of farming risk perception and mitigation strategies on rice farming performance in Tebas District. Thus, this study is expected to propose evidence-based recommendations for rice farmers, agricultural extension workers, and the government in designing effective risk mitigation programs to improve the resilience and performance of rice farming in risk-prone areas.

METHODS

A quantitative approach using survey techniques was applied in this study to analyze the relationship between risk perception, mitigation strategies, and rice farming performance. This approach was selected based on its ability to empirically explain the causal relationship between variables through statistical analysis procedures. The types of data collected for this study were primary and secondary data. Primary data collection was carried out through a direct interview process with respondents (Undari & Mohamad, 2024). Direct interviews were conducted with 91 rice farmers in Mensere and Tebas Sungai Villages, Tebas District, Sambas Regency. The location of the study was determined purposively because this area is known as the main rice production center in Sambas Regency and faces various significant farming risks such as floods, droughts, and pest attacks. Secondary data were obtained from the Central Statistics Agency (BPS) of West Kalimantan Province, BPS of Sambas Regency, local government reports, and relevant scientific journals and publications to support contextual analysis.

Data were collected using two main techniques: structured interviews using questionnaires and field observations. Face-to-face interviews were conducted with respondents selected using the Slovin formula from a population of 1,011 farmers. The questionnaire that became the research instrument was prepared using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). There are two types of variable classification: dependent variables (those that are affected/bound) and independent variables (those that affect/free). The questionnaire was designed to measure three main variables: risk perception (X1), benefits of mitigation strategies (X2), and farming performance (Y). The risk perception variable indicator refers to the concept of farming risk, which includes production, price, and environmental risks. The variable benefits of mitigation strategies are measured based on the application of risk management strategies in farming, while the variable of farming performance is measured using indicators of productivity, efficiency, and success of farming. The preparation of variable indicators refers to risk management theory and relevant previous studies (Sjamsir et al. 2025; Komarek et al. 2020; Nugraha & Heryanto, 2024). Observations were used to obtain a direct picture of land conditions, the application of agricultural technology, and risk mitigation practices performed by farmers.

The stages of research are carried out systematically, including: (1) problem identification and preparation of conceptual frameworks based on literature studies; (2) preparation of research instruments; (3) data collection through field surveys; (4) data processing and analysis; and (5) interpretation of results and drawing conclusions.

The Structural Equation Modeling-Partial Least Squares (SEM-PLS) method was selected as the data analysis tool, which was operated with the help of SmartPLS 3.0 software. This method was selected based on its advantages in testing the linkages between latent variables simultaneously and its flexibility in handling data that are not normally distributed (Megasari & Latif, 2022). The analysis consisted of two stages:

1. The Measurement Model Test (Outer Model) was used to test the validity and reliability of each

construct. The test procedure included three main stages. First, the convergent validity test was assessed based on the required loading factor value >0.70 and the required average variance extracted (AVE) value >0.50. Second, the discriminatory validity test was evaluated using the Fornell-Larcker criteria. All three reliability tests were measured using Croncbach's alpha (with a critical limit of > 0.60) and Composite Reliability (with a critical limit of > 0.70). (Savitri et al. 2021).

2. Structural model testing (Inner Model) was conducted to analyze the causal relationship between the latent constructs. The evaluation was performed using two main criteria. First, the determination coefficient (R-squared) is used to measure the degree of variation in endogenous variables that can be explained by exogenous variables. Second, significance testing was carried out using the bootstrapping technique at a significance level of 5% (α=0.05), where a t-statistical value of >1.96 showed a statistically significant influence.

The hypothesis in this study was formulated based on the theory of risk perception, risk management, and the framework of farmers' behavior in dealing with risks. The basis for hypothesis is the assumption that risk perception will drive the adoption of mitigation strategies and benefits from the adoption of mitigation strategies.

This will improve farming performance. The hypotheses tested were as follows:

H1: Risk perception positively affects the benefits of mitigation strategies. The basis for this hypothesis is the theory of risk perception, which states that awareness of threats encourages preventive action (Sjamsir et al. 2025).

H2: Risk perception has a direct negative effect on farming performance. The basis for this hypothesis is risk management theory, which states that unmanaged risk can decrease productivity and income (Komarek et al. 2020).

H3: The benefits of mitigation strategies positively affect farming performance. The basis for this hypothesis is research confirming that effective mitigation strategies can improve efficiency and farming yields (Nugraha and Heryanto, 2024).

The research model in this study refers to agribusiness risk management theory, which states that the perception of risk will influence farmers' decisions in adopting mitigation strategies, which in turn impacts farming performance. The framework of this study describes the causal relationship between risk perception (X1), the benefits of mitigation strategies (X2), and farming performance (Y) (Figure 1). Farmers' perceptions of risks such as floods, droughts, pest attacks, and price fluctuations affect their awareness of the importance of mitigation strategies. The mitigation strategies adopted are then felt where the benefits are really felt by farmers, which then acts as a mediating variable that transforms risk awareness into an improvement in farming performance, which is measured through productivity, efficiency, and income contribution. This framework emphasizes that the performance of farming is determined not only by risk perception but also by the implementation of appropriate mitigation strategies.

RESULTS

Respondent Characteristics

This study involved 91 rice farmers whose characteristics were analyzed in this study, randomly selected from the two villages, namely, Tebas Sungai Village and Mensere Village. The majority of respondents were women (70.3%), reflecting their significant role in rice farming activities in the region. As many as 83% of the total respondents were classified as productive age groups ranging from 15 to 64 years, while 18% were in the non-productive age category (aged >64 years). The respondents' level of formal education was generally low, with 52.7% completing only basic education (elementary/equivalent). The respondents' farming experience is quite long, with 44% having more than 20 years of experience. In addition, land tenure structures are small-scale, with 72% of respondents managing less than 0.5 hectares of land.

Evaluation of Measurement Models (Outer Model)

The validity and reliability of the research instruments were tested by evaluating the measurement model. The results of the data analysis showed that some indicators of loading factor values were below 0.7; therefore, an elimination process was carried out to meet the convergent validity criteria (Nasution et al. 2020). After elimination, the eligible indicators were as follows (Figure 2):

1. Risk Perception (X1): X1.2 (drought risk) with a loading factor value of 0.723, X1.5 (fungal attack risk) with a loading factor value of 0.782, and X1.6 (blast risk risk) with a loading factor value of 0.906.
2. Benefits of mitigation strategies (X2): X2.9 (planting time adjustment) with a loading factor value of 0.916, X2.10 (pest control) with a loading factor value of 0.921, X2.11 (disease control) with a loading factor value of 0.940, and X2.12 (weed control) with a loading factor value of 0.879.
3. Farming Performance (Y): Y1 (productivity) with a loading factor value of 0.924, Y2 (farming efficiency) with a loading factor value of 0.784.

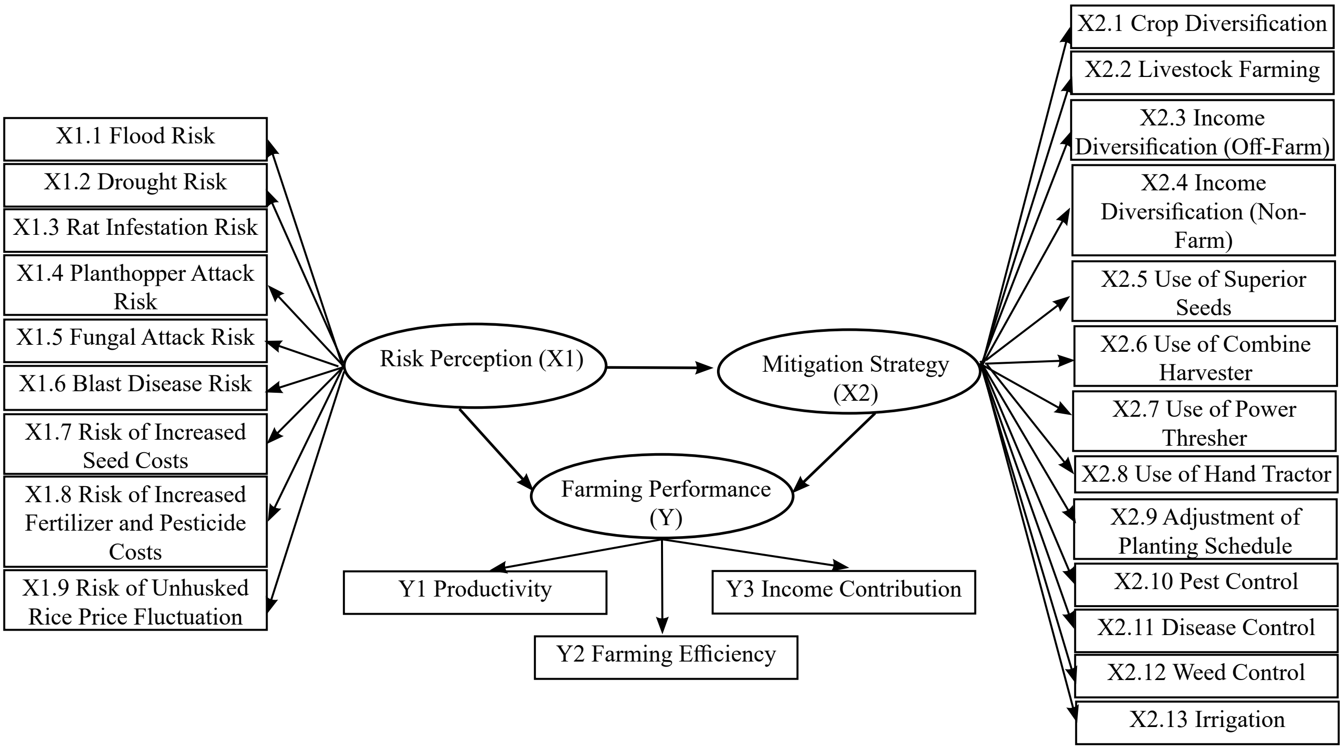

Figure 1. Framework of Thought

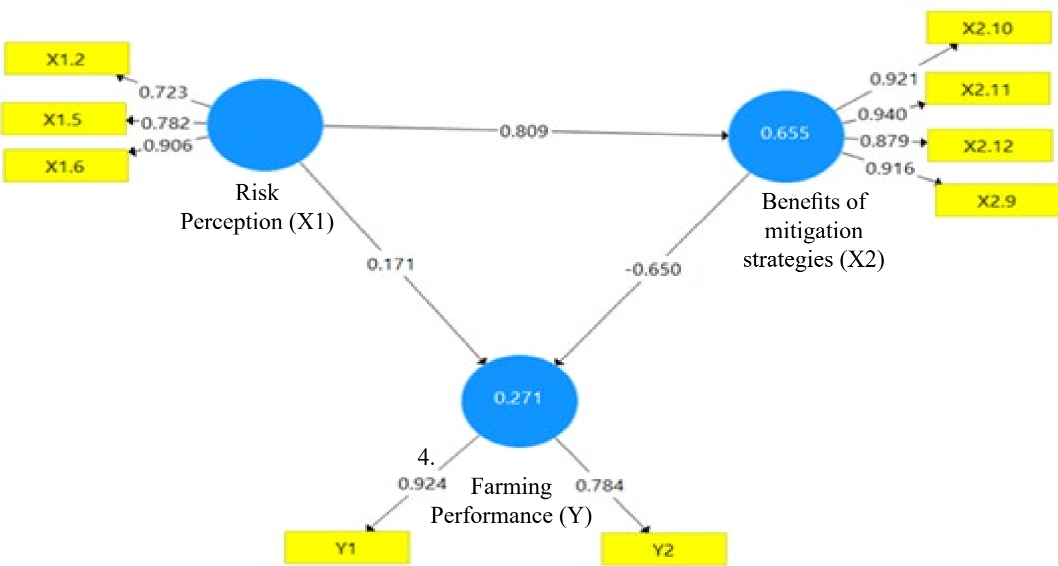

Figure 2. Model after elimination

In the following stage, the evaluation of discriminatory validity was carried out with reference to the Fornell-Larcker standard. The results of the analysis show that the root of the AVE value of each construct exceeds the correlation of the construct with other constructs, which indicates the fulfillment of the conditions of validity. Results of the discriminant validity test with fornell larcker criteria for risk perception variables, benefits of mitigation strategies, and farming performance in Table 1.

Furthermore, the average variance extracted (AVE) value of each construct was above 0.5 (X1= 0.652; X2= 0.836; Y= 0.734)(Table 2), which indicates that the variance extracted by each construct is adequate. A construct is declared reliable if the composite reliability and Cronbach's alpha values exceed the set threshold, that is, >0.70 for composite reliability and >0.60 for Cronchbach's alpha (Savitri et al. 2021). The results of the reliability test indicated that all constructs obtained Croncbach's alpha and Composite Reliability values that exceeded the 0.60 threshold. Based on these findings, the research instrument was declared to meet the criteria for reliability and internal consistency.

Evaluation of Structural Models (Inner Model)

The structural model was evaluated by observing the R-squared value (R^2) to measure the predictive strength of the model (Wardhana, 2024). The results of the analysis showed that the Mitigation Strategy Benefit variable (X2) had an R^2 of 0.655, which means that 65.5% of the variation in the mitigation strategy benefits could be explained by the moderate variables. The Farming Performance Variable (Y) has an R^2 of 0.271, which means that the variation in farming performance can be explained by the variables Risk Perception (X1) and Mitigation Strategy Benefit (X2) by 27.1%. This value is included in the weak category, indicating that other factors outside the model affect farming performance.

Hypothesis Testing

The bootstrapping method was used as a hypothesis test tool to produce t-statistics and p-values. The testing criteria used a significance level of 5% (α=0.05), with a t-statistical value of >1.96 indicating a significant influence Savitri et al. (2021).

Table 1. Results of the discriminant validity test with fornell larcker criteria for risk perception variables, benefits of mitigation strategies, and farming performance

	Farming Performance	Benefits of Mitigation Strategies	Risk Perception
Farming Performance	0.857		
Benefits of Mitigation Strategies	-0.511	0.914	
Risk Perception	-0.354	0.809	0.807

Table 2. Results of validity tests (loading factor and AVE) and reliability tests (croncbach's alpha and composite reliability) on risk perception measurement models, mitigation strategy benefits, and farming performance

Construct	Item	Loading Factor	AVE	Cronbach's Alpha	Composite Reliability	Description
Risk Perception	X1.2	0.723	0.652	0.740	0.848	Valid and Reliable
	X1.5	0.782				
	X1.6	0.906				
Benefits of Mitigation Strategies	X2.9	0.916	0.836	0.935	0.942	Valid and Reliable
	X2.10	0.921				
	X2.11	0.940				
	X2.12	0.879				
Farming Performance	Y1	0.924	0.734	0.655	0.759	Valid and Reliable
	Y2	0.784				

Hypothesis 1 (H1): Risk Perception (X1) has a positive and significant effect on the Benefits of Mitigation Strategy (X2). This result is supported by a t-statistical value of 30,928 (>1.96) and a p-value of 0.000 (0.05) (Table 3). Thus, the higher the perception of the risks of farmers, the higher their confidence in the benefits of the mitigation strategies.

Hypothesis 2 (H2): Risk Perception (X1) has no significant effect on Farming Performance (Y). The t-statistical value of 1.153 (1.96) and p-value of 0.249 (0.05) indicate that risk perception does not directly affect farming performance (Table 3).

Hypothesis 3 (H3): The benefits of mitigation strategies (X2) have a positive and significant effect on the performance of farming (Y). The t-statistical value of 4,135 (>1.96) and p-value 0.000 (<0.05) showed that the mitigation strategy was beneficial in improving farming performance (Table 3).

The Effect of Risk Perception on the Benefits of Mitigation Strategies

The results of this study found that risk perception had a positive and significant impact on the benefits of mitigation strategies (t=30,928; p<0.05). This shows that increasing farmers' awareness of risks will be followed by an increase in their tendency to implement mitigation strategies as a beneficial action. This relationship is strengthened by the specific attachment between indicators, where the perception of drought risk encourages farmers to implement planting time adjustment strategies and weed control as an adaptive effort to address water scarcity conditions. Similarly, perceptions of the risk of fungal and blast disease attacks increase farmers' confidence in the benefits of disease control and pest control.

These findings are in line with risk management theory, which states that risk awareness will encourage individuals or business actors to take mitigation measures as a form of response to the threats faced (Sjamsir et al. 2025). In the context of rice farming in the Tebas District, farmers with a high perception of the risk of drought, fungal attacks, and blast disease tend to be more proactive in implementing mitigation strategies, such as adjusting planting times, pest control, and weed control. In addition, PMT proposed by Rogers (1975) was integrated into this research, which explains that individuals are motivated to protect themselves from threats through two main cognitive assessments. First, threat appraisal involves an individual's perception of the severity of the threat and their vulnerability to it. In the context of this study, farmers who perceive the risk of drought, fungal infestation, and blast disease as serious threats will experience increased awareness of the need for protective measures. In addition, von Neumann et al. (1944) also strengthens the understanding of these mechanisms. EUT states that individuals are rational decision-makers who choose alternatives by maximizing expected utility (benefits). In this context, farmers will adopt mitigation strategies if they perceive that the expected benefits of such strategies outweigh the costs incurred by them. The results of the study showed that farmers in Tebas District had a strong belief that the benefits of mitigation strategies outweighed the costs incurred; therefore, they were motivated to adopt them.

Table 3. Results of hypothesis testing the direct influence between risk perception, mitigation strategy benefits, and farming performance based on t-statistical and p-value values at a significance level of 5%

Hypothesis	T-statistic	p-value	Verdict
H1: Risk Perception (X1)→ The benefits of mitigation strategies (X2) (Positive)	30.928	0.000	Accepted
H2: Risk Perception (X1)→ Farming Performance (Y) (Negative)	1.153	0.249	Rejected
H3: The benefits of mitigation strategies (X2)→Farming Performance (Y) (Positive)	4.135	0.000	Accepted

These results are also in line with the research of Lawolo and Waruwu (2022), who found that the identification of production and market risks encourages farmers to implement risk management, such as irrigation improvements and price surveys. However, there are significant contextual differences between these two studies. Lawolo and Warawu conducted research in the Gido District, Nias Regency, North Sumatra Province, which has a dryland agricultural system and hilly topography. This research was conducted in Tebas District, Sambas Regency, West Kalimantan, which has an agricultural system of rainfed land in lowlands with peatland and swamp characteristics. These differences in agricultural systems affect the dominant types of risks and the relevant mitigation strategies. In Nias, the main risks are erosion and water limitation, while in Tebas, the high perception of the risk of drought in the dry season, the risk of fungal attacks, and the risk of blast attacks are the main drivers for farmers to proactively seek and experience a productive cycle of vigilance where risk awareness does not stop at mere concern, but is followed up with concrete actions. Lowolo and Warawu (2022) used a quantitative descriptive analysis approach with frequency tabulation, while this study used SEM-PLS, which allows testing the causal relationship between variables simultaneously. The SEM-PLS approach provides an advantage in uncovering more complex relationship mechanisms, such as how risk perception indirectly affects performance through the adoption of mitigation strategies.

This research also supports the findings of Pramono and Romdon (2022) that adaptation to climate change can be carried out by adjusting planting times and planting patterns to rainfall conditions. However, Pramono and Romdon (2022) focused more on the technical aspects of cultivation without examining the psychological aspects of risk perception. This research complements the findings of Handayani and Abadi (2023) by showing that the adoption of such technical strategies is driven by a strong perception of risk and a belief in the benefits of the strategy. In addition, the results of this study reinforce the statement that farmers' negative perception of disease attacks causes less than optimal implementation of integrated pest control; therefore, it is necessary to increase awareness of the importance of disease control. However, Pramono and Romdon (2022) conducted peeling in Bekasi Regency, West Java, an area with an intensive agricultural system and better access to technology, while in Tebas, farmers' access to information technology is still limited. This difference in context explains why the increased risk perception in Tebas must be followed by strengthening technical capacity and access to resources.

The novelty of these findings lies in the identification of specific relationships between specific types of risks and selected mitigation strategies, where drought risk specifically drives planting time adjustments and weed control, while disease risk drives integrated pest and disease control. This specific relationship has not been widely revealed in previous research, which tends to discuss risk in general.

However, in contrast to the results of the research from Pranata (2025), where it is stated that risk perception does not always correlate positively with the adoption of mitigation strategies due to limited access to information and capital. This difference is suspected to be due to the characteristics of farmers in Tebas District, who have long farming experience (44% have more than 20 years of experience); therefore, they are better able to associate risk with the right mitigation strategy. Thus, farming experience acts as a moderating factor that increases the strength of the relationship. between the perception of risk and the benefits of mitigation strategies. The results of this study show that risk perception not only increases awareness but also strengthens farmers' confidence in the benefits of mitigation strategies implemented in the local context of Tebas District.

The Effect of Risk Perception on Farming Performance

The results indicate that risk perception does not significantly influence farming performance. Conceptually, these findings reflect a gap between perception and action, where farmers with high-risk awareness are not necessarily able to implement effective strategies to improve farming performance. These findings indicate that mitigation strategies play a role as a full mediating variable in the relationship between risk perception and farming performance. This condition can be caused by limited access to capital, technology, and information owned by farmers. These findings indicate that although farmers are aware of various risk threats, this awareness does not necessarily increase productivity or efficiency of farming without the implementation of appropriate mitigation strategies, but it is not enough to achieve optimal farming performance (Komarek et al. 2020). This finding is in line with PMT, which states that threat appraisal must be accompanied by countermeasures to produce protection results. In this context, risk perception (threat assessment) alone is not enough; farmers must also have confidence that mitigation strategies are effective and can be implemented. Without a positive assessment of coping skills, risk perception remains only cognitive awareness with no behavioral consequences.

The results of this study are consistent with the research conducted by Puspitasari et al. (2022), who stated that high income risk does not directly cause a decrease in farming performance but is responded to with various mitigation efforts. Nevertheless, there are significant differences in the approaches of the two studies. Puspitasari et al. (2022) used a risk analysis approach based on the value of the income variation coefficient to measure objective risk, whereas this study used an approach to measure farmers' subjective risk perception using a Likert scale. Puspitasari et al. (2022) showed that objective risk does not automatically decrease performance, whereas this study shows that the subjective perception of risk also does not directly affect performance. Both indicate that there is a variable that mediates the risk-performance relationship. Therefore, it can be concluded based on the above explanation that risk perception plays more of a role as a driving factor for the adoption of mitigation strategies, not as a direct determinant of farming performance.

However, this finding is different from the results of Hikarim et al. (2022), who found that production risk has a direct negative influence on the income of paddy rice farming. This difference occurs because Hikarim et al. (2022) measured objective risk realization (such as loss of actual yield), whereas this study measured farmers' subjective perception of risk. Farmers who perceive high risk may be more vigilant and try harder, so that the negative effects are not directly visible. This means that a high-risk perception can trigger preventive behaviors that ultimately protect farming performance. This study provides an empirical contribution by showing that in the context of farmers in Tebas District, risk perception is an important initial factor but not the main determinant of achieving farming performance. The success of farming is determined by how the perception of risk is implemented into productive actions.

The Effect of the Benefits of Mitigation Strategies on Farming Performance

The benefits of mitigation strategies have been shown to have a positive and significant effect on farming performance. This indicates that mitigation strategies that farmers feel benefit them, such as planting time adjustments, pest control, disease control, and weed control, directly contribute to increasing productivity and farming efficiency. This relationship is reinforced by the specific linkages between indicators, where planting time adjustments directly increase productivity by ensuring that rice crops grow in optimal climatic periods. Pest and disease control contributes to increased efficiency by reducing competition for nutrients, water, and sunlight between weeds and rice plants.

These findings are supported by research by Daud Perdana et al. (2020), who suggested that the application of appropriate technologies, such as pest traps, contributes significantly to the control of plant-disrupting organisms (OPT) and increases crop yields. In addition, Nugraha and Heryanto (2024) confirmed that good farming performance reflects farmers' ability to minimize risks while optimizing production yields through effective mitigation strategies. Wihardjaka et al. (2020) also reported that adaptive technologies for rainfed rice farming, including the use of improved cropping calendars for determining planting time, water resource management, and integrated pest and disease control, can contribute to improving rice farming productivity.

The EUT of von Neumann et al. (1944) provides a robust framework for understanding these results. According to the EUT, farmers are rational decision-makers who adopt mitigation strategies if the expected benefits outweigh the costs incurred. The results of this study show that farmers in Tebas District perceive the benefits of mitigation strategies to be greater than the costs, which is reflected in the high loading factor value for all mitigation strategy indicators. The positive and significant relationship between the benefits of the farming strategy and the performance of farming indicates that the mitigation strategies implemented provide results that are in line with farmers' expectations, thus strengthening their confidence to continue adopting the strategy in the future.

These findings are consistent with Pertama et al. (2024), who concluded that climate mitigation and adaptation strategies act as a bridge linking risk awareness with improved farming performance. However, there are significant differences in their methodologies. Pertama et al. (2024) used a technical efficiency analysis approach with Stochastic Frontier Analysis (SFA), while this study uses SEM-PLS, which allows testing of causal relationships between variables simultaneously. SEM-PLS provides an advantage by revealing more complex mediation mechanisms, such as those found in this study.

The novelty of this study lies in the identification of the specific contribution of each mitigation strategy indicator to farming performance. Previous research has tended to dissect mitigation strategies in aggregate, without indicating the relative contribution of each strategy. These findings are important for designing more effective outreach programs, as they can prioritize strategies that have the greatest impact while still paying attention to other supporting strategies.

However, in contrast to the conclusions obtained by Maliano et al. (2022), who explained that the performance of rainfed rice farming in Sungai Kakap District was more influenced by external factors such as government support and irrigation access, not solely by farmer mitigation strategies. This difference can be explained by the characteristics of the research location; Tebas District has a higher level of risk (floods, droughts, and bluster) than the Kakap River, so mitigation strategies are a more critical factor in determining farming performance. The novelty of this finding lies in the empirical proof that each mitigation strategy indicator has a specific contribution to improving certain aspects of farming performance; therefore, the development of mitigation strategies needs to be carried out in an integrated and contextual manner.

The Role of Mitigation Strategies as a Mediation Variable

Based on the results of the analysis, it can be concluded that mitigation strategies act as a mediating variable that connects risk perception and farming performance. Although risk perception does not directly affect farming performance, these variables trigger the adoption of mitigation strategies that ultimately improve farming performance. Thus, the mechanism of the relationship among the three variables can be described as follows: Risk Perception→ Benefits of Mitigation Strategies→ Farming Performance.

In the first stage of this mediation mechanism, risk perception measured through drought risk indicators, fungal disease attack risk, and blast disease risk was proven to significantly affect farmers' confidence in the benefits of mitigation strategies measured through planting time adjustments, pest control, disease control, and weed control, which were proven to significantly increase productivity and farming efficiency.

The PMT provides a comprehensive explanation of this mediation mechanism. According to PMT, individuals engage in protective behaviors when they perceive a threat (threat assessment) and believe that the recommended behavior is effective (countermeasure assessment). The full mediation observed in this study shows that the assessment of countermeasures (benefits of mitigation strategies) is a critical pathway that affects behavioral outcomes (farming performance) through threats (risk perception). Without an effective counter-response, threat assessments alone do not improve performance. In addition to PMT, EUT further strengthens this interpretation by explaining that farmers' decisions to adopt perceived mitigation strategies (measured through indicators such as planting time adjustments, pest control, disease control, and weed control) represent a reduction in their utility. This assessment drives adoption decisions, which, in turn, affects farming performance. Significant indirect effects confirm that the utility of mitigation strategies is embodied in improved performance.

The results are in line Pertama et al. (2024) with the results of the study which concludes that climate mitigation and adaptation strategies act as a bridge that connects risk awareness with improving farming performance. However, Pertama et al. (2024) only identified the existence of a relationship without formally testing whether the relationship was a one-way or partial mediation. This study formally tested and confirmed that mitigation strategies act as full mediators, which is a more methodologically robust finding. Research by Ni and Sasongko (2025) also supports that the implementation of climate-smart agriculture is consistently correlated with improved farming performance, especially in terms of productivity and efficiency. However, Ni and Aris Sasongko (2025) did not test the role of mediation specifically. This study complements these findings by showing that mitigation strategies are not only correlated with performance but also structurally function as a mechanism that links risk perception with performance.

The novelty of this study's findings lies in the identification of a complete mediation mechanism that shows how risk perception is transformed into performance improvement through the implementation of mitigation strategies. This provides a theoretical implication that in agricultural risk management studies, risk perceptions cannot be viewed as direct predictors of performance but rather should be placed within a broader framework that includes farmers' behavioral responses in shaping mitigation strategies. In practical terms, these findings underscore the importance of extension programs that not only build awareness of risks but also equip farmers with the technical skills to implement mitigation strategies effectively.

However, in contrast to research that focuses more on identifying agricultural risk types, this study provides empirical evidence that mitigation strategies function as a structural mechanism linking risk awareness and performance improvement. In the context of rice farming in the Tebas District, the implementation of the right mitigation strategy is key to transforming risk awareness into real performance improvement. Komarek et al. (2020)

Managerial Implications

The results of this study provide managerial implications that emphasize the importance of an action-based approach to risk management in farming in risk-prone areas. For farmers, these findings confirm that risk awareness must be followed by concrete actions through the adoption of measurable and sustainable mitigation strategies, such as adjusting planting times to climate-based planting calendars, using pest-resistant varieties, implementing integrated pest and disease control, using appropriate technologies, and increasing productivity and efficiency. For the government and agricultural extension workers, the results of this study show the need to strengthen extension programs that provide information and practical benefits through technical training and direct assistance in the field. In addition, support for access to technology, financing, and agricultural insurance is an important factor in increasing the effectiveness of mitigation strategies, which encourages the realization of a stronger and more competitive agricultural ecosystem. Policymakers need to integrate a comprehensive risk management approach, focusing not only on increasing production but also on strengthening farmers' capacity to face risks and strengthening climate and agricultural information systems. For future research, a research model should be developed by including other variables that affect farming performance, conducting longitudinal research (time-series), expanding the scope of the research area, and increasing the number of samples. Strategically, these results can be used as a basis for formulating risk management-based agricultural policies to improve the resilience and sustainability of rice farming in risk-prone areas.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the overall results of the analysis and discussion presented, it can be concluded that risk perception in farming has a positive and significant effect on the benefits of mitigation strategies. These findings indicate that the higher the farmers' awareness of the risks of drought, fungal infestation, and blast disease, the more confident they are in the benefits of mitigation strategies such as planting time adjustment, pest control, disease control, and weed control. These results are in line with those of Lawolo and Waruwu (2022), who found that risk identification encourages farmers to implement risk management. This study also strengthens PMT and EUT in the context of agriculture, where threat and counteraction assessments together drive the adoption of mitigation strategies. However, risk perception did not have a direct effect on rice farming performance in Tebas District. These findings are consistent with those of Puspitasari et al. (2022), who stated that high income risk does not directly cause a decline in farming performance but is responded to with various mitigation efforts. Thus, risk perception plays a more important role as a driving factor for adopting mitigation strategies as a direct determinant of farming performance. These findings also support the research of Komarek et al. (2020), who noted that perceived risk does not automatically lead to performance enhancement unless followed by strategic adaptation. The benefits of mitigation strategies have a positive and significant effect on farming performance. The mitigation strategies that had the most significant effect on performance were disease control, pest control, planting time adjustment, and weed control. These findings are in line with those of Pertama et al. (2024) and Ni and Aris Sasongko (2025), who state that climate mitigation and adaptation strategies are consistently correlated with improved farming performance, especially in terms of productivity and efficiency. These results indicate that farmers' perception of farming risks alone is not sufficient to improve performance without the implementation of appropriate mitigation strategies. In contrast, the benefits of mitigation strategies significantly influence farm performance, confirming their role as a crucial mediating verability. These findings confirm that the perception of risk affects farming performance only through the implementation of mitigation strategies. This mechanism supports PMT, which states that threat assessment (risk perception) must be accompanied by countermeasure assessment (mitigation strategies) to produce protection outcomes (farming performance). Thus, it can be concluded that the mitigation strategy functions as a bridge that transforms the perception of risk into a real improvement in farming performance, where the success of rice farming in Tebas District is largely determined by the effectiveness of the mitigation strategies implemented.

Recommendations

Based on the findings of this study, several suggestions are submitted for various parties. It is advisable for farmers to actively adopt and develop mitigation strategies that have proven beneficial. For local governments and agricultural extensions, it is recommended to develop an integrated extension program that not only addresses the technical aspects of cultivation but also builds awareness and capacity among farmers in risk management. Future researchers should explore external factors outside the framework of this research model that affect farming performance and expand the scope of the research area.

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