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ANALYSIS OF FACTORS INFLUENCING RISK MANAGEMENT STRATEGY AND SUSTAINABILITY OF SMALLHOLDER OIL PALM PLANTATION BUSINESSES IN ACEH JAYA REGENCY

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Abstract

The existence of smallholder oil palm plantations has become the cause of various risks that have a negative impact on the social, economic, and environmental aspects of the community, so it is necessary to have appropriate risk management strategies and the implementation of sustainable cultivation practices to support the existence and sustainability of smallholder oil palm plantation businesses. This study aims to analyze the factors that affect the risk management strategy and sustainability of smallholder oil palm plantations in Aceh Jaya Regency. This study uses a quantitative descriptive method. The population in this study is smallholder oil palm farmers in Aceh Jaya Regency, with a sample of 100 respondents consisting of 47 oil palm farmers in Teunom District and 53 oil palm farmers in Indra Jaya District, which were taken using the multi-stage cluster random sampling method. The data was analyzed using the Structural Equation Model (SEM) method, which was analyzed using the Smart PLS 4.0 application. The results show that farmers' perceptions and risk impacts have a positive and significant effect on risk management strategy. Farmer characteristics have a negative and significant effect on sustainability. Farmer perception, and risk management strategy has a positive and significant effect on sustainability.

Keywords : ***Smallholder Oil Palm Plantations, Risks, Risk Management Strategy, Sustainability.***

1. INTRODUCTION

Palm oil is a commercial crop in the plantation industry sector that produces the largest oil source in the world and has a high selling value in the domestic and international markets. The existence of the oil palm plantation industry in Indonesia has contributed 3.5% of the total national GDP and employs more than 16 million farm workers in Indonesia. Aceh Jaya Regency is the district with the 8th largest smallholder oil palm plantation area in Aceh Province, with a plantation area of 16,504 ha in 2022, consisting of 5,360 ha of unproductive crop land (TBM), 8,152 ha of producing crop land (TM), and 2,992 ha of reconstruction crop land (TR), with a total production of 23,237 tons and a productivity of 2,850 kg/ha. (Direktorat Jenderal Perkebunan, 2024).

The existence of community oil palm plantations in Aceh Jaya Regency not only has a positive impact on improving people's welfare through increasing income and labor absorption, However, it can also pose various risks that have negative implications for the social, economic, and environmental aspects of the community. According to Santika et al., (2019), oil palm farms have a detrimental effect on the social, economic, and even environmental welfare of small villages. This is especially important because it is implied that smallholders and rural communities will benefit from oil palm plantations' social, economic, and environmental risks, but they will be the ones who bear the consequences. (Ogahara et al., 2022).

According to Dharmawan et al., (2020), from an environmental standpoint, the expansion of oil palm plantation areas has led to deforestation, biodiversity loss, higher carbon emissions, and modifications in the function of forest ecosystems, hydrology, and carbon stocks. From a social perspective, it frequently causes agrarian conflicts, land disputes, and clashes. According to Hafizuddin et al., (2024), added that negative impacts from an economic perspective can be in the form of potential losses due to unpredictable weather changes, pest and disease attacks, wildlife attacks, changes in input and output costs, volatility in selling prices, and the length of the FFB supply chain cycle from farmers, supplier agents, and processing plants (PPKS), which can affect the income level of farmers.

The selection of the right risk management strategy will be able to reduce the impact of risks and hazards that occur due to oil palm cultivation practices by farmers who only focus on taking results without paying attention to the negative impacts caused by cultivation activities on the environment, social, and economic aspects of the community because they are not limited by certain instruments, standards, and policies. Risk preferences, information availability, financial resources, and familiarity with suitable risk management instruments are some of the variables that impact farmers' decisions to implement risk management techniques. (Shukla et al., 2023). According to Chaa et al., (2023), risk management applications are affected by socio-demographic factors (farmer characteristics), risk perception, institutional support, and environmental impacts heterogeneously and significantly.

Sustainable cultivation practices that pay attention to negative impacts on the environment will be able to support the sustainability of smallholder oil palm plantation businesses. Qaim et al., (2020), stated that sustainable smallholder oil palm plantations can be achieved through capital accumulation, increased income, reduced poverty rates, increased electrification in rural areas, construction of roads and markets, and improved education services and health facilities. According to Mulyasari et al., (2023), policies that support smallholders, especially those related to productivity improvement, coaching, plantation risk management and guarantee of land ownership rights, are required in order to accomplish smallholder oil palm plantations' sustainable development. Farmers' socio-demographic characteristics, risk perception, institutional support, and risk impact are expected to influence the perspective of farmers in viewing risks and the selection of risk management strategies in order to be willing and able to carry out sustainable oil palm cultivation practices by paying attention to social, economic, and environmental aspects of the community.

2. LITERATURE REVIEW

2.1. Farmer Characteristics

Farmer characteristics are behaviors that are reflected in the way farmers think, behave, and act towards the environment (Mandang et al., 2020). The character of farmers as the main actors in farming describes characteristics that include motivation, personal traits, self-concept, level of knowledge, and skills that define excellence in farming (Hapsari et al., 2019).

2.2. Farmers' Perception

Farmer perception is a way of viewing, understanding, and subjectively assessing farmers on various indicators that affect the success of farming. Risk perception refers to how individuals connect, collect, select, and interpret signals about the impact of uncertainty from events, activities, or technologies. The probability of past and future risks, the perceived ability to prevent risks, and the severity of risks significantly affect a farmer's perception of risk. A clear understanding of risk perception by farmers is essential to getting effective support in managing risk (Osiemo et al., 2021). Farmers' perception of risk greatly influences their production, investment, and agricultural management decisions. Farmers tend to use different risk management or risk avoidance strategies to minimize the impact that occurs (Sarwar & Saeed, 2013).

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2.3. Institutional Support

Farmer institutions serve as a platform for education, an avenue for collaboration, and units that supply infrastructure and production facilities, as well as processing, marketing, and supporting service units. Participation in farmer institutions can help farmers in anticipating problems that occur in farming so that they can find solutions in preventing and overcoming them, so as to ensure that agricultural operations run as planned. (Syahza et al., 2023). Farmer institutions in villages play an important role in accelerating the socioeconomic advancement of farmers through promoting the adoption of agricultural technologies and providing access to markets, infrastructure, financing sources, and agricultural information. The existence of farmer institutions makes it easier for the government and related parties to provide support and improve farmers' capabilities (Anantanyu, 2011).

2.4. Impact of Risk

Although having an advantage over the country's economic resources, smallholder oil palm plantations can pose risks that have a negative impact on the community, especially in terms of social conflicts and environmental pollution issues. This negative impact triggered a reaction against its development in Indonesia by various parties. Various parties emphasized the importance of the sustainable development of smallholder oil palm plantations to prevent negative impacts on the community. The principles of sustainable agriculture, which include social, economic, and ecological aspects, are the basis for sustainable oil palm plantations. The application of RSPO and ISPO guidelines is a step towards achieving this goal. However, currently, sustainability criteria are still not met by many plantations, triggering problems such as haze due to land fires, child labor use, land disputes, and low levels of labor welfare (Mulyasari et al., 2023).

2.5. Risk Management Strategy

A risk management strategy is a series of actions taken to identify, measure, reduce, or eliminate the negative impact of risk. Risk management strategies aim to prevent or reduce the probability of risks or events that have the potential to cause losses. Farmers' understanding of risks is essential to being able to identify types of risks and determine appropriate risk management tools. According to Imelda et al., (2023), farmers' decisions in adopting risk management strategies depend on their physical abilities, knowledge, and financial condition. In social risks, farmers can carry out social approach strategies; in economic risks, financial approach strategies can be carried out; and environmental risks can be minimized or prevented through physical actions.

2.6. Sustainability

Sustainable agriculture is the utilization and management of agricultural ecosystems for the purpose of meeting current and future needs for economic and social functions at the local, national, and international levels by preserving biodiversity, productivity, regeneration capacity, vitality, and its ability to function by avoiding damage to other ecosystems. (Suardi et al., 2022). Wigena et al., (2018), stated that sustainable oil palm plantation development includes three dimensions, namely:1. Social sustainability includes being fair, humane, and socially and ecologically adaptable. 2). Economic sustainability means that the needs of farmers can be met. Ecological sustainability is intended so that the implementation of the governance system is able to maintain environmental quality and land productivity.

3. IMPLEMENTATION METHOD

This study was carried out in May of 2024. The object of the study is oil palm farmers in Aceh Jaya Regency. The multi-stage cluster random sampling method was used to select the research location by selecting 2 out of 9 sub-districts in Aceh Jaya Regency, namely: Teunom District and Indra Jaya District, as the research location, and then 2 villages from each of the sub-districts were selected, taking into account that the location has different or heterogeneous characteristics with the largest and smallest number of farmer populations. The population in this study amounted to 11,527 farmers, which is then calculated with a standard error rate of 10% using the Slovin formula, so that the number of farmer samples was as many as 100 respondents, as follows:

$$n = \frac{N}{1+N(e)^2}$$

$$n = \frac{11527}{1+11527\,(10\%)^2} = 99{,}9 = 100$$

Description:
n = Number of samples
N = Total population
e = Standard error

To determine the proportional allocation of the number of farmer samples in each research village cluster, the following formula can be used:

$$ni = \frac{Ni}{N} \times n$$

Description:
ni = Number of samples by cluster
Ni = Number of cluster population
N = Total population of cluster
n = Number of samples

So that the number of proportions of farmer sample allocation in each village cluster is obtained as summarized in Table 1 below:

Table 1. Population and Sample

No	Name of District	Population Characteristic	Name of Sub-District	Name of Village	Number of Population	Number of Farmer Samples
1	Aceh Jaya	Largest population	Teunom	Lueng Gayo	345	345/698 x 100 = 46
		Smallest population		Gampong Baro	5	5/698 x 100 = 1
		Largest population	Indra Jaya	Ceunampron g	376	376/698 x 100 = 51
		Smallest population		Keude Unga	12	12/698 x 100 = 2
	Amount				**698**	**100**

Source: *Primary Data (Processed), 2024.*

Primary and secondary data are used in this investigation. Primary data were collected using observation techniques and direct interviews with farmers; Secondary data were obtained from related agencies and literature studies. The data analysis in this study used Structural Equation Modeling (SEM), which is analyzed using the Smart PLS 4.0 application. The following formulation can be used to represent the structural equation model of the relationship between exogenous and endogenous variables:

$Y_1 = X_1+X_2+X_3+X_4+ .....+X_n$
$Y_2 = X_1+X_2+X_3+X_4+ .....+X_n$

4. RESULTS AND DISCUSSION

3.1 Characteristics of Oil Palm Farmers in Aceh Jaya District

Farmer characteristics are qualities or attributes possessed by a farmer and are shown through their mindset, attitude, and action toward their surroundings. The characteristics of individual farmers can be seen from their behavior in carrying out farming activities (Arita et al., 2022). The illustrations of the characteristics of oil palm farmers in this study consist of: age, education level, length of farming, land area, and number of family dependents. Based on field findings, it demonstrates that as many as 67% of oil palm farmers in Aceh Jaya Regency are in the age range of 41–55 years. Based on Labor Law No. 13 of 2003, the productive age is between 15 to 64 years old. Setiyowati et al., (2022), stated that farmers who are of productive age have better abilities in developing farming, so they have the potential to increase work productivity in managing oil palm plantations in a sustainable manner. On average, 46% of farmers take an education period of 6–9 years, which is the graduation of elementary and junior high school. This demonstrates that the level of education at the study location remains quite low. Low levels of education lead to low farmers' ability and performance in managing and developing their farming.

As many as 86% of oil palm farmers in the study site have a land area of between 1 and 2 ha. Glenday & Paol, (2015), stated that the average farming household in rural areas manages about 2 hectares of oil palm plantation land with lower crop productivity per hectare. 72% of farmers have 8–15 years of farming experience. This shows that oil palm farmers on the research site are quite experienced in managing their oil palm plantation businesses. Fangohoi et al., (2021), stated that farmers who are more experienced and supported by adequate production facilities will be better able to increase farming productivity. And as many as 60% of farmers have family dependents of 1-3 people. According to the Central Statistics Agency, families with a total number of dependents of 1-3 people are classified as small families. The following is a detailed overview of the characteristics of oil palm farmers in Aceh Jaya Regency.

Table 2 Characteristics of farmers

No	Indicators	Category	District				Total (n=100)	
			Teunom		Indra Jaya			
			n=47	Percentage	n=53	Percentage	Amount	Percentage
1	Age	>55 years	8	17,02%	4	7,55%	12	12%
		41-55 years	29	61,70%	38	71,70%	67	67%
		25-40 years	10	21,28%	11	20,75%	21	21%
2	Education Level	6-9 years	17	36,17%	29	54,72%	46	46%
		12 years	15	31,91%	12	22,64%	27	27%
		>12 years	15	31,91%	12	22,64%	27	27%
3	Land Area	<1 ha	5	10,64%	0	0%	5	5%
		1-2 ha	39	82,98%	47	88,68%	86	86%
		>2 ha	3	6,38%	6	11,32%	9	9%
4	Farming Experience	<8 years	11	23,40%	17	32,08%	28	28%
		8-15 years	36	76,60%	36	67,92%	72	72%
		16-25 years	0	0%	0	0%	0	0%
5	Number of Family Dependents	1-3 people	26	55,32%	34	64,15%	60	60%
		4-6 people	21	44,68%	19	35,85%	40	40%
		>6 people	0	0,00%	0	0,00%	0	0%

Source: *Primary Data (Processed), 2024.*

3.2 Outer Model

The outer model was tested to determine the extent to which the manifest variable (observed variable) represented the latent variable (Ghozali and Latan 2015). The outer model is evaluated to confirm that the measurement model's variables are valid and reliable. The outer model is evaluated using Smart PLS 4.0 in three stages: convergent validity, composite reliability, and discriminant validity analysis, as shown below.

1. Convergent Validity

Convergent validity tests are used to assess the validity of correlations between indicators and their constructions, or latent variables. The convergence validity test can be seen from the loading factor value on each construction indicator. A loading factor value of > 0.7 is ideal and indicates that the indicator is accurate in assessing construction. This value is the percentage by which construction can explain the variance in the indicator (Haryono, 2017). The research model is considered valid if the loading factor value is > 0.6. However, as long as the model is still in the development stage, the loading factor value of 0.5 to 0.6 is still acceptable (valid) (Ghozali & Latan, 2015). In this study, the criteria for factor loading value > 6 were used. Variable indicators with a factor loading value of < 6 will be dropped from the model. The following is a comparison of the loading factor values before and after being dropped out of the model:

Table 3 Comparison of loading factor values before and after invalid indicators in drop out of the model

Variables	Indicators	Loading Factor Value		Description
		Before Drop Out	After Drop Out	
Characteristics of farmer (X1)	X1.1	0,609	0,704	Valid
	X1.2	0,961	0,965	Valid
	X1.3	0,030		Invalid
	X1.4	-0,263		Invalid
	X1.5	-0,327		Invalid
Farmers' perception (X2)	X2.1	0,795	0,793	Valid
	X2.2	0,976	0,977	Valid
Institutional support (X3)	X3.1	0,784	0,790	Valid
	X3.2	0,934	0,931	Valid
Impact of risk (X4)	X4.1	0,825	0,824	Valid
	X4.2	0,727	0,721	Valid
	X4.3	0,831	0,835	Valid
Risk management strategy (Y1)	Y1.1	0,828	0,830	Valid
	Y1.2	0,217		Invalid
	Y1.3	0,860	0,860	Valid
Sustainability (Y2)	Y2.1	0,898	0,934	Valid
	Y2.2	0,936	0,927	Valid
	Y2.3	0,582		Invalid

Source: *Primary Data (Processed), 2024*

2. Reliability Test (Composite Reliability, Cronbach's Alpha and Average Variance Extracted (AVE))

Reliability tests were carried out to determine the accuracy, consistency, and precision of measuring instruments used to measure data (Hair. et al., 2014). The reliability of the construction can be assessed using composite realibility and Cronbach alpha values. A construction is considered valid if the composite reliability value is > 0.7 and the recommended Cronbach alpha value is > 0.6. (Ghozali, 2014), and the average variance extracted (AVE) value is > 0.5 (Ghozali, 2013). The composite reliability value between 0.6-0.7 indicates good reliability (Ghozali 2021).

Table 4 Realibility values (Composite Reliability Cronbach's Alpha and Average Variance Extracted (AVE))

Variabel	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Characteristics of farmer (X1)	0.660	0.829	0.713
Farmers' perception (X2)	0.784	0.882	0.791
Institutional support (X3)	0.677	0.853	0.745
Risk Impact (X4)	0.721	0.837	0.632
Risk management strategy(Y1)	0.600	0.833	0.714
Sustainaility (Y2)	0.846	0.928	0.866

Source: *Primary Data (Processed), 2024.*

Table 4 shows that the composite reliability and Cronbach alpha values of each variable range from 0.6 to 0.7 or higher, with the Y1 variable having the lowest Cronbach's alpha value of 0.6. According to Sugiyono, (2013), the variable instrument of the study with a Cronbach alpha value of 0.6 or higher can be considered reliable, and each variable in the construction has an average value of extraction variance (AVE) of > 0.5, indicating that the entire variable construction is reliable, so that they have the potential to produce stable and consistent results in measuring the construct.

3. Validity Test (Discriminant Validity)

Discriminant validity testing can be done by looking at cross-loading values and the Fornell-Larcker criterion. The evaluation of the validity of discrimination with the cross-loading value can be said to be good if it has an indicator value of each construction higher than the indicator value of other constructs, while a test with the Fornell-Larcker criterion can be said to be good if the root value of AVE is greater than the correlation of the construction with other latent variables. (Sekaran & Bougie, 2016).

Table 5 Discriminant Validity Based on the Fornell-Larcker Criterion

Variables	X1	X2	X3	X4	Y1	Y2	Description
Characteristics of farmer (X1)	0.845						Valid
Farmers' perception (X2)	0.245	0.890					Valid
Institutional support (X3)	0.303	0.276	0.863				Valid
Risk Impact (X4)	0.312	-0.107	0.202	0.795			Valid
Risk management strategy (Y1)	0.222	0.420	0.270	0.169	0.845		Valid
Sustainability (Y2)	0.279	0.029	0.250	0.192	0.352	0.931	Valid

Source: *Primary Data (Processed), 2024.*

According to the results of the discrimination validity test using the Fornell-Larcker criterion, the correlation between the variable and other variables is greater than the size of the latent variable itself. This shows that the requirements for the validity value of discrimination have been met and are acceptable.

3.3 Inner Model

The inner model is a structural model used to forecast causality linkages (cause and effect correlations) between latent variables or variables that are not directly assessed. The inner model can be evaluated by looking at the value of the determination coefficient (R-square) in the endogenous construct and the estimation of path coefficients, which is carried out through the bootstrapping test procedure.

1. Determinant Coefficients (R-square)

The coefficient of determination (R-squared) is a value that shows how much the independent (exogenous) variable affects the dependent variable (endogenous). The value of R-square represents the amount of variance in the construction described by the model. The higher the R-square value, the more powerful it will be in explaining the PLS structural model, so the better the prediction of endogenous construction.(Hair. et al., 2014). Chin, (1998), stated that the R-square value consists of three criteria: 0.67 for the strong category, 0.33 for the moderate category, and 0.19 for the weak category.

Table 6 Determination Coefficient Value (R-square)

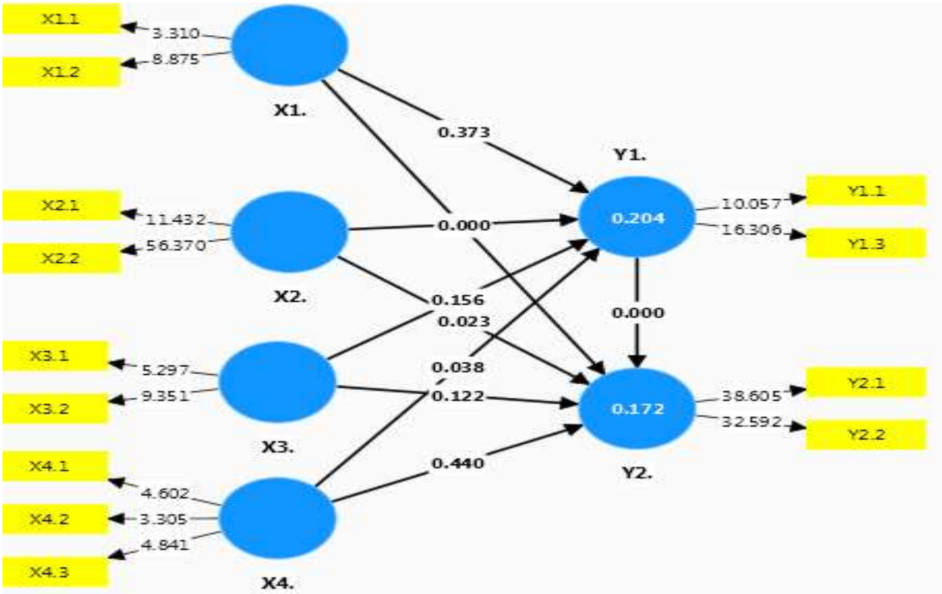
Variables	*R-Square*	*R-Square Adjusted*
Risk mananagement strategy (Y1)	0.236	0.204
Sustainability (Y2)	0.214	0.172

Source: *Primary Data (Processed), 2024.*

Table 6 shows the value of the determination coefficient (R-square) in the endogenous variable construct of the risk management strategy (Y1) is 0.236. This shows that the variables of farmer characteristics (X1), farmer perception (X2), institutional support (X3), and risk impact (X4) are able to explain the risk management strategy construct variable (Y1) of 23.6%, and the remaining 76.4% are contributions from external variables outside this study model, and the endogenous variable of sustainability (Y2) has an R-square value of 0.214. This shows that the variables of farmer characteristics (X1), farmer perception (X2), institutional support (X3), and risk impact (X4) are able to explain the sustainability (Y2) construct variable of 21.4%, and the remaining 78.6% are contributions from other variables outside this research model. According to Ozili, (2023), In social science empirical modeling, the lowest minimum R-square value of 0.10 is acceptable, provided that there are some or all statistically significant explanatory variables.

2. Bootstrapping

The bootstrapping test is used to determine the approximate value of the path coefficient. The pathway coefficient is used to highlight how strong the effect or influence of exogenous factors is on endogenous variables, as indicated by the correlation values of direct effects and indirect effects. The path coefficient is declared positive if it has a value range of 0 to 1, and negative if it has a value range of -1 to 0. (Ghozali, 2016). Hair. et al., (2014), states that if the p-value is < 0.05, the hypothesis is acceptable.



Picture 1. Path Coefficients Diagram

Table 7 Results of Path Coefficients Analysis

Influence Between Variables	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-Statistics (O/STDEV)	P-Values
Direct effect)					
Farmers' Characteristic (X1) -> Risk management strategy (Y1)	0.034	0.045	0.106	0.324	0.373
Farmers' Characteristic (X1) -> Sustainability (Y2)	0.201	0.204	0.115	1.753	0.040
Farmers' perception (X2) -> Risk management strategy (Y1)	0.399	0.403	0.095	4.181	0.000
Farmers' perception (X2) -> Sustainability (Y2)	-0.207	-0.200	0.103	1.996	0.023
Institutional support (X3) -> Risk management strategy (Y1)	0.114	0.117	0.113	1.011	0.156
Institutional support (X3) -> Sustainability (Y2)	0.147	0.151	0.126	1.165	0.122
Impact of risk (X4) -> Risk management strategy (Y1)	0.178	0.198	0.101	1.769	0.038
Impact of risk (X4) -> Sustainability (Y2)	0.018	0.030	0.119	0.150	0.440
Risk management strategy (Y1)-> Sustainability (Y2)	0.351	0.346	0.107	3.296	0.000
Indirect effects					
Farmers' Characteristic (X1) -> Risk management strategy (Y1)	0.012	0.015	0.037	0.321	0.374

-> Sustainability (Y2)					
Farmers' perception (X2) -> Risk management strategy (Y1) -> Sustainability (Y2)	0.140	0.141	0.059	2.370	0.009
Institutional support (X3) -> Risk management strategy (Y1) -> Sustainability (Y2)	0.040	0.040	0.042	0.943	0.173
Impact of risk (X4) -> Risk management strategy (Y1) -> Sustainability (Y2)	0.063	0.069	0.043	1.460	0.072

Source: *Primary Data (Processed), 2024.*

The following is a model of structural equations that can be derived based on factors that affect risk management strategies (Y1) and sustainability (Y2) from the results of path coefficient analysis, namely:

$Y_1 = 0,399X_2 + 0,178X_4$

$Y_2 = 0,201X_1 – 0,207X_2 + 0,351Y_1$

The results of the interpretation of the direct effect hypothesis based on the results of the path coefficients analysis are, as follows:

1. The direct influence of farmer characteristics (X1) on risk management strategy (Y1) is 0.034, which means that if farmer characteristics (X1) increase by 1%, then risk contro management strategy (Y1) will increase by 3.4%. This effect is positive but not significant because the p-value is > 0.05.
2. The direct influence of farmer characteristics (X1) on sustainability (Y2) is 0.201, which means that if farmer characteristics (X1) increase by 1%, then sustainability (Y2) will increase by 20.1%. This influence is positive and significant because the p-value is < 0.05.
3. The direct influence of farmers' perception (X2) on the risk management strategy (Y1) is 0.399, which means that if the perception of farmers (X2) increases by 1%, then the risk management strategy (Y1) will increase by 39.9%. This influence is positive and significant because the p-value is < 0.05.
4. The direct influence of farmer perception (X2) on sustainability (Y2) is -0.207, which means that if farmer perception (X2) increases by 1%, then sustainability (Y2) will increase by 2.07%. This effect is negative and significant because the p-value is < 0.05.
5. The direct influence of institutional support (X3) on the risk management strategy (Y1) is 0.114, which means that if institutional support (X3) increases by 1%, then the risk management strategy (Y1) will increase by 1.14%. This effect is positive but not significant because the p-value is > 0.05.
6. The direct effect of institutional support (X3) on sustainability (Y2) is 0.147, which means that if institutional support (X3) increases by 1%, then sustainability (Y2) will increase by 1.47%. This effect is positive but not significant because the p-value is > 0.05.
7. The direct effect of the risk impact (X4) on the risk management strategy (Y1) is 0.178, which means that if the risk impact (X4) increases by 1%, then the risk management strategy (Y1) will increase by 1.78%. This effect is positive and significant because the p-value is < 0.05.
8. The direct effect of the risk impact (X4) on sustainability (Y2) is 0.018, which means that if the risk impact (X4) increases by 1%, then sustainability (Y2) will increase by 1.8%. This effect is positive but not significant because the p-value is > 0.05.
9. The direct influence of the risk management strategy (Y1) on sustainability (Y2) is 0.351, which means that if the risk management strategy (Y1) increases by 1%, then sustainability

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(Y2) will increase by 3.51%. This influence is positive and significant because the p-value is < 0.05.

The results of the interpretation of the indirect effect hypothesis based on the estimated value of the specific indirect effect are as follows:

1. The indirect influence of farmer characteristics (X1) on sustainability (X2) through risk management strategy (Y1) is 0.012, which means that if farmer characteristics (X1) increase by 1%, it will indirectly increase sustainability (Y2) through risk management strategy (Y1) by 1.2%. This effect is positive but not significant because the p-value is > 0.05.
2. The indirect influence of farmers' perceptions (X2) on sustainability (X2) through risk management strategy (Y1) is 0.140, which means that if farmers' perceptions (X2) increase by 1%, it will indirectly increase sustainability (Y2) through risk management strategies (Y1) by 1.40%. This influence is positive and significant because the p-value is < 0.05.
3. The indirect influence of institutional support (X3) on sustainability (X2) through the risk management strategy (Y1) is 0.040, which means that if institutional support (X3) increases by 1%, it will indirectly increase sustainability (Y2) through the risk management strategy (Y1) by 4%. This effect is positive but not significant because the p-value is > 0.05.
4. The indirect effect of risk impact (X4) on sustainability (X2) through risk management strategy (Y1) is 0.063, which means that if the risk impact (X4) increases by 1%, it will indirectly increase sustainability (Y2) through risk management strategy (Y1) by 6.3%. This effect is positive but not significant because the p-value is > 0.05.

4. CONCLUSION

The results of this study are, as follows:

1. Farmer perception (X2) and risk impact (X4) have a positive and significant effect on risk management strategy (Y1) with p-values of 0.000 and 0.038 < 0.05.
2. Farmer characteristics (X1) have a negative and significant effect on sustainability (Y2) with path coefficients -0.207 and p-value 0.040 < 0.05, while farmer perception (X2) and risk management strategy (Y1) has a positive and significant effect on sustainability (Y2) with p-value of 0.023 and 0,000 < 0.05, respectively.

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