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FLOOD IMPACT TO FARMER'S ADAPTATION AND ORANGE FARMER HOUSEHOLDS INCOME IN TIDAL SWAMPLAND OF CERBON SUB-DISTRICT, BARITO KUALA REGENCY

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ABSTRACT
Barito Kuala Regency is one of the districts located in South Kalimantan, with tidal land that has great potential in developing farming, especially for Siamese Banjar citrus plants. In 2021, both the number of planting area, harvest area and production of Siamese Banjar citrus plants in Barito Kuala Regency decreased considerably. From 2020 to 2021, the planting area of Siamese Banjar oranges decreased by 913.19 ha, the harvest area of Siamese Banjar oranges decreased by 1,142.57 ha and the production of Siamese Banjar oranges by 31,592.9 tons. The decrease in planting area, harvest area and also production of Siamese oranges in Barito Kuala Regency was caused by floods that soaked citrus plants for months due to increased rainfall. This study aims to (1) identify the impact of flooding on the risk level of Siamese Banjar citrus farming resources, (2) identify adaptation options made by Siamese Banjar orange farmers in facing floods, (3) analyze factors that affect the cost of recovery of Siamese Banjar orange farmers in facing floods, and (4) analyze the impact of floods on household incomes of Siamese Banjar orange farmers in Cerbon District. The number of samples used in this study was 60 orange farmers. This research uses two data analysis methods, namely descriptive or qualitative analysis methods and quantitative analysis. The results showed that most citrus farmers in Cerbon sub-district were at moderate risk as much as 60% of orange farmers, the remaining 5% low risk and 35% high risk. The adaptation choices made by orange farmers sequentially from the largest to the smallest are (i) preparing seeds for embroidery (ii) regulating water management (iii) increasing the height of the reservoir / baluran (iv) pruning twigs (v) carrying out mulching techniques (vi) adding pesticide types and (vii) increase the intensity of pesticide spraying. There are three independent variables that have a real influence on the cost of recovering citrus farming, namely non-Siamese Banjar household income, the level of damage to Siamese Banjar Orange Farming, and the area of agricultural land. household income of Siamese Banjar orange farmers. The household income structure of orange farmers in 2022 after the flood consists of on-farm at 61.28%, non-farm activities at 29.65%, and *off-farm* at 9.06%.

KEY WORDS
Qualitative and quantitative analysis, Barito Kuala, tides, flood impact, household income.

Indonesia is a country that has an area of 1,916,906.77 km^2 of which most of the area is used as agricultural land. Indonesia is also a country with a high population of 272,682.5 with a population growth rate of 1.22% (Statistics Indonesia, 2022). Indonesia is unique in weather and climate factors that allow Indonesia to be very suitable as an agricultural country. This tropical climate condition makes most of the Indonesian population depend on their lives as farmers. Initially, climate change patterns were relatively stable and did not change much over a long period of time, but these days, in a relatively short period of time, the climate often changes and is difficult to predict. The impact of climate change such as high rainfall and long dry season causes a decrease in food production which has a direct effect on decreasing the welfare level of farmers and hampering the development function (Irawan, 2006).

The problems of the agricultural sector, especially Siamese oranges, cannot be separated from rainfall. The regularity of rain patterns and distribution in an area greatly determines the guarantee of agricultural activities. The rainfall conditions of a region can describe the conditions of the region.

Citrus farming has been affected by high rainfall which causes flooding and results in crop failure and crop failure. To minimize the impact of floods on their farms, citrus farmers carry out various dynamic flood mitigation responses. Based on BPS data in 2022, one of the provinces in Indonesia, namely South Kalimantan, is the 4th largest producer of Siamese oranges in 2020 and the 5th in 2021 in Indonesia. Siamese orange production in South Kalimantan in 2020 was 158,462 tons and in 2021 it was 113,898 tons.

In 2021, South Kalimantan has also felt a major impact from extreme flooding, especially in Barito Kuala Regency. In early 2021, Barito Kuala Regency experienced floods which resulted in agricultural businesses experiencing crop failure, not only in food crops but also horticulture, especially citrus plants. In addition to crop failure, many citrus plants also died, and the mortality rate of citrus plants in 2021 was quite high compared to previous years. Therefore, in 2021 the area data of citrus plants decreased from 7,497.98 ha in 2020 to 6,584.79 ha in 2021.

Apart from the planting area, the harvest area also decreased in 2021. Because the harvest area has decreased, the production has also decreased. Several sub-districts experienced a decrease in production in 2021. However, of these several sub-districts, 3 districts that experienced the highest decline in production were Mandastana District, Rantau Badauh District and Cerbon District. The large decrease in Siamese Banjar orange production in Rantau Badauh District is number 1 highest from 2020 to 2021 at 6,720.30 tons. The large decrease in Siamese Banjar orange production in Cerbon District is number 2 highest from 2020 to 2021 at 4,869.45 tons. The large decrease in Siamese Banjar orange production in Mandastana District is number 3 highest from 2020 to 2021 at 3,641.34 tons.

Based on the background and formulation of the problem, the objectives of this study are (1) identify the impact of flooding on the risk level of Siamese Banjar citrus agricultural resources; (2) identify the form of adaptation options made by Siamese Banjar orange farmers in the face of floods; (3) analyze the factors affecting the recovery costs of Siamese Banjar orange farmers in the face of floods; and (4) analyze the impact of floods on household incomes of Siamese Banjar orange farmers.

METHODS OF RESEARCH

This research was conducted in Barito Kuala Regency, South Kalimantan Province. The location selection was chosen deliberately with the consideration that Cerbon District is one of the districts that has also been affected by floods in the last two years, besides that Cerbon District is also among the longest affected by floods, which is three months. The research time was carried out from August 2022 to April 2023 , namely from preparation to report writing.

The types of data used in this study are primary data and secondary data. Primary data were obtained through direct interviews with farmers in Cerbon sub-district with the help of questionnaires provided by researchers on farmers' perceptions of floods, adaptations made by farmers due to floods, production yields, input and output prices during the period of extreme floods and before floods. Secondary data include the Central Bureau of Statistics (BPS) of Barito Kuala Regency and other sources that are relevant to the topic studied.

The method of drawing examples in this study was carried out through several stages. These stages consist of determining the sub-district area, then determining the research sampling unit. The sampling determination process was carried out by (1) selecting two villages, namely Simpang Nungki Village and Sawahan Village with the consideration that these two villages were the villages that experienced the longest flood, namely for approximately 3 months in Cerbon District; (2) Select a sample of farmers who carry out Siamese Banjar orange farming and are affected by floods as a sampling unit. Determination of samples of Siamese Banjar orange farmers by the *Proportionate Random Sampling* method with the number of samples taken by 60 farmers. This number of samples is considered to be representative of the population because the characteristics of sample farmers are not too diverse.

To answer the first objective, namely by identifying the effect of flooding on the risk level of failure of Siamese Banjar Orange Agriculture with the Siamese Banjar Citrus Agricultural Resource Risk Matrix method, by linking the variable scale of flood perception with the rate of decline in Siamese Banjar orange production as a consequence of flooding. To answer the second goal, namely by identifying the adaptations made by Siamese Banjar orange farmers in dealing with floods with descriptive analysis methods, by presenting several adaptation options for each Siamese Banjar orange farmer. To answer the third goal, namely by analyzing the factors that affect the amount of recovery costs of farmers facing floods using the Cobb-Douglas Model by analyzing factors that have a significant effect on the recovery costs of Siamese Banjar orange farmers. To answer the fourth goal, namely by estimating the impact of floods on household incomes of Siamese Banjar orange farmers by analyzing farming by calculating the household income of orange farmers in 2022.

Table 1 – Flood assessment scale

Scale	Valuation	Description
1	No flooding	The probability of a hazard threat event is very low.
2	Slight flooding	The probability of hazard occurrence is low with a percentage of 1-25%.
3	Moderate flooding	The probability of hazard threat events is moderate with a percentage of ≥ 26-50%.
4	High flooding	The probability of hazard occurrence is high in the time span with a percentage of ≥ 51-75%.
5	Flooding is extreme	The probability of occurrence is very high based on historical records and flood projections with a percentage of ≥ 76-100%.

Source: Modification from USAID (2011).

Table 2 – Scale of assessment of the consequences (impacts) of the agricultural harvest of Siamese Banjar oranges

Scale	Valuation	Description
1	No potential for crop failure	The impact on Siamese Banjar citrus farming is almost non-existent or not felt by farmers at all.
2	Low crop failure potential	There was a decrease in crop yields with a percentage decrease of 1-25%.
3	Potential for Moderate crop failure	There was a decrease in crop yields with a percentage decrease of ≥ 26-50%.
4	High potential for crop failure	There was a decrease in crop yields with a percentage decrease of ≥ 51-75%.
5	The potential for crop failure is very high	Long-term impact with huge financial losses. This is a decrease in crop yields with a percentage decrease of ≥ 76-100%.

Source: Modification of the Ministry of Agriculture (Risk Assessment and Climate Change Adaptation Lombok Island, West Nusa Tenggara, 2012).

Table 3 – Risk level indicators based on resource risk matrix

Risk Level	Consequences of adaptation
Extreme	Need as soon adaptation as possible
Tall	Adaptation steps need to be prioritized
Moderate	Need adaptation steps to reduce risk
Low	May need adaptation
No risk	No need for expenditure on adaptation / adaptation can be ignored

Source: USAID (2011).

The effect of flooding on Siamese Banjar citrus farming was identified using an assessment based on the scale of the flood and the consequences on agriculture. The assessment of floods and their consequences is then analyzed again using the resource risk matrix. The *Asset Risk Matrix* is a semi-quantitative tool using risk analysis to estimate and rank natural resources and the likelihood of flooding according to the level of risk description. This method is adopted from the resource risk matrix used by the *US Agency for International Development* (USAID) in calculating vulnerability to water resources due to flooding (USAID 2012). The data and information needed include assessments of floods and changes in Siamese citrus yields when the climate experiences extreme changes. The results obtained are then grouped based on the same scale or assessment and percentage based on the number of respondents. The largest percentage of each outcome is the dominant factor of each variable analyzed. Tables 1 and 2 provide information on measuring the assessment of farmers' perceptions of flooding and the consequences of Siamese orange yields due to the flood.

Table 3 shows the level of agricultural risk as a result of the analysis on the matrix based on the perception of changes and consequences experienced by Siamese Banjar orange farmers, the linkage between the two will produce a level of risk based on color indicators that indicate high or low risk of crop failure. The level of risk faced by farmers will determine priorities in making adjustments or adaptations in the face of floods that occur.

Identification is carried out by asking questions about the form and choice of adaptation made by Siamese Banjar orange farmers when facing floods, efforts that can be made in overcoming these floods and obstacles faced when making these adjustments or adaptations. This identification was carried out through interviews with Siamese Banjar orange farmers using questionnaires. The results obtained are then grouped based on the same adaptation options and percentage based on the number of respondents. The largest percentage of each yield is the dominant adaptation of each adaptation made by Siamese orange growers.

Each farmer who became a respondent was asked to determine what adaptations they had made when facing floods. Each farmer may choose more than one adaptation or do a combination of adaptations in his farming activities. The results of each adaptation option will determine the amount of costs that farmers incur as recovery costs for Siamese Banjar orange farmers.

The analysis in assessing the factors that affect the costs incurred by farmers in adapting to floods is to use the Cobb-Douglas Model with independent variables (X) are non-Siamese Banjar household income (X1), credit / loan (X2), damage rate of Siamese Banjar Orange farming (X3) and agricultural land area (X4) and the variable of non-free or dependent variables (Y) is recovery costs. The equation of the Cobb-Douglas model between the above variables can be formulated as follows:

$$Ln\ Y = \alpha + \beta\ 1\ Ln\ X_1 + \beta\ 2\ Ln\ X_2 + \beta\ 3\ Ln\ X_3 + \beta\ 4\ Ln\ X\ 4 + ɼ$$

Where: Ln Y - Recovery cost of Siamese Banjar orange farmer (Rp); α – intercept; Ln X_1 - Non-Siamese Banjar Income (Rp); Ln X_2 - Credit / loan (Rp); Ln X_3 - Damage rate of Siamese Banjar orange farming (%); Ln X_4 - Area of agricultural land (m^2); β_i - Regression coefficient; ɼ - *Error term*.

Based on the OLS estimation method, this test can be seen from the *F-statistic* probability value If all the actual values of the regression parameter are equal to zero, it can be concluded that there is no linear relationship between the dependent variable and the independent variable. As for the procedure used in the F test (Gujarati 2003):

$$H\ 0 = \beta_1 = \beta_2 = \beta_3 = = \beta_i = 0$$
$$H_1 = \text{there is at least one } \beta_i \neq 0$$
$$Fhit= \frac{JKR/(k-1)}{JKG/(n-k)}$$

Where: JKR - Number of squares of regression; JKG - Number of squares of errors; k - Number of variables against intercepts; n - Number of observations/samples.

If $F_{counts} \leq F_{of\ the\ table}$, then $_{H0}$ is accepted and H1 is rejected, which means that the independent variable (X_i) has no real effect on the non-free variable (Y). If $F_{counts} > F_{of\ the\ table}$, then $_{H0}$ is rejected and$_{H1}$ is accepted, which means that the independent variable (X_i) has a real effect on the non-free variable (Y).

The *R-squared* value reflects how much diversity of the dependent variable can be explained by the independent variable. R-squared can describe the ability of independent variables to simultaneously explain variations of non-free variables. The R-squared value has a positive magnitude of 0 ≤ R-squared ≤ 1. If the R-squared value is zero, then it means that the diversity of the dependent variable cannot be explained by its independent variable. Conversely, if the R-squared value is one then the diversity of the dependent variable as a whole can be perfectly explained by its independent variable (Gujarati 2003). The R-squared formula can be seen as follows:

$$R^2 = \frac{ESS}{TSS}$$

Where: ESS - Explained of sum squared; TSS: *Total Sum of squared*.

The t test is performed to calculate the regression coefficient of each independent variable so that the influence of the independent variable on the dependent variable can be known. Procedure in t Test testing by Gujarati (2003):

$$H\ 0: \beta_i = 0$$
$$H\ 0: \beta_i \neq 0$$
$$t = \frac{b - \beta i}{se\beta i}$$

Where: B - Conjecture parameter; β_i - Hypothesis parameter; $se\beta_i$ - Standard *error* parameter β.

If $t_{\text{counts } (n-k)} \leq t_{\text{table } \alpha/2}$, then H0 is accepted, meaning that the variable (X_i) has no real effect on (Y). However, if $t_{\text{counts } (n-k)} > t_{\text{table } \alpha/2}$, then H0 is rejected, meaning that the variable (X_i) has a real effect on (Y).

The estimated income of farmers due to the flood that occurred was calculated using the analysis of household income of Siamese Banjar orange farmers.

To find out the amount of cost seen from total cost which is the sum of all components of explicit costs and implicit costs systematically formulated:

$$TC=TCe+TCi$$

Where: TC - Total cost of farming (Rp); TCe - Explicit cost of farming (Rp); TCi - Total implicit cost of farming (Rp).

Revenue is the result of multiplication between the production obtained and the selling price, so it must be known the amount of production and the selling price of production per unit. Admission is calculated by the formula:

$$TR=Y.\ Py$$

Where: TR - Total revenue/total farmer revenue (Rp); Y - The amount of output obtained during its production period (blek); Py - Price of agricultural branch production (Rp/unit).

Farm income earned by farmers during a certain farming period is the difference between the total farm revenue and the explicit costs of farming covered in a certain farming period.

$$FI=TR-TCe$$

Where: FI - Farm income (Rp); TR - Total farm revenue (Rp); TCe - Explicit cost of farming (Rp).

Household income is income derived from farming (on farm), non-farming (off farm), and from outside agricultural business (non-farm). Revenue is obtained by calculating the difference between the total revenue from business results and the total production costs incurred by farmers for one year (Mudatsir, 2021).

Farmer household income can be calculated by the formula:

$$Prt = P\ \text{on-farm} + P\ \text{off-farm} + P\ \text{non-farm}$$

Where: P_{rt} - Farmer's household income (Rp); $P_{on\text{-}farm}$ - Income from farming (Rp); $P_{off\text{-}farm}$ - Non-farm income (Rp); $P_{non\text{-}farm}$ - Non-farm income (Rp).

RESULTS AND DISCUSSION

In general, age can determine a person's physical condition in working to meet food needs. If a person is outside the productive age, then the person's ability will be reduced in doing a job (farming). The distribution of respondents of orange farmers in Cerbon sub-district by age group is presented in Figure 1 below. Based on the data presented in Figure 1 below, it shows that the most orange farmers in this study are in the age group of 51 – 60 years, which is as much as 35 percent. While at least in the age group ≤ 40 years, which is only 10 percent.

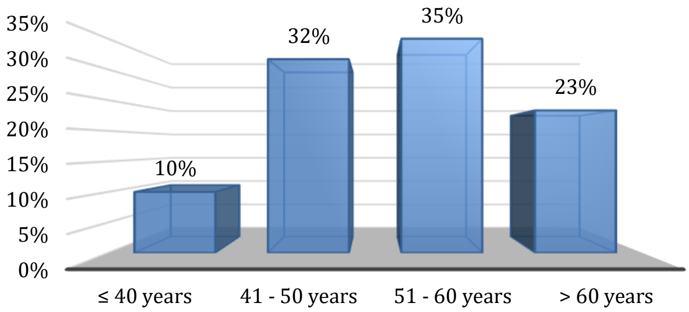

Figure 1 – Distribution of citrus farmer respondents by age group

The higher a person's education, of course, the better the way of thinking for that person in making decisions. Based on the data presented in Figure 2, it shows that orange farmers with education did not finish elementary school, still considered the most, which is as much as 53 percent. The distribution of citrus farmers in tidal swamps in Cerbon District based on formal education taken is presented in Figure 2.

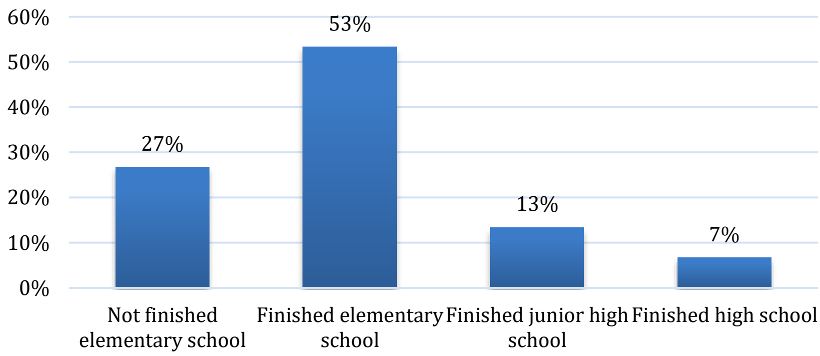

Figure 2 – Distribution of citrus farmer respondents by education level

The experience of orange farming can be seen from the length of citrus farming carried out by farmers in this study. Orange growers will go through an experiential process that will provide choices in their decisions based on the experience they have gone through. Based on the data presented in Figure 6, it shows that the most orange farmers are found in the group of farming experience between 9 - 12 years, which is 50 percent. While the rest in the group of farming experience between 5-8 years amounted to 28 percent, and experience between 13-16 years 22 percent. The average experience of citrus farming in Cerbon District ranges from 10.22 years, with the lowest experience of 7 years and the highest experience of 15 years. The distribution of farmers based on the experience of citrus farming can be seen in Figure 3.

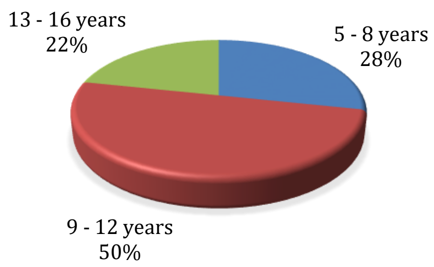

Figure 3 – Distribution of respondents of orange farmers based on length of farming

The number of household members is the sum of all existing members of the household, but excluding the head of the household. Based on the data presented in Figure 4, it shows that the dominance of orange farmers is the most with 1 dependent person, which is 40 percent, while the rest have 2 dependents of 33 percent, 3 dependents of 15 percent, 4 dependents of 7 percent, and 5 dependents of 3 percent. In addition, there are 2 percent of orange farmers who do not have household members. The number of respondents based on the number of household members of orange farmers in tidal swampland in Cerbon sub-district in the study is presented in Figure 4.

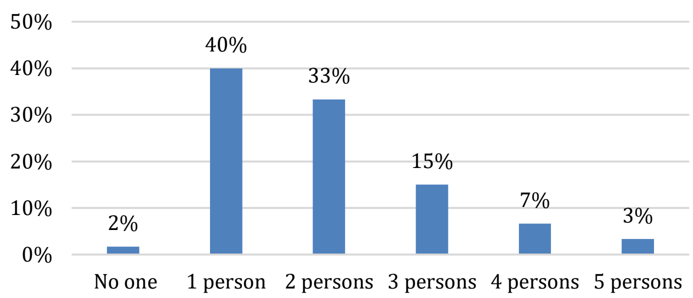

Figure 4 – Distribution of orange farmer respondents based on the number of household members

Land is a factor of production of a farm, the greater the area of land owned, the more production produced. Citrus farming in this study has an average land area of 1.12 ha. Based on the data presented in Figure 8, it shows that the largest number of farmers are in the strata of agricultural land area of 0.5 – 1.0 ha, which is 45 percent. While the rest in the strata of agricultural land area of 1.1 - 1.5 ha of 25 percent, strata of land area of 1.6 - 2.0 ha of 26.67 percent, and strata of land area of > 2 ha of 3.33 percent. The distribution of orange farmers based on the strata of agricultural land area in tidal swamps in Cerbon District can be seen in Figure 5.

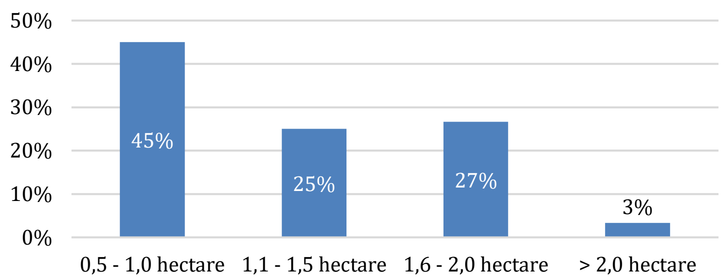

Figure 5 – Distribution of orange farmer respondents based on strata of agricultural land area

An assessment of the flood felt by farmers can be seen in Figure 9 below. Flood assessment is based on five rating scales. Based on the data presented in Figure 6, it shows that climate change that causes flood impacts is at a moderate flood level, with a percentage of 75 percent. It states that from the perceptions of 60 farmers, 75 percent stated that the climate is experiencing moderate changes, where the probability of hazard events is at a moderate level. In addition, there are also farmers who have a perception that climate change has a very large flood impact, namely 20 percent of orange farmers, the remaining 5 percent of farmers have a slight perception of flood impacts. The distribution of citrus farmers based on the assessment of climate change that causes flood impacts is presented in Figure 6.

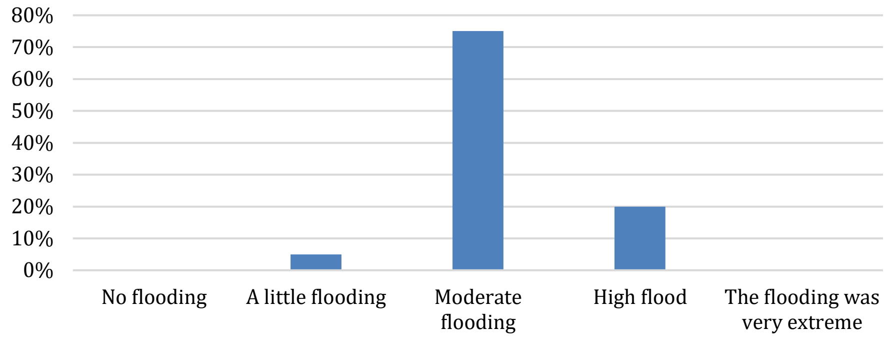

Figure 6 – Distribution of farmers based on climate change assessment

The flood that occurred in Cerbon District caused several levels of consequences that occurred on citrus yields / production. The level of consequences received by farmers is assessed with five scales assessing the potential for crop failure. Most farmers experienced the negative consequences of the floods that occurred in 2020, where the output of oranges decreased between 20 – 70 percent. The consequences of potential crop failure are low experienced by 2 percent of citrus farmers, with a scale of decline of 20 – 25 percent. The consequences of potential crop failure are being experienced by 63 percent of farmers who accept the consequences of decreasing orange yields with a percentage scale decrease of 26-50 percent. The remaining consequences of high crop failure potential are experienced by 35% of farmers who accept the consequences of decreasing rice yields with a scale of 51-75 percent decrease. The percentage of consequences (impacts) of climate change on citrus prediction results in Cerbon District is presented in Figure 7.

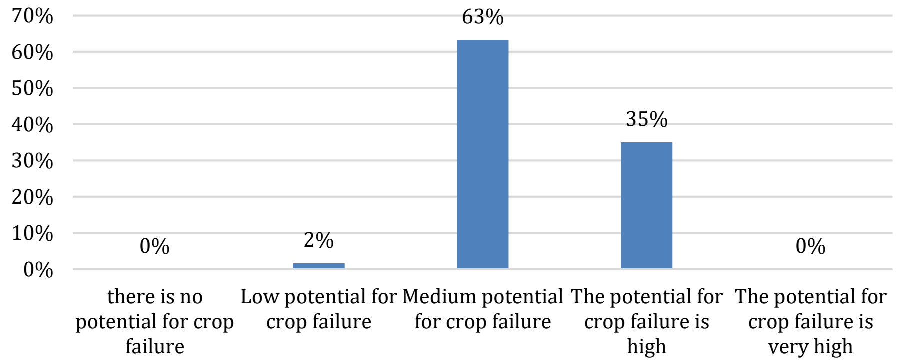

Figure 7 – Distribution of farmers based on perception of potential crop failure

Risk levels based on the consequences (impacts) of citrus production yields and perceptions of flooding felt by farmers are presented in Figure 8. The matrix shows the percentage of each level of risk of citrus farming experienced by farmers in Cerbon District, the percentage shows that most farmers in the region are in columns and rows with yellow indicators, where the indicator shows that the risk faced is a moderate level of risk, it can be seen from the percentage of the number of farmers who experience the risk as much as 60%.

Consequences (Impact)						
	Very High Potential for Crop Failure					
	High Potential for Crop Failure			High Risk (15.00%)	High Risk (20,00%)	
	Medium Potential for Crop Failure		Low Risk (3.33%)	Moderate Risk (60.00%)		
	Low Potential for Crop Failure		Low Risk (1.67%)			
	No Potential for Crop Failure					
	n/n	No	Slight	Moderate	High	Extreme
Flooding						

Figure 8 – Resource risk matrix based on flood risk level

Farmers in making various forms of adjustment or adaptation to climate change have taken into account various considerations based on farming experience that has been carried out so far. The choice of the type of adaptation of each farmer in adjusting to climate change that causes flooding is presented in Figure 9 below. Based on the data presented in Figure 9, it shows that the highest adaptation option is to prepare seeds for embroidery, which is 88 percent of orange farmers.

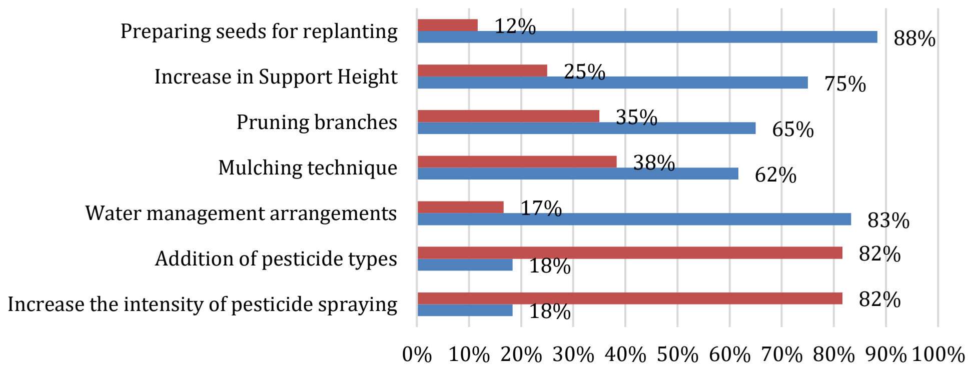

Figure 9 – Distribution of respondents based on the type of adaptation options of citrus farmers in facing floods (Red line – No, Blue line – Yes)

The estimation model of the factors affecting the cost of farm recovery is the *Cobb-Douglas* regression model. The *Cobb-Douglas* regression technique is used to analyze the factors that affect the value of the costs incurred by farmers in recovering citrus farms due to flooding. The model was obtained from data processing through *IBM SPSS 26 software*. The output of multiple linear regression results for the recovery costs of citrus farming is presented in full in Table 4.

Table 4 – Factors affecting the cost of recovering citrus farming

Variable	Coefficient	T count	Sig.	Information
Constant	9,907	5,305	0,000	
Non-Siamese household income (X1)	0,247	2,374	0,021*	Real Effect
Credit / loan (X2)	0,034	0,300	0,766	No Real Effect
Damage rate of Siamese Banjar orange farming (X3)	0,283	2,489	0,016*	Real Effect
Area of farmland (X4)	0,361	3,115	0,003*	Real Effect
R^2 (*R square*)= 0.949				
F_{count} = 257.729				
α= 10% (0,1)				

Source: Primary Data Processing, 2023.

Based on the data presented in Table 4, it is a statistical model to estimate the factors that affect the cost of recovering citrus farming, it can be said to be feasible and meet *the*

Goodnes of Fit criteria. This can be seen from the value of R^2 (*R square*) of 0.949 which states the ability of the free variable (non-Siamese Banjar Orange household income, credit / loan, damage rate of Siamese Banjar orange farming, and agricultural land area) able to explain the non-free variable (recovery cost of orange farming) by 94.9 percent, while the remaining 5.1 percent is explained by other variables outside the model.

The equation of the regression model resulting from the effect of the cost of recovery of citrus farming is:

$$Y = 9.740 + 0.247\ LnX1 + 0.034\ LnX2 + 0.283\ LnX3 + 0.361\ LnX4$$

Based on the test results in the model, it shows that there are three independent variables that have a real influence on the cost of recovering citrus farming. The three variables consist of non-Siamese Banjar household income, the level of damage to Siamese Banjar orange farming, and agricultural land area. Meanwhile, variable credit / loans have no real effect on the cost of recovering citrus farming.

The variable income of non-citrus farming households has a real influence on the cost of recovering citrus farming; this is expressed by *the sig value* 0.021, which means less than α (0.1). The variable coefficient of influence of non-farm orange household income is 0.247, meaning that each unit increase in income will increase recovery costs by 0.247. This means that with an increase in income, the recovery costs that farmers can afford to spend will be higher.

The variable level of damage to Siamese Banjar citrus farming has a real influence on the cost of recovering citrus farming; this is expressed by *the value of SIG.* 0.016 which means less than α (0.1). The variable coefficient of damage to citrus farming is 0.034, meaning that every increase in damage to citrus farming by one unit percent will increase recovery costs by 0.034. This means that with the increase in farm damage, the recovery costs that will be incurred by farmers will also be greater.

The variable area of orange farming land has a real influence on the cost of recovering citrus farming; this is expressed by *the sig value* 0.003 is smaller than α (0.1). The variable coefficient of influence of orange farming area is 0.361, meaning that every increase in orange farm area by one percent will increase recovery costs by 0.034. This means that with an increase in the area of agricultural land, the recovery costs that will be incurred by farmers will also be greater.

The income structure of farmer households consists of on-farm, off-farm and *non-farm* income. The calculated household income data of orange farmers is their income in 2022. By looking at the income structure of these farmer households, we will see each contribution to the type of business activities that orange farmers produce to meet their living needs. The amount of household income structure of Siamese Banjar orange farmers after the flood in 2022 is presented in Table 5.

Table 5 – Household income structure of Siamese Banjar orange farmers in 2022

Field of Activity	Revenue per year (Rp)
On-Farm	
1. Rice Farming	18.540.000
2. Orange Farm	4.250.000
3. Vegetable Farm	1.450.000
Off-Farm	
1. Farm worker	2.845.000
2. Chicken farming	325.000
3. Employees of palm oil companies	414.000
Non-Farm	
1. Laborer/Builder	7.750.000
2. Trader	3.225.000
3. Ojek Driver	326.000
4. Others	428.333
Total Revenue	39.553.333

Source: Primary Data Processing, 2023.

Based on the data presented in Table 5, it shows that the income structure of orange farmers is still large contribution from *on-farm* activities, which is 61.28 percent or Rp. 24,240,000 / year consisting of income from rice farming of Rp. 18,540,000,-, vegetable farming of Rp. 1,450,000, - and the remaining citrus farming of Rp. 4,250,000,-. In addition to the field of on-farm activities, the field of *non-farm* activities also contributed quite high, namely 29.65 percent or Rp. 11,729,333 / year, in this field consisting of income from laborers / builders of Rp. 7,750,000,-, traders of Rp. 3,225,000,-, motorcycle taxi drivers of Rp. 326,000,-, and others of Rp. 428,333 ,-. While in *off-farm* activities, the contribution given is only 9.06 percent or Rp3,584,000 / year. In this field, the type of income generated from activities as agricultural laborers amounted to Rp. 2,845,000,-, chicken farms amounted to Rp. 325,000,-, and from income as employees of palm oil companies amounted to Rp. 414,000,-.

CONCLUSION

Most citrus farmers in Cerbon sub-district are at moderate risk as many as 60% of orange farmers, the remaining 5% are low risk and 35% are high risk.

The adaptation options carried out by orange farmers sequentially from the largest to the smallest are (i) preparing seeds for embroidery, (ii) regulating water management, (iii) increasing the height of the reservoir / baluran, (iv) trimming twigs, (v) carrying out mulching techniques, (vi) adding pesticide types, and (vii) increasing the intensity of pesticide spraying.

There are three independent variables that have a real influence on the cost of recovering citrus farming, consisting of non-Siamese Banjar Orange household income, the level of damage to Siamese Banjar Orange Farming, and the area of agricultural land.

The household income structure of orange farmers in 2022 after the flood consists of on-farm at 61.28%, non-farm activities at 29.65%, and *off-farm* at 9.06%.

There should be handling by the government, especially in repairing primary waterways in Cerbon District, so that when there is a high level of rainfall it will be able to reduce the potential for longer flooding.

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