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FLOOD DISASTER ADAPTATION STRATEGY IN CERBON DISTRICT OF SOUTH KALIMANTAN, INDONESIA

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ABSTRACT

Farming households have adaptation mechanisms in dealing with vulnerability due to the impact of climate variability, namely ecological, economic and social adaptation. Farming households that own land will have harvested reserves that can be used for food stocks and sold when they need funds for urgent needs. Based on the results of the AHP analysis, the priority order of adaptation mechanisms carried out by farmers in Cerbon District is ecological adaptation, economic adaptation, and social adaptation. Farmers mostly carry out ecological adaptations, including shifting the planting season, changing varieties, and adjusting plant types depending on the season. Economic adaptations carried out by farmers in the event of a crisis include selling previous harvests, withdrawing savings, selling livestock, and selling assets. The dominant social adaptation carried out by farmers is by utilizing social networks, such as borrowing money from relatives, neighbors, or rice field owners and using assistance from the government. Resilience action is a priority for rice farming households in Cerbon District by working in the on farm, off farm and nonfarm sectors.

KEY WORDS

Adaptation mechanism, resilience, rice farmers.

The recent global climate change impacts the accumulation of high rainfall in a short time. With relatively the same annual rain but with a short duration, it will have an impact on increasing the intensity of the floods that occur.

Indonesia is a country with a humid tropical climate characterized by high rainfall in the rainy season. As a result, in several places during the rainy season, floods occur, which cause casualties and losses of both lives and property.

Natural disasters in Indonesia tend to increase yearly, as well as floods. In the past, floods only hit big cities in Indonesia, but now they are in remote areas of the country. Five essential factors that cause flooding in Indonesia are the main factor, the watershed retention factor, the planning error factor for river channel development, the river silting factor, the regional planning error factor, and the construction of facilities and infrastructure.

Based on the value of losses and the frequency of flood disasters, it can be seen that there is a reasonably high increase. The impact of the flood disaster will also affect the condition of agricultural land for food crops in the affected area.

Floods with a wide impact scale also hit the South Kalimantan region in mid-January 2021. The Agency for the Assessment and Application of Technology stated that the estimated impact of the South Kalimantan flood disaster was Rp. 1.349 trillion, the loss to the community productivity sector was around Rp. 604.562 billion and the agricultural industry. Around Rp. 216.266 billion. Where are the area of agricultural land for food crops and horticulture damaged by floods of more than 200 thousand hectares

Barito Kuala Regency is one of the districts affected by flooding, with a water level of 50-70 cm. This situation dramatically affects the community's economy, where most people depend on agricultural activities. The flood incident in Barito Kuala Regency disrupted community activities, causing the community to experience substantial economic losses. The community shares financial losses in the form of damage and loss of buildings and household equipment owned by the community. In addition, this event also causes a decrease in the quality of the environment that causes various diseases.



From the agricultural side, farmers' losses are not only from products but also from damage to farm equipment and land such as tractors, destroyed paddy fields, and also residual mud and plastic waste that pollutes agricultural land.

The large number of economic losses experienced by the community is proof that the community has not been successful in making adaptation efforts to floods. This makes the community vulnerable to disasters. This study attempts to analyze the resilience and adaptation strategies of post-flood communities in Barito Kuala District.

METHODS OF RESEARCH

Post-flood adaptation strategy is carried out using the Analytical Hierarchy Process (AHP) method. Based on the hierarchical structure of the AHP, the objective (level 1) of this analysis is to obtain the chosen strategy design based on the hierarchy. The criteria (level 2) and sub-criteria (level 3) are described as influencing factors based on the requirements, and at level 4 (alternative), several alternative strategies are presented.

The AHP measurement method used at the criteria and sub-criteria level is a relative measurement method. Measurement at the alternative level is carried out using 2 (two) measurement methods: absolute and relative. The decision patterns of the two measures at the alternative level are compared in a similar way.

AHP analyzed respondents' choice data and combined preferences to obtain the weight of each element at the criteria, sub-criteria, and alternative levels. The weighting results of each component are used to obtain the eigenvalues as values that determine the value of the consistency ratio. Specifically for the relative measurement method, the consistency ratio value is used to explain the consistency of the hierarchy (answers) or the assessment of the judgment data made

Determining the weight of each element/factor is carried out in two measurement methods: relative and absolute. The comparative measurement method uses combined preference data to build an assessment matrix for each criteria level, sub-criteria, and alternatives. The complete measurement method and group priority are created after the element weighting analysis is carried out for each respondent. The weight of the selected elements at the sub-criteria level is taken from the average weight of the components resulting from the relative and absolute measurement methods. The element weights at the alternative levels are then compared between the two measurement methods.

RESULTS AND DISCUSSION

According to Ellis (2000), five livelihood resources can be used to survive or maintain an economic crisis and develop the ability to deal with emergencies: natural capital, physical capital, human capital, financial capital, and social capital. Respondents' availability of five means in eight villages in the Cerbon sub-district varied. The more ownership of assets by farmer households, the livelihood strategies of farmer households will also be more varied.

The availability of livelihood capital which is dominant by the impact of drought due to climate variability is social capital. The comparison of the strength of the five livelihood capitals in Cerbon District based on the AHP analysis of the two villages can be seen in Figure 1.

Based on the analysis of assets or living capital in Figure 1, the biggest problem is the low physical and human capital level faced in Cerbon District. However, social networks (social capital) can help low human capital in maintaining survival. The utilization of natural money by farming households can be done to help the community in sustaining their lives. This is because most people work in the agricultural sector, such as rice and vegetables, while perennials are citrus and oil palm, variations of these crops (seasonal crops and annual crops) can help farmers when a flood causes damage to seasonal produce.

Plant diversity can provide a variety of sources of livelihood so that people have better financial capital. The availability of money will affect farmer households' ability to respond to climate variability's impact. Natural capital includes the availability of land and water sources.



Physical capital has the availability of agricultural production facilities, household equipment, transportation, and livestock. Human resource capital includes the education level of the head of the household, the number of family members who work, and the number of dependents. Financial capital has the availability of savings owned by farmer households. Social capital includes networks that can be utilized by farming households and assistance obtained from the government.

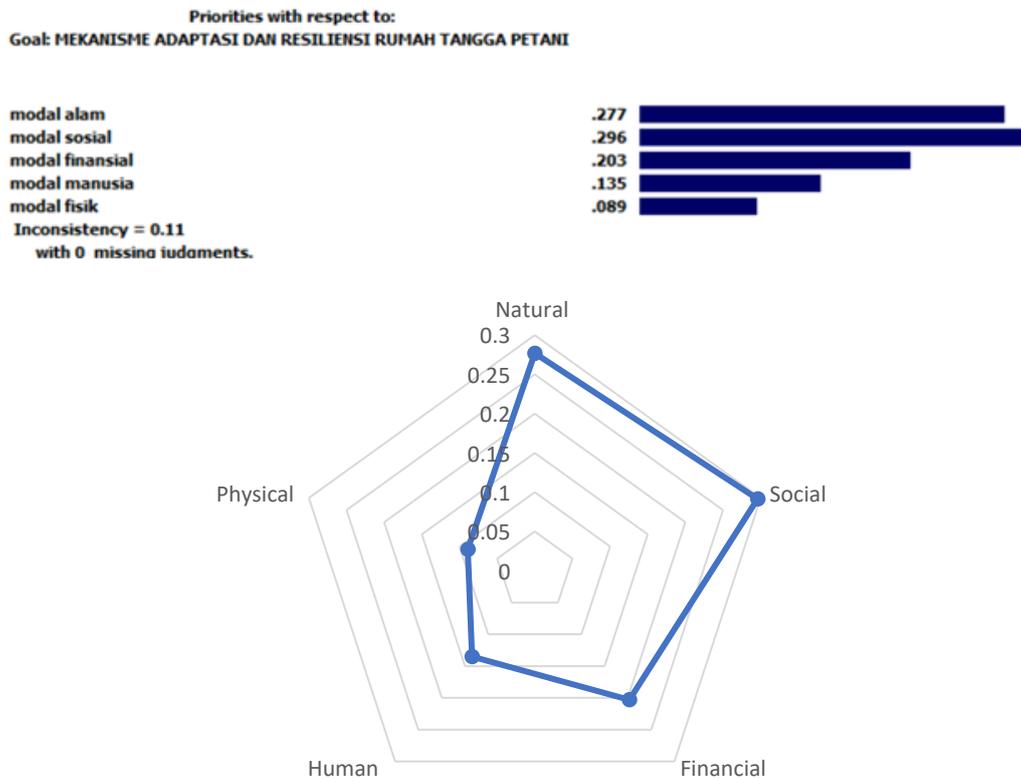


Figure 1 – Availability of living capital in Cerbon District

Flood is one of the impacts caused by climate variability in Cerbon District. Adaptation is critical in reducing the potential impact of climate variability on smallholder farmers. The vulnerability of smallholders will continue to increase without adaptation. The form of adaptation response is, in principle, to minimize exposure and build resilience. Adaptation mechanisms can be grouped into three categories, namely: ecological adaptation; economic adaptation and social adaptation.

Based on the results of the AHP analysis, the priority order of adaptation mechanisms carried out by farmers in Cerbon District is an ecological adaptation, economic adaptation, and social adaptation.

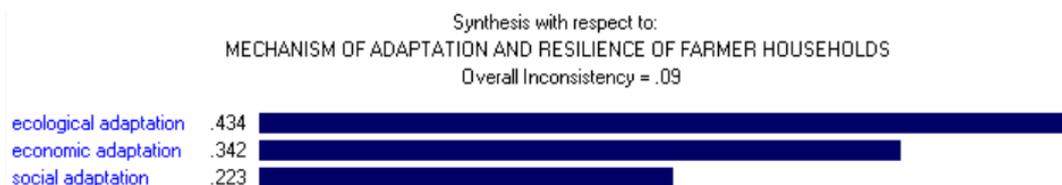


Figure 2 – Results of AHP analysis of priority adaptation mechanisms by farmers

Adaptation mechanism carried out by each layer of farmer households in Cerbon District.



Farmers mostly carry out ecological adaptations, including shifting the planting season, changing varieties, adjusting plant types depending on the season, or looking for fish in rivers. Farmers generally carry out the planting season ranging from October to March. Farmers will start planting when there is enough water. This condition will experience a setback if the rainfall is very high. In addition, farmers also cultivate vegetables, such as eggplant, long beans, and cucumbers, and perennials, such as oranges and oil palm.

In the event of a crisis, farmer households with natural capital will make ecological adaptations by planting vegetables in polybags such as celery plants and usually placed on the side of the road that is higher than the surface of the rice fields. For farmers who have oil palm plantations, they will be more resilient in facing the crisis because they can only grow oil palm in flood conditions

Economic adaptations carried out by farmers in the event of a crisis include selling previous harvests, withdrawing savings, selling livestock, and selling assets. The economic adaptation mechanism most chosen by farmer households is selling the previous harvest. In addition, farming households also withdraw their savings, sell livestock, and look for other jobs in and outside the village. This depends on the assets owned by the farming family. The more support they have, the easier and more varied the adaptation mechanism to be carried out by the agricultural household will be. Family members' involvement in livelihood adaptation benefits the economy of farmer households.

The dominant social adaptation carried out by farmers is by utilizing social networks, such as borrowing money from relatives, neighbors, or rice field owners and using assistance from the government. Social adaptation is built based on the trust factor that underlies the farmer's household with the surrounding social network. Social adaptation mechanisms include actions such as the use of kinship networks, the use of neighboring networks, and friendship.

Farming households prefer the utilization of social adaptation. In addition to utilizing kinship and neighborhood networks, most farming households also take advantage of the assistance provided by the government.

Parameters of resilience strength of a farmer household in the face of climate variability include the ability of the agricultural sector as a source of income for farmer households; the capacity of farmers to maintain secure livelihoods (by utilizing assistance from the government, organizations or institutions and the private sector) to survive; the availability of economic opportunities; the availability of assets or capital resources as a means of survival and the stability of farmer household incomes to sustain life (Dharmawan et al. 2016). The resilience of farmer households can be assumed to be equal to the number of possible mechanisms of resilience strategies used by each farmer household to return to normal after experiencing a crisis due to flooding. The form of resilience action that is a priority by rice farmer households in Cerbon District is to take resilience actions by working in the non-farm sector. Various types of livelihood resilience measures and resilience on agricultural land in surviving during crisis conditions, including:

1. Working in the non-farm sector farming households mainly carry out the non-farm sector as a form of resilience in dealing with the impacts of climate variability. The routine jobs include selling, building construction, and borrowing money from other parties or family members. This work sometimes has to be carried out outside the village, such as being a construction worker. This shows that the respondents have expertise in other fields besides farming. Different skills will help farmer households earn additional income to have strong livelihoods. Borrowing money from other parties is borrowed from relatives, neighbours, friends, farmer groups and rice field owners. Borrowing money from relatives is mainly done by farming households. Most of the respondents from farmer households rarely borrow money from banks because they are constrained by the requirements that must be met, while farmer groups do not provide cash loan assistance. Farmer groups only assist in the procurement of subsidized seeds or fertilizers. Almost all farming households in both villages take advantage of assistance from the government in the form of welfare rice, which is very helpful, especially for lower-income families.



2. Working in the on-farm sector the majority of the population in both villages work as lowland rice farmers. Farming households' ownership of paddy fields in both is high; more than 50% of respondents own their land with an average land area of approximately 1 ha. The productivity generated from this farming is optimal if maximum irrigation sources support it. However, the rice fields in Cerbon District are rainfed rice fields. Constraints in agriculture if there is a drought (dry season) result in limited water sources. On the other hand, if the extreme rainy season results in flooding that inundates their fields or land. To survive, apart from cultivating rice fields for rice cultivation, some farmer households grow vegetables and perennials. Several farmers also raise chickens and ducks as an alternative source of household income. Farmer households mostly did the resilience action of selling the previous harvest. For farmers who have extensive lands and high yields of rice, the results are all for sale. Some are used as reserves for household consumption, and the rest as savings if there is a sudden need and a crisis occurs due to crop failure or decreased production.

3. Working in the off-farm sector farmers who own land less than 0.5 ha, about 26%-38% of the total respondents. The income earned by working the fields within a narrow area is minimal. Therefore, farmers work in other people's fields as a form of resilience carried out in the household. Most farmers in Cerbon Sub-district work on other people's areas using a profit-sharing or rental system. Apart from relying on harvests from their land, they also get additional income by working in other people's fields. For farmer households who do not own their land, apart from working on other people's fields, the work that can be done is to become farm labourers. Husband or wife can do farm labour in a household. They can move from one village to another to become farm labourers, especially during the harvest season. When you become a harvest worker, the income you receive is in the form of harvests that have been shared with the land owner and other workers. Farming patterns have not been the right solution in dealing with climate variability. This is because the source of their business is only on plants, if there is a flood, then all plants will also be disturbed and even die. For upper-class farming households, one of the resilience strategies is to plant short-lived crops such as vegetables and long-lived/perennial crops such as citrus and oil palm.

4. Resilience measures on agricultural land. In facing the extreme rainy season/flood or dry/dry season, farmers in Cerbon District make adjustments to the rice varieties planted. Farmers use emerging varieties that are resistant to flooding during floods or high rainfall, while in times of drought, they use IR or Ciherang varieties. The drought that occurs causes farmers to be unable to grow rice. Of course, it will lead to reduced rice production and decreased income. Farmers are still trying to find other work as farm laborers or selling when a crisis occurs. When the workers cannot overcome the problem in their families, farmers can usually take advantage of the social capital they have. Most farmers do not have a better job choice because of their limited education and skills. For farmers with a narrow land area, most of their harvests are used for food reserves for the next year; the rest is sold for urgent needs.

CONCLUSION

The vulnerability of farmer households in Cerbon District due to climate variability poses various social, economic, ecological and institutional risks. Climate variability causes changes in the composition of farmer household incomes. Farming households carry out ecological, economic and social adaptation mechanisms by utilizing the available capital to reduce vulnerabilities that arise due to the adverse impacts of climate variability. The resilience action that many farmer households do is working in the non-farm sector.

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