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FARMERS' ADAPTATION STRATEGY TO CLIMATE CHANGE IN ACEH BESAR DISTRICT OF INDONESIA

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ABSTRACT

Climate change has a negative impact on agricultural production; this is caused by changes in weather conditions. Climate change has an impact on rice production in Aceh Besar District. The decline in production in Aceh Besar District was caused by changes in rainfall that occurred in the region. Changes in rainfall result in an unstable water supply for agricultural land. This study aims to determine the adaptation strategies and factors that influence the adaptation of farmers in Aceh Besar District in dealing with climate change. The research locations were determined by purposive sampling in three areas, namely in the Districts of Montasik, Peukan Bada, and Jantho. This research involved 150 farmers who were determined based on the slovin technique. The data analysis technique used is a quantitative method which is analyzed using the Structural Equation Model (SEM). The results showed that the adaptation strategies carried out by farmers in Aceh Besar District against climate change were building drainage and irrigation, using water pumps, using superior seeds, and adjusting the spacing. Factors that influence adaptation are farmers' perceptions, support from farmer groups, and social support.

KEY WORDS

Adaptation, climate change, adaptation factors, crop failure, rice farmers, social community.

Climate change is the result of global warming which has a negative impact on people's life activities. The negative impacts of the climate change phenomenon include rising global temperatures, extreme weather intensity, changes in rainfall patterns and big waves (Nurhayati et al. 2020). Based on the results of a survey of international natural disaster data, around 60% of natural disasters that occur are caused by climate change such as floods, droughts, storms, landslides, and high waves (Boer, 2018). The impact of climate change has become a world concern and has many negative impacts on various life activities. Climate change is seen from various natural phenomena such as floods, droughts, and the occurrence of storms (Liverman, 2008).

The negative impacts of climate change on the agricultural sector include crop failures, extreme weather, and increased disease outbreaks. The impact of climate change that has the most influence on the agricultural sector is causing the area of agriculture to decrease, water availability to decrease, and weather changes can also cause natural disasters and damage to agricultural land. The decline in agricultural production and the heat of the earth can hamper production and productivity in the agricultural sector. In addition, the planting and harvesting periods have also changed due to the phenomenon of climate change, not only shifts in the harvesting and planting periods, another impact is the emergence of pests and diseases in agricultural crops (Ditjen PPI, 2020).

Based on data from the Central Bureau of Statistics for Aceh Province, 86.90 percent of Acehnese work as farmers. Aceh Besar District is one of the districts in Aceh Province, as much as 60 percent of the people's livelihoods are in agriculture. From 2018 to 2019 rice production has decreased sharply, where in 2018 rice production was 300,000 tons, and in 2019 rice production fell to 187,597 tons.

Distanbun Aceh noted that around 150 hectares of rice plants in Aceh Besar District experienced crop failure due to drought. This drought occurs during the post-planting period from January to May. Meanwhile, according to farmers' predictions, this month still includes



the rainy season. The decline in rice production was also accompanied by a decrease in land area and harvested area. The decline in production in Aceh Besar District was caused by changes in rainfall. Changes in rainfall result in an unstable water supply for agricultural land.

Sumaryanto (2016) the impact of climate change will have a direct impact on biophysical aspects, where climate change has had an impact on plant physiology, increased pest and disease disturbances in plants, and changes in land and water resources. This is in line with the results of Wardani's research (2017) that climate change has a direct effect on pest and disease attacks on plants; this is because climate change affects the pest breeding process.

Adaptation to climate change can be carried out in a planned and spontaneous manner. This spontaneous action is carried out without awareness, in predicting climate change, people usually do it based on ordinary experience and existing natural conditions (Kalinda et al, 2011). The level of adaptation of farmers is based on the experience and knowledge of farmers in carrying out their agricultural activities (Rasmikayati et al, 2015). Several factors will influence farmers to adapt, including education level, land area, farming experience, and support from extension services (Lail et al, 2020). Support from agricultural extension workers, support from community groups, and support from government agencies will increase the adaptation capacity of farmers to the impacts of climate change (Arbuckle et al, 2013).

METHODS OF RESEARCH

The research locations were determined purposively in three areas, namely in the Districts of Montasik, Peukan Bada, and Jantho. The selection of each selected sub-district was carried out by purposive sampling because this area is the center of the highest rice production. Farmer groups were selected using a purposive sampling method, taking into account the activeness of the group in participating in agricultural extension activities based on extension data in each region. Determining the number of samples in this study used the Slovin formula with an error rate of eight percent, so that the sample in this study was 150 farmers.

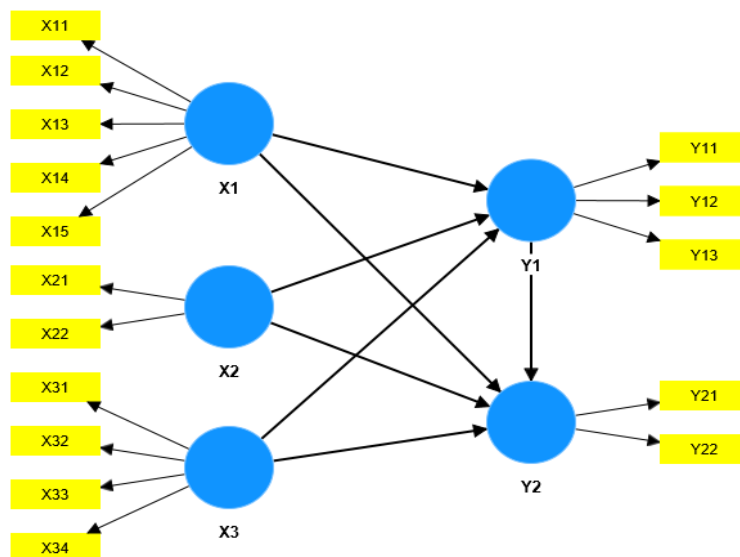


Figure 1 – Analysis Model

The analytical method used in this research is descriptive analysis method with qualitative and quantitative approaches. Qualitative methods to explain facts, phenomena, and circumstances that occur when conducting research. While the quantitative method was analyzed using the Structural Equation Model (SEM) with Smart PLS, namely to see the effect of latent variables.



Table 1 – Analysis Indicators

Measurement Dimensions	Indicator
Individual characteristics (X1)	Age
	Level of education
	Been trying to grow crops for a long time
	Land area
	Number of family dependents
Perception of farmers (X2)	Perceptions of climate change
	Perception of adaptation
Institutional support (X3)	Agricultural extension
	Farmer
	Social
	Government
Farmer adaptation (Y1)	Physique
	Social
	Economy
Continuity (Y2)	Ecology
	Economy

The important thing that must be considered in the Structural Equation Model (SEM) analysis is the Outer model measurement, which is done by looking at the Convergent Validity values, the reliability and validity of the variables, and the Discriminant Validity. Furthermore, measurement of the Inner model is carried out by looking at the Analysis of Variance (R²) or the Determination Test and the results of the Path Coefficient analysis, namely to see whether or not a hypothesis proposed in the study is accepted.

RESULTS AND DISCUSSION

The impact of climate change requires farmers to carry out various ways of adaptation in their farming business. Adaptations made by farmers are highly dependent on environmental conditions, social interactions, and economic conditions.

Table 2 – Level of Adaptation of Farmers in Peukan Bada, Montasik, and Jantho Districts

Adaptation	Peukan Bada	Montasik	Jantho
Physique	2.5	2.25	2.40
Social	2.76	2.12	2.54
Economy	2.51	2.28	2.35
Total Score	2.59	2.22	2.43

Table 2 shows that the total score of the adaptation level of farmers in the Peukan Bada, Montasik, and Jantho sub-districts of the study was in the high category with a value of 2.43. Social adaptation has the highest score (2.54), followed by physical adaptation (2.40) and economic adaptation (2.35). Farmers in the Peukan Bada area did more physical adaptation with a score of 2.5, and the lowest was in Montasik 2.25. This is because farmers in Peukan Bada need to do various ways to get water sources for their agricultural land.

Peukan Bada farmers experience more social adaptation with a score of 2.76, followed by jantho farmers with a score of 2.74, and the lowest is in Montasik with a score of 2.12. Areas that have the highest farmer scores indicate that farmers generally adapt well socially, while areas that have low farmer scores because farmers are generally farmers who only run their farming business in the village, but are not residents living in the village.

Most of the economic adaptation was carried out by farmers in the Peukan Bada area with a score of 2.51, and the least by farmers in the Jantho area with a score of 2.26. Farmers who adapt economically are farmers who generally look for additional work besides farming. While farmers with the lowest scores are because farmers make the agricultural profession their main job, they only rely on their agricultural products.

Adaptations are made by farmers due to climate change which has an impact on their farming business. Based on the research results in table 3, several indicators can be seen



that support farmers in adapting, namely farmers' perceptions of climate change, support from farmer groups in adapting, and social support that supports farmers in adapting.

Table 3 – Factors Influencing Adaptation

Factors Influencing	Indicators
Institutional support	<ul style="list-style-type: none"> Farmer group support Social support
Perception	<ul style="list-style-type: none"> Perceptions of climate change
Individual characteristics	<ul style="list-style-type: none"> Level of education
Adaptation	<ul style="list-style-type: none"> Physical adaptation Social adaptation

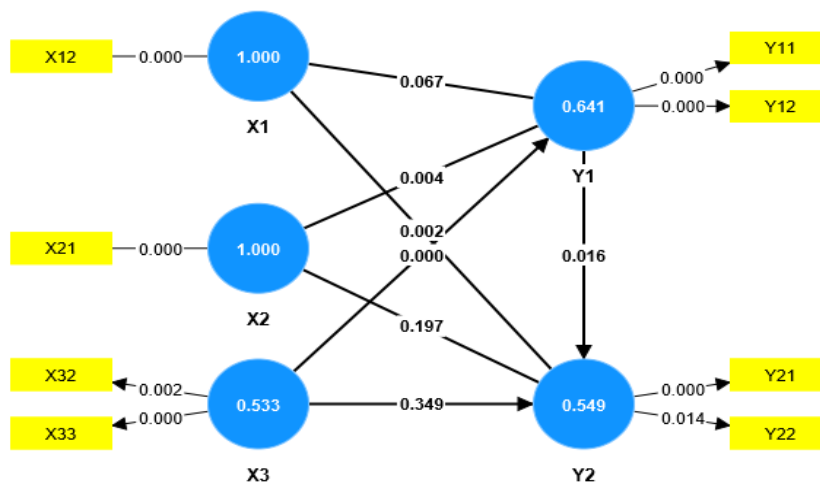


Figure 2 – Factors Influencing Adaptation

Figure 2 shows the results of model estimation using the Structural Equation Model analysis at the adaptation level in Peukan Bada, Montasik, and Jantho Districts. It can be seen that the factors that have a significant and positive effect on the Adaptation variable (Y1) are farmers' perceptions (X2) with a P-value of 0.004 < 0.05, and institutional support (X3) with a value of 0.000. While the characteristics of farmers (X1) have no real and positive effect on adaptation (Y1), the characteristics of farmers (X1) have a direct effect on the sustainability of farming (Y2) with P-values 0.002 < 0.05. While the factors that have a direct and positive effect on the sustainability of farming (Y2) are the characteristics of farmers (X1) with a P-value of 0.002 and adaptation (Y1) with a value of 0.016.

Factors that influence farmers' adaptation are farmers' perceptions of climate change. Farmers in the study area stated that they felt that climate change had an impact on their farming business. According to the results people's perceptions of climate change affect people's adaptation strategies. Communities claim to have felt the impact of climate change.

Group support influences farmers' adaptation. As the function of farmer groups as a forum for farmers in the process of learning, collaboration, production units, farmer groups really help farmers in solving problems faced by farmers. Farmers in the research area actively discussed with group members regarding the strategies used in overcoming farming problems. Farmers also work together to build infrastructure independently, such as making drainage to drain water to agricultural land.

Social support that influences farmers in adapting is shown by the participation and support of village communities who often hold meetings with farmers to exchange information and solve problems related to climate conditions and impacts, especially in handling pest attacks and drought.

Adaptations made by farmers in the form of physical and social adaptation. The observation results show that the adaptation strategy carried out by farmers physically is in the form of agricultural infrastructure development such as making drainage independently



by farmer groups, this is done to drain water into agricultural land. If there is flooding in the land, drainage is used to drain water from the fields with the help of a water pump. Farmers also drill boreholes to channel water to their farms during the dry season.

Farmers have used superior seeds that are resistant to various changes in climate conditions in running their farming business. In order for the growth of rice plants to remain good during the rainy season, farmers also plant rice by applying a spacing pattern, so that during heavy rains the intensity of pests on rice plants can be reduced.

Social adaptation by farmers by actively participating in farmer group meetings, this can help farmers in finding information related to farming and the ways that need to be done to overcome their farming business problems. Farmers also carry out social activities for all village communities by participating in mutual cooperation activities held in their villages, besides that farmers also take part in traditional activities held in the village such as holding agricultural land preparation activities before planting, and carrying out traditional activities after planting. From social activities carried out by farmers can increase cooperation between group members, so that in overcoming agricultural problems can help each other.

Economic adaptation by farmers is in the form of looking for additional work besides running their farming business. Income earned from the harvest will be stored and used for daily needs. Farmers also store grain harvested for daily consumption before entering the next harvest season. Generally farmers do not take advantage of loans from agricultural cooperatives, so to manage their farming business they use capital from crops and other income.

CONCLUSION

The adaptation strategy undertaken by farmers in Aceh Besar District to climate change consists of physical adaptation and social adaptation. Physical adaptation is carried out by building drainage and irrigation, using water pumps, using superior seeds and adjusting the spacing. Social adaptation is carried out by farmers by actively participating in farmer group meetings, actively participating in mutual cooperation activities, sharing information about what to do when experiencing climate change. However, adaptation economically is lower, farmers rely on income from food crops, and generally their main occupation is rice farming. So that economic adaptation has no effect.

Factors influencing rice farmers' adaptation to climate change are farmers' perceptions and institutional support. Farmers' perceptions have a positive effect on adaptation as reflected in farmers' perceptions of climate change. Farmers really feel climate change during farming. Institutional support has a significant effect on adaptation consisting of support from farmer groups and social support.

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