Strategy of Risk Adaptation for Local Maize Farmers Based on Livelihood Assets in Madura

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ABSTRACT

Local maize is the main food for Madura's farmers. The initiation of superior hybrid seeds which causes the conversion of commodities from local corn to hybrid corn creates a lot of risks and losses. This study aims to 1) Analyze the level of access to livelihood assets of local corn farmers 2) Analyze the level of risk and level of adoption of local corn farmers' adaptation strategies based on livelihood assets 3) The Effect of livelihood assets on strategy adoption. The research was conducted in Guluk-Guluk, Sumenep Regency. The analysis used is pentagonal assets analysis, descriptive analysis, and binary logistic regression. The results showed that the highest access of farmers to livelihood assets was access to social capital. The highest risk experienced by farmers is a technological risk. Meanwhile, the adaptation strategy chosen by the majority of farmers is hybrid crop diversification. Human capital, natural capital, and financial capital have a significant influence on the decision to adopt the adaptation strategy. So farmers need to adapt by maximizing their livelihood assets for better livelihood sustainability.

Keywords: Adaptation Strategy, Livelihood Risks, Livelihood Assets.

INTRODUCTION

Corn is one of the primary food crop commodities which has an essential and strategic role in improving the Indonesian economy. Corn has a multi-use function, both for direct consumption, as the primary raw material for the feed industry and the food industry; even in many countries, corn has been used as raw material for bio-energy. Also, corn farming is still the primary source of income for farming families. The consumption and development of maize use among Indonesians have increased from year to year, although it fluctuates.

The use of national maize tends to experience favorable growth, although, in some uses, it has fluctuated. Pusdatin data also states, the need for corn for direct consumption in the 2010-2016 period increased by about 2.85% per year, although not as significant as the need for feed raw materials by 7.76% and processed food by 6.73%. It is estimated that the increase in direct consumption needs is due to the increase in population in areas that still use corn as the staple food (Sulaiman et al., 2017).

As in Suprapti's et. al (2018) showed that Madura Island, especially Sumenep Regency, is one of the largest maize-producing areas and provides an opportunity for maize farmers to improve their knowledge and skills in corn commodity cultivation. Three local varieties are widely planted in Sumenep, namely local maize varieties Manding, Talango, and local maize varieties Guluk-Guluk which are widely grown in Guluk-Guluk District surroundings, Talango District and its surroundings, and Talango District and its surroundings (Arifin & Fatmawati, 2012). In 2019 Guluk-Guluk

local maize had the highest productivity among 26 other sub-districts in Sumenep Regency, namely 25.52 kW/ha or 2,552 tonnes/ha with a planted area of 1,427 ha. The productivity of local maize in the sub-district also produces other superior local maize varieties such as Manding at 14, 79 kW/ha or 1.479 tonnes/ha with a planted area of 487 ha, Talango at 16.86 kW/ha or 1.686 tonnes/ha with an area planting of 1,912 ha has lower productivity than Guluk-Guluk District (Department of Food Crops Agriculture, Horticultural and Plantation, Sumenep Regency, 2020).

Guluk-Guluk District is one of the corn production centers in East Java Province, which has superior local varieties(Isdiana Suprapti, Dwidjono Hadi Darwanto, 2014). The majority of farmers grow local maize for food supply, and a small portion is sold (Amzeri, 2018). Local maize (Guluk-Guluk) has the fastest growth (antesis, silking, harvest time) compared to hybrid and composite varieties but has the lowest morphology and production(Windra sukma, 2018). In 2019, Guluk-Guluk local maize production was recorded at 4,446.60 tonnes/ha with a planted area of 1,427 ha lower than Guluk-Guluk hybrid maize production total of 22,167.65 in a planted area of 4,908 ha (Department of Food Crops Agriculture, Horticultural and Plantation, Sumenep Regency, 2020).

Growing local maize is a source of livelihood for some farmers in Guluk-Guluk Village. Along with the growing trend of domestic demand for corn, it has encouraged efforts to increase the productivity of maize, one of which is in Guluk-Guluk. However, the increase in productivity was mainly dominated by hybrid maize, which assessed superior properties compared to local maize (Ainun Nikmah, 2013). The productivity of Guluk-Guluk hybrid maize in 2019 was 49.53 kW / ha or 4.953 tonnes/ha, more significant than the productivity of local maize of 25.52 kW / ha or 2,552 tonnes/ha (Department of Food Crops Agriculture, Horticultural and Plantation, Sumenep Regency, 2020).

The land tenure per farmer's family is relatively narrow, so that if farmers rely only on income from local corn farming, they cannot adequately fulfill their family's needs. The more incessant promotion of superior hybrid seeds initiation also presents new challenges for local maize farmers in market competition and limited access to information and technology in local maize development. As a form of promotion in 2019, the government provides hybrid corn subsidies of 18,150 kg or 18.15 tonnes to 85 farmer groups in Guluk-Guluk District (BPP Guluk-Guluk, 2020). Meanwhile, for local maize development, the government never provides subsidies, does not provide proper seed storage facilities after the cultivation of local maize seeds in 2007 in Guluk-Guluk. Local government policies that favor the development of hybrid maize also marginalize local maize farmers. The profession as a local maize farmer carried out by residents in the last ten years has decreased drastically, from around 600 people in 2010 to only 106 people in 2020 in Guluk-Guluk Village.

To sustain sustainable livelihoods, most people in Guluk-Guluk Village who work as local maize farmers are required to implement adaptation strategies to face risks and sustain their livelihoods. As in Upadhyay's (2019) research regarding the adaptation strategy of Bardiya, Nepal, in overcoming extreme climate change. Due to climate change, the losses and vulnerabilities of farmers that are not matched by the ability of farmers to adapt are a threat to their livelihood sustainability. The adaptation strategy undertaken by Nepalese farmers is by combining indigenous knowledge (sensory insight, cumulative experience from generation to generation, local skills) with modern knowledge (information through media) in the form of adaptation to changing the pattern and timing of planting. Different from this research is Guluk-Guluk farmers do diversification to overcome the technological risks they face. Research by Kuang et al. (2020) that farmers are

vulnerable to agricultural risks in the form of natural risks and market risks caused by erratic climate change that threatens farmers' livelihoods in the city of Rugao, China. As a form of adaptation of farmers to this problem, farmers have a relatively better percentage of human and natural assets than the other three assets.

Guluk-Guluk is one of the villages that still use local corn as the main food, this research is important to do recommend an effective adaptation strategy policy for Guluk-Guluk farmers, namely diversification (growing hybrid maize and local maize at the same time). Recommendation. This strategy is effective because it can increase income by planting. Hybrid corn can at the same time meet the food needs of farmers while maintaining planting local corn at the same time.

The information in this study will also provide knowledge to local maize farmers in utilizing critical assets that can reduce risk and strategy recommendations to adapt to superior hybrid corn farming. Farmers' income increases by planting hybrid maize, food needs can also be met, which in the end, farmers will experience an increase in welfare in the village of their birth. Therefore, the adaptation strategy of farmer households in managing and utilizing livelihood assets for local maize in Guluk-Guluk Village is interesting to study to analyze the livelihood assets of farmer households, know the risks and adaptation strategies of farmer households, and know the relationship of livelihood asset ownership to risks and adaptation strategies of local maize farmers in Guluk-Guluk Village. The objective of the research are *analyze the level of access to livelihood assets of local corn farmers analyze the level of risk and level of adoption of local corn farmers' adaptation strategies based on livelihood assets analyze the effect of livelihood assets on strategy adoption. the research was conducted in guluk-guluk, sumenep regency.*

METHODOLOGY
Research Locations
The research location was conducted in Guluk-Guluk District, Sumenep Regency. The location was determined purposively because the area is one of the corn production centers with superior local varieties having the highest productivity among the other 26 sub-districts in Sumenep Regency.

Sample Determination
The population in this study were local maize farmers in Guluk-Guluk Village. The sample was determined by the random sampling technique (random sample). The random sampling technique is a technique of taking samples from the population so that each sample unit in the population has an equal chance of being selected into the sample (C.P.Parel et al., 1973). The number of samples obtained was 51 local maize farmers with the determination of the number of samples using the Slovin method (Umar, 2005).

Method of Collecting Data
This research data collection uses several methods, including interviews, questionnaires, participant observation, and documentation. The interview process was carried out by digging in-depth information from local maize farmers to obtain information about local maize farmers' demographics and data that supported the information in the questionnaire, such as risks, asset ownership, and adaptation strategies of local maize farmers. Observation is applied by participating in observing directly with farmers related to local maize farming. Documentation is carried out as evidence of research in the form of authentic notes on the results of interviews, pictures/photos while carrying out research activities, and the process of documenting other supporting data.

Data Analysis
Analysis of objective 1 using pentagonal asset analysis by using a Likert scale calculation with the following scale categories:

Interval Cascade Values= (The Highest Score-The Lowest Score)/(Number of Criteria Statement)
Interval Cascade Values=(4-1)/4
Interval Cascade Values=0,75

Then obtained the following scale categories: 1.00-1.75 Very Bad, 1.76-2.50 Not Good, 2.51-3.25 Good, and 3.26-4.00 Very Good (Sugiyono, 2017). Analysis of objective 2 using frequency descriptive analysis. Meanwhile, Analysis of objective 3 using two (2) binary logistic regression models. Binary logistic regression is a regression with the dependent variable that is dichotomous, has two categories, namely whether an event occurs or does not occur (Y = 1 or Y = 0) with the following formula (Dahlan, 2019):

$$Y=\ln (Pi / 1\text{-}Pi) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e(1)$$

Where for the 1 Y model is the decision to adopt an adaptation strategy (Pi = 1, farmers plant other crop varieties (hybrids), Pi = 0, farmers do not adopt an adaptation strategy), **β0** is a constant, **X1** is Human Capital, **X2** is Social Capital, **X3** is Natural Capital, **X4** is Physical Capital, **X5** is Financial Capital, **b1-b0** is the regression coefficient, **e** is an error. Model 2 **Y** is the decision to adopt an adaptation strategy (Pi = 1, the farmer changes the planting date of local maize with a hybrid, Pi = 0, the farmer does not adopt an adaptation

strategy), **β0** is a constant, **X1** is Human Capital, **X2** is Social Capital, **X3** is Capital In Nature, **X4** is Physical Capital, **X5** is Financial Capital, **b1-b0** is the regression coefficient, **e** is an error.

RESULTS AND DISCUSSION
Livelihood Assets Conditions for Local Maize Farmers
The condition of controlling farmer assets supports adopting the farmer's adaptation strategy in facing livelihood risks in the form of natural risks, market risks, technology risks, and policy risks in this study. Also, farmer asset profiles can help governments and practitioners decide the size of an intervention or assistance during or after vulnerability. Therefore, an accurate and realistic understanding of farmers' assets is essential in order to be able to analyze how they are trying to convert their assets into positive livelihood outcomes (Udoh et al., 2017).

Based on the presentation of DFID (1999) particularly the livelihoods of the poor. It was developed over a period of several months by the Sustainable Rural Livelihoods Advisory Committee, building on earlier work by the Institute of Development Studies (amongst others believes that in carrying out their life, they need at least five essential assets which are interconnected in order to maintain a sustainable livelihood, namely; natural assets (natural capital), human assets (human capital), physical assets (physical capital), social capital, and financial assets (financial capital). The conditions for controlling the five assets of farmers in this study are as follows (Figure 1).

Table 1
Conditions of Control of Local Corn Farmers' Assets

Livelihod Assets	Average Value	Criteria
Human Capital	2,07	Not Good
Social Capital	3,03	Good
Natural Capital	1,97	Not Good
Physical Capital	1,58	Very Bad
Financial Capital	1,87	Not Good

Source: Primary Data Processed, 2021

Pentagonal Assets of Local Maize Farmers
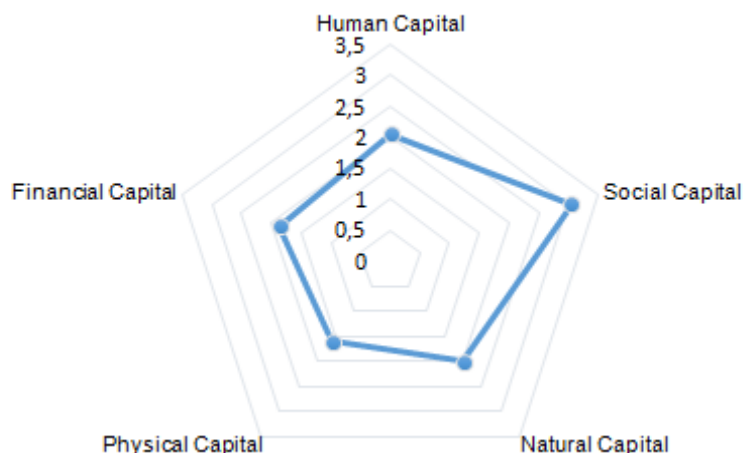
Source: Primary Data Processed, 2021

Figure 1
Pentagonal Assets of Local Maize Farmers Guluk-Guluk

It can be seen from the pentagonal livelihood assets of local maize farmers in Guluk-Guluk above that it shows that the most significant asset access is social capital with an average value of 3.03 (Good). Gotong royong in carrying out farming activities is a culture passed down from generation to generation, commonly practiced by Guluk-Guluk farmers, including in local maize farming. Local maize harvesting is carried out with close neighbors and relatives, so there is no need to pay wages. This is done in turns for each neighbor who is doing the harvesting.

The participation of farmers in social organizations such as LAZISNU, Majelis Dzikir, and Ansor in each branch is a separate force for farmers to carry out agricultural activities, including planting local maize as food. The food granary program to maintain the stability of food security in the organization is driven by most village Kiai who are role models for the community and are always respected by the community in driving social mobility. The strong social relationship between the role of the Kiai towards the santri and the abangan (local community) in managing agriculture, animal husbandry, and coo-perative activities has existed since 70 years ago (Akarhanaf, 2018). Relationships of trust, reciprocity, and exchange that facilitates collaboration support the strength of social capital for farmers (Rohmah, 2019). In line with research (Retno Andriani et al., 2020)social capital in the form of organizational participation, FGD *(Focus Group Discussion),* and harmony between neighbors are the assets with the highest access to banana farmers in Malang.

According to Ma et al. (2018), farmers' assets, especially social assets, are the most critical factors affecting the increase in income. Lack of livelihood capital, such as social assets, information, and others, is the root cause for low-income people trapped in poverty. Just as in Kuang's et al. (2020), considering the dynamics in maintaining farmers' livelihoods in the Rugou-China, social capital is proved significant.

Physical capital is an asset with the lowest tenure condition of 1.58 (Very Bad). This is because most owners of agricultural infrastructure are limited to hoes and sickles and property in the form of livestock, which does not entirely belong to local maize farmers but belongs to the skipper who is herded. Like Azzahra & Dharmawan (2015) research although the physical capital owned by lower and upper

layers of farmers is in the medium category. Areas that are constantly flooded every rainy season make farm households do not have many valuable household assets. Even though the household income of the upper layer farmers is high, the household assets are not luxurious, only in the form of a bit of gold in Sukabakti Village, Tambelang District, Bekasi Regency.

Livelihood Risk and Adaptation Strategy for Local Maize Farmers

Guluk-Guluk local maize farmers experience several livelihood risks, including technology risk, market risk, natural risk, and policy risk. The most significant percentage of affected risk was technology risk at 96.1%. On the one hand, the initiation of new technology in the form of superior hybrid seeds has a positive impact on income distribution; on the other hand, it hurts local maize farmers. As in Aeni et al., (2021) research which states that every business contains risks, including agricultural businesses.

New trends that enter the life of farmers require farmers to adapt to this trend. With the existence of hybrid maize, the price of maize becomes cheaper because the yields of the corn harvest are abundant. From the price of IDR 7,000 in the 1980s to IDR 3000-4000 in 2021. With the modernization of agriculture (hybrids), it is a challenge for farmers to improve their knowledge of planting techniques (spacing, applying fertilizers, irrigation) which is more structured than before. Who usually carry out agricultural activities with traditional systems. They are threatening the scarcity of local maize food, which is believed to be the primary energy source and health for farmers.

Based on the interviews with staff of the Alsintan field of the District Agriculture Office, Sumenep, it was explained that the expansion of local maize farming would not be carried out because, in 2021, Guluk-Guluk District was the target of developing hybrid maize that was superior to previous years. So that policies regarding local maize development will be improved. The government's misuse of technology in the form of alsintan assistance for farmer groups does not function properly for farmer group members, like a plow machine.

The second highest risk of impact is the natural risk, with a percentage of 90.2%. Erratic extreme weather conditions impact local maize crops, which are susceptible to rats, caterpillars, and downy mildew. The same thing impacts fluctuating maize prices due to the poor quality of maize and the decline in maize production.

Based on the findings in the field, respondents said that the increasing variety of diseases was also influenced by the entry of hybrid maize in Madura. Therefore, farmers need to utilize their livelihood assets for farmers' decisions regarding agricultural production and help families overcome livelihood vulnerabilities and livelihood risks (García de Jalón et al., 2018).

The adaptation strategy undertaken by farmers in facing various livelihood risks is an agricultural adaptation strategy in the form of a diversification (hybrid) strategy and a strategy to change the planting date. Based on table 3 above, it can be seen

Table 2
Percentage of Livelihood Risk Level of Local Corn Farmers

Livelihood Risk	Not Affected by Risk %	Affected by Risk %
Natural Risk	9,8	90,2
Market Risk	13,7	86,3
Technology Risk	3,9	96,1
Policy Risk	23,5	76,5

Source: Primary Data Processed, 2021

that the adoption of an adaptation strategy for the diversification of hybrid maize growers together with local maize is the primary choice of local maize farmers with a percentage of 80.4%. Comparing two times the yield of hybrid maize yields of 6.5 tonnes/season compared to local maize of 3.6 tonnes/season under normal conditions can help increase farmers' income. On the other hand, farmers' food needs must be met by simultaneously planting local maize as the primary food so that the adoption of a diversified (hybrid) adaptation strategy is the primary choice in reducing some of the risk impacts, including financial risk and technology risk.

The decision of several other farmers in choosing an adaptation strategy to change the planting date or change the planting season by 64.7% was motivated by supportive natural conditions. In Planting Season 2 (MT 2), January-March, the wind conditions are more stable than MT 1, with more vital wind conditions that can overthrow local maize plants with smaller stems than hybrid maize.

Analysis of the Effect of Livelihood Assets on Adaptation Strategy Adaptation with Binary Logit Regression
In model 1, this study has variable Y with two categories: code 1 (adopting an adaptation strategy of hybrid planting diversification) and code 0 (not adopting an adaptation strategy of hybrid planting diversification). Model 2 has variable Y with two categories: code 1 (adopting an adaptation strategy to change the planting date) and code 0 (not adopting an adaptation strategy to change the planting date). All categories with code 1 will be used as a hypothesis strengthened

through independent variables (X1 = Human Capital, X2 = Social Capital, X3 = Natural Capital, X4 = Physical Capital, X5 = Financial Capital).

The variables in the equation table present the output that from the five independent variables, there is one variable, namely X2 (Social Capital), which has a partially significant effect on the variable Y code 1 (adopting a hybrid planting diversification adaptation strategy) and code 0 (not adopting a strategy adaptation of diversification of hybrid planting) with a sig value of 0.003 <0.05 and a wald value of 8.748 greater with a chi-square table df 1 value of 3,841. The Exp value (B) of variable X2 is 0.036, and this indicates that the higher the social capital of local maize farmers, the more likely they are to adopt a diversification (hybrid) adaptation strategy of 0.036 times compared to farmers who have low social capital. Then the value of B X2 of 3.333 indicates that social capital has a positive relationship with the decision to adopt a diversification (hybrid) adaptation strategy.

Research by Liu et al. (2018) indicated that having different social assets positively affects the allocation of livelihood assets for agricultural households. However, in the empirical analysis of his research in China, social capital does not significantly influence the choice of livelihood strategies of farmer households. It shows that in the analysis of the livelihoods of farmer households, quantitative analysis and qualitative analysis of social background must be considered.

The living tradition of local maize farmers who cooperate with each

Table 3
Percentage of Adaptation Strategies for Local Corn Farmers

Adaptation Strategy	Not Adopting an Adaptation Strategy %	Adopt an Adaptation Strategy %
Diversification (hybrid) strategy	19,6	80,4
Change the planting datestrategy	35,3	64,7

Source: Primary Data Processed, 2021

Table 4
Results of Logit Analysis on the Effect of Livelihood Assets on Adoption of Local Corn Farmers Adaptation Strategies

Variables	B	Wald	Df	Sig	Exp (B)
Human Cpital (X_1)	-0,320	1,086	1	0,297	0,726
Social Capital (X_2)	3,333	8,748	1	0,003	0,036
Natural Capital (X_3)	-0,856	2,287	1	0,130	0,425
Physical Capital (X_4)	-0,222	0,284	1	0,594	0,801
Financial Capital (X_5)	-0,320	2,145	1	0,143	1,803
Constanta	37,118				
Omnibus Test of Model Coefficients (Overall Test)			5	0.000	
Chi Square count					22,389
Chi Square table			5		11.070
Chi Square table			1		3.841
-2 Log Likelihood Block Number = 0					53,182
-2 Log Likelihood Block Number = 1					30,793
Hosmer and Lemeshow Test				0,714	
Negelkerge/Pseudo R Square					0,549
Overall Percentage					84,3 %

Source: Primary Data Processed, 2021

other's neighbors strengthens the trust of each other constantly to be involved in agricultural activities. The social organization, which village Kiai mainly leads, is a forum for farmers to help each other in farming activities. Such as making organic fertilizers, agricultural cooperatives, and other agricultural activities closely tied between pesantren Kiai, students, and farmers (Fatchan & Soekamto, 2015). In line with Paul's et al. (2020) research, social capital is the most important and supports the sustainability of the livelihoods of shifting cultivators in India.

The Variables table in the equation presents the output that of the five independent variables, there are two variables, namely X1 (Human Capital), which has a partially significant effect on the variable Y code 1 (adopting an adaptation strategy to change the planting date) and code 0 (not adopting a strategy adaptation to change the planting date) with a sig value of 0.021 <0.05 and a wald value of 5.350 greater with a chi-square value of df 1 table valued at 3,841. The value of Exp (B) from

the variable X1 is 1.821, and this indicates that the higher the human capital of local maize farmers, the more likely they are to adopt an adaptation strategy to change the planting date by 1.821 times compared to farmers who have low human capital. Then the value of B X1 of 0.599 indicates that human capital has a positive relationship with the decision to adopt an adaptation strategy to change the planting date.

Furthermore, X5 (Financial Capital) which has a partially significant effect on the variable Y code 1 (adopting an adaptation strategy to change the planting date) and code 0 (not adopting an adaptation strategy to change the planting date) with a sig value of 0.027 <0.05 and a wald value. 4,875 is more significant with the chi-square table df 1 value of 3,841. Value Exp (B) From variable X5 is 0.523, which indicates that the higher the financial capital owned by local maize farmers, the more likely they are to adopt an adaptation strategy to change the planting date by 0.523 times farmers who have low financial capital. Then the B X5 value of 0.648 shows that human capital has a positive

relationship with adopting an adaptation strategy to change the planting date. The higher the skills and education of farmers result in higher skills of farmers in choosing a good strategy for the sustainability of their livelihoods. As in Paul's et al. (2020) study, the choice of livelihood strategy largely depends on the type of livelihood capital owned by the household. Financial capital is imperative capital and supports the sustainability of the livelihoods of the shifting cultivators in Jhumias, India.

Salatalohy (2019) also explains that human capital includes the level of labor allocation, the level of education, and the number of household skills; it is known that more than 50% of households will support the making of livelihood strategies that support increased income. The savings of farmers each month encourage farmers to adopt a strategy of changing the planting date of local maize at MT 2 as food. Planting Season 1 can plant hybrid maize to increase income which is then set aside for storage. This finding is also in line with the research of Maulidah et al. (2020)

that financial assets have a positive and significant effect on the production aspect to achieve rice self-sufficiency in Indonesia.

CONCLUSION

The most dominant level of access to livelihood assets for local corn farmers is social capital because farmers form strong mutual trust between relatives and friends in carrying out every local corn farming activity and prioritize the principle of mutual cooperation in social relations, both individually and in groups. Meanwhile, the lowest level of access to livelihood assets is physical assets due to the low level of farmers' income which causes the majority of facilities and infrastructure owned by farmers to be limited to hoes and sickles which are used for generations.The highest level of risk affected by farmers is a technological risk because the initiation of new hybrid corn technology can shift the existence of local corn farming, the conversion of hybrid commodities, and the increase in diseases that cause a decrease in local corn productivity. While

Table 5
Results of Logit Analysis The Effect of Livelihood Assets on Adoption of Local Corn Farmers Adaptation Strategy Model 1

Variables	B	Wald	Df	Sig	Exp (B)
Human Capital (X_1)	0,599	5,350	1	0,021	1,821
Social Capital (X_2)	-0,125	,232	1	0,630	0,882
Natural Capital (X_3)	0,187	,221	1	0,638	1,206
Physical Capital (X_4)	-0,021	,004	1	0,951	0,980
Financial Capital (X_5)	-0,648	4,875	1	0,027	0,523
Constanta	0,762				
Omnibus Test of Model Coefficients (Overall Test)			5	0.044	
Chi Square count					11,399
Chi Square table			5		11.070
Chi Square table			1		3.841
-2 Log Likelihood Block Number = 0					66,223
-2 Log Likelihood Block Number = 1					54,824
Hosmer and Lemeshow Test				0,606	
Negelkerge/Pseudo R Square					0,275
Overall Percentage					72,5

Source: Primary Data Processed, 2021

the level of adoption of the most dominant adaptation strategy is the adaptation strategy of diversification (hybrid) because by adopting this strategy farmers can meet their food needs while simultaneously increasing their income.Human capital, natural capital, and financial capital have a positive and significant impact on farmers' adaptation adoption decisions because farmers need money to buy hybrid seeds and favorable weather when diversifying hybrid crops.

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