

OPEN ACCESS: Research Article 

## Adaptation Strategies of Wet-Rice and Dry-Rice Farming Households in Facing Local Climate Change in Polewali Mandar, Indonesia

Aulia Nurul Hikmah<sup>1\*</sup>, Putra Astaman<sup>2\*</sup>, Muhammad Dassir<sup>3</sup>, Sitti Nadirah<sup>4</sup>, Sadam Suliman Mohamed Yousof<sup>5</sup>

<sup>1</sup>Agribusiness Study Program, Institute of Technology and Business Muhammadiyah Polewali Mandar, Indonesia

<sup>2</sup>Agribusiness Study Program, Faculty of Agriculture, Muhammadiyah University of Sinjai, Indonesia

<sup>3</sup>Faculty of Forestry, Hasanuddin University, Indonesia

<sup>4</sup>Agricultural Engineering Study Program, University of East Indonesia, Indonesia

<sup>5</sup>Department of Animal Production, Faculty of Veterinary Science, University of Gadarif, Sudan

\*Correspondence e-mail: [aulianurulhikmah@gmail.com](mailto:aulianurulhikmah@gmail.com); [utthaastaman@gmail.com](mailto:utthaastaman@gmail.com)

Received : August 20, 2023

Accepted : November 17, 2023

Published : November 24, 2023

### Abstract

Climate change makes it difficult for farmers to run their farming businesses, especially rice farmers in Matakali Sub-district, Polewali Mandar District. Climate change encourages wet-rice and field-rice farmers to implement adaptation strategies that can minimize the negative impacts of climate change. The negative impacts are crop failure and decreased rice production. Adaptation by farmers is expected to reduce losses due to climate change impacts. This study aimed to analyze the adaptation strategies of households of wet-rice and field rice farmers in the face of climate change (drought and flood). The research was conducted in Matakali Sub-district, Polewali Mandar Regency, with the research design of survey method and interviews on Farmer Households as the unit of analysis. The results showed that the adaptation strategies carried out by households of wet-rice and field rice farmers in Matakali District to minimize the negative impacts of climate change include: 1) survival strategy, 2) consolidation strategy, and 3) accumulation strategy. Survival strategies carried out by households of wet-rice and field rice farmers in maintaining their survival are by diversifying their work, economic adaptation, and getting assistance from the government. The consolidation strategy is carried out by households of wet rice and field rice farmers who can still fulfill their needs despite experiencing crop failure. Farming communities that apply consolidation strategies borrow money from relatives, families, banks, and cooperatives. Accommodation strategies are carried out by groups of farming households, namely opening a grocery store business. The application of survival, consolidation, and accumulation strategies is sometimes still needed to meet all the needs of the households of wet-rice and field rice farmers.

### Keywords

Climate change; adaptation strategy; drought; flood; rice farmer

## 1. Introduction

People currently need to become more familiar with climate change, but they are aware of the impacts caused by climate change. The people who feel the effects the most are those who depend their economic resources on natural conditions, such as farmers. Smallholder farmers generally need the ability to adapt and deal with the impacts of climate change. (Arifah et al., 2023). Climate change, such as reduced rainfall intensity, causes land degradation, which affects crop yields and farmers' income (Wolka et al., 2023). (Wolka et al., 2023). Research by Hidayati & Suryanto (2015) stated that almost all farmers feel the impact of climate change, such as reduced water availability and changes in crop yields that cause a decrease in production/harvest. It was causing a decrease in production/harvest yields. To minimize the impact of climate change, things that can be done are land management in the form of soil and water conservation using terraces and barriers, planting trees, and developing forage fodder. (Amjath-Babu et al., 2016; Alewoye Getie et al., 2020)

Management and adaptation strategies need to be carried out so that farmers who previously did not know become aware (Kural et al., 2021; Lee et al., 2021; Ray Biswas & Rahman, 2023; Zong et al., 2022), who are less prepared become more prepared to face the phenomenon of climate change (Adeagbo et al., 2021; Gurung et al., 2021; Sitati et al., 2021; Trnka et al., 2021), and can adjust by minimizing the negative impacts and optimizing the positive impacts of climate change so that losses in quantity and quality of crops can be minimized (Valkengoed et al., 2023).

Research (Aziz et al., 2022; Hidayati & Suryanto, 2015) shows that adaptations made by rice farmers include changing varieties, changing doses and types of fertilizers, controlling pests and shifting planting times, while households of wet-rice and field-rice farmers in Matakali District carry out adaptation strategies such as survival, consolidation, and accumulation strategies. Various adaptation strategies are prepared to deal with the adverse effects of climate change so that farmer households are able to adapt and have increased resilience. Tofu et al. (2022) argue that the vulnerability of farmers will continue to increase without adaptation. The form of adaptation response, in principle, is to minimize vulnerability and build resilience; in other words, farmers must have a more resistant and robust condition against climate change (drought and flood). This study aims to analyze the adaptation strategies of households of wet-rice and field rice farmers in the Matakali Sub-district in the face of climate change (drought and flood).

Climate Change can cause stress and shocks to households of wet-rice and dry-rice farmers in the Matakali Sub-district. The agricultural sector is one of the sectors that is vulnerable to climate change (droughts and floods). Most people in the Matakali Sub-district depend on farming, especially rice. Currently, the area of paddy fields in Matakali Sub-district is 2,100

hectares and dry land in smallholder plantations and fields is 1,993 hectares. Farmers' fields in Matakali Sub-district are primarily located in mountainous areas. According to Braunschweiger & Ingold (2023), the impact of climate change in mountainous areas is the reduction of water sources resulting in drought. Matakali sub-district is one area experiencing climate change's impact with disaster-prone categories (floods and droughts). The flood vulnerability map in the sub-district is in the medium to high category, while the level of drought vulnerability is in the medium category (BPS Kecamatan Matakali, 2021).

Spring water in the research location becomes a major problem when entering the June-November planting season (dry season). This season is considered the most vulnerable season for drought given the minimal availability of springs, requiring farmers to carry out adaptation strategies to climate change so that the productivity and income of wet-rice and dry-rice farmers do not decline.

There have been many studies on the adaptation of households of paddy and field rice farmers to climate change, such as: (1) Farmers' Adaptation to Climate Change, Its Determinants and Impacts on Rice Yield in Nepal (Khanal et al., 2018); (2) Synergy between climate risk perception, adaptation responses, and agricultural productivity: the case of rice farming communities in Pakistan (Khan et al., 2022); (3) Impact of climate change on agricultural production; Issues, challenges, and opportunities in Asia (Habib-ur-Rahman et al., 2022); (4) Determinants of climate change adaptation strategies and its impact on the net farm income of rice farmers in south-west Nigeria (Ojo & Baiyegunhi, 2020); (5) Climate change impacts and the rice farmers' responses at irrigated upstream and downstream in Indonesia (Arifah et al., 2022). However, no research has attempted to reveal the phenomenon of comparative adaptation of households of wetland and field rice farmers facing climate change, so the aims of this study is to analyze the adaptation strategies of households of wetland and field rice farmers in Matakali District in the face of climate change (drought and flood).

## 2. Materials and Methods

### 2.1. Research Site

The research was conducted in Matakali District, Polewali Mandar Regency. The research location was chosen *purposively* because the sub-district is one of the ecologically vulnerable areas characterized by droughts and floods that will come periodically every year. Data collection and processing were carried out from June 2023 - August 2023. The map of the research location is shown in Figure 1.

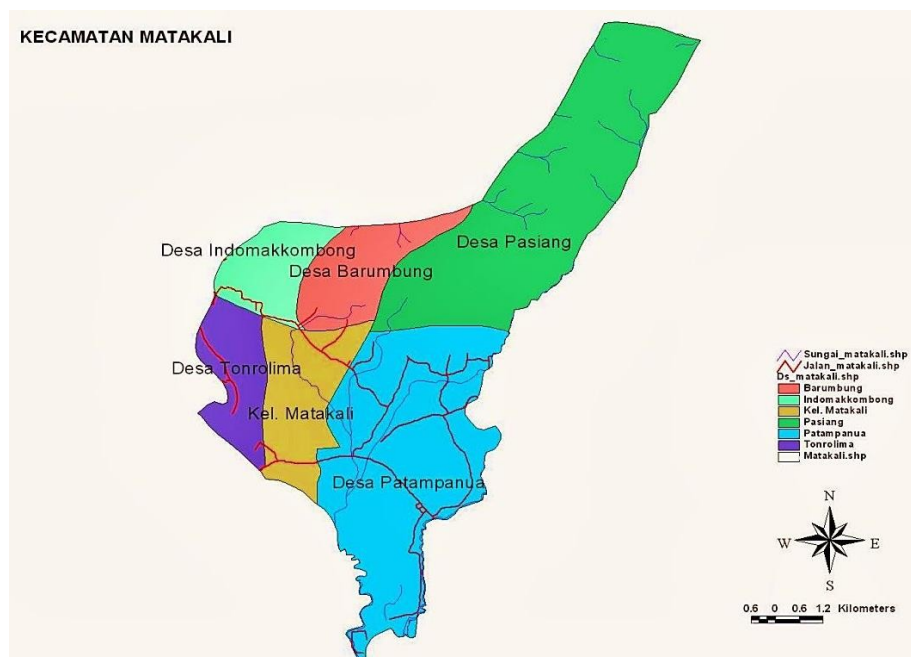


Figure 1. Research location map

## 2.2. Data Type and Source

The data used includes primary and secondary data. Primary data came from interviews using questionnaires and *in-depth interviews*. Primary data needed include the characteristics of respondents and adaptation strategies (survival, consolidation, accumulation) carried out by households of wet-rice and field rice farmers in Matakali District in the face of climate change. Secondary data comes from literature and other supporting data for writing the results of this study.

## 2.3. Data Collection Method

The determination of respondents is done *purposively*. Sugiyono (2013) states that *purposive sampling* is a sampling technique with specific considerations. The number of respondents in this study was 50 farmer households consisting of 25 households of wetland ricefarmers and 25 households of field rice farmers who had the characteristics of a farmer:

1. Has a farming land area ranging from 0.5 - >1 Ha
2. Have at least three years of farming experience
3. Joining a farmer's group
4. Farmers who have felt and experienced the impacts of climate change on wetland and dryland farming.

#### 2.4. Data Processing and Analysis Techniques

The data obtained in the research is analyzed descriptively and quantitative. Quantitative data from questionnaires and *interviews were* processed using *Microsoft Excel*. The data processed using *Microsoft Excel* was then analyzed descriptively to describe the form of adaptation carried out by households of wet-rice and field rice farmers. The indicators of adaptation strategies of households of wet-rice and field rice farmers in the Matakali Sub-district can be seen in Table 1.

**Table 1.** Data Collection Methods and Information on Adaptation Strategies of Rice Paddy and FieldFarmer Households in Matakali Sub-district

Variables	Data collected	Indicator	Data Type
Adaptation strategies during a crisis	Adaptation strategies needed by farming households during crop failure or lean times (crisis)	<ol style="list-style-type: none"> <li>Survival strategies (job diversification, economic adaptation, and government assistance)</li> <li>Consolidation strategies (borrowing money from relatives, borrowing money from family, borrowing money from banks, borrowing money from cooperatives)</li> <li>Accumulation strategy (Addition of income sources and surplus production)</li> </ol>	Descriptive

It should clearly describe the time and research sites, research design, types and sources of data, data collection techniques, and data analysis techniques. Emphasis on how to acquire data, analysis techniques and strongly relies on addressed problem in introduction section.

#### 2.5 Stages of Research Activities

This research consists of three stages, namely the first stage of direct observation to the research location. The second stage is conducting interviews with respondents and the third stage is distributing questionnaires. After obtaining information and data, data processing will then be carried out using a qualitative descriptive analysis tool.

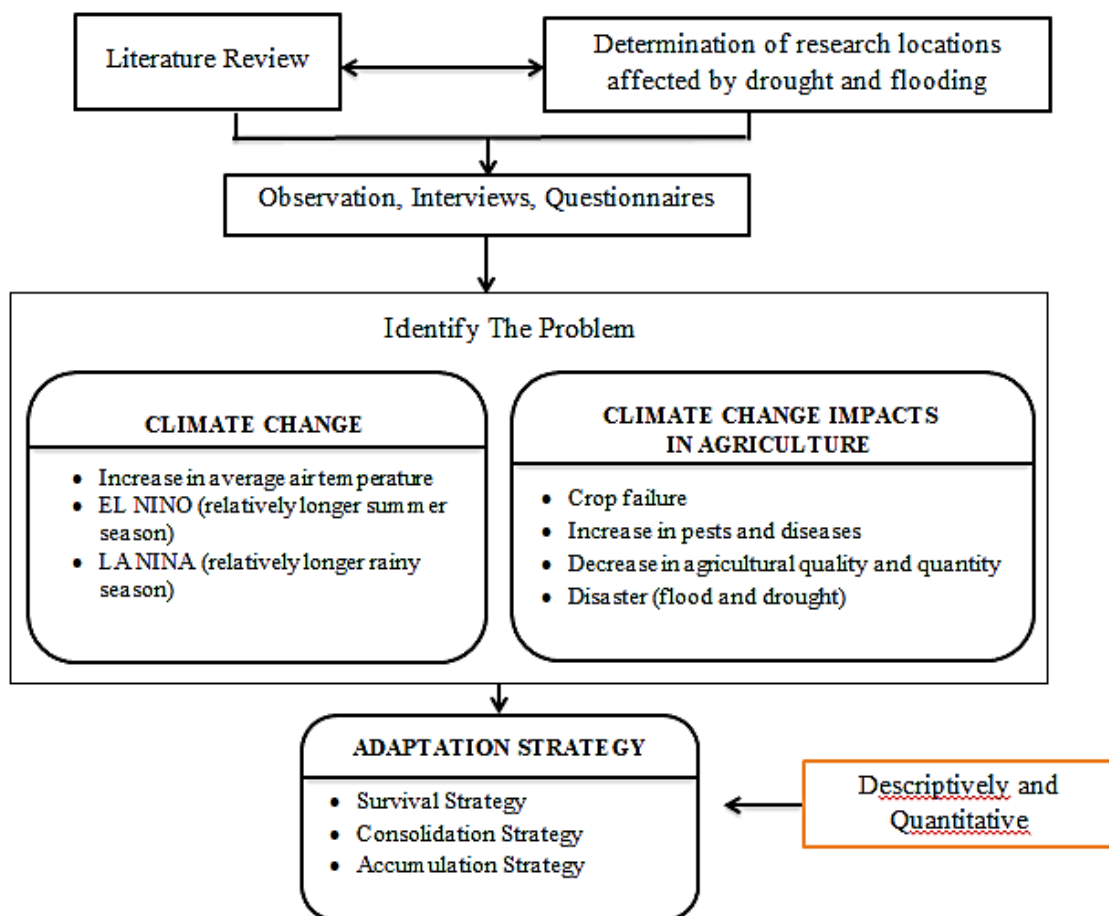


Figure 2. Research flowchart

### 3. Results and Discussions

#### 3.1. Forms of Adaptation Strategies of Rice Paddy and Field Farmer Households

Rice yields are the primary income for households of wet-rice and field rice farmers to maintain the quality of life in their households. If there is a crop failure due to climate change (drought and flood), the quality of life will be threatened. This condition will create vulnerability and anxiety in the households of paddy fields and lead rice farmers to meet the family's economic needs so that the households of wet rice and field rice farmers carry out various adaptation strategies in the face of climate change (droughts and floods) to regain an adequate quality of life. According to White (1991), adaptation strategies are survival, consolidation, and accumulation strategies (Figure 2). The three strategies are used by households of wet rice and field rice farmers to survive the difficulties and losses experienced

as a result of climate change (droughts and floods). Wetland rice farmer households can use other adaptation strategies, according to research by Aniah et al. (2019) (2019), namely changing varieties, changing planting times, planting trees, and migrating to reduce farmer losses due to climate change (drought and floods).

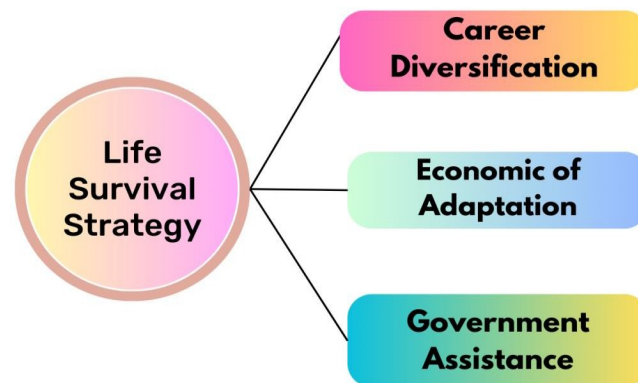


**Figure 3.** Adaptation Strategies of Rice Paddy and Field Farmer Households in Matakali Sub-district in the Face of Climate Change

### 3.2. Life Survival Strategy of Rice Paddy and Field Farmer Households

Survival strategy is carried out by farmers who have little or no land and only work as farm laborers with low rewards (White, 1991). People who apply a survival strategy usually have pre-prosperous status in the sense of small capital and narrow agricultural land area (Abidin & Wahyuni, 2015).

The survival strategies applied by households of wet-rice and field rice farmers in Matakali Sub-district are doing career diversification, economic of adaptation, and assistance from the government (Figure 3).



**Figure 4.** Survival Strategies of Rice Paddy and Field Farmer Households in Facing Climate Change

### 3.3. Career Diversification

More than the harvest income is needed to return the business capital of rice paddy and field farmerhouseholds, so they must find ways to fulfill their household needs and get business capital for the next planting season. Career diversification is one of the strategies that households of wet-rice farmers and field rice farmers use when experiencing crop failure and decreased rice production due to climate change. Farmers in Matakali Sub-district still maintain their main livelihood as rice farmers. However, uncertain climatic conditions have forced wetland rice farming households to implement a job diversification strategy to fulfill their family's economic needs (Table 2).

**Table 2.** Types of Career Diversification of Household Occupations of Rice Paddy and Field Farmers in Matakali Subdistrict

No.	Type of Career Diversification	Number of Respondents (Person)	Percentage (%)
1	Breeders	13	26,00
2	Farm Laborer	17	34,00
3	Building Laborer	9	18,00
4	Woodworker	2	4,00
5	Trade	5	10,00
6	Other	4	8,00
Total		50	100,00

In the face of climate change, 17 respondents diversified their careers as farm laborers. Not all paddy and field rice farmers have their land, so they have a survival strategy to maintain their economy by managing other people's land. In addition, 13 respondents chose a side job as a farmer to fulfill their family's economic needs.

Efforts to increase income by diversifying work have only provided a small addition to the source of income for households of wet-rice and field rice farmers in the Matakali Sub-district. This is because the side jobs done by households of wet-rice and field rice farmers are only as farm laborers as many 17 respondents and construction workers as many 9 respondents. So that the wages received are still relatively low and make other family members (wife and children) work to help increase the family's income source. Irawan (2018) said earning a living is not only the responsibility of the husband (farmer) but the responsibility of all family members (wife and children) in order to increase income and meet family needs.

### 3.4. Household Economic Adaptation of Rice Paddy and Field Farmers

The economic adaptation carried out by wet rice and field rice farmers in when experiencing crop failure and decreased production due to climate change is by selling the previous harvest,



livestock, and jewelry (Table 3). The *survival* strategy is used to fulfill life needs such as farming capital, children's education costs, family health costs, and daily needs.

**Table 3.** Household economic adaptation of paddy and field rice farmers in the face of climate change

No.	Economic Adaptation	Number of Respondents (Soul)	Percentage (%)
1	Selling the previous harvest	28	56,00
2	Selling livestock	15	30,00
3	Selling gold (jewelry)	7	14,00
	Total	50	100,00

The harvest obtained is usually stored for family consumption supplies for one year, while the rest is sold to meet daily needs. The sale of assets in the form of jewelry (gold) is made by some wives of wet-rice and dry-field farmers when the family economy is unstable due to the impact of climate change. The obstacle wet-rice and dry-field farmer households face after selling their valuable assets is that it is challenging to repurchase them.

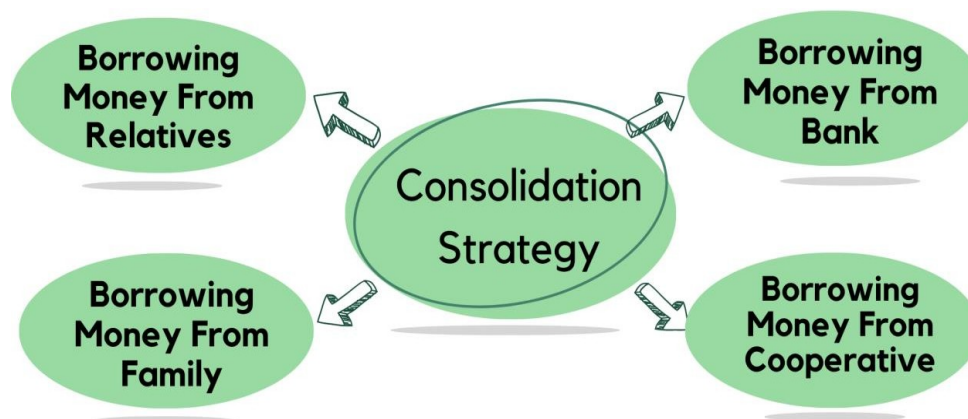
Rice paddy and landing farmer households will do various ways to deal with vulnerability due to climate change. Adaptation of rice paddy and landing farmer households depends on how many assets they have. The more assets owned, the more straightforward and more varied the adaptations made by the rice paddy and landing farmer households will be.

### 3.5. Government Assistance

Most rice farming households in the Matakali sub-district have yet to receive any assistance from the government in dealing with climate change. Only three respondents received assistance from the government in the form of receiving necessities. Whereas with assistance from the government, the households of wet-rice and field rice farmers in Matakali Sub-district can be helped in reducing the cost of living due to the impact of climate change. The distribution of government assistance has yet to be maximized, making the households of wet rice and field rice farmers lack capital and choose to take loans when facing climate change.

## 4. Household Consolidation Strategies of Rice Paddy and Field Farmers

The consolidation strategy is a middle group strategy that prioritizes security and income stability from processing its resources (White, 1991). Research conducted by Wulan et al. (2016) mentioned that households with a consolidation strategy can fulfill primary needs well and even fulfill secondary and tertiary needs.



**Figure 5.** Consolidation Strategy of Rice Paddy and Field Farmer Households in Facing Climate Change

Consolidation strategies undertaken by rice paddy and field rice farmer households are in the form of borrowing money. This strategy is carried out when farmer households are in difficult circumstances due to climate change (droughts and floods) and is used as capital for the next planting period. In addition, the money-borrowing strategy covers economic shortfalls when income is not in good condition.

On average, rice paddy and field rice farmer households use the money-borrowing strategy as capital in farming and to fulfill the family's economic needs (Table 4). According to (Runturambi et al., 2019), farming families borrow money from family and relatives to meet their needs because they do not have savings from farming.

**Table 4.** Household Consolidation Strategies of Rice Paddy and Field Farmers in Matakali Sub-district in Facing Climate Change.

No.	Consolidation Strategy	Number of Respondents (Head)	Percent (%)
1	Borrowing money from relatives/neighbors	18	36,00
2	Borrowing money from family	11	22,00
3	Borrowing money from a cooperative	6	12,00
4	Borrowing money from a bank	10	20,00
5	Not Borrowing Money	5	10,00
	Total	50	100,00

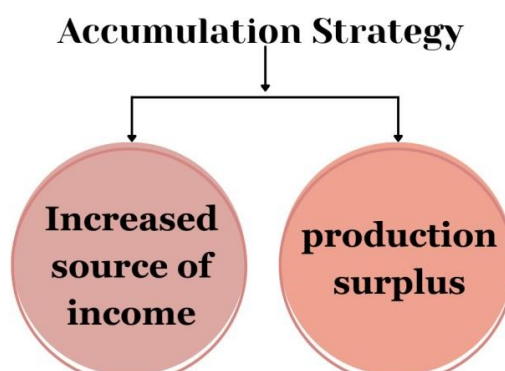
Based on the table, as many as 18 respondents of rice paddy and field rice farming households choose to borrow money from relatives/neighbors and 11 respondents borrowed money from

family in small nominal amounts. Meanwhile, 10 respondents choose to borrow from banks and 6 respondents borrowed from cooperatives when they need money suddenly and in large nominal amounts.

Borrowing money is a practical way to get money quickly when there is crop failure and decreased rice production due to climate change (drought and flood). For rice paddy and field rice farmer households that own valuable assets (gold), they will usually pawn the jewelry when they need money and redeem it after the harvest season arrives. In contrast to households of wet-rice and dry-field rice farmers who do not have valuable assets (gold), they usually borrow and repay them when they have money or pay off their debts when the harvestseason arrives.

### 5. Household Accumulation Strategies of Rice Paddy and Field Farmers

Wealthy farmers or entrepreneurs carry out an accumulation strategy with many resources. (Suryadi et al., 2013). The accumulation strategy carried out by respondents is to have a grocery store business and sell culinary in the form of food and snacks. The proceeds from these sales increase the family's economic income. This is to the income of Nurhayati et al. (2020). Common adaptation strategies to increase income sources are opening grocery stores, producing handicrafts, and becoming tourist *tour guides* for areas that can become tourist attractions. In addition, when there is a surplus of rice production, households of wet rice and field rice farmers use it forfamily consumption and fulfill secondary needs.



**Figure 6.** Accumulation Strategy of Rice Paddy and Field Farmer Households in Facing Climate Change

### 4. Conclusion

Adaptation strategies carried out by households of wet-rice and field rice farmers to minimize the negative impacts of climate change include 1) survival strategy, 2) consolidation strategy, and 3) accumulation strategy. The survival strategies carried out by households of wet-rice and field rice farmers in maintaining their survival are diversifying their work, making

economic adaptations, and getting assistance from the government. The consolidation strategy is carried out by households of wet rice and field rice farmers who can still fulfill their needs despite experiencing crop failure. People who apply the consolidation strategy can still fulfill their primary, secondary, and tertiary needs. Some of the things done in the consolidation strategy are borrowing money from relatives, family, banks, and cooperatives. Prosperous farmer household groups carry out accommodation strategies. Efforts made by wet-rice and field rice farmer households to fulfill their needs are opening a grocery store business. Implementing survival, consolidation, and accumulation strategies is sometimes not enough to fulfill all the needs of the households of wet-rice and dry-rice farmers. Especially when wetland rice farmer households need money suddenly and in large amounts due to crop failure due to climate change (droughts and floods), this certainly impacts the yields obtained a little, and the selling price has decreased. The government is expected to assist the development of rice farming in paddy fields and fields, such as facilitating the distribution of fertilizers so that fertilizer scarcity is not created and facilitating access to savings and loans. In addition, providing agricultural insurance can relieve farmers of the problem of capital procurement and financial losses due to climate change.

## References

- Abidin, Z., & Wahyuni, S. (2015). SURVIVAL STRATEGIES OF SMALL FARMERS IN SINDETLAMI KECAMATAN BESUK DISTRICT PROBOLINGGO (Zainal Abidin \*) & Sri Wahyuni \*\*). *Journal of Economic Education*, 9(2), 27-45.
- Adeagbo, O. A., Ojo, T. O., & Adetoro, A. A. (2021). Understanding the determinants of climate change adaptation strategies among smallholder maize farmers in South-west, Nigeria. *Heliyon*, 7(2), e06231. <https://doi.org/10.1016/j.heliyon.2021.e06231>
- Alewoye Getie, M., Legesse, S. A., Mekonnen, M., & Aschalew, A. (2020). Soil Properties and Crop Productivity Strategies as a Potential Climate Variability Adaptation Options in Adefwuha Watershed, Ethiopia. *Earth Systems and Environment*, 4(2), 359-368. <https://doi.org/10.1007/s41748-020-00156-8>
- Amjath-Babu, T. S., Krupnik, T. J., Aravindakshan, S., Arshad, M., & Kaechele, H. (2016). Climate change and indicators of probable shifts in the consumption portfolios of dryland farmers in Sub-Saharan Africa: Policy implications. *Ecological Indicators*, 67, 830-838. <https://doi.org/10.1016/j.ecolind.2016.03.030>
- Aniah, P., Kaunza-Nu-Dem, M. K., & Ayembilla, J. A. (2019). Smallholder farmers' livelihood adaptation to climate variability and ecological changes in the savanna agroecological zone of Ghana. *Heliyon*, 5(4), e01492. <https://doi.org/10.1016/j.heliyon.2019.e01492>
- Arifah, Salman, D., Yassi, A., & Bahsar-Demallino, E. (2022). Climate change impacts and the rice farmers' responses at irrigated upstream and downstream in Indonesia. *Heliyon*, 8(12), e11923. <https://doi.org/10.1016/j.heliyon.2022.e11923>
- Arifah, Salman, D., Yassi, A., & Bahsar Demmallino, E. (2023). Knowledge flow analysis of knowledge co-production-based climate change adaptation for lowland rice farmers in Bulukumba Regency, Indonesia. *Regional Sustainability*, 4(2), 194-202.

- <https://doi.org/10.1016/j.regsus.2023.05.005>  
BPS Kecamatan Matakali. Matakali Sub-district in Figures 2021. BPS Polewali Mandar Regency. ISBN: 978-623-7530-36-7
- Braunschweiger, D., & Ingold, K. (2023). What drives local climate change adaptation? A qualitative comparative analysis. *Environmental Science and Policy*, 145 (July 2022), 40-49. <https://doi.org/10.1016/j.envsci.2023.03.013>
- Gurung, L. J., Miller, K. K., Venn, S., & Bryan, B. A. (2021). Climate change adaptation for managing non-timber forest products in the Nepalese Himalaya. *Science of The Total Environment*, 796, 148853. <https://doi.org/10.1016/j.scitotenv.2021.148853>
- Habib-ur-Rahman, M., Ahmad, A., Raza, A., Hasnain, M. U., Alharby, H. F., Alzahrani, Y. M., Bamagoos, A. A., Hakeem, K. R., Ahmad, S., Nasim, W., Ali, S., Mansour, F., & Sabagh, A. E. L. (2022). Impact of climate change on agricultural production; Issues, challenges, and opportunities in Asia. *Frontiers in Plant Science*, 13, 925548. <https://doi.org/10.3389/fpls.2022.925548>
- Hidayati, I. N., & Suryanto, S. (2015). The Effect of Climate Change on Agricultural Production and Adaptation Strategies on Drought Prone Land. *Journal of Economics & Development Studies*, 16(1), 42-52. <https://doi.org/10.18196/jesp.16.1.1217>
- Irawan, C. (2018). Survival Strategy of Chili Farmers in Tegalagung Village, Semanding District, Tuban Regency. *Journal of Geography Education*, 5(5), 62–69.
- Khan, N. A., Gong, Z., & Shah, A. A. (2022). Synergy between climate risk perception, adaptation responses, and agricultural productivity: the case of rice farming communities in Pakistan. *Environmental Science and Pollution Research*, 29(16), 23750–23766. <https://doi.org/10.1007/s11356-021-17615-y>
- Khanal, U., Wilson, C., Hoang, V.-N., & Lee, B. (2018). Farmers' Adaptation to Climate Change, Its Determinants and Impacts on Rice Yield in Nepal. *Ecological Economics*, 144, 139–147. <https://doi.org/https://doi.org/10.1016/j.ecolecon.2017.08.006>
- Kural, E., Dellmuth, L. M., & Gustafsson, M.-T. (2021). International organizations and climate change adaptation: A new dataset for the social scientific study of adaptation, 1990–2017. *PLOS ONE*, 16(9), e0257101. <https://doi.org/10.1371/journal.pone.0257101>
- Lee, D., Shin, J., Song, Y., Chang, H., Cho, H., Park, J., & Hong, J. (2021). The development process and significance of the 3rd National Climate Change Adaptation Plan (2021–2025) of the Republic of Korea. *Science of The Total Environment*, 818, 151728. <https://doi.org/10.1016/j.scitotenv.2021.151728>
- Nurhayati, D., Dhokhikah, Y., & Mandala, M. (2020). Perceptions and Strategies for Community Adaptation to Climate Change in the Southeast Asian Region. *Journal of Protection*, 1(1), 39-44.
- Ojo, T. O., & Baiyegunhi, L. J. S. (2020). Determinants of climate change adaptation strategies and its impact on the net farm income of rice farmers in south-west Nigeria. *Land Use Policy*, 95, 103946. <https://doi.org/https://doi.org/10.1016/j.landusepol.2019.04.007>
- Ray Biswas, R., & Rahman, A. (2023). Adaptation to climate change: A study on regional climate change adaptation policy and practice framework. *Journal of Environmental Management*, 336, 117666. <https://doi.org/10.1016/j.jenvman.2023.117666>
- Runturambi, G., Manginsela, E. P., & Laoh, O. E. H. (2019). LIFE STRATEGIES OF WET-RICE FARMERS IN TUMANI SELATAN VILLAGE, MAESAAN SUB-DISTRICT, SOUTH

- MINAHASA DISTRICT. *Agri-Socioeconomics Unsrat*, 15(1), 1-8.
- Sitati, A., Joe, E., Pentz, B., Grayson, C., Jaime, C., Gilmore, E., Galappaththi, E., Hudson, A., Alverio, G. N., Mach, K. J., van Aalst, M., Simpson, N., Schwerdtle, P. N., Templeman, S., Zommers, Z., Ajibade, I., Chalkasra, L. S. S., Umunay, P., Togola, I., ... de Perez, E. C. (2021). Climate change adaptation in conflict-affected countries: A systematic assessment of evidence. *Discover Sustainability*, 2(1), 42. <https://doi.org/10.1007/s43621-021-00052-9>
- Sugiyono. (2013). *Combination Research Methods (Mixed Methods)*. Bandung (ID). Alfabeta.
- Suryadi, Hamid, A. H., & Agussabti. (2013). Survival Strategies of Post-Conflict Coffee Farmers (Case Study in Kute Panang District, Central Aceh Regency). *Journal of Agrisep*, 14(1), 44-53.
- Tofu, D. A., Woldeamanuel, T., & Haile, F. (2022). Smallholder farmers' vulnerability and adaptation to climate change induced shocks: The case of Northern Ethiopia highlands. *Journal of Agriculture and Food Research*, 8(April), 100312. <https://doi.org/10.1016/j.jafr.2022.100312>
- Trnka, M., Bartošová, L., Grammatikopoulou, I., Havlík, P., Olesen, J. E., Hlavinka, P., Marek, M. V., Vačkářová, D., Skjelvåg, A., & Žalud, Z. (2021). The Possibility of Consensus Regarding Climate Change Adaptation Policies in Agriculture and Forestry among Stakeholder Groups in the Czech Republic. *Environmental Management*, 69(1), 128–139. <https://doi.org/10.1007/s00267-021-01499-2>
- Valkengoed, A. M., Perlaviciute, G., & Steg, L. (2023). From believing in climate change to adapting to climate change: The role of risk perception and efficacy beliefs. *Risk Analysis*. <https://doi.org/10.1111/risa.14193>
- Wolka, K., Uma, T., & Tofu, D. A. (2023). The role of integrated watershed management in climate change adaptation for small-scale farmers in Southwest Ethiopia. *Environmental and Sustainability Indicators*, 19(May), 100260. <https://doi.org/10.1016/j.indic.2023.100260>
- Wulan, T. R., Maulana, E., Maulia, N., Ambarwulan, W., Raharjo, T., Ibrahim, F., Putra, M. D., Wahyuningsih, D. S., & Setyaningsih, Z. (2016). Community Livelihood Strategies in the Flood Disaster Crisis Period on Agricultural Land in Coastal Bantul Regency (Case Study: People of Depok Hamlet, Parangtritis Village, Kretek Sub-district, Bantul Regency, Yogyakarta Special Region). *Proceedings of the National Marine Seminar, Trunojoyo University Madura*, Table 1, 267-275. [http://ilmukelautan.trunojoyo.ac.id/wp-content/uploads/2016/08/37\\_Prosiding\\_semnaskel\\_2016.pdf](http://ilmukelautan.trunojoyo.ac.id/wp-content/uploads/2016/08/37_Prosiding_semnaskel_2016.pdf)
- White, B. et al. (1991). In the Shadow of Agriculture: Non-farm Activities in the Javanese Economy, Past and Present. *The Journal of Asian Studies*, Volume 51, Issue 3, August 1992, pp.708–710. <https://doi.org/10.2307/2058014>
- Zong, L., Yang, F., & Pei, X. (2022). Implementing Climate Change Adaptation in Territory Spatial Planning Systems: Challenges and Approaches Based on Practices in Guiyang. *International Journal of Environmental Research and Public Health*, 20(1), 490. <https://doi.org/10.3390/ijerph20010490>

