DISASTER RESILIENT AGRICULTURAL INNOVATION: A STUDY OF FARMERS' PERCEPTIONS OF THE FLOATING RAFT RICE CULTIVATION SYSTEM IN FLOOD-PRONE AREAS

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Abstract

This study contains a study of the perspectives of flood-affected farmers in Laskap Village, East Luwu Regency related to interventions to solve problems by implementing organic rice farming technology using a floating raft system. This study describes aspects such as; effectiveness of technology, ease of technology operation, affordability of technology costs, productivity of technology and social acceptance after the application of technology in the lands of affected communities. The data collection method was carried out by primary surveys and secondary surveys and using the Likert scoring technique and descriptive statistics as analysis techniques (mixed methods). The respondents used were 40 people consisting of 20 respondents who were members of the Pada Idi farmer group and 20 respondents who were members of the Padi Hijau farmer group. Overall, this survey provides important insights from the perspective of technology users regarding the advantages and disadvantages of implementing organic rice cultivation using a floating raft system as an effort to increase capacity in disaster mitigation and improve the economy of the community in flood-prone agricultural areas. Through the organic rice cultivation technology using a floating raft system, it is hoped that it can increase satisfactory results in the community so that positive perceptions can emerge in the community. This result is what will make this technology can be quickly adopted by other farmers who experience similar phenomena. The results of the study showed that as many as 67.5% of respondents expressed confidence that this system can increase rice resilience to flood disasters and confirmed that the majority of farmers can adopt this agricultural system.

Keyword: *Community Resilience; Floating Rice; Floating Raft System; Flood Prone; Agricultural Innovation*

A. INTRODUCTION

Global climate change has presented significant challenges to the agricultural sector in Indonesia, especially in terms of rice production as a major food commodity. One of the real impacts of climate change is the increasing frequency and intensity of flooding that threatens productive agricultural land. In facing this situation, innovation in rice cultivation techniques is very crucial to maintain national food security.

Laskap Village, Malili District, East Luwu Regency is one of the areas prone to flooding and this phenomenon has not been resolved until now. Most of the people in Laskap Village depend on the agricultural sector, especially rice farming. The increasingly uncertain natural conditions due to climate change and the geographical conditions of the village located between the Larona River and the Pongkeru River have exacerbated the social, psychological, and physical impacts on the community, including farmers in this village (Muis et al., 2024). The floating raft organic rice system is present as a potential solution that offers an adaptive approach to land conditions affected by flooding.Metodologi ini mengintegrasikan prinsip-prinsip hidroponik dengan teknik budidaya padi konvensional, menghasilkan suatu paradigma baru dalam ketahanan pangan yang adaptif terhadap perubahan iklim (Muis et al., 2024).

The floating raft organic rice system is a rice cultivation method that combines the principles of organic farming with floating raft technology. This method allows rice plants to remain productive even on land that is submerged in water. The application of this system not only answers the challenge of flooding, but is also in line with the principles of sustainable agriculture that prioritize environmental sustainability.

In an effort to increase the resilience of the rice production system to the threat of flooding in this region, academics and farmers have made modern innovations by introducing the use of organic rice cultivation system technology by utilizing floating rafts that adjust to rice conditions on land that

is inundated/flooded. The floating raft organic rice farming system is an important innovation to realize agriculture that is resilient to disasters in flood-prone areas (Salampessy, 2018).

Farming using organic rice technology with a floating raft system has several advantages compared to conventional cultivation systems, including optimizing the use of flood-prone land that has not been productive, increasing the amount of rice harvest, and using organic production inputs to maintain environmental quality and the sustainability of agricultural ecosystems (Mutmainnah et al., 2022) (Supriyo, 2022). Recent research shows that the organic rice floating raft system has great potential in increasing farmer resilience to the impacts of climate change. A study conducted by Yulianti et al. (2022) revealed that this method can increase rice productivity by up to 15% compared to conventional methods on flood-prone land. Meanwhile, Pratiwi and Setiawan (2023) emphasized the importance of integrating local knowledge in the development of this system to increase adoption at the farmer level. In the context of national policy, the implementation of the organic rice floating raft system is in line with the government's agenda to strengthen food security and climate change adaptation. The Ministry of Agriculture, through the Environmentally Friendly Agriculture program, has encouraged the implementation of this method in various flood-prone areas in Indonesia. (Kementerian Pertanian, 2023).

This study aims to analyze farmers' perceptions of the floating raft organic rice cultivation system in Laskap Village, Malili District, East Luwu Regency. The analysis process will later contain aspects of technological effectiveness, ease of technological operation, technological affordability, technological productivity and social acceptance of technology.

The results of this study are expected to provide useful information for farmers who experience similar conditions and decision makers in developing and disseminating disaster-resilient agricultural technology that is in accordance with the needs of farmers in flood-prone areas. In addition, the results of this study can also contribute to the development of science in the field of agricultural management in disaster-prone areas.

B. LITERATURE REVIEW

Innovation in the agricultural sector is key to facing the challenges of climate change and natural disasters such as floods. According to Adger et al. (2005), adaptation to climate change in the agricultural sector involves the application of technologies and strategies that can increase resilience to disasters. One of the innovations that is developing is a water-based agricultural system, such as floating raft rice, which is designed to overcome the impact of flooding on food production (Rahman et al., 2024). Floating raft rice is a cultivation method that uses rafts or buoys to support plants on water, so that they can survive in flood conditions. A study by Rahman et al. (2024) in Bangladesh showed that this method can increase rice production in flood-prone areas with high efficiency. In addition, research by Nazir et al. (2016) showed that this system can be combined with hydroponic methods to increase yields and production sustainability.

The acceptance and success of an agricultural innovation is highly dependent on farmers' perceptions. According to Rogers (2003), innovation diffusion occurs through a communication process that allows farmers to understand the benefits and risks of new technologies. A study by De La Fuente et al., (2020) shows that factors such as education level, access to information, and farming experience influence the adoption of new technologies by farmers in Indonesia. The implementation of the floating raft rice system not only has an impact on food security but also on the social and economic aspects of the farming community. A study by Irianto et al., (2019) found that this technology can increase farmers' income in flooded areas, reduce losses due to crop failure, and strengthen local food security. However, several challenges such as high initial costs and limited access to technology are still obstacles to widespread implementation (Santoso et al., 2021).

C. METHOD

This research is a descriptive study. Quantitative-qualitative analysis techniques (mix method) were used to assess the perception of farmers who have rice fields in flood-prone areas for the application of organic rice cultivation with a floating raft system. Farmer perception data were collected through a questionnaire technique that covers five aspects, namely effectiveness, ease of operation, cost affordability, productivity and social acceptance (Table 1).

Table 1. Aspects and Indicators for Assessing Farmer Community Perceptions of the Implementation of Organic Cultivation with a Floating Raft System

Aspect	Indicators
Effectiveness	Flood Inundation Resistance
	Resistance to Pests and Diseases
Ease of Operation	Resource Availability
	Technical Knowledge
	Time and Labor
Cost Affordability	Raw Material Costs
	Labor costs
	Operational and maintenance costs
	Harvesting Costs
Productivity	Increased Yield
	Rice Quality
	Harvest Frequency
Social Acceptance	Environmental Impact
	Climate Change Adaptation
	Sustainability
	Farmer Independence

This research was conducted in Laskap Village, Malili District, East Luwu Regency in 2024. The selection of the research location was based on the condition of agricultural land in Laskap Village which has been affected by flooding every year since 2011 (Muis, 2023). Furthermore, the results of research by Muis (2023) showed that farmers in Langkap Village always experience crop failure due to flooding. The number of respondents used in this study was 40 farmers. The number and selection of respondents were determined purposively, namely farmers who are members of farmer groups in Laskap Village and have agricultural land affected by flooding.

The questionnaire was given to each respondent after being given a basic understanding of organic rice cultivation with a floating raft system through a 2-day seminar and workshop. The results of the perception are presented in graphical form using a Likers scale. The conclusion was drawn using a qualitative approach by considering the percentage of the perception results of each indicator.

D. RESEARCH RESULT

The survey conducted on 40 farmers in Laskap Village aims to measure farmers' ability to implement organic rice cultivation with a floating raft system. The survey was conducted after providing basic understanding to respondents through socialization activities (Figure 1) and the creation of demonstration plots (Figure 2). The assessment of farmers' perceptions was carried out based on five main aspects, namely aspects of effectiveness, ease of operation, affordability, productivity, and social acceptance.

Figure 1: Socialization of the organic rice cultivation program using the floating raft system

Figure 2: Technical guidance for implementing organic rice cultivation using a floating raft system

The results of the farmer perception survey in Laskap Village provide a comprehensive picture of the acceptance and ability of farmers in implementing organic rice cultivation using the floating raft system on flood-prone land. As shown in Figure 1, 47.5% of respondents agreed and 20% strongly agreed that the floating raft system is effective in dealing with flooding, while 42.5% of respondents also agreed that this system can reduce the impact of pests and diseases on their crops. This reflects farmers' awareness that this system can be a solution to overcome the challenge of flooding which is a major problem for their agriculture.

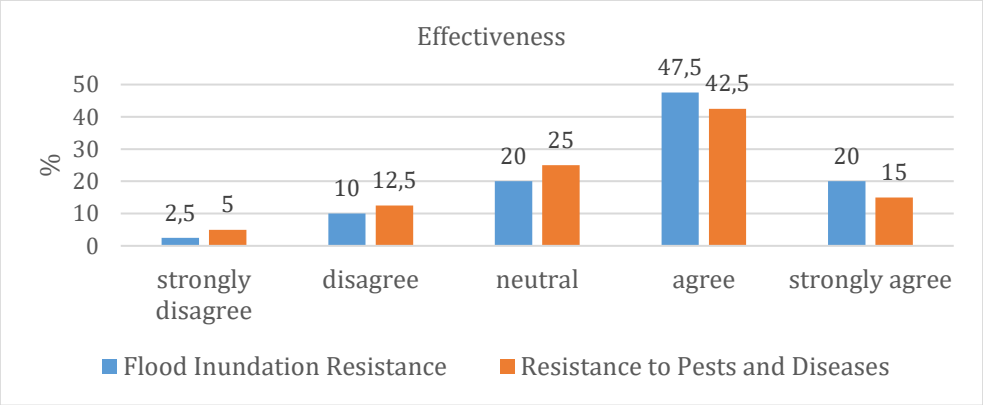

Figure 1: Percentage of farmer responses to the effectiveness of organic rice cultivation using a floating raft system

The results of the implementation of socialization and technical training provided farmers with an overview of the comparison of the implementation of floating raft cultivation systems with convectional systems. This is illustrated in the aspect of operational ease of floating raft cultivation systems which resulted in varying responses among farmers (Figure 2). As many as 50% (agree and strongly agree) of respondents felt that the availability of resources (materials and tools for making floating raft systems) could be easily accessed and as many as 75% (agree and strongly agree) of respondents felt confident in being able to implement organic rice cultivation with a floating raft system well. However, the aspects of time and labor (Figure 3) received a rather low positive response (<50%). This is likely because respondents are accustomed to carrying out rice cultivation activities individually with a faster planting process compared to the floating raft system.

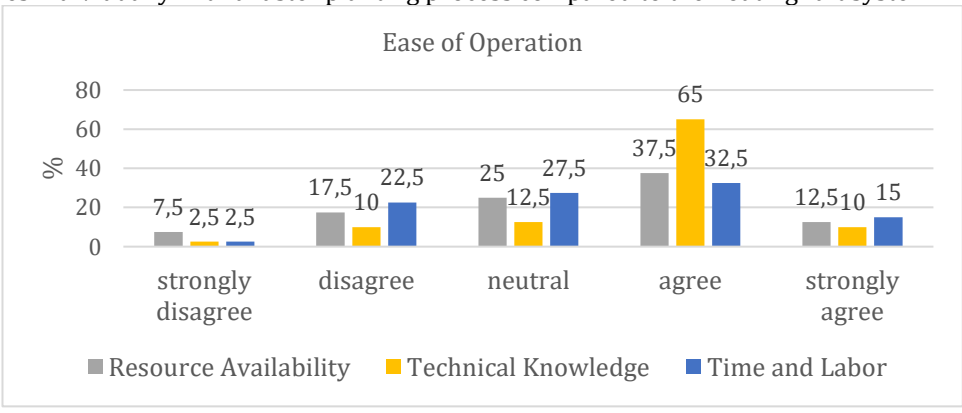

Figure 2: Percentage of farmer responses to the operational ease of organic rice cultivation using the floating raft system.

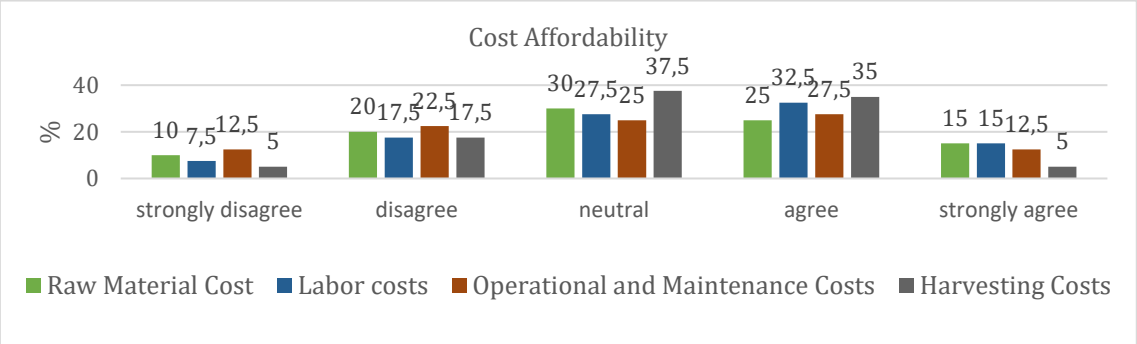

Figure 3: Percentage of farmer community responses to the aspect of affordability of organic rice cultivation using a floating raft system.

The aspect of cost affordability is also an important factor in the adoption of this technology. Positive responses from farmers regarding the cost of raw materials, labor, operational and maintenance and harvesting costs are relatively low (less than 50%). This indicates that most farmers in Laskap Village consider the cost of implementing the floating raft system to be relatively high compared to the convectional system. However, in terms of productivity (Figure 4), the majority of respondents consider that the floating raft system can increase yields, rice quality and harvest frequency with positive responses of each above 50% (agree and strongly agree). Therefore, business capital support from the government or private sector can increase the capacity of farmers in Laskap Village in developing organic rice cultivation using the floating raft system on flood-prone land.

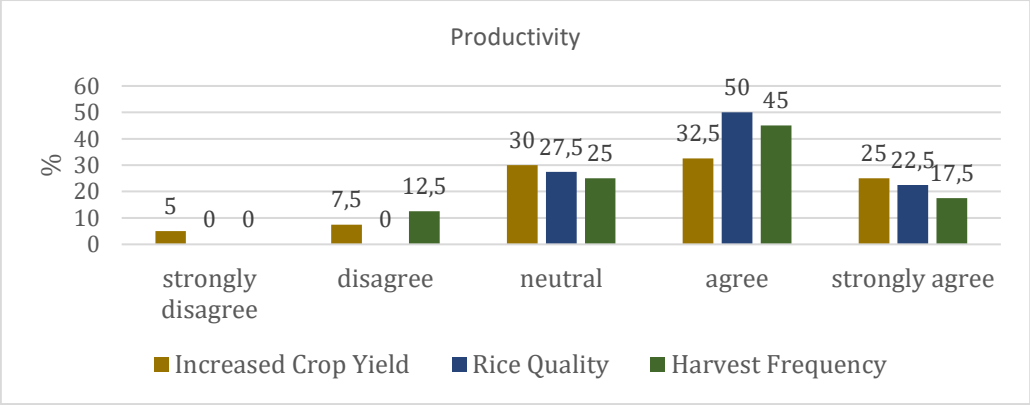

Figure 4: Percentage of farmer responses to the productivity aspects of organic rice cultivation using the floating raft system.

The social acceptance aspect of the floating raft system also showed quite positive results. Farmers generally agreed that this system can have a positive impact on the environment and climate change adaptation. More than 70% of respondents agreed that this technology can help reduce environmental impacts and contribute to climate change adaptation (Figure 5). In addition, more than 60% (agree and strongly agree) of respondents agreed that the floating raft system can improve their sustainability and independence in farming.

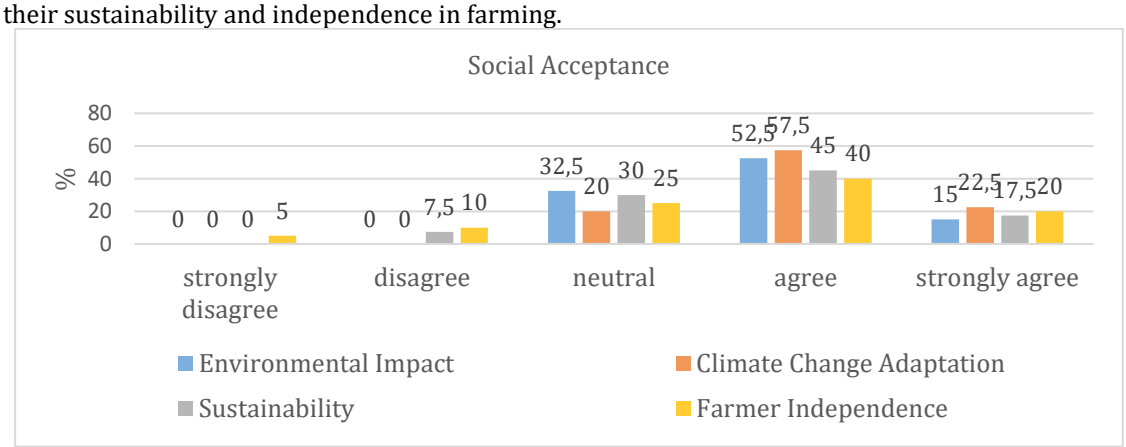

Figure 5: Percentage of social acceptance of organic rice cultivation using the floating raft system

E. DISCUSSION

The results of a survey on farmers' perceptions in Laskap Village regarding the potential for implementing organic rice cultivation with a floating raft system provide an initial picture of the acceptance and challenges faced in implementing this farming system. This survey aims to explore the extent to which farmers are willing to implement the floating raft farming system. Although the floating raft system is new to farmers in Laskap Village, they consider this system to be an effective and affordable solution to overcome crop failure due to flooding every year. In line with research by [1] which confirms that the floating raft system is a solution that must be adopted to increase farmer productivity in flood-prone areas. This is also felt by farmers in Laskap Village, most of whom have a positive response to this farming concept. As many as 67.5% of respondents expressed confidence that this system can increase rice resistance to flooding, which indicates a high willingness by farmers to adopt this farming system.

On the other hand, the majority of farmers also believe that the use of superior organic rice seeds can increase rice resistance to pests and diseases. Although farmers have not tested it directly, their high expectations indicate an understanding of the benefits of an organic farming system that is more environmentally friendly compared to conventional farming practices that rely on pesticides. This understanding is an important capital for cultivating an environmentally friendly farming system among farmers. Organic farming is one strategy that plays an important role in minimizing environmental and ecological impacts amidst the influence of rapid development [2]

However, in terms of operational convenience, respondents expressed doubts regarding the labor and time requirements required to implement organic rice cultivation with a floating raft system. Around 25% of respondents considered this system to be inefficient in terms of time and energy compared to conventional farming methods. This concern underlines the importance of modern technological innovation that can support the efficiency of organic rice cultivation practices with a floating raft system [3], especially at the planting and harvesting stages. Adoption of modern technology will increase agricultural productivity [4], including in organic rice farming with a floating raft system. In addition, the existence of modern technology will increase farmer participation in implementing the floating raft system, so that food and economic security for farmers in flood-prone areas can be realized.

In terms of cost, respondents have varying perceptions. Although there is hope that this method can reduce harvesting costs, most farmers are concerned about the high initial costs for the materials and equipment needed. In line with research by [5] which states that the floating raft system has higher operational costs compared to conventional systems. However, research [6] shows that the operational costs of the floating raft system will decrease as the planting period increases. This suggests that although floating raft technology promises long-term efficiency, small farmers may need financial support to cover the initial investment costs. Interventions in the form of government subsidies or capital assistance programs can be a strategic step to increase farmers' interest in adopting this technology.

In terms of productivity, farmers are optimistic that this system has the potential to increase yields in terms of both quantity and quality. As many as 57.5% of respondents believe that the quality of the rice produced will be better, which has the potential to open up new market opportunities, especially in the higher-value organic market segment. This expectation is important to consider in agricultural policy planning. Given that market demand for organic rice shows an increasing trend [7], it can be a strategic program in improving the economy of farmers, especially in flood-prone areas.

The social acceptance aspect shows that farmers in Laskap Village have a fairly high awareness of the importance of climate change adaptation and environmental sustainability. More than 75% of respondents stated that they support the implementation of a more environmentally friendly organic farming system. In addition, the survey results showed that some farmers felt capable of implementing this cultivation system independently. This perception can be a strong social capital to support the implementation of organic rice cultivation using the floating raft system. However, there are challenges related to the efficiency of implementation costs, limited initial capital and the availability of extension workers. Farmers still feel the need for capital assistance and intensive assistance to implement the floating raft system. This can be an important strategic input to strengthen food security in flood-prone agricultural areas.

Overall, this survey provides important initial insights into the implementation strategy of organic rice cultivation using a floating raft system as a solution to increase the economic capacity of communities in flood-prone agricultural areas. Despite challenges related to costs, labor, and

technical knowledge, farmers' optimistic views on effectiveness, environmental benefits, and productivity indicate that the organic rice cultivation program using a floating raft system can be adopted by farmers in Laskap Village. To realize this potential, strategic efforts are needed in the form of policy support, access to financing, and targeted extension programs to increase farmers' capacity to face obstacles in its implementation in the future.

F. CONCLUSION

Research on the implementation of organic rice cultivation with a floating raft system in Laskap Village showed positive acceptance, although there are still several challenges that require further solutions. This study produced the following conclusions:

1. The majority of farmers (67.5%) acknowledged that the floating raft system can increase the resilience of rice plants in flood-prone areas with waterlogging (flooding) and reduce the impact of pests. These results indicate that public interest in utilizing this technology is very high.
2. As many as 75% of respondents felt confident that they could implement this system well, although there were doubts about the efficiency of time and labor, with less than 50% of respondents considering this system efficient compared to conventional methods. This shows the need for technology development and evidence of implementation that can be directly observed by farmers.
3. Farmers' perceptions of material and operational costs are relatively low, with many feeling that the cost of implementing the floating raft system is still too high. This emphasizes the need for financial support, such as subsidies or capital assistance from the government or other parties to increase the adoption of this technology.
4. Despite concerns about costs, more than 57% of respondents were optimistic that this system can improve the quality and quantity of harvests, which can provide new market opportunities in the organic rice sector.
5. Most farmers recognize the importance of sustainability and climate change adaptation, with more than 70% agreeing that these systems have a positive impact on the environment.

Overall, the results of this study indicate that with policy support, access to financing, and appropriate extension programs, the potential for adopting organic rice cultivation with a floating raft system in Laskap Village can be realized, thereby helping to increase local economic resilience and food security.

ACKNOWLEDGEMENT

DRTPM Kemendikbudristek conveyed as the funding provider through the 2024 Kosabangsa program.

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