Household Welfare of Rice-fish Farmers: An Income-Expenditure Ratio Approach

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Abstract. The increase in agricultural land conversion activities can cause a decrease in rice productivity, while food demand is increasing. One of the alternatives that can be sought is land intensification through the rice-fish farming system. This study aims to determine the household income of farmers, household expenditures of farmers, and the welfare of households of rice mina farmers. The research was carried out in Candibinangun Village, which was determined by purposive, with a sample of 35 respondents taken by census. The analysis technique used is welfare analysis using the Good Service Ratio and the Farmer Household Income Exchange Rate, namely the household income-expenditure ratio. The results of the study show that the household income of rice-fish farmers, which is IDR 31,134,079, is greater than the household expenditure of farmers, which is IDR 22,078,686. With the contribution of mina rice farming to household income is 20.34%. Rice-fish farmer households in Candibinangun Village are categorized as prosperous based on welfare analysis using Good Service Ratio and FHIER. With a welfare value based on the Good Service Ratio of 0.98 and a welfare value based on the Farmer Household Income Exchange Rate of 1.41. However, these welfare indicators can be achieved by the contribution of income from activities outside the agricultural sector.

1 Introduction

Agriculture is a culture that was first developed by humans as a response to the challenge of survival which is increasingly difficult due to the depletion of food commodity sources in nature due to the rate of human growth. Agricultural development in Indonesia is considered the most important in terms of economic development because the agricultural sector is the savior of the national economy [1].

Over time, agricultural land has undergone many changes in function to non-agricultural land, such as the conversion of land into buildings for settlements and industries. Based on data from the Central Statistics Agency, the area of agricultural land in Indonesia in 2019 was 7,463,948 Ha, which decreased from 2017 which was 8,164,045 Ha [2].

In order to prevent the further reduction of agricultural land, especially rice field agricultural land due to land conversion, it is necessary to take alternative options as the first step to prevent the shortage of agricultural land, namely through the intensification of

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agricultural land. Agricultural intensification is a process of cultivating agricultural land that has been available as well as possible, in order to increase agricultural yields by using various means [3] Agricultural land intensification is considered to be the only way and hope to continue to be able to meet food demand in the future, besides that land intensification is carried out as a consideration of agricultural land efficiency in order to continue to obtain large profits [4]

One of the alternative options that can be done to prevent land conversion is through the Integrated Rice-Fish Farming System (IRFFS) or the integration of the rice-fish farming system [5] Rice-fish is an integration of rice and fish cultivation in one land so as to produce the output of two commodities at once. The rice-fish system is one of the land intensification systems recommended by the government since 1950 until now [6]. The implementation of the rice mina system is also able to reduce the risk if there is a failure in one of the commodities. Therefore, the rice rice monoculture system can be a sustainable alternative to rice monoculture from both an economic and ecological perspective [7].

The rice-fish system has been implemented in various Asian countries such as China, Malaysia, Vietnam, and Bangladesh. Some of these countries have previously proven that there are advantages of implementing the rice mina system such as reducing pest attacks, reducing agrochemical inputs, increasing soil fertility and increasing economic benefits or income [8].

One of the areas that implements the rice farming system is in Candibinangun Village, Kapanewon Pakem, Sleman Regency. Based on a survey that has been conducted, farmers in Candibinangun Village depend on the income of rice-fish farming even though there are some farmers who also work outside farming and even outside agricultural activities. However, the majority of rice-fish farmers use all the income obtained from rice-fish farming to meet household needs. Whether the income of farmer households is able to meet all their needs to achieve welfare is a study that will be the focus of discussion in this paper.

Several studies show the impact of the implementation of innovation on the welfare of farmer households. In general, the adoption of agricultural innovation has a positive and significant influence on agricultural production indicators and farmers' household welfare measures [9]. The adoption of the Korra tef shows a positive and significant impact on the spending of adopters [10]. The adoption of sorghum varieties shows improved agricultural performance and better welfare. [11]. that the increase in the adoption of rice varieties reduces multidimensional poverty and subjective poverty by 1.7% and 12.4%, respectively [12]. that the increase in the adoption of corn varieties increases household income, asset ownership and corn consumption while reducing income poverty [13].

In addition to the adoption of innovation, farmers must also adapt to changes in their farming environment. Therefore, the Climate Cahnge Adaptation Strategy (CCAS) has a positive and significant influence on the pattern of welfare improvement among smallholders, but the combination of CCAS gives the highest results [14]. It also shows that farmers who adapt to climate change are more productive and have more household assets than their counterfactual counterfactual [15]. One form of adaptation to climate change is irrigation management. Irrigated planted areas allow small farmers to grow crops more than once a year; Ensuring positive and stable production, income, consumption, and asset accumulation [16]. The study found the positive impact and association between smallholder irrigation schemes and household welfare in the study [17].

Several previous studies have highlighted the welfare of farmer households from the aspects of adoption of variety technological innovations and adaptation strategies to climate change. Their analytical approach focuses on household income, expenditure and asset growth. Some of these approaches do not reflect the ability of farmer households to meet their primary and secondary needs from the results obtained from running their farms. Therefore, this paper will discuss the welfare of farmers using the Good Service Ratio analysis approach and the exchange rate of farmers' households as a reflection of farmers' purchasing power based on income from the rice-fish farming innovations that have been implemented.

2 Research method

The research was conducted in Candibinangun Village https://tinyurl.com/Samberembe Kapanewon Pakem, Sleman Regency Special Region of Yogyakarta, which was determined by purposive, namely deliberate sampling of the area. The area located in the Java Island part of Indonesia as presented in Figure 1 dan Figure 2.

Fig. 1. Java Island part of Indonesian Indonesian archipelago

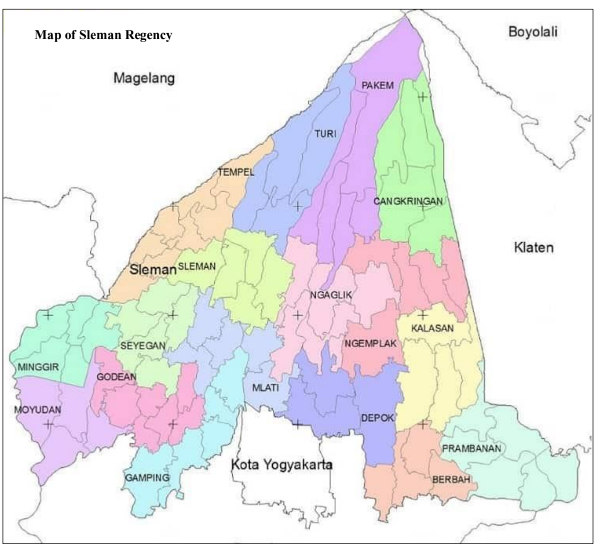

Fig. 2. Sleman map included Pakem Sub district map, part of Yogyakarta Indonesia

The total population of rice-fish farmers in Candibinangun Village is 35 people, so the determination of respondents uses a census technique with a total of 35 farmers, of which 20 farmers from the Mina Muda Samberembe Farmers Group and 15 farmers from the Mina Maju Kemput Farmers Group. The data obtained was through primary data obtained directly in the field through the distribution of questionnaires and interviews. As well as secondary data obtained through related institutions or agencies such as UPT BP4 Region 5 Pakem, Kelurahan, Central Statistics Agency, and others.

The data analysis technique for this study uses descriptive analysis and quantitative analysis. Descriptive analysis was used to interpret the income and household welfare of rice mina farmers. Meanwhile, quantitative analysis is used to test the income, expenditure, and welfare of farmer households. Welfare can be calculated using two analyses, namely the Good Service Ratio (GSR) and the Farmer Household Income Exchange Rate (FHIER).

2.1 Household Income

2.1.1 Farm Income

Farming income is the net value received by farmers from the results of farming carried out after deducting explicit costs. The explicit fee in question is a fee that is actually, and cash paid by the farmer. The calculation of farming income calculation can be formulated as follows:

$$IF = TR - TEC \tag{1}$$

Information;
IF = Farm Income, Net Return of Farm production
TR = Total revenue of farm production
TEC = Total explicit Cost of Farm production

2.1.2 Household Income

Household income is sourced from all businesses run by farmer households, both farming and non-farming. The three main components of farmers' household income sources are on farm, off farm and non-farm income. Thus, household income can be formulated as follows:

$$HI = IF + OF + NF \tag{2}$$

Information:
HI = Farmer household income
IF = On farm Income
OF = Off farm income
NF = Non-farm income

2.2 Good Service Ratio (GSR)

This analysis is based on Engel's law which states that the proportion of food in total consumption expenditure is negatively related to household income [18]. Therefore, the higher the household income, the lower the proportion of food expenditure. The smaller the proportion of household food expenditure, this can indicate an improvement in family health. Welfare is realized if there is an increase in income so that the proportion of food production is smaller than the proportion of non-food waste. Thus, the formulation of the welfare index based on household expenditure (Good Service Ratio = GSR) can be written as follows:

$$GSR = \frac{\text{Expenditure on food needs}}{\text{Expenditure on non-food needs}} \tag{3}$$

Criteria:
GSR ≥ 1, This means that the economy of farmers' households is less prosperous
GSR < 1, This means that the farmer's household economy is prosperous

2.3 Farmer Household Income Exchange Rate (FHIER)

Farmer household income exchange rate analysis measures the ability of farmer households to meet all household needs from farmer income that has been obtained in a certain period of time. The higher the income, assuming expenditure and prices are constant, the potential welfare index increases. Thus, the welfare index is the ratio between household income and household expenditure in a certain period of time. Mathematically, the welfare index is formulated as follows:

$$FHIER = HI / HE \tag{4}$$

where:

$$HE = FE + NFE \tag{5}$$

Information:
FHIER = Farmer Household Income Exchange Rate
HI = Farmer household income
HE = Farmer household expenses

Criteria:
FHIER ≤ 1 This means that the level of welfare of farmer households is categorized as not prosperous.
FHIER > 1 This means that the level of welfare of farmer households is categorized as prosperous.

3 Results and discussion

3.1 Rice Fish Cultivation

3.1.1 Rice Fish Planting Pattern

The scale of rice farming developed by farmers ranges from 500 to 1,400 square meters with an average land area of 1,063 square meters. The rice fish business can be run all year round in three seasons with the same planting pattern as presented in Table 1.

Table 1. Rice Planting Pattern in Candibinangun Village

Season	Commodities	Moon
Planting Season 1	Rice – Tilapia	April-July
Planting Season 2	Rice – Tilapia	April-July
Planting Season 3	Rice – Tilapia	December-March

The rice cultivation process consists of preparation, planting, seedling, maintenance and harvesting. The preparation stage includes the construction of embankments, sewers, channels and reservoirs. At the planting stage, it consists of land cultivation and rice planting. The next stage is the scattering of fish fry and maintenance including regular fertilization and feeding. The rest of the feed and fish manure are useful as organic fertilizers for rice plants. The use of organic farming systems can achieve the goal of zero emissions. The proposed integrated nursery and cultivation system increases agricultural productivity, the environment and increases farmers' income by up to 41.55% [19].

3.1.2 Manufacture of the embankments

The embankments must be high and strong enough to be able to hold water. The height of the embankment should be between 25-40 cm depending on the height of the water level. The width of the bottom of the rice field should not be less than 50 cm, while the width of the upper rice field should be 25 cm. Feeders can be made using soil that is compacted by stepping on them until they are in the expected shape and should not be made using plants because they will be easily damaged and rotten so that they can cause leaks.

3.1.3 Sewer manufacturing

The creation of a sewer is intended to protect fish from:
a. Pest attacks such as birds, snakes or water ferrets.
b. Danger of drought caused by high water evaporation.
c. Increase the water temperature due to the heat of the sun.
d. The sewer can be made not less than 30cm crosswise. During maintenance, the water in the sewer must always be controlled so that it does not reach less.

3.1.4 Water inlet and discharge channels

Water inlets and outlets are made to regulate the level of water so that rice fields do not lack and excess water. Water channels can be made with bamboo or pipe planted in the rice fields. The water level was adjusted to the growth of the rice height. At the beginning of fish rearing, the water level was 40% of the height of the rice plant or about 10-15 cm. After the rice was 3 weeks old, the water level in the field can reach 20-25 cm.

3.1.5 Reservoir

The reservoir is useful for holding fish when harvesting so that the fish are easy to catch. This reservoir should be made near the discharge channel. The reservoir should be deeper than the ditch.

3.1.6 Land tillage and planting of rice seedlings

Soil tillage is intended to provide a good medium for the growth of rice plants and fish-eating organisms. First, hoe the soil 20 cm deep, then drain the water so that it is slightly muddy and sprinkle urea, *phonska* and organic fertilizer as a basic fertilizer evenly over the entire soil surface with a dose of 10-15 kg for every 1,000 square meters and also add dolomite lime as a balance for Ph. After the rice seedlings are planted, then the water flows back until the surface reaches a height of 20 cm and left for 4-7 days to give opportunities to food organisms fish to grow. Rice seeds are planted with a 2:1 *legowo* alignment technique which provides the most optimal results for the growth of rice and fish. Rice seeds are *ciherang* varieties.

3.1.7 Scattering of fish fry

The sowing of fish seeds is carried out on rice that is 7-15 days old, this is intended to avoid damage to rice plants, at that age the rice is resistant to waterlogging. The fish stocked is 3 fingers of an adult hand or 10-13 cm with a density of 3-5 fish per meter. Fish in *minapadi* land is enlargement, not cultivation which is like ponds in general which are stocked with fish seeds that are relatively small. So that the time needed for harvest is not long, only 3-4 months are needed. Fish is also an organic fertilizer. The use of organic farming systems can achieve the goal of zero emissions. The proposed integrated nursery and cultivation system increases agricultural productivity, the environment and increases farmers' income by up to 41.55% [19].

3.1.8 Feeding

Feeding is done in the morning and evening, when the rice is 1-6 weeks old the feed will be spread on the rice plants and at the age of 7 weeks and onwards the feed will be spread in the pond and in the *kemalir*.

3.1.9 Fish harvest

Harvesting fish in rice fields is not much different from harvesting fish in ponds. First of all, the water intake channel is closed, and the water drain is opened, so that the water goes down. At that time, efforts must be made so that all the existing fish can gather in the sewers. Water discharge is still being carried out so that the fish are forced to swim to the reservoir.

Furthermore, fish that have gathered in the reservoir can be immediately caught using a *tangguk*. Never take those that are trapped between the rice, because the rice plants will be stepped on and damaged so that they can cause losses. This fish harvest is carried out a week before the rice harvest. The harvested fish are consumption tilapia that are sold with a weight of 1kg of 7 fish or more.

3.1.10 Rice harvest

Rice harvesting is carried out when the fish has been harvested and the water has receded the rice harvest period is not far from the fish harvest, the rice harvest is carried out not much different from the rice harvest in ordinary land. Rice harvesting is carried out by the same workforce that harvested fish a week ago. The labor used in this harvesting activity is mostly workers outside the family who are experienced and understand and have been prepared by the farmer group itself. So, the harvesting process can be said to be efficient and effective because the workforce can be said to be experienced.

3.2 Farmer Household Income

The household life of farmers is certainly inseparable from the daily needs that must be met. To be able to meet these needs, costs are needed that can be obtained through farmer household income consisting of on-farm, off-farm, and non-farm income. Income is obtained from each business run after deducting costs. Farming costs consist of the cost of production facilities, labor, equipment and other costs.

3.2.1 Rice-fish Farming Costs

Production input costs are costs incurred by farmers to support the process of farming activities as presented in Table 2. The results of the analysis show that the average production input cost of rice-fish farmers during the three planting seasons is IDR 17,151,314 with an average land area of 1,063 m2. The first season of rice-fish farming in Candibinangun Village ranges from April to July with a production input cost of IDR 5,703,600. The second season ranges from August to November with a production facility cost of IDR 5,601,657. As well as the third season, which ranges from December to March with a production input cost of

IDR 5,846,057. Fish and feed seeds are the largest component of this cost. Fish seeds, which are young fish used for stocking, are more expensive than seeds used for rice cultivation. This higher cost of fish seeds adds to the overall cost of fish farming. In addition, Fish need a commercial feed diet and fertilizers, which are more expensive than fertilizers used for rice cultivation. This increase in feed and fertilizer costs contributes to higher fish farming costs [20].

Table 2. Cost of Rice-fish Farming Production Facilities

Input type	Season 1		Season 2		Season 3	
	Quantity (kg)	**Cost (IDR)**	**Quantity (IDR)**	**Cost (IDR)**	**Quantity (IDR)**	**Cost (IDR)**
Rice Seeds	2.23	22,800	2.23	22,800	2.23	22,800
Fish Seeds	42.29	1,268,571	42.29	1,282,286	42.14	1,306,286
Fish Feed	14.14	4,258,286	13.34	4,142,629	13.74	4,363,029
Organic Fertilizer	4.57	68,571	4.57	68,571	4.57	68,571
Urea Fertilizer	15.43	32,657	15.43	32,657	15.43	32,657
Phonska Fertilizer	10.40	26,000	10.40	26,000	10.40	26,000
Dolomit	5.34	26,714	5.34	26,714	5.34	26,714
Total per season		5,703,600		5,601,657		5,846,057
Total						17,151,314

Non-family labor costs are costs incurred by farmers to provide wages to workers who come from non-family rice farmers. The results of the analysis presented in Table 3 show that the total expenditure of non-family workers for one year is IDR 2,476,714. Judging from the use of the overall cost, the largest use of costs in each planting season is in harvesting activities with a total cost of IDR 479,143 in the first planting season, IDR 478,714 in the second planting season, and IDR 475,714 in the third planting season. This is because in the harvesting process a lot of labor is needed and wages for harvesting activities are higher than land cultivation and planting activities. Rice-fish cultivation involves the simultaneous cultivation of rice and fish in the same field, which requires careful management and coordination. This complexity increases the costs associated with harvesting, as farmers need to ensure that both crops are harvested efficiently and effectively [21].

Table 3. Labor Costs of Non-Family Rice-fish Farming

Job Type	Season 1		Season 2		Season 3	
	Quantity (FTE)	**Cost (IDR)**	**Quantity (FTE)**	**Cost (IDR)**	**Quantity (FTE)**	**Cost (IDR)**
Land Cultivation	10.36	370,000	7.07	252,857	6.79	242,857
Planting	1.66	58,571	1.69	59,714	1.67	59,143
Harvesting	7.24	479,143	7.24	478,714	7.20	475,714
Total per season		907,714		791,286		777,714
Total						2,476,714

The depreciation cost of tools is a cost that arises due to the depreciation of agricultural tools used during the rice farming process. The results of the analysis as presented in Table 4 show that the total depreciation cost during the three planting seasons is IDR 359,604. The highest depreciation cost of the tool is the depreciation cost for the fence net of IDR 60,000, which is caused by the purchase price of the fence net which is quite expensive. Meanwhile, the smallest tool depreciation cost is for a bucket of IDR 2,375. In rice farming, buckets are used by farmers both to sow fish seeds, feed fish, and harvest fish themselves.

Table 4. Cost of Depreciation of Rice-fish Farming Tools

Tool	Season 1 (IDR)	Season 2 (IDR)	Season 3 (IDR)
Mattock	3,525	3,525	3,525
Fence Mesh	60,000	60,000	60,000
Top Net	47,619	47,619	47,619
Ember	2,375	2,375	2,375
Fishing Nets	6,349	6,349	6,349
Total per season	119,868	119,868	119,868
Total			359,604

Miscellaneous costs are additional costs incurred directly by rice mina farmers. Other costs include tax fees, group dues, tractor rental fees, and land rental fees. The results of the analysis as presented in Table 5 show that the total cost of other mina rice farming for one year or three planting seasons is IDR 618,789. The highest cost incurred during the three growing seasons is the cost of renting a tractor, which is IDR 137,714, where the cost of renting a tractor range from IDR 150,000 – IDR 200,000 per 1000 m2. The monthly group contribution fee is IDR 2,000 for the Mina Maju Kemput Farmers Group and IDR 3,000 for the Mina Muda Samberembe Farmers Group. Meanwhile, the land rental cost incurred is IDR 300,000 per 1000 meters square.

Table 5. Other Costs of Rice-fish Farming

Type	Season 1 (IDR)	Season 2 (IDR)	Season 3 (IDR)
Tax	15,406	15,406	15,406
Group Contributions	10,286	10,286	10,286
Tractor rent	137,714	137,714	137,714
Land rent	42,857	42,857	42,857
Total per season	206,263	206,263	206,263
Total			618,789

Explicit costs are the total costs incurred directly or by farmers during the rice-fish farming process. The results of the analysis as presented in Table 6 show that the total explicit cost incurred for mina rice farming in Candibinangun Village during three planting seasons is IDR 20,606,421. The largest explicit cost of three times the planting season is found in the third planting season with an amount of IDR 6,949,902. The explicit cost in the third planting season is influenced by the high cost of production facilities.

Table 6. Explicit Cost of Rice-fish Farming

Description	Season 1 (IDR)	Season 2 (IDR)	Season 3 (IDR)
Input	5,703,600	5,601,657	5,846,057
Non-Family Labor	907,714	791,286	777,714
Total Depreciation	119,868	119,868	119,868
Miscellaneous cost	206,263	206,263	206,263
Total per season	6,937,445	6,719,074	6,949,902
Total Explicit Costs			20,606,421

3.1.2 Rice-fish Farming Income

Rice-fish farming income is the net value of rice-fish farming after deducting explicit costs. This rice-fish farming runs three production seasons for a year. Each production period produces a different number of products and values as presented in Table 7.

Farming revenue is the result obtained by farmers through the multiplication between the amount of production produced and the selling price of the production. The results of the analysis showed that the total income of mina rice farming at the research site for one year was IDR 26,937,643. The highest revenue from rice farming is the revenue in the first planting season, which is IDR 9,144,500. Meanwhile, the lowest income from mina rice farming is in the third planting season of IDR 8,712,900. In addition, of the total 35 respondents, the smallest receipt is IDR 6,000,000 and the largest revenue is IDR 13,000,000.

Rice-fish income is income obtained from self-managed rice-fish farming activities. The results of the analysis showed that the income of rice-fish farming during the three planting seasons varied and increased or decreased. Overall, the total income on farm of rice-fish farming in Candibinangun Village for one year is IDR 6,331,222 or IDR 527,602 per month (Table 8). This income has the potential to improve the nutritional status and livelihoods of participating farmers [22].

Table 7. Rice-fish Farming Production

Product	Season 1		Season 2		Season 3	
	Quantity (Kg)	**Value (IDR)**	**Quantity (Kg)**	**Value (IDR)**	**Quantity (Kg)**	**Value (IDR)**
Rice	373	1,805,529	366	1,768,929	342	1,663,757
Fish	312	7,338,971	311	7,311,314	300	7,049,143
Total per season		9,144,500		9,080,243		8,712,900
Total						26,937,643

Table 8. Rice-fish Farming Income

Description	Season 1 (IDR)	Season 2 (IDR)	Season 3 (IDR)
Revenue	9,144,500	9,080,243	8,712,900
Explicit Cost	6,937,445	6,719,074	6,949,902
Income	2,207,055	2,361,169	1,762,998
Total			6,331,222

3.1.3 non-Rice-fish Farming Income

On-farm income can not only be obtained from rice farming, but also from other types of farming to meet household needs. The results of the analysis as presented in Table 9 show that the total on-farm income other than rice-fish farming is IDR 3,828,571 with the highest income obtained from chili commodities which is IDR 2,205,714. Then for salacca as many as one person with a total income for one year is approximately IDR 7,000,000. As for cucumber-fish farming, it is carried out on its own land in the sense that it does not use the same land as rice-fish with an average income for one year of IDR 1,400,000.

Table 9. Non-Rice-fish Farming Income

Commodities	Nilai (IDR)
Chili	2,205,714
Salacca	222,857
Cucumber-fish	1,400,000
Total	3,828,571

3.1.4 Off Farm Income

Off farm income is income obtained from activities outside of one's own farming. The results of the analysis as presented in Table 10 show that off farm income is obtained from farmers and farmer family members who work as farm laborers in farms owned by others. The largest income was obtained from a husband who worked as a farm worker with an amount of IDR 3,188,571. Meanwhile, the smallest income was obtained from children who worked as farm laborers of IDR 642,857.

Table 10. Off farm income of Rice-fish Farmer Households

Source	Value (IDR)
Husband	3,188,571
Wife	822,857
Child	642,857
Total	4,654,286

3.1.5 Non-Farm Income

Non-farm income is income obtained from activities outside the agricultural sector. The results of the analysis as presented in Table 11 show that non-farm income is dominated by income from working as a construction worker with a total income for one year of IDR 7,200,000. This is because farmers who are still able to work choose to use their labor to work as laborers where they generally get a greater daily yield. Non-farm income is not only obtained from farmers who work outside the agricultural sector but also from the income of farmer family members who also work outside the agricultural sector. After the three types of income are known, the total household income of farmers will be obtained

Table 11. Non-Farm Income of Rice-fish Farmer Households

Occupation/source	Value (IDR)
Construction Workers	7,200,000
Driver	1,200,000
Security	1,988,571
Civil Servant/Retired	3,188,571
Merchant	685,714
Entrepreneurial	2,057,143
Remittance Money	1,371,429
Total	16,320.000

Table 12. Household income of Rice-fish Farmers

Source	Value (IDR)	Contribution (%)
On Farm Rice-fish	6,331,222	20.34
On Farm Non-Rice-fish	3,828,571	12.30
Off Farm	4,654,286	14.95
Non-Farm	16,320,000	52.42
Total Income (IDR)	31,134,079	100.00

The results of the analysis as presented in Table 12 show that the total household income of farmers for one year is IDR 31,134,079. The smallest source of income is obtained from on-farm income other than rice mina, which is IDR 3,828,571, while the largest is obtained from non-farm income, which is IDR 16,320,000. Farming contribution is a form in the form of a value in percentage that shows how much rice-fish farming contributes to the farmer's household income. It is known that the contribution of rice-fish farming income to the total household income of farmers is 20.34%. This shows that the contribution of mina rice farming income to total household income is still relatively low or even lower than organic rice farming [23].

3.2 Farmer Household Expenses

Farmer household expenses are the overall costs incurred by farmer households to meet their living needs within a period of one year. The form of household expenditure of farmers is divided into two, namely food expenditure and non-food expenditure.

3.2.1 Food Expenditure

Food expenditure for farmer households is a cost incurred to meet daily food needs. The results of the analysis as presented in Table 13 show that overall, the food expenditure of rice-fish farmers in Candibinangun Village for one year is IDR 10,169,143. The highest cost of food expenditure is the distribution of vegetables with a percentage of 24% and an amount of IDR 2,444,571 for one year. The type of food expenditure that costs quite a lot is the expenditure on cigarettes and the least food expenditure is the expenditure on fish.

Table 13. Food Expenditure of Rice-fish Farmers' Households

Food type	Value (IDR)	Percentage (%)
Rice	752,229	6.89
Other Carbohydrate	183,429	1.68
Chicken meat	613,029	5.61
Beef	232,800	2.13
Fish	138,857	1.27
Tofu and Tempeh	447,771	4.10
Egg	393,943	3.61
Vegetable	2,444,571	22.38
Fruits	594,857	5.45
Seasoning	643,886	5.90
Cooking oil	706,286	6.47
Drink	747,429	6.84
Junk food	1,445,143	13.23
Cigarette	1,577,143	14.44
Total	10,921,371	100.00

3.2.2 Non-Food Expenditure

Non-food expenditure is the overall cost incurred to meet needs that can support their survival. The results of the analysis as presented in Table 14 show that the total non-food expenditure of rice-fish farmers in Candibinangun Village for one year is IDR 11,157,314. The highest expenditure is expenditure on education and transportation which is IDR 1,914,857 and IDR 1,918,286 respectively with a percentage of 17%. Meanwhile, expenditure on clothing, PBB, and recreation is the smallest among other expenses, which are below IDR 300,000 per year.

3.3 Household Welfare of Rice-Fish Farmers

3.3.1 Good Service Ratio Analysis

Good Reservice Ratio or GSR analysis is an analysis used as a measure of the welfare of farmers' households by comparing food expenditure and non-food expenditure. The results of the analysis as presented in Table 15 show that based on the Good Service Ratio analysis, it produces a GSR value of 0.98 which means prosperous. In accordance with the benchmark criteria according to the Good Service Ratio analysis, namely if the GSR value is < 1, then the farmer's household is classified as more prosperous than the GSR value = 1. This is in accordance with Engel's theory which states that along with the increase in income, expenditure on food will decrease and vice versa [18]. This also happens in the informal worker community [24].

Table 14. Non-Food Expenditure of Rice-farmer Farmer Households

Non-Food Expenditure	Value (IDR)	Percentage (%)
Electricity	499,543	4.48
Gas LPG	625,029	5.60
Transportation (Fuel)	1,914,857	17.16
Communication (Phone credit, Internet)	1,445,143	12.95
Healthcare costs	1,246,286	11.17
Tuition fees	1,918,286	17.19
Therapy	1,637,143	14.67
Village Contribution	510,857	4.58
Fashion	240,857	2.16
Vehicle Tax	482,000	4.32
Building Tax	54,457	0.49
Recreation	152,857	1.37
Celebration/Social	430,000	3.85
Sum	11,157,314	100.00

Table 15. Analysis of Good Service Ratio of Rice-fish Farmer Households

Expenditure	Value
Food Expenditure (IDR)	10,921,371
Non-Food Expenditure (IDR)	11,157,314
Value GSR	0.98

3.3.2 Analysis of the Rice-fish Farmers Household Income Exchange Rate

Farmer Household Income Exchange Rate Analysis or FHIER is an analysis that is also used to measure the level of welfare of farmer households by using a comparison between the total income of farmer households and the total expenditure of farmer households. The results of the analysis as presented in Table 16 showed that the FHIER value > 1 was 1.41 with the understanding that the households of Rice-fish farmers in Candibinangun Village could be categorized as prosperous. Based on the FHIER value obtained, it can also provide opportunities for farmers to save money by investing or others to meet other unexpected and emergency needs. This indicates that the purchasing power of farmers has increased due to contributions from rice farming. In addition, farmers' purchasing power can also be affected by changes in input prices used in agricultural production. For example, if input prices decrease, farmers' profit margins increase, leading to an increase in their purchasing power. Conversely, an increase in input prices can have a negative impact on production and purchasing power [24].

Table 16. Analysis of the Rice-fish Farmers Household Income Exchange Rate

Description	Value
Total Revenue (IDR)	31,134,079
Total Expenses (IDR)	22,078,686
FHIER	1.41

4 Conclusion and recommendation

The household income of rice-fish farmers in Candibinangun Village consists of on-farm and on-farm income in addition to rice-fish, off farm, and non-farm. The total household income of farmers obtained is IDR 31,134,079 per year. The rice-fish farming income has a contribution of 20.34% which is quite low. Meanwhile, farmers' household expenditures consist of food expenditure and non-food expenditure with a total expenditure of IDR 22,078,686. The welfare of rice farming households in Candibinangun Village can be measured using two analyses, namely Good Service Ratio (GSR) analysis and Farmer Household Income Exchange Rate (FHIER) analysis. The results of the analysis using the Good Service Ratio are 0.98. Meanwhile, the results of the welfare analysis using the Farmer Household Income Exchange Rate were 1.41. From the results of the two analyses, it shows that the households of rice-fish farmers in Candibinangun Village can be categorized as prosperous. However, the achievement of this welfare is not only influenced by the amount of income from rice-fish farming, but also determined by the amount of income from outside-fish farming activities.

This research can provide views to rice farmers related to household income and expenditure and its relationship with the welfare of rice farmers in Candibinangun Village. The results of the study show that the contribution of rice farming to household income is still relatively low. Therefore, it is necessary to make efforts to develop rice-fish farming in order to increase the income and welfare of farmer households. Rice-fish farming has great potential to be able to increase the income and welfare of farmers' households through several ways such as agro-tourism management, culinary, and can also take advantage of the surrounding environment by providing outbound facilities and educational training about rice-fish farming.

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References

1. Salahuddin, La Ode Muh Munadi, Muhammad Amrullah Pagala, and Rina Astarika, Int. J. Sci. Technol. Manag. **2**, 1203 (2021)
2. Kementrian Pertanian, 1 (2020)
3. F. Hidayati, Y. Yonariza, N. Nofialdi, and D. Yuzaria, Unri Conf. Ser. Agric. Food Secur. **1**, 113 (2019)
4. N. Yaqoob, S. A. Ali, D. Kannaiah, N. Khan, and ..., … Sci. Pollut. … (2022)
5. A. H. Saiful Islam, in *Technol. Institutional Innov. Marginalized Smallholders Agric. Dev.* (Springer International Publishing, 2016), pp. 289–322
6. H. Mulyadi, D. Rochdiani, and D. L. Hakim, J. Ilm. Mhs. Agroinfo Galuh **7**, 45 (2020)
7. A. Dey, K. Sarma, U. Kumar, S. Mohanty, T. Kumar, and B. P. Bhatt, Org. Agric. **9**, 99 (2019)
8. N. F. Wan, S. X. Li, T. Li, A. Cavalieri, J. Weiner, X. Q. Zheng, X. Y. Ji, J. Q. Zhang, H. L. Zhang, H. Zhang, N. L. Bai, Y. J. Chen, H. Y. Zhang, X. Bin Tao, H. L. Zhang, W. G. Lv, J. X. Jiang, and B. Li, J. Clean. Prod. **234**, 1002 (2019)
9. K. Ogundari and O. D. Bolarinwa, Agric. Resour. Econ. Rev. **48**, 142 (2019)
10. S. Z. Leul, A. A. Bekele, A. G. Hailu, and S. T. Feleke, Cogent Food Agric. **9**, (2023)
11. A. Abdul-Rahaman, J. Agric. Food Res. **13**, (2023)

12. A. Assaye, E. Habte, S. Sakurai, and D. Alemu, J. Agric. Food Res. **10**, (2022)
13. A. G. Geffersa, F. W. Agbola, and A. Mahmood, Aust. J. Agric. Resour. Econ. **66**, 860 (2022)
14. Y. K. Mogess and D. D. Ayen, Food Energy Secur. **12**, (2023)
15. P. M. Etwire, I. Koomson, and E. Martey, Clim. Change **170**, (2022)
16. M. G. Tesfay, Irrig. Drain. **70**, 306 (2021)
17. P. Jiba, A. Obi, L. Mdoda, and C. Mzuyanda, South African J. Agric. Ext. **52**, 48 (2024)
18. M. Chen, Rev. Dev. Econ. **26**, 1640 (2022)
19. L. Thanh Hai, Q. B. Tran, V. T. Tra, T. P. T. Nguyen, T. N. Le, H. Schnitzer, G. Braunegg, S. Le, C. T. Hoang, X. C. Nguyen, V. H. Nguyen, W. Peng, S. Y. Kim, S. S. Lam, and Q. Van Le, Environ. Pollut. **265**, (2020)
20. R. Jirasinha, *Socio-Economic Analysis of Rice-Fish Culture Based Systems in Myanmar* (International Water Management Institute, 2022)
21. Sumpam Tangjang and P. K. Ramachandran Nair, J. Environ. Sci. Eng. A **4**, 545 (2015)
22. K. Ramanathan, V. Sangeeviraman, P. Chandrahasan, B. N. Chaudhary, and S. S. Ramachandra, Sci. Rep. **10**, (2020)
23. T. Triyono, M. F. F. Al Qudsi, N. Rahmawati, Z. Rozaki, and M. F. Kamarudin, Open Agric. **9**, (2024)
24. R. Roy and A. Kundu, Asian Dev. Policy Rev. **10**, 307 (2022)
25. Z. Bayramoğlu, S. Ağızan, M. B. Akçil, and K. Ağızan, in (2022)