ISSN : 1412-8837
e-ISSN : 2579-9959
JURNAL AGRISEP
Kajian Masalah Sosial Ekonomi Pertanian dan Agribisnis

DOI: 10.31186/jagrisep.23.01.55-74

# A CASE STUDY IN SLEMAN: A FEASIBILITY ANALYSIS OF RICE-FISH FARMING BASED ON RESOURCES PRODUCTIVITY

## *Studi Kasus di Sleman: Analisis Kelayakan Usahatani Mina Padi Berbasis Produktivitas Sumberdaya*

**Triyono[1)]; Dafit Alvaseno[2)]**
***[1),2)]Agribusiness Department, Faculty of Agriculture, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia***
**Email: triyono@umy.ac.id**

### *ABSTRACT*

*One of the efforts to optimize resources in order to increase farm income is mina rice, which is rice and fish farming on one land and season in an integrated manner. This study aims to determine the cost, revenue, income, and profit of rice-fish farming. In addition, this study aims to determine the feasibility of rice-fish farming through a resource productivity approach. The method used is descriptive analysis, by taking respondents as many as 35 farmers in Samberembe village, Candibinangun, Pakem, Sleman, and the Special Region of Yogyakarta. The results of the study showed that the average paddy-fish farming area of 1,063 square meters requires an average total cost incurred for one year for production is IDR. 27,591,910.95. Rice-fish farming revenue amounted to IDR. 36,293,686, so that the income obtained amounted to IDR. 21,590,063.81. Meanwhile, the profit of rice-fish farming amounted to IDR. 8,701,774.77 for three seasons per year. The results of the feasibility analysis showed an R/C value of 1.3, a capital productivity value of 62% per year, and a labor productivity value of IDR. 206,125.21 per full time day, and a land productivity value of IDR. 7,292.00 per square meter. These results indicate that rice-fish farming is feasible to develop.*

***Keyword: feasibility, productivity, resources, rice-fish***

### *ABSTRAK*

*Salah satu usaha optimalisasi sumberdaya dalam rangka peningkatan pendapatan usahatani adalah mina padi, yakni usahatani padi dan ikan dalam satu* *lahan dan musim secara terpadu. Penelitian ini bertujuan untuk mengetahui biaya, penerimaan, pendapatan dan keuntungan usahatani mina padi. Selain itu penelitian ini bertujuan mengetahui kelayakan usahatani rice-fish melalui pendekatan produktivitas sumberdaya. Metode yang digunakan yaitu deskriptif analisis, dengan mengambil responden sebanyak 35 petani di kampung samberembe Candibinangun Pakem Sleman Daerah Istimewa Yogyakarta. Hasil dari penelitian menunjukkan luas lahan usahatani rice-fish rata-rata sebesar 1,063 meter persegi memerlukan biaya total rata-rata yang dikeluarkan selama satu tahun untuk produksi adalah IDR. 27,591,910.95. Penerimaan usahatani mina padi sebesar IDR. 36,293,686 sehingga pendapatan yang diperoleh sebesar IDR 21,590,063.81. Sementara itu, Keuntungan usahatani mina padi sebesar IDR. 8,701,774.77 selama tiga musim per tahun. Hasil analisis kelayakan menunjukkan nilai R/C sebesar 1.3, nilai produktivitas modal sebesar 62% pertahun, nilai produktivitas tenaga kerja sebesar IDR. 206,125.21 per HKO, dan nilai produktivitas lahan sebesar IDR. 7,292.00 per meter persegi. Hasil tersebut mengindikasikan bahwa usahatani mina padi layak dikembangkan.*

***Kata Kunci: kelayakan, produktivitas, sumber daya, ikan padi***

## INTRODUCTION

Rice is one of the main food crops in Indonesia, cultivated by many farmers. Therefore, the Ministry of Agriculture has four succession targets to achieve sustainable food self-sufficiency. The targets are increasing food diversification, increasing added value, competitiveness and exports, and improving the welfare of farmers. Food diversification is one of the best policies that must be implemented to achieve food independence and anticipate food crises. It makes optimal use of land by developing an integrated agricultural system so that agriculture is more efficient and environmentally sound (Ansar & Fathurrahman, 2018).

One of the innovations adopted in the application of integrated agriculture is rice-fishing. This technique has been adopted by farmers since 2011 in Pakem Sleman, Special Region of Yogyakarta. Rice-fish is the intercropping cultivation of two types of commodities on one land, namely rice and fish. Fish are raised on the sidelines of rice plants as a substitute for crops in rice fields with a good irrigation system (Widodo et al., 2017). Integrated agricultural systems are important because agricultural systems that combine two or more agricultural commodities, which are based on the concept of biological recycling, and are related input-output between reciprocal commodities that approach the utilization of low external inputs, carried out on land, through the utilization of plant waste, animal waste, fish waste for the purpose of increasing production and productivity so as to increase farmers' income and can create conditions that Eco-friendly agriculture (Mukhlis et al., 2018). The integration of fish and rice that utilizes maximum niches can be a potential production that improved agriculture in terms of farmers' income and increases soil fertility through effective nutrition and rice ecology (Nayak et al., 2018). These plant nutrients include Fish Scale Waste which can be used as potential fertilizer for rice production (Sarkar & Das, 2022).

Rice-fish is a system that is considered quite useful and good for rice farmers whose commodities are the staple food for more than 95 percent of Indonesia's population. It also supports food security by contributing nutritional intake in the form of carbohydrates and animal protein at the same time. Previous studies have shown that rice mining can support food security and improve community welfare. Based on these advantages, rice-fish deserves to be applied because rice-fish provides various benefits in terms of social, ecological, and economic aspects for rural communities (Lestari & Bambang, 2017; Fatimah et al., 2020).

In Sleman Regency, there are 17 sub-districts that have implemented the rice-fish system (Badan Pusat Statistik Indonesia, 2016). One of the areas that has carried out rice-fish cultivation is Candibinangun Village, Pakem District. The management of the Rice-fish farm utilizes its own rice fields which are done by farmers themselves by involving labor in the family. Meanwhile, the capital used for farming rice-fish utilizes its own capital. Thus, the size of rice-fish farming is still on a small or household scale. Based on these problems, whether this rice-fish farming is profitable and worth working on needs further study.

Rice-fish as a form of integrated agricultural system requires a holistic approach to agriculture aimed at meeting various demands (providing agricultural resilience, farmers' livelihoods, food security, ecosystem services, and making agriculture adaptive and resilient). The systems are characterized by the temporal, and spatial mixing of crops, livestock, fisheries, and allied activities in one farm. It is hypothesized that these complex farms are more productive at the system level, less prone to volatility, and produce fewer negative externalities than simplified farms (Paramesh et al., 2022). Integrated Farming Systems (IFS) ensure efficient utilization of available agricultural resources, increase unit productivity and income which are prerequisites for sustainable livelihoods of small and marginalized farmers. The main components in the IFS model are agriculture, horticulture, animal husbandry and subsidiary components such as fisheries, vermicompost, mushrooms and azolla. Field crops, vegetables and livestock components are included in the IFS model taking into account soil topography, soil texture and preferences for tribal livelihoods (Kumar et al., 2018).

The integrated farming system over the past seven years and a cursory analysis of investments shows that it is good enough to provide an average daily income of 617/day with an engagement of 0.93 units of labor/day (Patel et al., 2019). In this system, a set of interrelated enterprises is used so that waste from one component becomes an input for another enterprise of the system, which reduces costs and increases production and thus revenue.

It seems to be a possible solution to the continued increase in demand for food and nutrition, income stability and improved livelihoods especially for small and marginalized farmers with few resources (Kumar et al., 2018) A study in China found about the genetics of fish is new because the combination of fish and rice makes the evolution of fish types and habits into new with a new climate system that is different from the original residence of goldfish (Zhang et al., 2022).

Based on previous research, we have not found a review of the productivity of the main production factors (land, labor and capital) in the context of household-scale rice farming in Indonesia. Integrated farming as mina rice has many advantages and can be expected to be a solution related to the increasingly narrow land, unemployment, high food needs and also increasingly massive innovation. Therefore, this paper will discuss the feasibility of household-scale rice-fish farming developed by farmers in Sleman, Yogyakarta.

## RESEARCH METHOD

This research was conducted in a sub-district that has good rice-fish potential with farmers who are actively cultivating rice-fish. Sampling was carried out by census, namely all rice-fish farmers in Candibinangun Village, Pakem District, as many as 35 rice-fish farmers. Sampling is an important step when designing an empirical study to justify the size of the sample to be collected (Lakens, 2022).

The data used in this study consisted of those directly obtained from farmers through interviews and observations using a list of questions (questionnaires) that had been compiled in advance. The data taken includes the identity of farmers, capital, input costs, labor, the amount of rice and fish production.

Data analysis techniques used are farm analysis and feasibility analysis which includes Costs, Revenues, Income, Profits and Farm Feasibility (Banguno et al., 2021); (Sundari, 2011). Some of the formulations of analysis used are as follows:

### Step 1: Farm Analysis

***Total Cost***

$$TC = TEC + TIC \quad (1).$$

Note: TC : Total Cost ; TEC : Total Explicit Cost; and TIC : Total Implicit Cost

***Revenue***

$$TR = Py.Y \quad (2).$$

Note: TR : Total Revenue ; Py : Price of product; and Y : Production

***Income***

$$NR = TR - TEC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3).$$

Note: NR : Net Return; TEC : Total Eksplicit Cost; and TR : Total Revenue

***Profit***

$$\Pi = TR - TC) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4).$$

Note: Π : Profit; TR : Total Revenue; and TC : Total Cost

**Step 2: Feasibility Analysis**

***1). Revenue Cost Ratio (R/C)***

Revenue Cost Ratio (R/C) is the ratio between revenue and cost. According to (Banguno et al., 2021) the return cost ratio analysis is a comparison with the overall revenue obtained with the overall amount of production.

$$R/C = \frac{TR}{TIC + TEC} = \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5).$$

Note: TR: Total Revenue; TIC: Total Implicit Cost; and TEC: Total Explicit Cost

Rice-Fish farming is considered feasible if the R/C value is > 1, which means that the farm can generate revenue that is greater than the costs that have been incurred. Conversely, if R/C ≤ 1 then farming is not feasible.

***2). Land Productivity***

The value of land productivity reflects the results of the effort of each unit area in a given season. Land cost is the rental value of each unit of land in a certain time or season. Therefore, this feasibility is seen based on the ratio of net farm results after deducting explicit costs, family labor wages and interest on own capital to land rental costs.

$$\text{Land productivity} = \frac{NR - WF - i}{Land} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Note: NR: Net Return; WF: Wages of Family Labor; and i: interest on own capital

If land productivity > from land rent, then the farm is feasible. Conversely, if land productivity ≤ from land rent, then the farming is not feasible to continue.

***3). Labor Productivity***

Labor productivity is the result of effort obtained by each outpouring of labor per working day of people. The cost of labor per working day of people is often referred to as wages. Therefore, feasibility is based on labor productivity as a ratio between the achievement of net farm results after deducting explicit costs, land rent and capital interest to the prevailing wage value in the study area. As a benchmark for the value of wages is the regional minimum wage of Sleman Regency (RMW).

$$\text{Labor productivity} = \frac{NR - LR - i}{FL} \quad \text{.............................(7)}$$

Note: NR: Net Revenue; LR: Land Rent; FL: Family Labor; and i: interest on own capital

If labor productivity > from RMW, then the farm is worth working on. Conversely, if labor productivity ≤ from RMW, then the farm is not worth working on.

***4). Capital Productivity***

Business capital can come from farmers' own or borrowed capital. Therefore, the cost of capital can be in the form of interest on loans that must be paid to financial or banking institutions. Capital productivity is net revenue after deducting explicit costs, land rents and labor wages against total explicit costs.

$$\text{Capital productivity} = \frac{NR - LR - WF}{TEC} \times 100\% \quad \text{.......... (8)}$$

Note: NR: Net Return; TEC : Total Explicit; and WF: Wages of Family Labor

If capital productivity > savings interest rates, then the farm is worth working on. But on the contrary, if capital productivity ≤ from the interest rate on farm food savings is not feasible to cultivate.

## RESULT AND DISCUSSION

**General Overview of the Respondents**

Human resources are one of the important supporting factors in agricultural production activities. In general, the gender that does a lot of farming activities is the male gender, this is certainly related to a greater amount of energy or physique. In addition, based on the culture in Indonesia, women are more dominant in activities inside the household and few activities outside the home. So that the majority of rice-fish activities are carried out by men as presented on Table 1. The majority of farmers are men at 97.14% more than female farmers at 2.86%. One of the factors that support the optimization of production is the gender of farmers with more male sex in value can be maximized in carrying out agricultural activities compared to female farmers. This is based on the energy possessed by stronger male farmers.

Table 1. Characteristic of Respondents on Rice-fish Farm

| Description | | Number | Percentage (%) |
|---|---|---|---|
| Gender | Male | 34 | 97.14 |
| | Female | 1 | 2.86 |
| | Sum | 35 | 100.00 |
| Age (years old) | 28-37 | 8 | 22.86 |
| | 38-47 | 4 | 11.43 |
| | 48-57 | 15 | 42.86 |
| | 58-67 | 4 | 11.43 |
| | >67 | 4 | 11,43 |
| | Sum | 35 | 100.00 |
| Education | Elementary School | 5 | 14,29 |
| | Yunior School | 4 | 11.43 |
| | High School | 20 | 57.14 |
| | High Education | 6 | 17.14 |
| | Sum | 35 | 100.00 |
| Experience (year) | 3 | 7 | 20.00 |
| | 5 | 7 | 20.00 |
| | 9 | 15 | 42.86 |
| | 10 | 6 | 17.14 |
| | Sum | 35 | 100.00 |
| Land ($m^2$) | 500 - 600 | 2 | 5.71 |
| | 700 - 800 | 2 | 5.71 |
| | 900 - 1,000 | 23 | 65.71 |
| | 1,100 - 1,200 | 2 | 5.71 |
| | 1,300 - 1,400 | 4 | 11.43 |
| | >1400 | 2 | 5.71 |
| | Sum | 35 | 100.00 |

Source: Primary data, 2022

The majority of farmers are around 48-57 years old, but there are young farmers aged 28-37 years around 22.86%. This shows that the age of minapadi farmers in Candibinangun Village is still in productive age compared to the age of farmers who are not in productive age only 11% of farmers. With the age of rice-fish farmers in Candibinangun Village who are still productive, they can maximize the farming that is run with strong physical abilities.

Farmers who have the highest education as undergraduates are 6 people, while the majority of farmer education is high school / high school education as 57% of all minapadi farmers. Here it can be seen that the education of minapadi farmers in Candibinangun Village is high and is valued to be able to overcome every problem that will be faced in the farming process and take advantage of opportunities and innovations in the development of the Minapadi system. This ability is supported by their experience in minapadi farming for 3 to 10 years. However, the majority of minapadi farmers in Candibinangun Village only manage an average land area of 1000 m² with a percentage of 65.71%. Meanwhile, the largest farmer's arable land is only 1,400 m² managed by two farmers.

**Rice-fish Farm Analysis**

The scale of rice-fish farming developed by farmers ranges from 500 – 1,400 square meters with an average land area of 1,063 square meters. Rice-fish business can be carried out throughout the year in three seasons with the same planting pattern.

Table 2. Rice-fish Planting Pattern in Candibinangun Village

| Season | Commodities | Duration |
|---|---|---|
| Growing Season 1 | Rice – Parrot fish | April-July |
| Growing Season 2 | Rice – Parrot fish | August-November |
| Growing Season 3 | Rice – Parrot fish | December- March |

Source: Primary Data, 2022

The rice-fish cultivation process consists of preparation, planting, stocking seedlings, maintaining and harvesting. The preparatory stage includes the activities of making ripens, gutters, channels and reservoirs. The planting stage consists of tillage and rice planting. The next stage is the stocking of fish fry and maintenance including fertilization and regular feeding. Leftover feed and fish manure are useful as organic fertilizer for rice plants. The use of organic farming systems can achieve the goal of zero emissions. The proposed integrated breeding and cultivation system increases agricultural productivity, the environment and increases farmers' incomes by up to 41.55% (Thanh et al., 2020).

Production costs in farming are one of the needs needed to support every agricultural activity. Costs themselves consist of explicit and implicit costs. Explicit costs are real costs such as fertilizers, rice seeds, fish seeds, pesticides and out-of-family labor. While the implicit costs themselves are costs incurred intangibly by farmers such as labor in the family, rent of own land and interest on own capital. The following is the study program data needed to support rice-fish farming activities.

Table 3. Total Cost of Production Input Rice-fish Farm

| Input | Growing Season 1 | | Growing Season 2 | | Growing Season 3 | |
|---|---|---|---|---|---|---|
| | Number | Cost (IDR) | Number | Cost (IDR) | Number | Cost (IDR) |
| Paddy Seeds (kg) | 3.73 | 44,742.86 | 3.73 | 44,742.86 | 3.81 | 45,771.43 |
| Fish Breeds (kg) | 48.71 | 974,285.71 | 48.43 | 968,571.43 | 50.51 | 1,004,571.42 |
| Fish Feed (sak) | 6.49 | 1,621,428.57 | 6.49 | 1,621,428.57 | 6.49 | 1,621,428.57 |
| Organic Fertilizer | 2.57 | 33,428.57 | 4.57 | 59,428.57 | 4.57 | 59,428.57 |
| N Fertilizer (kg) | 15.43 | 33,017.14 | 15.43 | 33,017.14 | 15.43 | 34,302.86 |
| NPK Fertilizer (kg) | 10.40 | 41,285.71 | 10.40 | 41,285.71 | 10.40 | 42,142.86 |
| Ca-Dolomit (kg) | 5.34 | 29,342.86 | 5.34 | 29,342.86 | 5.34 | 29,342.86 |
| Sum | | 2,777,531.43 | | 2,797,817.14 | | 2,836,988.57 |
| Total Input Cost | | | | | | 8,412,337,38 |

Source: Primary data, 2022

The seeds used by rice-fish farmers in Candibinangun Village are types of ciherang rice which are valued heavier and more when they are in harvest age. And this type of rice is stronger in roots and resistant to stagnant water so it is very suitable to be one of the rice that can be combined with fish in terms of the rice-fish system. Ciherang rice variety is thought to have a fairly high productive sapling of 14.80 saplings and weighs 1000 grains, Ciherang rice is also considered quite resistant to pests and diseases (Hambali & Lubis, 2015). The amount released by farmers in each season is not much different, it's just that there are some farmers who add the amount of inputs for increasing revenue. Meanwhile, the largest expenditure for seeds is in planting season 3 with an average of IDR. 45,771.45. which is greater than the average planting season 1 and 2 which averaged IDR. 44,742.86.

The fish seeds stocked are red parrot which is considered more resistant to this rice-fish concept and also red parrot fish has a more expensive price than black parrot fish, the demand is quite high also makes this parrot fish is a good enough choice to be combined with the rice-fish system petically and easy maintenance. In three planting seasons carried out by rice-fish farmers, the highest fish seedlings occurred in planting season 3 with an average of IDR. 1,004,571.43 with an average fish seed of 50.23/kg.

There are two types of feed given in the Rice-fish business in Candibinangun Village, namely independent feed made by farmers themselves or given feed in the form of leaves as well. For routine feed is fish pellets that are given every 2 times for one day. Farmers buy fish feed in the form of sacks with an average amount of 6.49 kg at a price of IDR. 250,000.00 and the average that must be spent by farmers is in each growing season for fish feed is IDR. 1,621,428.57.

Fertilizer in Rice-fish is needed as a basic fertilizer to stimulate the soil to be more fertile before stocking fish seedlings. Fertilization is needed because permanent agricultural land is poor in nutrients (Savci, 2012). Fertilizers used by Rice-fish farmers in Candibinangun Village are divided into two types, namely organic and non-organic fertilizers. Organic fertilizer used is manure that is stocked to get or grow organisms that can be parrot fish feed. The largest average use of organic fertilizers in growing seasons 1 and 2 was 4.57 Kg. Meanwhile, the largest use of inorganic fertilizers in the form of urea in planting season 3 with an average of 15.43 Kg. In addition, this farm also uses phosnka fertilizers and dolomite lime. Dolomite lime functions as a soil neutralizer before replanting rice seedlings and parrot fish fry, which makes the soil pH neutral again. Dolomite lime will react by neutralizing ions contained in the soil (Sumarwan & Arman, 2015).

Table 4. Depreciation of Tools in Rice-fish Farming per Year

| Types of Tools | Quantity (units) | Purchase Price (IDR) | Depreciation (IDR ) |
|---|---|---|---|
| Cangkul | 2.09 | 3,815.07 | 7,957.14 |
| Side Paranet | 1,50 | 90,000.00 | 135,000.00 |
| Sheeting | 1.00 | 233,333.33 | 233,333.33 |
| Top Paranet | 4.29 | 33,333.33 | 142,857.14 |
| Bucket | 1.94 | 2,750.00 | 5,342.86 |
| Fishing Net | 2.14 | 6,666.67 | 14,285.71 |
| Total Depreciation | | | 538,776.19 |
| Per season | | | 179,592.06 |

Source: Primary data, 2022

Equipment depreciation is a value that can be reached to buy back agricultural equipment within a certain period of time. From the table above, the highest depreciation of the tool is mulch by IDR. 233,333.33. This happens because mulch is often damaged by destructive pests such as otters or damage occurs during harvesting.

Farmer labor costs are costs incurred to pay for labor that has been incurred in one year or three growing seasons of rice-fish farming. There are two types of labor costs, namely labor costs within the family and also labor costs outside the family. The labor costs of an outside family is the real cost incurred by farmers to pay for labor in terms of rice-fish farm production. The following is a breakdown of out-of-family labor costs incurred by farmers.

Labor costs outside the family in rice-fish farming refer to the expenses incurred for agricultural laborers or people outside the family who are paid with an agreed daily wage. These costs are significant, particularly during the planting season, due to the large amount of labor required for land processing. For example, in season one, the labor cost can be as high as IDR 2,501,428.57, primarily because land processing requires a substantial amount of labor, with 12.36 FTD (full-time days) (Xuegui et al., 1995).

Table 5. Outside family Labor Costs on Rice-fish Farm

| Types of Activities | Growing Season 1 | | Growing Season 2 | | Growing season 3 | |
|---|---|---|---|---|---|---|
| | FTD | Cost (IDR) | FTD | Cost (IDR) | FTD | Cost (IDR) |
| Land Processing | 12.36 | 1,762,857.14 | 7.29 | 1,037,142.86 | 5.93 | 862,857.14 |
| Planting | 2.30 | 82,857.14 | 1.74 | 61,142.86 | 1.33 | 47,285.71 |
| Harvesting | 5.01 | 655,714.29 | 2.19 | 286,714.29 | 1.82 | 239,571.43 |
| Sum | | 2,501,428.57 | | 1,385,000.00 | | 1,149,714.29 |
| Total Labor Cost | | | | | | 5,036,142.86 |

Source: Primary Data, 2022

On the other hand, labor costs in the family are intangible costs incurred by farmers in rice-fish farming. These costs are associated with the labor provided by family members and are not typically quantified in monetary terms. Family members contribute to various activities in rice-fish farming, such as planting, harvesting, and maintenance, without receiving a separate wage.

Rice-fish farming has been shown to improve labor productivity and generate higher land and labor productivity measured in value output compared to rice field fisheries and rice monocultures. It also provides a good return on investment and can lead to increased yield, improved household nutrition, and income for farming families (Li et al., 2023 & Berg et al., 2023). The following is a breakdown of labor costs in the family incurred by farmers.

Table 6. Family Labor Costs on Rice-fish Farm

| Types of Activities | Growing Season 1 | | Growing Season 2 | | Growing season 3 | |
|---|---|---|---|---|---|---|
| | FTD | Cost (IDR) | FTD | Cost (IDR) | FTD | Cost (IDR) |
| Land Processing | 3.00 | 437,142.86 | 2.71 | 391,428.57 | 2.64 | 380,000.00 |
| Planting | 0.61 | 22,428.57 | 0.57 | 20,714.29 | 0.54 | 19,571.43 |
| Weeding | 30.00 | 3,600,000.00 | 30.00 | 3,600,000.00 | 30.00 | 3,600,000.00 |
| Harvesting | 1.76 | 233,142.86 | 0.86 | 113,571.43 | 0.81 | 107,571.43 |
| Sum | | 4,292,714.29 | | 4,125,714.29 | | 4,107,142.86 |
| Total Cost | | | | | | 12,525,571.43 |

Source: Primary Data, 2022

Based on Table 6. above, the highest cost occurs in planting season 1 because season 1 is the beginning of the land preparation year with more activities such as making ripens, gutters and drains and mulching.

The total cost of one year or in three growing seasons incurred by the farmer is presented in Table 7. The highest costs are required in season 1 farming considering that the need for manpower and equipment in preparation for the beginning of season 1 is actually greater than in subsequent seasons.

Cumulatively, the total annual cost is IDR. 27,591,911, but in real terms expenses occur every season so this is seasonal cash flow. Thus, this business requires costs that are realistically not too large, so that farmers are able to manage business capital flexibly.

Table 7. Total Cost of Rice-fish Farm

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Explicit Costs | | | |
| Input (IDR) | 2,777,531 | 2,797,817 | 2,836,989 |
| Outside Family Labor (IDR) | 2,501,429 | 1,385,000 | 1,149,714 |
| Tool Depreciation (IDR) | 179,592 | 179,592 | 179,592 |
| Others (IDR) | 238,789 | 238,789 | 238,789 |
| Sum (IDR) | 5,697,341 | 4,601,198 | 4,405,083 |
| Implicit Costs | | | |
| Family Labor (IDR) | 4,292,714 | 4,125,714 | 4,107,143 |
| Land Rent (IDR) | 42,000 | 42,000 | 42,000 |
| Own Capital Interest (IDR) | 90,848 | 74,406 | 71,464 |
| Sum (IDR) | 4,425,562 | 4,242,120 | 4,220,607 |
| Total Cost | 10,122,903 | 8,843,318 | 8,625,690 |
| Total Cost of One Year | | | IDR. 27,591,911 |

Source: Primary Data, 2022

Rice production in the three seasons is relatively the same. Likewise, fish production is also relatively similar. There is no significant difference in production prices between seasons. Rice productivity reaches more than 7 tons per hectare, while fish productivity reaches more than three tons per hectare. This system is the best planting system by achieving the best results on several other parameters (Yassi et al., 2020). This shows that rice-fish farming is classified as productive, able to produce quality food sources. Thus, fish-rice farming can generate economic benefits that contribute significantly to sustainable food security (Bhatnagar et al., 2021).

Table 8. Production and Revenue of Rice-fish Farm in Candibinangun Village

| Prdct | Growing Season 1 | | | Growing Season 2 | | | Growing Season 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Yield (Kg) | Price (IDR/Kg) | Revenue (IDR) | Yield (Kg) | Price (IDR/Kg) | Revenue (IDR) | Yield (Kg) | Price (IDR/Kg) | Revenue (IDR) |
| Rice | 763 | 4,581 | 3,495,303 | 762 | 4,581 | 3,490,722 | 777 | 4,586 | 3,563,322 |
| Fish | 359 | 24,000 | 8,606,400 | 353 | 24,000 | 8,472,000 | 361 | 24,000 | 8,664,000 |
| Sum | | | 12,101,703 | | | 11,962,722 | | | 12,227,322 |
| Total | | | | | | | | | 36,291,747 |

Source: Primary Data, 2022

Based on Table 8. it can be seen that the receipt of rice-fish farmers in Candibinangun Village in one year for rice and fish commodities is IDR.

36,293,686. with the highest acceptance in growing season 3 with the amount of IDR. 12,222,600 and the smallest number of receipts is in planting season 2 with the amount of IDR. 11.968.400.

Income is the difference between receipts and explicit costs that have been incurred by farmers, this income shows how much yield rice fish farmers get in one year or 3 times the growing season. The following is a table showing the income of rice-fish farmers in Candibinangun Village.

Table 9. Rice-fish Farm Income in Candibinangun Village

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Revenue (IDR) | 12,102,686 | 11,968,400 | 12,222,600 |
| Explicit costs (IDR) | 5,697,341 | 4,601,198 | 4,405,083 |
| Income (IDR) | 6,405,345 | 7,367,202 | 7,817,517 |
| Total Income (IDR) | | | 21,590,064 |

Source: Primary Data, 2022

Regarding Table 9. the income of rice-fish farmers in one year is IDR. 21,590,064. For the highest growing season is planting season 3 worth IDR. 7,817,517 and for the lowest income is growing season 1 of 6,405,345. This happens because the explicit cost in the first growing season is quite large, namely IDR. 5,697,341. Meanwhile, the profit obtained by farmers in one year was 8,701,774. The smallest amount of profit is the growing season of 1 IDR. 1,979,782 and the highest amount of profit was in planting season 3 of IDR. 3,596,910 growing season 1 gets the smallest profit because the total cost incurred for season one is quite large, namely IDR. 10,122,904. There is additional income when farmers implement rice-fish farming and also minimize the risk if some components fail (Hasbi & Tunggal, 2021).

Table 10. Profit of Rice-fish Farming in Candibinangun Village

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Revenue (IDR) | 12,102,686 | 11,968,400 | 12,222,600 |
| Total Cost (IDR) | 10,122,904 | 8,843,318 | 8,625,690 |
| Profit (IDR) | 1,979,782 | 3,125,082 | 3,596,910 |
| Total Profit (IDR) | | | 8.701.774 |

Source: Primary data, 2022

**The Feasibility of Rice-fish Farm**

The feasibility of rice-fish farming can be seen from the R/C ratio, productivity of land, labor and capital. Based on the R/C ratio, the feasibility of farming can be found by dividing revenue by total production costs. The following is a table of R/C calculations of rice-fish farming in Candibinangun Village, Pakem District.

Regarding Table 11. it can be seen that the results of R/C rice-fish farming run by rice-fish farmers in Candibinangun Village, Pakem District are worth a decent value with an R/C of 1.3 which means R/C of more than 1. This means that every 100 rupiah spent by farmers will get 130 rupiah in revenue. The highest R/C based on season is growing season 2 and 3 with an R/C value of 1.4 and the growing season with the lowest R/C occurs in growing season 1 with a value of 1.2. And of all seasons during the year his R/C was above one. These results, in line with research conducted by (Sulistyanto et al., 2013) which analyzed rice farming with an R/C yield of 1.58 with results worthy of cultivation or financially profitable, have even provided benefits for farmers and each shows rice mining business as an economically viable agricultural technology (Husaini et al., 2021 & Joseph, 2019).

Tabel 11. Revenue Cost Ratio Usahatani Rice-fish

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 | Year |
|---|---|---|---|---|
| Revenue (IDR) | 12,102,682.71 | 11,968,400.00 | 12,222,600.00 | 36,293,682,71 |
| Total Cost (IDR) | 10,122,902.79 | 8,843,317.79 | 8,625,690.39 | 27,591,910.97 |
| R/C | 1.20 | 1.40 | 1.40 | 1.30 |

Source: Primary Data, 2022

Capital productivity can be determined by means of income minus own land rent minus the value of labor in the family divided by the explicit total cost and multiplied by one hundred percent. Farming is feasible if capital productivity is greater than the reference interest rate on loans in the place. The loan interest rate in Sleman Regency, Pakem District, Candibinangun Village for People's Business Credit (KUR) by Bank Rakyat Indonesia (BRI) is 6% per year.

Table 12. Capital Productivity on Rice-fish Farming in Candibinangun Village

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Revenue (IDR) | 6,046,161 | 7,008,018.10 | 7,458,332.38 |
| Rent Own Land (IDR) | 42,000 | 42,000 | 42,000 |
| Family Labor (IDR) | 4,292,741 | 4,125,714 | 4,107,143 |
| Total Explicit Costs (IDR) | 5,697,341 | 4,601,198 | 4,405,083 |
| Capital Productivity % | 30 | 62 | 75 |
| Capital Productivity per year (%) | | | 62 |

Source: Primary Data, 2022

Table 12. shows that capital productivity is greater than the reference interest rate per season and knows. In capital productivity, if the farm that is run is greater in interest rates compared to the loan interest in that place, then the farm is considered feasible to run. For annual capital productivity of 62%

and for the season that gets the highest capital productivity is season 3 with 75%. These results are in line with research conducted (Mardhiah & Firdaus, 2017) in the feasibility analysis of rice in Aceh Province with capital productivity results of 48.5% which is greater than the regional interest rate for a year of 16% so that capital productivity is worth it.

Labor productivity can be determined by calculating income at implicit cost divided by the amount of labor in the family. Farming is said to be feasible if labor productivity is greater than the labor daily wage in a predetermined area. The labor force in the family is usually farmer's own wife and son.

Table 13. Labor Productivity on Rice-fish Farming

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Income (IDR) | 6,046,160.95 | 7,008,018.10 | 7,458,332.38 |
| Interest of Capital (IDR) | 90,848 | 74,406 | 71,464 |
| Rent Own Land | 42,000 | 42,000 | 42,000 |
| Family Labor (FTD) | 35.37 | 34.14 | 34.00 |
| Labor Productivity (IDR) | 167,178 | 201,846 | 216,026 |
| Labor Productivity (IDR)/FTD per year | | | 206,125,21 |

Source: Primary Data, 2022

It is known in Table 13. that the daily wage received is IDR. 206,125.21 per full time day (FTD) which is more than the existing wage in Sleman Regency with a UMR of IDR 70,000 per day. For the season with the highest labor productivity is in season 3 with IDR 216.026 That way farmers prefer to cultivate their own land because of higher income compared to working elsewhere. The results are greater than the results of the previous study which was only IDR amount. 96,753 per FTD (Widodo et al., 2017) on rice-fish farming in Sleman.

Land productivity can be determined by calculating income minus the number of labor families minus the interest on own capital divided by land area. Land productivity can be said to be feasible if land productivity is greater than the land rental price.

Table 14. Land Productivity on Rice-fish Farming in Candibinangun Village

| Description | Growing Season 1 | Growing Season 2 | Growing Season 3 |
|---|---|---|---|
| Income (IDR) | 6,046,160.95 | 7,008,018.10 | 7,458,332 |
| Family Labor Costs (IDR) | 4,292,714 | 4,125,714 | 4,104,143 |
| Own capital interest (IDR) | 90,848 | 74,406 | 71,464 |
| Land | 1,063 | 1,063 | 1,063 |
| Land Productivity (IDR/m) | 1,564 | 2,642 | 3,086 |
| Land Productivity (IDR/m) per year | | | 7,292 |

Source : Primary Data, 2022

Table 14 shows that the annual yield of land managed by rice-fish farmers in Candibinangun Village is noteworthy, reaching IDR 7,292 per square meter. Notably, growing season 3 has the highest land productivity, with IDR 3,086, while growing season 1 has the lowest output, with IDR 1,564. These data strongly suggest that establishing rice-fish farming is feasible, given that land production exceeds the prevalent land rental price in Candibinangun Village, which is fixed at IDR 900 per square meter/year.

This conclusion is consistent with prior research, particularly that of Widodo et al. (2017), who emphasize the long-term potential of rice-fish farming. Furthermore, transforming rice fields into crayfish-freshwater fish farming ponds has been recognized as a solution with dual benefits: reduced climate effect and improved economic outcomes (Hu et al., 2022).

Paddy-fish agriculture not only provides farmers with an additional income stream, but it also serves as a risk mitigation technique in the event of component failure (Hasbi & Tunggal, 2021). The benefits of rice-fish farming go beyond economics; the systems have shown positive ecological and socioeconomic implications on the village community (Fatimah et al., 2020).

Based on these findings, the rice-fish farming model emerges as an important reference for the development of sustainable agricultural and fish farming businesses. This is especially important in possible cage locations, as Shitote et al. (2023) imply. The complete research reported in this paper adds to the expanding body of knowledge supporting rice-fish farming integration as a feasible and sustainable technique.

The use of capital resources, labor and land is able to produce greater production value due to an integrated business between fish and rice. The integrated business of two commodities provides economic benefits both in terms of cost and results. Fish manure and fish feed residues can be organic fertilizer for rice plants so that fertilizer costs will be more efficient. While organic rice production is of higher quality and healthy so that the price of products will be higher than non-organic rice. This will increase farmers' income from the crops of rice and fish cultivated. Thus, overall, all resources utilized in farming have higher productivity than monoculture businesses.

## CONCLUSION AND SUGGESTION

### Conclusion

Based on the results of rice-fish farming analysis research conducted in Candibinangun Village, it can be concluded that the area of rice-fish farming land in Candibinangun Village is on average 1,063 square meters has provided income of IDR 21,590,063.81 and a profit of IDR 8,701,774.77. Rice-fish farming carried out in Candibinangun Village deserves to be developed sustainably based on the R/C ratio, capital productivity, land and labor. This shows that all the resources utilized in integrated fish and rice farming have produced high productivity for the sustainability of the business in the future.

**Suggestion**

Rice-fish farming has provided double income for farming households. This integrated agricultural model can be developed on a wider business scale vertically and horizontally that can reach a wider area and farmer households so that the benefits and welfare of the community can be increased. Business development in the form of fish product processing and agrotourism is an effort that can be considered for sustainable rural agribusiness development. Therefore, the Sleman Regency government needs to formulate an integrated agricultural development model policy based on agrotourism and sustainable agribusiness in realizing community welfare.

## REFERENCES

Ansar, M., & Fathurrahman. (2018). Sustainable Integrated Farming System: A Solution For National Food Security And Sovereignty. *IOP Conference Series: Earth And Environmental Science*, 157(1), 1-7. doi:10.1088/1755-1315/157/1/012061

Badan Pusat Statistik Indonesia. (2016). *Luas Area, Produksi Dan Rata-Rata Produksi Ikan Budi Daya Mina Padi Per Kecamatan Di Sleman*. Retrieved from https://slemankab.bps.go.id/statictable/2017/11/15/255/luas-area-produksi-dan-rata-rata-produksi-ikan-budi-daya-mina-padi-per-kecamatan-di-sleman-2016.html

Banguno, I. F., Yatim, H., & Zaenuddin, R. A. (2021). Analisis Pendapatan Dan Kelayakan Usahatani Padi Sawah Di Desa Tatakalai Kecamatan Tinangkung Utara. *CELEBES Agricultural*, 1(2), 68–75. doi: 10.52045/jca.v1i2.42

Berg, H., et al. (2023). An Ecological Economic Comparison Between Integrated Rice-Fish Farming And Rice Monocultures With Low And High Dikes In The Mekong Delta, Vietnam. *Ambio*, 52(9), 1462–1474. doi: 10.1007/s13280-023-01864-x

Bhatnagar, A., et al. (2021). Paddy Cum Fish Culture: Growth Performance Of Channa Punctatus, Paddy Yield And Economics. *Journal Of Applied And Natural Science*, 13(1), 145–156. doi: 10.31018/jans.v13i1.2462

Fatimah, I. N., Iskandar, J., & Partasasmita, R. (2020). Ethnoecology Of Paddy-Fish Integrative Farming (Minapadi) In Lampegan Village, West Java, Indonesia. *Biodiversitas*, 21(9), 4419–4432. doi: 10.13057/biodiv/d210961

Hambali, A., & Lubis, I. (2015). Evaluasi Produktivitas Beberapa Varietas Padi. *Buletin Agrohorti*, 3(2), 137–145. doi: 10.29244/agrob.v3i2.15496

Hasbi, & Tunggal, T. (2021). Paddy-Fish Integrated Agricultural System To Increase Income And Food Security. *In IOP Conference Series: Earth And Environmental Science*, 782(2), 1-6. doi: 10.1088/1755-1315/782/2/022019

Hu, Z., et al. (2022). Crayfish–Fish Aquaculture Ponds Exert Reduced Climatic Impacts And Higher Economic Benefits Than Traditional Wheat–Rice Paddy Cultivation. *Agriculture (Switzerland)*, 12(4), 1-16. doi: 10.3390/agriculture12040515

Husaini, et al. (2021). Feasibility Analysis Of Traditional Rice Farming With Combine Harvester In Teureubeh Village, Aceh Besar District. *E3S Web of Conferences*, 306 (1), 1-8. doi: 10.1051/e3sconf/202130602044

Kumar, R., et al. (2018). Comparative Evaluation Of Different Integrated Farming System Models For Small And Marginal Farmers Under The Eastern Himalayas. *Indian Journal Of Agricultural Sciences*, 88(11), 1722–1729. doi: 10.56093/ijas.v88i11.84913

Joseph, I. (2019). Economic Feasibility And Resource Use Efficiency Of Coastal Cage Fish Farming In Kerala. *Economic Affairs*, 64(1). doi: 10.30954/0424-2513.1.2019.19

Kumar, S., et al. (2018). Integrated Farming System In India: Current Status, Scope And Future Prospects In Changing Agricultural Scenario. *Indian Journal Of Agricultural Sciences*, 88(11), 1661–1675. doi: 10.56093/ijas.v88i11.84880

Lakens, D. (2022). Sample Size Justification. *Collabra: Psychology*, 8(1), 1–28. doi: 10.1525/collabra.33267

Lestari, S., & Bambang, A. N. (2017). Penerapan Minapadi Dalam Rangka Mendukung Ketahanan Pangan Dan Meningkatkan Kesejahteraan Masyarakat. *Proceeding Biology Education Conference*, 14(1), 70–74. Retrieved from https://jurnal.uns.ac.id/prosbi/article/download/17616/14046

Li, Y., et al. (2023). Status Of Rice-Fish Farming And Rice Field Fisheries In Northern Laos. *Frontiers In Sustainable Food Systems*, 7(1), 1-13. doi: 10.3389/fsufs.2023.1174172

Mardhiah, A., & Firdaus. (2017). Analisis Rentabilitas Usahatani Padi Sawah Varietas Inpari 30 Dengan Sistem Jajar Legowo Kecamatan Indrapuri Kabupaten Aceh Besar. *Jurnal Agriflora*, 1(2), 68–72. doi: 10.3061/unayaded.v1i2.128

Mukhlis, Noer, M., Nofialdi, & Mahdi. (2018). The Integrated Farming System Of Crop And Livestock: A Review Of Rice And Cattle Integration Farming. *International Journal Of Sciences: Basic And Applied Research (IJSBAR)* 42(3), 68–82. Retrieved from https://www.gssrr.org/index.php/JournalOfBasicAndApplied/article/view/9477

Nayak, P. K., et al. (2018). Ecological Mechanism And Diversity In Rice Based Integrated Farming System. *Ecological Indicators*, 91(1), 359–375. doi: 10.1016/j.ecolind.2018.04.025

Paramesh, V., et al. (2022). Integrated Farming System Approaches To Achieve Food And Nutritional Security For Enhancing Profitability, Employment, And Climate Resilience In India. *Food And Energy Security*, 11(2), 1-16. doi: 10.1002/fes3.321

Patel, A. M., Patel, K. M., & Patel, P. K. (2019). Sustainability Of Farm And Farmers Through Integrated Farming System Approach. *Indian Journal Of Agronomy*, 64(3), 320–323. Retrieved from https://www.researchgate.net/publication/344298503_Sustainability_of_farm_and_farmers_through_integrated_farming_system_approach

Sarkar, C., & Das, M. (2022). Evaluation Of Effluent From Fish (Labeo Rohita) Scale Processing As A Fertilizer For Paddy (*Oryza sativa*) Production. *International Journal Of Recycling Of Organic Waste In Agriculture*, 11(1), 33–46. doi: 10.30486/ijrowa.2021.1906849.1118

Savci, S. (2012). An Agricultural Pollutant: Chemical Fertilizer. *International Journal Of Environmental Science And Development*, 3(1), 73–80. doi: 10.7763/ijesd.2012.v3.191

Shitote, Z., Munala, N. O., & Maremwa, J. S. (2023). Feasibility For Cage Farming In Africa: The Case Of The Kenyan Part Of Lake Victoria. *Aquatic Ecosystem Health And Management*, 25(4), 22–27. doi: 10.14321/aehm.025.04.22

Sulistyanto, G. D., Kusrini, N., & Maswadi. (2013). Analisis Kelayakan Usahatani Tanaman Padi Di Kecamatan Sebangki Kabupaten Landak. *Jurnal Penelitian*, 1–10. Retrieved from https://media.neliti.com/media/publications/190240-ID-analisis-kelayakan-usahatani-tanaman-pad.pdf

Sumarwan, S., & Arman, Y. (2015). Pengaruh Kapur Dolomit Terhadap Nilai Resistivitas Tanah Gambut. *Prisma Fisika*, 3(22), 47–50. Retrieved from https://jurnal.untan.ac.id/index.php/jpfu/article/view/51245

Sundari, Mei T. (2011). Analisis Biaya Dan Pendapatan Usaha Tani Wortel Di Kabupaten Karanganyar. *Sepa*, 7(2), 119–126. doi: 10.20961/sepa.v7i2.48897

Thanh, L., et al. (2020). Integrated Farming System Producing Zero Emissions And Sustainable Livelihood For Small-Scale Cattle Farms: Case Study In The Mekong Delta, Vietnam. *Environmental Pollution*, 265(2), 1-40. doi: 10.1016/j.envpol.2020.114853

Widodo, A. S., Widodo, & Aryanto, D. D. (2017). Kelayakan Usahatani Mina Padi Di Kabupaten Sleman. *Prosiding Seminar Nasional "Pengembangan Sumber Daya Perdesaan Dan Kearifan Lokal Berkelanjutan VII," 5*, 874–883. Retrieved from http://ejournal-balitbang.kkp.go.id/index.php/chanos2/article/view/9034/1000

Xuegui, L., Linxiu, Z., & Guiting, H. (1995). *Economic Analysis Of Rice-Fish Culture*. International Development Research Centre. Retrieved from http://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/16142/IDL-16142.pdf

Yassi, A., Kaimuddin, & Ekawati, I. (2020). Paddy-Fish Cultivation Within An Integrated Farming System. In *IOP Conference Series: Earth And Environmental Science*, 575(1), 1-9. doi: 10.1088/1755-1315/575/1/012144

Zhang, X., et al. (2022). Genetic And Reproductive Mode Analyses Of A Golden-Back Mutant Of Crucian Carp From A Rice-Fish Integrated Farming System. *Aquaculture Reports*, 24(1), 1-9. doi: 10.1016/j.aqrep.2022.101146

Attachment 1. Cash Flow of Rice-fish Farming in Candibinangun Pakem Sleman

| Cash Flow | Description | Season I | Season I | Season III |
|---|---|---|---|---|
| Cash In | Sales of rice yield | 3,495,303 | 3,490,722 | 3,563,322 |
| | Sale of fish harvest | 8,606,400 | 8,472,000 | 8,664,000 |
| | | | | |
| Cash Out | Cost of Operating Activity: | | | |
| | Paddy Seeds | 44,742.86 | 44,742.86 | 45,771.43 |
| | Fish Breeds | 974,285.71 | 968,571.43 | 1,004,51.43 |
| | Fish Feed | 1,621,428.57 | 1,621,428.57 | 1,621,428.57 |
| | Organic Fertilizer | 33,428.57 | 59,428.57 | 59,428.57 |
| | Urea Fertilizer | 33,017.14 | 33,017.14 | 34,302.86 |
| | Phonska Fertilizer | 41,285.71 | 41,285.71 | 42,142.86 |
| | Dolomit | 29,342.86 | 29,342.86 | 29,342.86 |
| | Depreciation of tools | 179,59 | 179,59 | 179,59 |
| | Out-of-Family Labour | 2,501,428.57 | 1,385,000.00 | 1,149,714.29 |
| | Others Costs | 238,789.00 | 238,789.00 | 238,789.00 |
| Net Cash | | 6,405,345.08 | 7,367,202.22 | 7,817,516.51 |