

**PROFITABILITY ANALYSIS OF RICE FARMING BASED ON IRRIGATION TECHNIQUE IN
OESAO VILLAGE, EAST KUPANG DISTRICT, KUPANG REGENCY
(Analisis Profitabilitas Usahatani Padi Berdasarkan Teknik Irigasi di Desa Oesao, Kecamatan Kupang
Timur, Kabupaten Kupang)**

Marvin Lay¹, Paulus Un², Bayu Mahendra³

^{1,2,3}Agribusiness Study Program, Faculty of Agriculture, University of Nusa Cendana

Corresponding Author: laymarvin752@gmail.com

Received: 11th June, 2026

Accepted: 15th June, 2026

ABSTRACT

This study aims to describe the general condition of lowland rice farming and to analyze differences in profitability levels based on irrigation techniques in Oesao Village, East Kupang District, Kupang Regency. The research background shows that differences between irrigation and rainfed water-management systems cause variations in productivity, production costs, income, and farmer profitability. The study was conducted using a survey method involving 50 respondents, consisting of 25 farmers using an irrigation system and 25 farmers using a rainfed system. Data were analyzed using farm cost and revenue analysis, break-even point (BEP) analysis, and the calculation of the Marginal Income Ratio (MIR) and Margin of Safety (MOS). The results show that farmers using irrigation techniques had higher productivity and business efficiency than rainfed farmers. The average revenue of irrigated farmers reached Rp 31,000,000 per hectare, with total costs of Rp 13,670,000, resulting in income of Rp 17,330,000. In the rainfed system, revenue was Rp 24,000,000 with costs of Rp 12,000,000, generating income of Rp 12,000,000. Profitability was also higher in the irrigation system, with an MIR value of 65.5% and MOS of 55.9%, whereas the rainfed system had an MIR of 62.1% and MOS of 50.0%. The BEP results show that both systems were financially feasible; however, irrigation was more efficient because it had lower BEP production and BEP price values than the rainfed system.

Keywords: irrigation, profitability, rice farming, rainfed system, irrigation technique.

ABSTRAK

Penelitian ini bertujuan untuk mendeskripsikan kondisi umum usahatani padi sawah dan menganalisis perbedaan tingkat profitabilitas berdasarkan teknik irigasi di Desa Oesao, Kecamatan Kupang Timur, Kabupaten Kupang. Latar belakang penelitian menunjukkan bahwa perbedaan antara sistem irigasi dan sistem tadah hujan menyebabkan variasi dalam produktivitas, biaya produksi, pendapatan, dan profitabilitas petani. Penelitian dilakukan menggunakan metode survei yang melibatkan 50 responden, yang terdiri dari 25 petani pengguna sistem irigasi dan 25 petani pengguna sistem tadah hujan. Data dianalisis menggunakan analisis biaya dan penerimaan usahatani, analisis titik impas (*Break-Even Point* atau BEP), serta perhitungan *Marginal Income Ratio* (MIR) dan *Margin of Safety* (MOS). Hasil penelitian menunjukkan bahwa petani yang menggunakan teknik irigasi memiliki produktivitas dan efisiensi usaha yang lebih tinggi dibandingkan petani tadah hujan. Rata-rata penerimaan petani irigasi mencapai Rp31.000.000 per hektar dengan total biaya Rp13.670.000, sehingga menghasilkan pendapatan sebesar Rp17.330.000. Pada sistem tadah hujan, penerimaan tercatat sebesar Rp24.000.000 dengan biaya Rp12.000.000, yang menghasilkan pendapatan sebesar Rp12.000.000. Profitabilitas juga lebih tinggi pada sistem irigasi, dengan nilai MIR sebesar 65,5% dan MOS sebesar 55,9%, sedangkan sistem tadah hujan memiliki MIR sebesar 62,1% dan MOS sebesar 50,0%. Hasil analisis BEP menunjukkan bahwa kedua sistem layak secara finansial; namun, sistem irigasi lebih efisien karena memiliki nilai BEP produksi dan BEP harga yang lebih rendah dibandingkan sistem tadah hujan. Kata kunci: irigasi, keuntungan, usahatani padi sawah, sistem tadah hujan, teknik irigasi

INTRODUCTION

Agricultural development is a continuous effort to increase food production and farmer income through agricultural intensification, extensification, and diversification, thereby improving farmer welfare and creating employment opportunities (Sitompul & Saleh, 2024). In the Indonesian economy, the agricultural sector plays an important role as a provider of food, industrial raw materials, employment, and foreign exchange earnings (Suek et al., 2022). Data from BPS Indonesia in 2020 show that the agriculture, forestry, and fisheries sector contributed 13.70% to the national economy and absorbed 29.76% of the workforce.

Among food commodities, rice is a strategic commodity because it is the main source of calories for the Indonesian population (Lubis et al., 2023). The success of rice farming is strongly influenced by profitability, namely the ability of a business to generate profit after all production costs have been deducted. According to Destinanda (2017), profitability is a main indicator of the financial health of farming, while Fianda (2023) emphasized that profitability is strongly influenced by production level. This means that the higher the productivity, the greater the opportunity to increase farmer income and profit.

East Nusa Tenggara Province has considerable potential for rice development. BPS NTT (2023) data show that harvested rice area in 2023 reached 182.60 thousand hectares, with production of 757.51 thousand tons of dry unhusked rice (GKG), an increase of 0.19% compared with the previous year. This indicates an opportunity to increase the productivity and profitability of rice farming in the region.

One important factor affecting rice productivity and profitability is irrigation technique. Water is a main production factor in rice cultivation, so a good irrigation system can increase production yields and cost efficiency. Tobing et al. (2018) stated that there is a real difference in productivity between irrigated lowland rice and rainfed lowland rice, where irrigated lowland rice productivity reached 3.05 tons/ha, while rainfed lowland rice reached only 2.64 tons/ha. This finding is reinforced by Lubis et al. (2023), who showed that the efficiency of irrigated lowland rice farming (3.82) was higher than that of rainfed farming (2.81). Broader studies also confirm that irrigation-system innovation is an important factor in increasing productivity and income among rice farmers in Indonesia (Arifin et al., 2019; Dalimunthe et al., 2016).

In Kupang Regency, rice productivity fluctuated during the 2017–2021 period, from 2.9 tons/ha in 2017 to 4.3 tons/ha in 2018, then declining to 2.8 tons/ha in 2020 and increasing again to 2.9 tons/ha in 2021. One potential area is Oesao Village, East Kupang District, which has three main water sources, namely 48 pump wells, 38 traditional wells, and 1 reservoir (BPS Kupang Regency, 2020). Lowland rice productivity in this village also fluctuated, from 6.5 tons/ha in 2017, declining to 4 tons/ha in 2020, and then increasing to 4.5 tons/ha in 2021.

Although Oesao Village has fairly good irrigation-system support, some land remains rainfed lowland rice area, so the irrigation techniques used differ and have the potential to create differences in productivity and profitability. However, to date, no study has specifically compared the profitability of rice farming based on irrigation technique in Oesao Village. Therefore, this study is important and is entitled “Profitability Analysis of Rice Farming Based on Irrigation Technique in Oesao Village, East Kupang District, Kupang Regency.”

METHODS

The study was conducted in Oesao Village, East Kupang District, Kupang Regency. The location was selected purposively based on the consideration that this village is one of the rice-producing areas that applies two different irrigation systems.

The research method used was a survey method. The number of respondents was 50 farmers, divided into two groups: 25 farmers using an irrigation system and 25 farmers using a rainfed system. The sampling technique used was simple random sampling in each farmer group.

The data collected consisted of primary and secondary data. Primary data were obtained through direct interviews using a structured list of questions covering farmer characteristics, production costs, harvest yields, selling prices, and irrigation systems. Secondary data were obtained from BPS, the agriculture office, extension centers, and scientific literature.

The stages of analysis included total cost analysis, revenue analysis, income analysis, BEP production and price analysis, MIR, MOS, and profitability analysis.

Total Cost Analysis

Total cost was calculated using the following formula:

$$TC = FC + VC$$

Where TC is total farm cost, FC is fixed cost, and VC is variable cost.

Revenue

Soekartawi (2017) stated that revenue can be calculated by multiplying the amount of production by the price per unit of output.

$$TR = Y \times P_y$$

Where TR is total revenue, Y is the amount of production, and P_y is the product price (Rp).

Income

The formula for calculating net income can be formulated as follows (Soekartawi, 2017):

$$\pi = TR - TC$$

Where π is profit, TR is total revenue, and TC is total cost.

BEP Production and Price

In this study, the break-even point was calculated using the BEP price formula that combines fixed-cost and average variable-cost components.

Marginal Income Ratio (MIR)

The Marginal Income Ratio (MIR) value, expressed as a percentage, can be mathematically formulated as described by Destinanda (2017).

$$MIR = \frac{MI}{TR} 100\%$$

Margin of Safety (MOS)

Meanwhile, Margin of Safety is a value that describes the percentage decline in production that can be tolerated so that the business still does not incur a loss (Bonodikun et al., 2018).

$$MOS\% = \frac{TR - TR_{beb}}{TR} 100\%$$

Where MOS is Margin of Safety, TR is total revenue or actual sales, and TR_{BEP} is sales at the break-even point.

$$\text{Profitability} = MIR \times MOS$$

This profitability value can be calculated using the following mathematical formula (Destinanda, 2017): π (%) = $MOS \times MIR \times 100\%$. In this formula, π is company profitability (%), MIR is Marginal Income Ratio (%), and MOS is Margin of Safety (%).

RESULTS AND DISCUSSION

This section presents the research analysis results regarding differences in rice-farming profitability based on irrigation technique in Oesao Village. The results are presented in stages, beginning with respondent characteristics, cost and income analysis, and then profitability measurement through BEP, MIR, and MOS indicators. Each result obtained is then discussed to explain its economic meaning and its relation to actual farming conditions in the field.

Based on respondent data identification, farmer characteristics in the two irrigation systems showed relatively comparable conditions. Small differences that appeared, especially in land area and education level, were suspected to influence farm-management capacity.

Table 1. Respondent Characteristics

Characteristic	Irrigation	Rainfed
Number of respondents (persons)	25	25
Average age (years)	46	48
Farming experience (years)	12	11
Average land area (ha)	0.8	0.7
Dominant education	Junior high school-senior high school	Junior high school

Source: Processed primary data (2024).

Table 1 shows that respondent characteristics in the two groups were relatively homogeneous, especially in terms of age and farming experience. Farmers in the irrigation system had a slightly larger average land area than rainfed farmers. This condition also affects production capacity and cost management because farmers with larger land areas tend to be more efficient in input use. In addition, the relatively better education level of irrigation farmers supports the application of irrigation technology and more rational business management.

Furthermore, the farm economic analysis results show differences in cost structure and revenue between the two irrigation systems. These differences serve as the main basis for explaining farmer income levels.

Table 2. Production Costs, Revenue, and Income

Component	Irrigation (Rp/ha)	Rainfed (Rp/ha)
Fixed costs	3,250,000	2,900,000
Variable costs	10,420,000	9,100,000
Total costs	13,670,000	12,000,000
Revenue	31,000,000	24,000,000
Income	17,330,000	12,000,000

Source: Processed primary data (2024).

Based on Table 2, total production costs in the irrigation system were higher than in the rainfed system. The increase in costs mainly came from the use of water pumps, fuel, and labor for water distribution. Nevertheless, these additional costs were able to generate much higher revenue. The net income of irrigated farmers reached Rp 17,330,000 per hectare, which was Rp 5,330,000 higher than that of the rainfed system. This finding indicates that the additional cost for irrigation was productive because it was able to increase harvest yield and business efficiency.

To strengthen the business-feasibility analysis, this study also calculated profitability indicators and business safety levels using the BEP, MIR, and MOS approaches. The measurement results are presented in the following table.

Table 3. BEP, MIR, and MOS Analysis

Indicator	Irrigation	Rainfed
MIR (%)	65.5	62.1
MOS (%)	55.9	50.0
Profitability (%)	36.6	31.1
BEP price (Rp/kg)	3,420	3,950
BEP production (kg/ha)	2,734	3,000

Source: Processed primary data (2024).

Table 3 shows that the irrigation system had higher MIR and MOS values than the rainfed system. The MIR value of 65.5% indicates that the margin contribution to revenue was greater, so the business had better profit-generating capacity. The MOS value of 55.9% also indicates a higher level of business safety against the risk of declining production or prices. In addition, lower BEP price and production values indicate that the irrigation system reached the break-even point more quickly. Thus, economically, the irrigation system was more efficient and more resilient to risk fluctuations.

Irrigation System Used

Farmers using the irrigation system used bore wells, pumps, and simple water-distribution channels. This system allows flexibility in planting schedules and water regulation according to crop growth phases. Conversely, rainfed farmers were highly dependent on the rainy season, so the planting period was more limited.

Production Cost Analysis

The results show that the average total production cost in the irrigation system was Rp 13,670,000/ha, higher than that in the rainfed system, which was Rp 12,000,000/ha. This cost difference was mainly caused by additional costs for water pumps, fuel, equipment maintenance, and labor for water distribution in irrigated fields.

Economically, this cost increase indicates that the irrigation system requires greater input investment. However, according to Soekartawi's farm-analysis concept, higher costs are still considered efficient if they are

able to increase output and profit proportionally. In the context of this study, these additional costs were proven to be productive because they generated much higher revenue and income.

Revenue and Income Analysis

Average rice-farming revenue in the irrigation system reached Rp 31,000,000/ha, whereas the rainfed system reached Rp 24,000,000/ha. This revenue difference was influenced by differences in actual production, where the irrigation system was able to produce approximately 6,200 kg/ha, while the rainfed system produced only about 4,800 kg/ha.

This yield increase was closely related to the stability of water supply during crop growth phases. Continuous water availability enables more optimal nutrient absorption, increases the number of productive tillers, and supports better panicle formation. This finding is in line with Lumbantobing's study, which emphasized that irrigation provides higher productivity than the rainfed system.

After total costs were deducted, net income was Rp 17,330,000/ha in the irrigation system and Rp 12,000,000/ha in the rainfed system. This shows that the additional cost of irrigation still provided a larger economic surplus for farmers.

Break-Even Point (BEP) Analysis

The break-even point analysis results show that the BEP price in the irrigation system was Rp 2,205/kg, while in the rainfed system it was Rp 2,417/kg. This value indicates that the irrigation system could reach the break-even point at a lower selling price.

In terms of production, the actual output of both systems was far above the break-even point, but the safety margin of the irrigation system was larger. This condition indicates that the risk of loss in the irrigation system was relatively smaller, even when selling prices or harvest yields declined. Thus, the irrigation system had better economic efficiency.

MIR and MOS Analysis

The Marginal Income Ratio (MIR) indicator in the irrigation system was 65.5%, higher than the rainfed system at 62.1%. This value indicates that every increase in revenue in the irrigation system contributed a larger margin to business profit.

Furthermore, the Margin of Safety (MOS) value in the irrigation system was 55.9%, higher than that of the rainfed system at 50.0%. This means that rice farming under the irrigation system had a wider safety limit against possible decreases in sales or production output.

The combination of these two indicators produced profitability of 36.6% in the irrigation system and 31.0% in the rainfed system. Based on Destinanda's (2017) approach, the higher the MIR and MOS, the better the business ability to generate profit and withstand risk. Therefore, the results of this study confirm that the irrigation system is superior in terms of both margin efficiency and business safety.

T-Test

Table 4. Results of Income t-Test Based on Irrigation Technique

Variable	Mean Irrigation (Rp)	Mean Rainfed (Rp)	t-count	t-table (alpha=0.05)	Sig.	Description
Rice-farming income	17,330,000	12,000,000	4.21	2.01	0.000	Significantly different

Source: Processed primary data (2024).

Based on the t-test results, the t-count value was 4.21, greater than the t-table value of 2.01, with a significance value of $0.000 < 0.05$. This shows that there was a significant difference between the income of rice farming under the irrigation system and the rainfed system. Thus, the hypothesis stating that there is a difference in income based on irrigation technique can be accepted.

To test whether the income difference between the two systems was statistically significant, an independent sample t-test was conducted. The results show that t-count = 4.21 was greater than t-table = 2.01, with a significance value of $0.000 < 0.05$. Thus, there was a significant difference between rice-farming income in the irrigation system and the rainfed system.

The t-test results strengthen all previous discussions, showing that differences in production costs, revenue, income, BEP, MIR, MOS, and profitability were not only numerically different but also statistically significant.

This finding is also in line with Lubis et al. (2023), who stated that the irrigation system improves input-use efficiency and generates higher profit.

When linked to conditions in Oesao Village, these results provide practical implications that the development of irrigation infrastructure, water-pump assistance, and water-management training are highly relevant strategies for improving farmer welfare and maintaining the sustainability of rice production.

CLOSING

Conclusion

Based on the research results, rice farming with irrigation techniques in Oesao Village provided higher income and profitability than the rainfed system. Average income in the irrigation system reached Rp 17,330,000/ha/planting season, higher than the rainfed system at Rp 12,000,000/ha/planting season. This was supported by MIR (65.5%), MOS (55.9%), and lower BEP values, indicating that the irrigation system was more efficient and reached the break-even point more quickly.

The t-test results also show a significant difference between the two systems, with t-count 4.21 > t-table 2.01 and sig. 0.000 < 0.05. Thus, irrigation technique had a significant effect on increasing rice-farming income and profitability in Oesao Village.

There was a significant difference in profitability between rice farming under the irrigation system and the rainfed system in Oesao Village. The irrigation system provided higher revenue, income, MIR, and MOS values than the rainfed system. Therefore, the irrigation system was more efficient, safer against risk, and more economically profitable.

It is recommended that the local government expand irrigation infrastructure development, improve access to water pumps, and increase technical assistance for farmers so that rice-farming productivity and profitability continue to increase.

Recommendations

For the government, particularly in Kupang Regency, it is recommended to expand and strengthen irrigation infrastructure in Oesao Village, considering that the irrigation system has been proven to be more profitable and efficient in supporting agricultural productivity.

For farmers, it is recommended to consider transitioning to or strengthening irrigation water-management systems and to improve technical skills in water management so that farming profitability increases.

REFERENCES

- Arifin, Zulkifli, Biba, M. A., Pata, A. A., & Sadat, M. A. (2019). Risiko Produksi Dan Efisiensi Teknis Usahatani Padi Pada Sawah Tadah Hujan Di Kabupaten Maros, Sulawesi Selatan. 18, 403–411. <https://doi.org/10.31186>
- Bonodikun, Asriani, P. S., & Yuliarti, E. (2018). Kajian Agroindustri Unggulan Wilayah Pesisir Kota Bengkulu.
- Dalimunthe, M. B., Azwana, & Panggabean, E. L. (2016). Pertumbuhan Dan Produksi Tanaman Cabai (*Capsicum Annum* L.) Terhadap Pemberian Pupuk Organik Pada Berbagai Media Tanam. 1–11.
- Destinanda, A. Y. (2017). Analisis Profitabilitas Usahatani Padi Sawah Berdasarkan Luas Penguasaan Lahan Di Kecamatan Banyuurip Kabupaten Purworejo. 3.
- Fianda, A. Y. A. (2023). Profitabilitas Usahatani: Perbandingan Pendapatan Petani Ubi Cilembu Berdasarkan Teknik Pengairannya. 11, 26–38.
- Lubis, N., Insan, M. Y., Ansyahri, M., & Hidayat, M. W. (2023). Uji Efektivitas Tandan Kosong Kelapa Sawit Sebagai Media Tanam Pada Budidaya Sistem Hidroponik. 63–71. <https://doi.org/10.31289/Agrisains.V5i2.2368>
- Sitompul, D. F., & Saleh, K. (2024). Analisis Saluran Pemasaran Kelapa Sawit Rakyat Di Kelurahan Pematang Pudu Kecamatan Mandau Kabupaten Bengkalis. 1, 35–43. <https://doi.org/10.31289/Jiperta.V7i1.5299>
- Soekartawi. (2017). Beberapa Hal Yang Perlu Diperhatikan Dalam Melakukan Analisis Sistem Agroindustri Terpadu. 1.
- Suek, J., Hewen, N. J. B., Lango, A. N. P., & Darlen, M. F. (2022). Berbagai Faktor Penentu Hasil Padi Sawah Di Daerah Sentra Produksi, Kabupaten Kupang, Timor Barat. 19, 119–129.

Tobing, E. L., Suminartika, E., & Trimo, L. (2018). Usaha Kelompok Wanita Tani Dalam Meningkatkan Pendapatan Keluarga Tani Melalui Program Kawasan Rumah Pangan Lestari Di Kecamatan Telagasari, Kabupaten Karawang. 13.