

Original Article

Title Economic Performance and Efficiency of Traditional Milkfish Pond Farming in Coastal Ponds of Sungai Undang Village, Seruyan Regency

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Abstract:

Traditional milkfish pond farming represents an important livelihood source for coastal communities, however, empirical information regarding income level and business efficiency in low input production systems remains limited. This study aimed to analyze production costs, revenue, income, and economic efficiency of traditional milkfish farming in Sungai Undang Village, Seruyan Regency. A quantitative survey approach was applied to 100 farmers selected using snowball sampling during one production cycle in 2025. Data were analyzed descriptively through the calculation of total cost, total revenue, income, and the revenue cost ratio (R/C). The results showed an average production of 625 kg per cycle, generating an income of IDR 2,950,000 per cycle and an R/C ratio of 1.23, indicating that the business remains financially feasible with moderate efficiency. Most farmers were classified into feasible categories with limited profit margins. This condition is associated with high stocking density combined with reliance on natural feed and low input pond management, resulting in suboptimal biological productivity but reduced production costs. These findings highlight the role of traditional milkfish farming as a relatively stable income source for coastal households and emphasize the need for improved simple technical management to enhance production performance and economic efficiency.

Keywords: Farm Income, Efficiency, R/C Ratio, Traditional Ponds, Milkfish

Submitted	: 11 February 2026
Revised	: 17 February 2026
Acceptance	: 22 February 2026
Publish Online	: 23 February 2026

Introduction

Milkfish (*Chanos chanos*) is one of the important coastal aquaculture commodities with significant economic value in the Asia-Pacific region. Domestic demand for milkfish in Indonesia has shown a relatively stable trend in recent years. This trend is associated with increasing fish consumption and the diversification of processed fishery products (FAO, 2021; KKP, 2022). In the national aquaculture

subsector, milkfish is considered a strategic commodity due to its broad ecological tolerance, relatively low production input requirements, and strong market acceptance at both household and culinary business levels ([KKP, 2023](#)).

Milkfish farming is generally conducted in pond systems with varying intensity levels, ranging from traditional to semi-intensive and intensive culture. Traditional systems remain widely practiced by small-scale farmers because they require relatively low capital and utilize natural pond fertility as the primary feed source. However, productivity in this system is strongly influenced by environmental water conditions, water quality management, stocking density, and farmers' technical capacity in maintaining pond ecosystem stability. Previous research in the Seruyan coastal area indicates that water suitability is a key factor determining milkfish farming success, directly affecting production levels and business sustainability ([Irawan & Handayani, 2021](#)).

Beyond production aspects, the sustainability of aquaculture businesses is closely related to technical pond management conditions, including the availability of natural feed, water quality, and fish survival rate during the culture period. In low-input traditional systems, production success is largely determined by farmers' adaptive environmental management rather than the application of modern technology. Therefore, economic analysis of milkfish farming must be understood in an integrated manner with technical culture conditions, since biological and managerial factors directly influence revenue generation and financial efficiency at the small-scale household level. Seruyan Regency is one of the coastal regions where traditional milkfish pond farming is actively practiced. Sungai Undang Village in Seruyan Hilir District is recognized as an area where community-based milkfish farming activities continue to operate. Previous studies, such as the risk analysis of milkfish farming in the same coastal area ([Winarti, 2017](#)), provide an initial overview of farming dynamics; however, recent scientific information specifically addressing income level and economic efficiency of traditional low-input milkfish farming remains limited.

In general, milkfish aquaculture research in Indonesia has focused more on major production centers such as Java and South Sulawesi, emphasizing biological production, technological intensification, or long-term investment feasibility. Studies examining short-term income structure and economic efficiency in traditional low-input pond systems remain limited in developing coastal regions. As a result, the relationship between technical pond characteristics and household-level economic performance is not yet fully understood. Therefore, this study aims to analyze the cost structure, revenue, income, and economic efficiency of traditional milkfish pond farming in Sungai Undang Village, Seruyan Regency. The findings are expected to provide empirical information supporting the economic sustainability of small-scale milkfish farming and to serve as a reference for community-based coastal aquaculture development policies. This study provides recent empirical evidence on the income structure and economic efficiency of traditional low-input milkfish farming in coastal Central Kalimantan and links financial performance with observed technical management practices at the household level. The findings contribute to a more context-specific understanding of livelihood-oriented small-scale aquaculture sustainability in developing coastal regions.

Literature Review

Economic performance assessment in small-scale aquaculture commonly relies on indicators such as total production cost, total revenue, income, and the revenue–cost (R/C) ratio, which provide a simple and transparent measure of short-term financial feasibility at the household level. Recent open-access studies emphasize that small-scale aquaculture contributes significantly to rural income generation and food security, although profitability varies depending on farmers' access to inputs, technical knowledge, and market connectivity ([Angermayr et al., 2023](#); [Hossain et al., 2023](#)).

In milkfish pond systems, biological productivity and economic return are closely linked to technical management factors including stocking density, feed availability, and water quality control. Nature-based or integrated pond approaches—such as mangrove-associated silvofishery—have been shown to improve water quality and natural food productivity, thereby enhancing growth performance and survival in low-input milkfish culture ([Novida et al., 2025](#)). These findings highlight the importance of ecological management in traditional ponds that rely primarily on natural feed rather than artificial inputs.

Recent empirical evidence from various Indonesian coastal regions also demonstrates heterogeneous financial outcomes in milkfish farming. While some traditional and semi-traditional ponds remain economically feasible with modest R/C or benefit–cost ratios, others experience marginal profitability due to constraints such as poor fry quality, limited supplemental feeding, and restricted market access ([Arkan, 2023](#); [Hamar, 2023](#)). Such variability indicates that financial indicators must be interpreted together with descriptive information on farm management practices to explain differences in economic performance among farmers.

Beyond farm-level technical aspects, institutional conditions—including limited extension services, restricted credit access, and weak marketing infrastructure—continue to constrain productivity improvement and scaling-up of small-scale aquaculture. Policy analyses suggest that strengthening farmer capacity and improving access to quality inputs and services can substantially enhance aquaculture output and livelihood resilience without increasing environmental pressure ([WorldFish, 2024](#)).

Despite these advances, recent empirical studies that integrate quantitative R/C-based economic analysis with detailed descriptions of traditional pond management in coastal Central Kalimantan remain scarce. Therefore, this study provides new field-based evidence from Sungai Undang Village by linking farm-level economic indicators with observed technical practices in a representative traditional milkfish-farming community, thereby contributing to a more context-specific understanding of small-scale aquaculture sustainability.

Methods

This study applied a quantitative survey approach to analyze the economic performance of traditional milkfish (*Chanos chanos*) pond farming at the household level. The quantitative design enabled the measurement of production cost structure, revenue, income, and business efficiency based on empirical field data obtained directly from farmers. The research was conducted in Sungai Undang Village, Seruyan Hilir District, Seruyan Regency, Central Kalimantan, Indonesia. This location was selected purposively because it represents an active coastal aquaculture area

dominated by small-scale traditional milkfish pond farming. Field data collection was carried out from October to December 2025 and covered one production cycle of approximately four months.

Primary data were collected through structured interviews using questionnaires and supported by direct field observations to capture both technical farming practices and economic characteristics of milkfish production. Secondary data were obtained from relevant institutions, including the local Fisheries Office, Statistics Indonesia, and related scientific literature. Respondents consisted of traditional milkfish farmers who harvested production during 2025. A snowball sampling technique was employed to identify active farmers within interconnected pond communities, resulting in a total sample of 100 respondents. Snowball sampling was applied because no complete registry of active traditional milkfish farmers was available, and farmer networks were the most reliable means of identifying respondents within dispersed coastal pond communities.

Economic analysis used one production season as the unit of analysis. The main observed variables included total production cost, harvest volume, and farm-gate selling price of milkfish. Farm income was calculated as the difference between total revenue and total production cost, where total revenue was derived from the multiplication of selling price per kilogram and production volume per cycle. Business feasibility was evaluated using the Revenue–Cost Ratio (R/C), in which a value greater than one indicates financial feasibility, a value equal to one indicates a break-even condition, and a value lower than one indicates financial infeasibility. Results were presented descriptively through mean values, minimum–maximum ranges, and distribution of efficiency categories to describe the overall economic performance of traditional milkfish farming.

In addition to economic variables, several technical aspects of traditional pond management were also observed descriptively, including stocking density, natural feed availability, water management practices, and fish survival rate during one production cycle. These observations were not analyzed experimentally but were used as supporting information to interpret variations in production, income, and efficiency among farmers operating in low-input traditional systems.

Results

Socio-Economic Characteristics of Farmers

The socio-economic characteristics of milkfish farmers in Sungai Undang Village are presented in Table 1. The results indicate that farmers are predominantly within the productive age group, possess relatively long farming experience, and have low levels of formal education.

Table 1. Socio-Economic Characteristics of Traditional Milkfish Farmers

Variable	Category	Number (Persons)	Percentage (%)
Age	< 30 years	6	6.0
	30–44 years	22	22.0
	45–60 years	51	51.0
	> 60 years	21	21.0
Education Level	Elementary School	52	52.0
	Junior High School	31	31.0
	Senior High School	17	17.0

Labor Source	Family Labor	74	74.0
	Hired Labor	26	26.0
Farming Experience	10–25 years	100	100.0

The dominance of the productive age group (45–60 years) shows that milkfish farming activities in Sungai Undang Village are still managed by active labor with adequate technical and physical capacity to conduct production activities. Similar patterns are reported in small-scale coastal aquaculture, where business actors are dominated by productive-age workers due to the physical endurance and technical field skills required ([Rahman et al., 2023](#)). Low formal education levels (elementary–junior high school) do not hinder pond management because farming skills are obtained through intergenerational experience and informal learning mechanisms among farmers. Recent studies note that technical knowledge in small-scale aquaculture systems is more strongly derived from experience and social networks than from formal education ([Sarkar & Bose, 2022](#)).

The use of family labor and self-financed capital further confirms the small-scale household-oriented nature of the business with relatively low production risk. This finding aligns with studies in South Asian small-scale aquaculture showing that family labor functions as a strategy to reduce costs while maintaining livelihood stability in coastal households ([Ali et al., 2021](#); [Rahman et al., 2023](#)). From a livelihood perspective, family involvement in production represents an adaptive strategy to sustain business continuity, particularly under limited access to capital and production technology ([Hossain et al., 2023](#)).

Overall, these socio-economic characteristics imply production input management, cost structure, and business orientation that emphasize income stability and household economic sustainability rather than maximum profit. Literature on small-scale aquaculture explains that such systems are generally livelihood-driven rather than profit-maximizing, especially under traditional low-input conditions dependent on farmers' experience ([Tacon, 2020](#); [Sarkar & Bose, 2022](#)). Therefore, the pattern observed in Sungai Undang Village is consistent with small-scale coastal aquaculture characteristics in Indonesia and other developing countries.

Cost Structure, Revenue, and Farm Income

Financial performance assessment was conducted through analysis of cost structure, revenue, income, and efficiency. The results are presented in Table 2. The cost structure of traditional milkfish farming in Sungai Undang Village is dominated by variable costs, particularly seed procurement and labor. This dominance indicates a low-input production system with minimal use of artificial feed, aeration, or technological inputs, relying mainly on natural pond productivity. Similar cost patterns are reported in coastal small-scale aquaculture systems in South and Southeast Asia ([Sarkar & Bose, 2022](#); [Rahman et al., 2023](#)), including Indonesian traditional brackishwater ponds that depend on ecological efficiency and experiential technical skills rather than capital-intensive investment ([KKP, 2023](#)).

Average production of 625 kg per season with a selling price of IDR 30,000 kg⁻¹ generated relatively small income of IDR 2,950,000 per season. Thin profit margins reflect biological and technical limitations of traditional systems but still contribute to household income. Such low-margin patterns are typical of livelihood-oriented small-scale aquaculture where production objectives emphasize income

stability and risk mitigation rather than profit maximization (Ali et al., 2021; Tacon, 2020). Similar findings were reported in traditional milkfish ponds in Brebes and Sidoarjo, where profits remain limited, but businesses persist due to low capital requirements and manageable risk (Hidayat et al., 2020).

Efficiency analysis shows an average R/C ratio of 1.23, indicating financial feasibility. Variation from 0.90 to 1.47 reflects heterogeneity among farmers due to differences in pond scale, cost structure, and productivity. Similar efficiency variation has been reported in Indonesian coastal milkfish farming where technical practices and pond size influence feasibility (Suryaningsih et al., 2021).

Overall, moderate efficiency aligns with the livelihood-oriented nature of traditional low-input systems that prioritize resilience over high profit. Literature highlights that such systems strengthen coastal household economic stability through diversified income sources, family labor utilization, and flexible cost structures (Hossain et al., 2023; KKP, 2023).

Table 2. Cost Structure, Production, Revenue, and Farm Income per Production Cycle

Component	Mean	Minimum–Maximum (IDR / Unit)
Fixed Cost (FC)	4,500,000	2,350,000 – 6,500,000
Variable Cost (VC)	19,800,000	12,700,000 – 28,250,000
Total Cost (TC)	24,300,000	15,050,000 – 34,750,000
Production (kg/cycle)	625	450 – 750
Selling Price (IDR/kg)	30,000	30,000 – 30,000
Total Revenue (TR)	18,750,000	13,500,000 – 22,500,000
Income (I)	2,950,000	–1,550,000 – 6,500,000
R/C Ratio	1.23	0.90 – 1.47

Discussion Feasibility Distribution

R/C variation indicates differing feasibility levels among farmers, classified in Table 3. Approximately 90 % of farmers are financially feasible, while 10 % are infeasible. This confirms that traditional milkfish farming generally generates positive financial value despite limited margins. Efficiency heterogeneity is common in small-scale aquaculture due to differences in input use, technical experience, and farm management (Aung et al., 2021).

Low-margin feasible farmers likely face technical and economic constraints such as reliance on family labor and limited access to improved inputs or technology. Stable but thin margins under variable-cost-dominated systems are widely documented in small-scale aquaculture (Meliko, 2021). Conversely, medium-margin farmers demonstrate better efficiency through improved management, experience, or diversification (Angermayr et al., 2023).

The small proportion of infeasible farms highlights production risks related to environmental fluctuation, water quality, or seed selection, consistent with studies on technical efficiency in small-scale aquaculture (Dorji, 2025).

Table 3. Distribution of Business Feasibility Based on R/C Ratio

Efficiency Category	R/C Interval	Number (Persons)	Percentage (%)
Not Feasible	< 1.00	10	10.0

Efficiency Category	R/C Interval	Number (Persons)	Percentage (%)
Feasible – Low Margin	1.00 – 1.20	45	45.0
Feasible – Medium Margin	> 1.20	45	45.0
Total		100	100

Technical Characteristics and Their Relation to Efficiency

Technical characteristics are presented in Table 4. Traditional ponds apply high stocking density with natural feed reliance and simple tidal water exchange, producing moderate survival and productivity but low production cost. High stocking density without additional nutrition creates competition for natural food, limiting growth and survival—commonly reported in traditional aquaculture systems (Tacon, 2020; Rahman et al., 2023; Hossain et al., 2023).

Economically, reliance on natural feed reduces production costs, allowing profitability despite moderate biological output. This pattern reflects livelihood-oriented aquaculture prioritizing income stability over production maximization (Belton & Thilsted, 2019; Tacon, 2020). Thus, efficiency in traditional milkfish farming is determined not only by biological production but also by farmers' ability to optimize natural resources and minimize costs—an adaptive strategy widely observed in Southeast Asian traditional aquaculture (Belton et al., 2020; Hossain et al., 2023).

Table 4. Technical Characteristics of Traditional Milkfish Farming

Technical Parameter	Mean Value	Range	Description
Stocking Density (fish/ha)	15,000	10,000 – 20,000	High density without intensification
Culture Period (months)	4	3 – 5	Consumption-size production cycle
Survival Rate (%)	65	50 – 80	Influenced by density and water quality
Feed Source	Predominantly natural	–	No intensive artificial feed
Water Management	Simple tidal exchange	–	No aeration system
Production (kg/ha/cycle)	625	400 – 900	Not proportional to stocking density
System Type	High-density, low-input traditional pond	–	Typical of developing coastal ponds

From a policy perspective, the persistence of financial feasibility under low-input conditions indicates that productivity improvement strategies should prioritize affordable technical interventions rather than capital-intensive intensification. Strengthening extension services, improving seed quality, and supporting simple water-management practices may provide the most efficient pathway for enhancing household income in traditional coastal aquaculture systems.

Conclusion

Traditional milkfish pond farming in Sungai Undang Village remains financially feasible, as indicated by an average income of IDR 2,950,000 per

production cycle and an R/C ratio of 1.23, reflecting moderate economic efficiency. Most farmers fall within feasible categories with limited profit margins, while only a small proportion experience financial infeasibility. These conditions are associated with the technical characteristics of traditional low-input farming systems that apply relatively high stocking density while relying primarily on natural feed and simple water management, resulting in moderate biological productivity but reduced production costs. Overall, traditional milkfish farming plays an important role in sustaining coastal household livelihoods. Improving basic technical management—particularly water quality control and survival rate optimization—is necessary to enhance production performance and economic efficiency without significantly increasing production costs.

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