Analysis of Productivity and Income of Floating Net Cage Businesses in the Koto Panjang Hydroelectric Reservoir, Riau

Analisis Produktivitas Usaha Keramba Jaring Apung di Waduk PLTA Koto Panjang Provinsi Riau

Afrina Putri[1], Darwis[1*], Chicka Willy Yanti[1]

[1]Department of Fisheries Socio-Economics, Faculty of Fisheries and Marine,
Universitas Riau, Pekanbaru 28293 Indonesia
email: darwis.an@lecturer.unri.ac.id

Abstract

The development of fish farming in floating net cages (KJA) in the Koto Panjang Hydroelectric Power Plant Reservoir is a strategic alternative to overcome the limitations of capture fisheries production. This study aims to analyze the productivity and income of KJA businesses based on business scale (small, medium, and large). The study was conducted from September to August 2024 at the Koto Panjang Hydroelectric Power Plant Reservoir, Riau Province. The research method involved a survey with primary data collection through interviews using questionnaires and secondary data from supporting literature. Data analysis included total productivity, gross income, net profit, production costs, and the income-to-cost ratio (R/C). The study results indicate that business productivity increases with scale, with an R/C ratio of 1.52 for small-scale businesses, 1.68 for medium-scale businesses, and 1.73 for large-scale businesses. Business income and profits also show significant increases at larger business scales. The average profit per period for small-scale businesses was IDR 331,771,000, for medium-scale businesses IDR 1,341,124,000, and for large-scale businesses IDR 6,472,092,000. An R/C ratio greater than one indicates that all scales of KJA businesses at the Koto Panjang PLTA Reservoir are economically profitable. This study recommends increasing the utilization of water resources and information technology to enhance efficiency and increase the income of fish farmers.

Keywords: Productivity, Floating Net Cages, Income, R/C Ratio.

Abstrak

Pengembangan budidaya ikan dalam keramba jaring apung (KJA) di Waduk PLTA Koto Panjang menjadi alternatif strategis untuk mengatasi keterbatasan produksi perikanan tangkap. Penelitian ini bertujuan untuk menganalisis produktivitas dan pendapatan usaha KJA berdasarkan skala usaha (kecil, menengah, dan besar). Penelitian dilaksanakan pada bulan September hingga Agustus 2024 di Waduk PLTA Koto Panjang, Provinsi Riau. Metode yang digunakan adalah survei dengan pengumpulan data primer melalui wawancara menggunakan kuesioner dan data sekunder dari literatur pendukung. Analisis data meliputi produktivitas total, penerimaan kotor, keuntungan bersih, biaya produksi, dan analisis rasio penerimaan terhadap biaya (R/C). Hasil penelitian menunjukkan bahwa produktivitas usaha meningkat seiring dengan skala usaha, dengan nilai R/C sebesar 1,52 untuk skala kecil, 1,68 untuk skala menengah, dan 1,73 untuk skala besar. Pendapatan dan keuntungan usaha juga menunjukkan peningkatan yang signifikan pada skala usaha yang lebih besar. Rata-rata keuntungan per periode untuk usaha skala kecil sebesar Rp 331.771.000, menengah Rp 1.341.124.000, dan besar Rp 6.472.092.000. Nilai

R/C yang lebih dari satu menunjukkan bahwa seluruh skala usaha KJA di Waduk PLTA Koto Panjang secara ekonomi menguntungkan. Penelitian ini merekomendasikan peningkatan pemanfaatan daya dukung perairan dan penggunaan teknologi informasi untuk mendorong efisiensi dan peningkatan pendapatan pembudidaya.

Kata kunci: Produktivitas, Keramba Jaring Apung, Pendapatan, R/C Ratio

1. Introduction

The Koto Panjang Hydroelectric Power Plant Reservoir is an area administratively located in two regions in West Sumatra Province with an area of 257,256.81 ha (78.11%) with details located in Pasaman Regency 54,757.04 ha (16.63%) and Lima Puluh Kota Regency 202,499.77 ha (61.49%) especially Pangkalan Baru District, while in Riau Province it is located in Kampar Regency, namely Kuok District and XIII Koto Kampar District, more precisely located at coordinates 1000 40 'BT-1010 00' BT and 000 10' N- 000 24' N.

Freshwater fisheries can be managed by cultivating fish in floating net cages. The development of fish farming in floating net cages is one of the alternatives to overcome the constraints of fish production. Increasing aquaculture production can be one of the promising economic improvements, where, from year to year, the selling price for certain commodities is increasing (Yuli, 2024). Fulfillment of the need for the amount of production for the domestic market and between regions must be increased, by knowing the productivity of farmers, which serves as a reference for increasing production, so that it will then have an impact on increasing income from farmers and then making this one of the efforts to improve the household economy.

This research aims to determine the productivity and income of floating net cage businesses in the Koto Panjang Hydroelectric Power Plant Reservoir.

2. Materials and Methods

2.1. Time and Place

This research was conducted in September - August 2024 at the Koto Panjang Hydroelectric Power Plant Reservoir, Riau Province, considering that the Koto Panjang Reservoir is an area with the most significant number of fish farms in floating net cages in Kampar Regency.

2.2. Methods

This study uses a survey method, namely direct observation, to collect data related to the research. The survey is a quantitative research method used to describe the situation, using the same structured and systematic questions with workers in the office. Then all the answers obtained by the researcher were recorded, processed, and analyzed (Gea, 2020).

2.3. Procedure

The data collected is primary data and secondary data. Primary data is from direct observations in the field obtained from respondents by conducting direct interviews guided by questionnaires as an instrument in research, and secondary data regarding libraries and literature.

2.4. Data Analysis

2.4.1. Total Productivity

The data analysis used in this study to answer the first problem formulation about the level of productivity used the total factor productivity analysis (Sarjono, 2001)

$$\text{Total Productivity} = \frac{Total\ output\ (Rp)}{Total\ input\ (Rp)}$$

Description:

Total output = total production (IDR)

Total Input   = feed input (IDR), + seed input (IDR) + labor input (IDR), + capital input (IDR)

2.4.2. Gross Income

Income is the amount of cultivation results multiplied by the selling price applicable at that time. To calculate the total income from this fish farming business, the following analysis tool can be used (Noviana et al., 2020):

$$TR = P.Q$$

Description:

TR   = Income (fish production)

P   = Fish selling price (IDR/kg)

Q   = amount sold (kg)

2.4.3. Net Income

Profit is the reduction of total revenue (TR) with total cost (TC) from fish farming in floating net cages; this analysis uses the formula (Hamdani et al., 2017).

$$\pi = \text{TR} - \text{TC}$$

Description:

π = income from fish farming (IDR)

TR = Income (IDR)

TC = Total Cost (IDR)

2.4.4. Total Cost

Total production cost is the sum of fixed costs and variable costs. Moreover, it can be written with the formula (Malau & Sofyani, 2020):

$$\text{TC} = \text{FC} + \text{VC}$$

Description:

TC = Total cost of farming (Total Cost) (IDR)

FC = Fixed Cost (IDR)

VC = Variable Cost (IDR)

2.4.5. Revenue -Cost Ratio (R/C)

R/C is the comparison between the income obtained and the total costs incurred in business activities, so that it can be known whether a business is making a profit, loss, or breakeven. It can be written with the formula (Hendrik, 2014).

$$\text{R/C} = \text{TR/TC}$$

Description:

TR = Total Income

TC = Total Cost

If R/C > 1, then the business is making a profit; If R/C = 1, then the business is breaking even (no profit, no loss); If R/C < 1, then the business is making a loss.

3. Result and Discussion

3.1. Business Scale

The scale of a business in the fisheries sector can be seen from several parameters, including the amount of capital, the amount of production, the number of workers, the application of technology, and the legal status and licensing of the business (KKP, 2008). The criteria for small businesses in the author's research include several factors, including the number of cages owned, which ranges between 3 and 8 cages, an average production volume in one unit of 7.5 tons per period, an average workforce of 2 people, and an average investment capital of IDR 28,875,000 per unit of small business scale. The criteria for medium businesses in the author's research include several factors, including the number of cages owned, for example, between 18 and 21 cages, an average production volume in one unit of 25.98 tons per period, an average workforce of 3 people, and a significant investment capital of IDR-60,700,000 per medium-scale unit.

The criteria for large businesses in the author's research include several factors, including the number of cages owned, for example, between more than 70 and 120 cages, an average production volume in one unit of 119.9 tons per period, an average number of workers of 5 people, and an investment capital of IDR 215,915,000 per large-scale unit. The total productivity of a business can be seen from the total output produced and the use of total production inputs. The inputs of the floating net cage business in the Koto Panjang PLTA reservoir include seed, feed, and labor input. Each input's productivity can be used to analyze the productivity of a floating net cage cultivation business (Amidarhana, 2000). The components and details of the total production analysis of the floating net cage business in the Koto Panjang Hydroelectric Power Plant Reservoir in 2024 can be seen in Table 1.

Table 1. Floating net cage business productivity per scale in 2024

KJA business scale	Total input per-scale (IDR)	Total output per-scale (IDR)	Business productivity KJA
1. Small Scale	767.975.000	961.350.000	1,25
Average	153.595.000	192.270.000	
2. Medium Scale	2.269.100.000	3.312.450.000	1,45
Average	453.820.000	662.490.000	
3. Large Scale	9.887.575.000	15.287.250.000	1,54
Average	1.977.515.000	3.057.450.000	

Based on Table 1, the productivity of the floating net cage business in the Koto Panjang hydropower reservoir in the small-scale category obtained a result of 1.25. This number is obtained from the division of total output and total input. This can be interpreted that for every use of the total input of floating net cages on a small-scale business of IDR 1,000,000, the farmer will get an output of IDR 1,250,000 from the total output/unit. On a

medium-scale business, the result is 1.45. This number is obtained from the division of total output and total input. This can be interpreted that for every use of total input on a medium-scale business of IDR 1,000,000, there will be an IDR 1,450,000 output/unit. On a large scale, the total productivity obtained is 1.54. This amount is obtained by dividing the total output and total input, so it can be interpreted that every use of total input on a large business scale of IDR 1,000,000 will get an output of IDR 1,540,000,000 per production of floating net cage cultivation activities.

3.2. Fixed Cost

Components and details for fixed costs for the floating net cage business at the Koto Panjang hydroelectric reservoir in 2024 can be seen in Table 2.

Table 2. Average fixed cost per period of floating net cages per unit and per scale in 2024

Fixed cost components (IDR)	Small business scale	Medium business scale	Large business scale
1. Labor cost	10.000.000	10.000.000	10.000.000
2. Maintenance cost	530.000	570.000	750.000
3. Depreciation cost	625.700	655.400	681.600
Fixed cost per unit	8.007.000	10.547.000	15.727.000
Average per- scale	19.195.800	25.225.200	53.431.600

Based on Table 2 description, the average fixed cost incurred by each cultivator on a small scale is IDR 19,195,800 per scale. The average fixed cost incurred in a medium-sized business is IDR 25,225,200 per scale. On a large business scale, the average fixed cost incurred by cultivators is IDR 53,431,600 per ha.

3.3. Variable Cost

Table 3 provides components and details for the variable costs of the floating net cage business at the Koto Panjang hydroelectric reservoir in 2024.

Table 3. Average variable costs per period of floating net cages per unit and per scale in 2024

Variable cost components (IDR)	Small business scale	Medium business scale	Large business scale
1. Seed Cost	13.920.000	48.080.000	222.400.000
2. Feed Cost	92.800.000	321.040.000	1.487.200.000
Variable Cost Per-Unit	18.400.000	18.400.000	18.400.000
Average Per-Scale	106.720.000	369.040.000	1.709.600.000

Based on the description in Table 3, the components of variable costs are seed and feed costs. The variable costs incurred by the floating net cage business in the Koto Panjang Hydroelectric Power Reservoir in one small-scale category unit are IDR 18,400,000 per cage unit. In one medium-scale unit, the fixed costs are IDR 18,400,000 per cage unit. In one large-scale unit, the fixed costs are IDR 18,400,000 per cage unit.

3.4. Total Production Cost

The components and details for the total production costs of the floating net cage business for the Koto Panjang hydroelectric reservoir in 2024 can be seen in Table 4.

Table 4. Average total production cost per-period, per-unit and per-scale in 2024

Total production cost components (IDR)	Small business scale	Medium business scale	Large business scale
1. Fixed costs	19.195.800	25.225.200	53.431.600
2. Variable costs	106.720.000	369.040.000	1.709.600.000
Total production cost per unit	26.407.000	28.947.000	34.127.000
Average per- scale	125.915.800	394.265.200	1.763.031.600

Based on the description in Table 4, the components of total production costs are fixed costs and variable costs. Total production costs are obtained from the sum of fixed and variable costs, so the production costs of the floating net cage business scale in the Koto Panjang Hydroelectric Power Reservoir are known. Based on Table 15. The total production cost for one floating net cage unit on a small business scale is IDR 26,407,000 per cage unit. The total production cost of one unit on a medium scale is IDR 947,000 per unit. The total production cost of one floating net cage unit on a large business scale is IDR 34,127,000 per cage unit.

3.5. Gross Income

The components and details for gross income or revenue from the floating net cage business at the Koto Panjang hydroelectric reservoir in 2024 can be seen in Table 5.

Table 5. Average income per period of floating net cage business in 2024.

Business Scale	Gross Income (IDR)
1. Small Scale	192.270.000
2. Medium Scale	662.490.000
3. Large Scale	3.057.450.000

Based on Table 5, the income is obtained by multiplying the production results by the selling price of fish/kg. The average income (gross income) of the small-scale business category farmers is IDR 192,270,000 per unit scale. The average income received by the medium-scale business category is IDR 662,490,000 per unit. The average income in the large-scale business category is IDR 3,057,450,000 per unit scale.

3.6. Net Income

The components and details for the net profit or income of the floating net cage business at the Koto Panjang hydroelectric reservoir in 2024 can be seen in Table 6.

Table 6. Average profit per period of the floating net cage business in 2024

Business scale	Net Income (IDR)
1. Small scale	66.354.200
2. Medium scale	268.224.800
3. Large scale	1.294.418.400

Based on Table 5, net income is obtained by subtracting revenue from total production costs. The average profit of the small business category is IDR 66,354,200 per unit on a scale. The average profit of the medium business category is IDR 268,224,800 per unit on a scale. The average profit (net income) in the large business category is IDR 1,294,418,400 per unit on a scale.

3.7. Return on Ratio (R/C)

The results of the revenue cost ratio /RCR of the floating net cage business in the Koto Panjang Hydroelectric Reservoir can be seen in Table 7.

Table 7. Revenue cost ratio of the floating net cage business scale 2024

Business Scale	Description (IDR)
1. Small Scale	
a. Total Revenue	961.350.000
b. Total Production Cost	629.579.000
c. R/C	1,52
2. Medium Scale	
a. Total Revenue	3.312.450.000
b. Total Production Cost	1.971.326.000
c. R/C	1,68
3. Large Scale	
a. Total Revenue	15.287.250.000
b. Total Production Cost	8.815.158.000
c. R/C	1,73

Based on Table 7, the R/C value for floating net cage businesses for small, medium, or large scales obtained results greater than > 1. According to the information from the formula, if R/C > 1, the business is profitable. If R/C = 1, the business breaks even (no profit or loss). If R/C < 1, then the business experiences a loss. Small-scale, medium-scale, and large-scale floating net cage businesses in the Koto Panjang Hydroelectric Power Plant Reservoir are profitable.

4. Conclusions

The productivity of large-scale floating net cage businesses in the Koto Panjang Hydroelectric Power Plant Reservoir is higher than the productivity of small and medium-scale businesses based on the results of the study obtained 1.25 for small business scale, obtained a value of 1.45 for medium business scale, and obtained a value of 1.54 for large category businesses. Income in the Koto Panjang Hydroelectric Power Plant Reservoir is profitable on a small scale, medium scale, and large scale. The total income from floating net cage fish farmers in the Koto Panjang Hydroelectric Power Plant Reservoir for small-scale businesses is IDR 961,350,000 per period. The medium-scale business is IDR 3,312,450,000 per period, and the large-scale business is IDR 15,287,250,000 per period. Moreover, the total profit fish farmers receive in the floating net cage business on a small scale is IDR 331,771,000 per period with an R/C value of 1.52. On a medium business scale, IDR 1,341,124,000 per period with an R/C value of 1.68; on a large business scale, IDR 6,472,092,000 per period with an R/C value of 1.73.

5. References

[KKP] Kementerian Kelautan dan Perikanan. (2008). *Peraturan Menteri Kelautan dan Perikanan Nomor PER.13/MEN/2008 Tentang Skala Usaha di Bidang Pembudidayaan Ikan*. https://jdih.kkp.go.id/peraturan/per-13-men-2008.pdf

Amidarhana, A. (2000). *Analisis Produktivitas Usaha Budidaya Ikan dalam Keramba Jaring Apung di Waduk Jatiluhur Kabupaten Purwakarta Provinsi Jawa Barat*. Institut Pertanian Bogor.

Gea, T.N. (2020). *Analisis Ekonomi Pengelolaan Sumberdaya Ikan Layur (Trichiurus spp.) di Perairan Kabupaten Cilacap Jawa Tengah.* Institut Pertanian Bogor.

Hamdani, H., Kelana, P.P., & Zidni, I. (2017). Kajian Peningkatan Produktivitas Polikultur pada Karamba Jaring Apung di Waduk Cirata dengan Pemanfaatan Teknologi Aerasi. *Akuatika Indonesia*, *2*(2): 120-127.

Hanafi, D. (2021). Studi Optimasi Operasional Waduk Koto Panjang untuk Pembangkit Listrik Tenaga Air. *Jurnal Saintis*, *21*(1): 31-44.

Hendrik, H. (2014). Analisis Usaha Keramba Jaring Apung, Prospek dan Kendala Pengembangannya di Nagari Tanjung Sani Kabupaten Agam Provinsi Sumatera Barat. *Jurnal Perikanan dan Kelautan*, 19(1): 36-44.

Malau, J.W., & Sofyani, T. (2020). Analisis Usaha Penangkapan Ikan Malong (*Muraenesox cinereus*) dengan Alat Tangkap Rawai Dasar (*Bottom longline*) di Kecamatan Sei Tualang Raso Kota Tanjung Balai Provinsi Sumatera Utara. *Jurnal Sosial Ekonomi Pesisir*, 1(4): 18-28.

Noviana, Y., Bathara, L., & Arief, H. (2020). Analisis Kelayakan Usaha Rendang Kerang di Kecamatan Bangko Kabupaten Rokan Hilir Provinsi Riau. *Sosial Ekonomi Pesisir*, 1(1): 67–73.

Sarjono, S. (2001). Model Pengukuran Produktivitas Berdasarkan Pendekatan Rasio Output Per Input. *Journal the Winners*, *2*(2): 130–136.

Sofyani, T. (2016). Pengorganisasian dan Analisis Usaha Perikanan Keramba di Waduk PLTA Koto Panjang Kabupaten Kampar. *Berkala Perikanan Terubuk*, *38*(5): 1–23.

Wahyudi, H.A., Bahri, S. & Tibrani, T (2016). Optimasi Usaha Budidaya Ikan Air Tawar pada Keramba Jaring Apung di Waduk PLTA Koto Panjang Kabupaten Kampar Provinsi Riau. *Jurnal Agribisnis,* 18(1): 11-24.

Yuli, Y. (2024). Increasing the Productivity of Floating Net Sage System Through an Integrated Multi-Trophic Aquaculture (IMTA). *Jurnal Perikanan dan Kelautan*, 12(2): 214–226