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PERFORMANCE OF CATFISH (*PANGASIUS SP.*) CULTIVATION WITH POND MEDIA: CASE STUDY IN BANJAR REGENCY, SOUTH KALIMANTAN PROVINCE, INDONESIA

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Abstract

Catfish is a fish that is increasingly in need in Indonesia and is one of the mainstays in increasing aquaculture productivity. This study aims to analyze the production performance and financial feasibility of catfish culture using pond media and analyze the marketing performance of catfish. This study uses a survey method. The research location was determined purposively in Banjar Regency; the research respondents were catfish cultivators in ponds, collectors, retailers, and catfish consumers. The data collected were analyzed descriptively; financial analysis, marketing margin analysis, and farmer share analysis were also used. The results showed that catfish cultivators had implemented good and correct technical cultivation activities, farming in ponds was financially feasible, and the catfish marketing system was running efficiently.

Key words**:** *performance, catfish, cultivation, Banjar Regency*

INTRODUCTION

Increased fish production can be achieved through the aquaculture process because increased production through capture can disrupt the preservation of fishery resources [2]. An aquaculture is an option for fisheries-producing countries to increase their production in business activities. Aquaculture is also one of the fastest-growing food producers globally and can meet the needs of fish for human consumption of more than fifty percent [34], [17], [10]. This is because the quality of fishery products produced using cultivation is considered better, and because of its availability that will always be there will not run out, so aquaculture business is considered more productive [12].

Fish farming also plays an important role in maintaining food security, increasing income and economic community development [3]. Fish farming activities can also be a source of income for fish farmers who run small-scale businesses [1, 9].

Catfish is a fish that is increasingly in demand in Indonesia and is one of the mainstays in increasing cultivation productivity. This can be proven by the increase in catfish production in 2015 by 339,069 tons and increased to 437.11 tons in 2016; catfish production is still increasing where the national catfish production target in 2019 is to be 1,149,400 tons [21].

One of the leading fisheries businesses in Indonesia is catfish [28]. Catfish is an important fish in aquaculture. Fisheries and Aquaculture Department of Food and Agriculture Organization (FAO) placed catfish fourth after goldfish (*Cyprinus carpio*). Catfish is a freshwater consumption fish with a long body and silver-white color with a bluish back. Catfish is also a commodity of high economic value because it has a high selling price and is needed by the community continuously [25]. Catfish cultivation business has a milder risk than the cultivation of other freshwater fish. In addition, the catfish cultivation business also does not require high technology so that everyone can cultivate it.

To support the success of fish farming activities, farmers must understand it. Things

that need to be understood are selecting cultivation locations, preparation of cultivation facilities and infrastructure, preparation and distribution of seeds, preparation and feeding, maintenance, pest and disease control, harvest and post-harvest [26].

Catfish farming activities play an important role in increasing people's incomes, creating jobs, food security and supporting development policies. Therefore, it is very important to understand catfish farming activities' product performance and economic performance for business continuity. The purpose of this study is to analyze production performance and financial feasibility in catfish farming with pond media and catfish marketing performance.

MATERIALS AND METHODS

Research Location

The study location was set purposively in Banjar Regency; the study respondents were catfish farmers in ponds, collecting merchants, retailers and consumers of catfish.

Data Collection Techniques and Data Types

This study used survey methods, limited to information collected from samples representing the entire population by using questionnaires as instruments in data collection, while sample selection was carried out *in purposive random sampling*. Other data collection techniques use interview techniques related to the supply chain and catfish distribution system. The data collected consists of primary and secondary data related to the technical cultivation of catfish in ponds, fish production data, cost data, pond land area, number of cultivators, and marketing systems.

Data Analysis Methods

Data analysis aims to simplify data in a more understandable form [23]. Especially for qualitative data, the information that has been collected in this study is grouped, then compiled and analyzed descriptively qualitatively. Analysis of purpose one is carried out data collection about the production system and its various inputs and sources, and technical production of catfish cultivation is then described. Analysis of purpose two using financial analysis, which includes profit/loss, Net Present Value (NPV), Gross Benefit Cost Ratio (Gross B/C), Internal Rate of Return (IRR) and Payback Period (PP)

Profit/loss analysis aims to find out the company's true ability to make a profit [15]. This calculation is taken from the remaining results of the business over a certain period. Business is profitable when the Total Revenue value is greater than the Total Cost. The formula used as a calculation of net income is as follows:

$$\pi = \mathbf{TR - TC} \quad \text{.....(1)}$$

where:

π = Profit; TR = Total Revenue; TC = Total Cost = Fixed cost + variable cost.

Net Present Value (NPV) is the present value of the entire cash flow until the end of the existing project. The project is said to be accepted if the NPV value > 0 or the largest NPV value [29]. The formula used as an NPV calculation is as follows:

$$\mathbf{NPV} = \sum_{t=1}^{n} \frac{(B_t - C_t)}{(1+i)^2} \quad \text{.....(2)}$$

where:

Bt = Benefit of the t-year; *Ct* = Cost of the t-year; *i* = the prevailing interest rate; *t* = length of time/age of investment.

Criteria:

NPV > 0, the effort is worth implementing

NPV < 0, the business is not worth implementing.

Gross Benefit-Cost Ratio (Gross B/C) illustrates the influence of additional costs on the benefits received. The formula used as a gross B /C calculation is as follows:

$$\mathbf{Gross\ B/C} = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+i)t}}{\sum_{t=1}^{n} \frac{Ct}{(1+i)t}} \quad \text{.....(3)}$$

where:

Bt = Benefit of the t-year; *Ct*= Cost of the t-year; *i* = the prevailing interest rate; *t* = length of time/age of investment.

Criteria:
Gross B/C > 1, the effort is worth carrying out
Gross B/C < 1, the effort is not worth doing
Gross B/C = 1, attempt in breakeven state
Internal Rate of Return (IRR) is a method used to calculate the interest rate that equates the value of the current investment with the value of net cash recipients in the future [32]. The formula used as an IRR calculation is as follows:

$$\mathbf{IRR} = \boldsymbol{i_1} + \frac{\boldsymbol{NPV_1}}{\boldsymbol{NPV_1 - NPV_2}} + (\boldsymbol{i_2} - \boldsymbol{i_1}) \quad \text{.....(4)}$$

where:
NPV_1 = Net Present Value (+)
NPV_2 = Net Present Value (-)
i_1 = Discount Rate generating (+)
i_2 = Discount Rate generating (-)
Criteria:
IRR > the applicable discount rate, the business is worth implementing
IRR < the prevailing discount rate, the business is not worth implementing
IRR = the prevailing discount rate; the business is not worth implementing.
The Payback Period (PP) method assesses the period required for the return on investment from cash inflows [11]. The formula used as a PP calculation is as follows:

$$\boldsymbol{PP} = \frac{\boldsymbol{Total\ Investmen\ x\ 1year}}{\boldsymbol{Profit}} \quad \text{.....(5)}$$

Criteria:
PP < 3 years, the rate of return on capital is said to be fast
PP 3 years < PP < 5 years, the rate of return on capital is said to be moderate
PP > 5 years, the rate of return on capital is said to be slow.
The analysis used to answer the third purpose is done with descriptive and quantitative analyses. The descriptive analysis describes the marketing channels that occur from the manufacturer to the end consumer's hands. At the same time, quantitative analysis is used to determine the efficiency level of marketing. The formula used as a calculation of the price part received by the manufacturer is as follows:

$$\boldsymbol{Farmers\ Share\ (FS)} = \frac{\boldsymbol{Pf}}{\boldsymbol{Pr}}\boldsymbol{x100\%} \quad \text{.....(6)}$$

where:
FS = Farmer share or share of the price received by the cultivator (%)
Pf = Purchase price at the cultivator level (Rp/kg)
Pt = Retail price at the consumer level (Rp/kg)
Criteria: Fs ≥ 40%, then marketing is said to be efficient [7].

RESULTS AND DISCUSSIONS

Catfish Cultivation Business Production Performance

The location of catfish farmers in Banjar Regency is very good because the determination of the location has been accompanied by the availability of public facilities that support the running of cultivation businesses in the location, such as irrigation water availability and business locations easily accessible to consumers and the many supporting facilities that are already available such as electricity, housing, labor and irrigation. The availability of existing infrastructure or public facilities can encourage the smooth operation of the catfish farming business.
The supporting facilities available are elements that support the operation of the business directly, such as the availability of electricity networks, telephones, local water company, housing for workers and small stalls available around fish farming business locations in Banjar Regency.
The need for supporting equipment for fish farming businesses such as water pumps feed, making machines, generator sets and so on has been taken into account by farmers as a unit in a system related to their business needs to be able to produce fish farming products by the capacity and quality that has been planned. Vehicles are also needed for operations during the construction period and operation of the existing fish farming business in Banjar Regency. The vehicles needed by fish farmers are very dependent on the amount

of effort, location and production produced. Most of the vehicles used by fish farmers are pickup cars and motorcycles.

Buildings owned by fish farmers in the form of feed warehouses, guard houses and fences. The shape and type of building owned by fish farmers are different, depending on the cost owned by each fish farmer there, the needs in the production process, and the form of the fish farming business.

Overall, the type of pond owned by the respondents of catfish farmers in Banjar Regency is a type of soil pond. The ground pond is also called an extensive pond, where the entire pond is made of soil [5]. Traditional pond structures generally still use natural materials, such as usually using compacted soil, sewerage, and water intake have not been made permanently [31]. Traditional ponds fall into the category of quiet water ponds. A quiet water pond is a fish maintenance container where the water is stagnant. A calm water pond is a fish rearing container where the water is stagnant [30]. The water that enters this pond is only to replace the water lost due to evaporation or seepage so that the height of the pond water level is maintained. The water source used to meet the needs of cultivated water in Banjar Regency comes from the Martapura Irrigation water flow.

The pond size used is between 20 x 25 meters to 25 x 35 meters. Before starting production, it is necessary to clean the pond to avoid disease pests that can grow and interfere with fish growth. Caring for a fish pond is very necessary because this is one of the important factors determining fish farming success. The success of fish farming is very influential with the construction of ponds made according to the correct rules. Pond care is not just about protecting and repairing from damage, but at the same time restoring its function and usefulness as a decent place to raise fish [30]. Before the catfish seeds are stocked, the pond should be given fertilizer. Fertilizers for ponds can use manure or green manure. The amount of fertilizer given is as much as 50–700 grams per square meter. The provision of fertilizers aims to grow natural food for catfish [33].

The solid spread of catfish seeds is as much as 20-30 heads per meter^3. This stocking solid exceeds the ideal catfish seed spread solid of 10-20 heads per m^3 [20]. The size of catfish seeds used by farmers is a size of three inches for IDR 375, four inches catfish seed size for IDR 425 and two inches catfish seed size for IDR 250. The picking catfish seeds is in the Bincau and Cindai Alus areas. Catfish seeds are sourced from several areas on the island of Java, namely from Bogor, Bekasi and Yogyakarta, which are then raised in Bincau and Cindai Alus.

The feeding duration generally given by fish farmers respondents is two times a day, namely morning and evening or adjusting weather conditions. The feed given by the bodyweight of catfish is as much as 3% - 5% of the total body weight. This is in line with the requirements for ideal feeding on catfish cultivation [27]. The source of feed used by catfish farmers consists of two, namely using factory-made feed from spreading seeds to harvesting, and cultivator respondents who use factory-made feed when spreading seeds until the fish are 3-4 months old then continued with self-made feed until the time. The source of factory-made feed is from feed entrepreneurs around Banjar Regency. At the same time, the source of feed made independently by cultivator respondents is divided into several areas, namely salted fish from Aluh-Aluh District, bran from Marabahan and oil palm meal from Pelaihari area, Tanah Laut Regency. The ingredients to make this feed are usually also provided directly by feed entrepreneurs to facilitate the cultivator respondents.

The length of catfish cultivation production, in general, is for 8, 12 and 18 months with weight sizes of 0.8 Kg, 1 Kg and 1.5 Kg, respectively. There are also respondents of catfish cultivators who choose to harvest with a sorting process, namely with a production time of 8 and 12 months. The selling price of catfish ranges from IDR 18,000 - IDR 20,000/ kilograms.

How to harvest catfish is by draining half the pond water using a water pumping machine, then the fish in the pond is herded from the

corner of the pond to the corner of the pond the other by using a net and then the fish is lifted using scoop which will be placed into a large basin and container that has been provided previously. Usually, cultivators pay a wage of IDR 300/kilogram to the workers/employees who carry out the harvest process. Then the way used by catfish farmers in marketing production results is to contact directly collecting traders who have become regular customers or install a notification plan in front of their respective cultivation sites that "sold farmed fish" for payment methods made by collecting merchants with producers, namely by paying cash or credit to the agreed price.

Financial Feasibility of Catfish Farming in Ponds

Cost is all the burden borne to provide goods and services [4]. In business activities, investment and operational costs are needed to carry out business activities. Investment costs are funds invested by business owners in capital objects [8]. The operational process consists of total fixed costs and total variable costs.

The fishery business that an entrepreneur will carry out must produce sustainable profits. Therefore, it is necessary to conduct a business analysis to determine a type of business [22]. The purpose of business analysis is to determine the level of profit, return on investment and break-even point of a business. Various anticipations to improve and increase company profits can also be done if the business analysis is carried out. Business analysis on fisheries business is needed given the considerable uncertainty of business [35]. Summary of Financing and feasibility of catfish farming business with pond media presented in the Table 1.

The number of investment costs invested by each fish farmer varies, depending on the fish farming business owned by each fish cultivator and the amount of capital each fish farmer owns. The average investment cost incurred by cultivators is IDR 346,986,000.

The investments issued are for a pond of 46.33%, warehouses of 32.75%, machines of 13.76%, scales of 3.44% of existing investment costs, net of 0.82%, basins of 0.25% and scoop for Rp. 60,000 or 0.20% of the total investment costs.

Fixed costs are costs whose amount is fixed for a short period and is independent of production volume [14, 16, 19]. This study is included in the fixed costs, namely the cost of renting the pond, maintaining the pond and the cost of depreciation of investment goods.

Table 1. Feasibility of Catfish Farming in Ponds, 2021

No	Description	Value
1.	Cost	
	• Investment (IDR)	346,986,000
	• Fixed cost (IDR)	63,251,479
	• Variable cost (IDR)	1,039,348,667
	• Operational Cost (IDR)	1,102,600,146
2.	Revenue	
	• Production (kilogram)	65,643
	• Price (IDR/kilogram)	19,000
	• Revenue (IDR)	1,247,209,933
3.	Profit	144,609,787
4.	Business feasibility	
	• NPV 7%	590,034,488
	• BCR 7%	1,079
	• IRR (%)	39,388
	• Payback Period (year)	2,399

Source: Primary data processed in 2021.

The average amount of fixed costs incurred by catfish farmers in Banjar Regency is IDR 63,251,479.

Variable costs are ever-changing costs – change in line with the natural changes of the production process or are the costs of production factors [14, 16, 19]. The amount of costs incurred by each fish farmer in Banjar Regency differs depending on the number and input of cultivators and changes in other productions each seeding season. The average variable cost annually incurred by fish farmers in Banjar regency amounted to IDR 1,039,348,667, with the largest type of cost incurred per year for the purchase of feed, which is 84.22% of the total average variable cost feed by 14.01%, labor of 1.73% and for the cost of purchasing drugs are amounting to 0.04% of the total variable costs.

Operational costs are all expenses incurred by a business to fund business operations to achieve the business's goals. The total operational costs in the fish farming business

in Banjar Regency are obtained from adding up fixed costs and variable costs. The entire operating cost of the catfish farming business per year is IDR 1,102,600,146.

Production is an activity to create or produce or add good value to an item to meet the community's needs [4]. The production produced by catfish farmers in Banjar Regency is the number of fish in a year of production by units (kilogram). The average production produced per catfish cultivator per year is 65,643 kilograms. Total acceptance is the amount of fish production produced per year multiplied by the price that occurs in the market between fish farmers and buyers. The average total revenue per catfish farmer per year is IDR 1,247,209,933, with the average selling price of fish per kilogram being IDR 19,000.

The profit of the catfish farming business in Banjar Regency is obtained from the difference between receipts and total operational costs and the average profit per cultivator per year of IDR 144,609,787 or IDR 12,050,816 per cultivator per month. This business can be profitable because it is worth more than the Regional Minimum Wage of South Kalimantan Province in 2021 of IDR 2,877,177.

Furthermore, based on various analysis results using investment criteria/financial analysis, it is stated that the catfish farming business in Banjar Regency is feasible to run and develop.

In principle, investment criteria analysis is an analysis used to assess whether a business is worth developing or not [13]. Each criterion uses a present value that has been discounted from the flow of interest and costs over the life of a business. This analysis used an interest rate of 7% by the interest rate of the Bank – Government Bank, which is commonly applicable to businesses engaged in agriculture and fisheries. The period used in this analysis is for ten years. Determination of the analysis period for ten years based on the economic age of the business.

Net Present Value (NPV) of 7% of 590,034,488 > 0 means that fish farming business activities in Banjar Regency provide a positive value which means that the benefits received (total revenue) are greater than the total costs incurred. The IRR rate of 39.388% is greater than the applicable credit rate at the bank (7%); this states that the value of the fish farming business is profitable and feasible to continue to be implemented and needs to be developed again for more advanced businesses.

Benefit Cost Ratio (BCR) 7%, which is 1,079 > 1; thus, the catfish farming business in Banjar Regency provides benefits and deserves to be run because BCR > 1. The BCR value indicates the present value on all land costs or, first coupled with the return for the investment invested in the business, will be refundable. The greater the BCR value of a business, the more efficient the business, so that the prospects for business returns and investments in the future will be better. The calculation results are known payback period (PP) obtained a value of 2,399 which means the time of return on investment costs invested by farmers in the catfish farming business is for 2,399 years.

Based on the various analyzes used, the catfish farming business in ponds in Banjar Regency is profitable and feasible to develop, this is in line with the research results of Alawode *et al*. (2020) [1], which show that the catfish aquaculture business in southwest Nigeria is profitable, but several challenges can reduce these profits and can even consume the invested capital.

Catfish Marketing Performance

Marketing specs related to the demand and supply of catfish production of ready-to-consume and its development in the future. The marketing spec concerns the marketing strategies and programs that will be made in marketing the production of farmed fish. The development of demand for aquaculture fish production can be known from changes in consumer income, tastes and consumer behavior in buying farmed catfish production.

The study results found that cultivators marketed the production of catfish farming products to various regions from South Kalimantan, East Kalimantan, Central Kalimantan and Java island with

intermediaries from collecting merchants and retailers from these areas. The results showed that market demand had exceeded the number of fish produced, so this is an opportunity for farmers to increase catfish production. Based on the results of research on catfish respondents/cultivators in Banjar Regency, data on the amount of production for one year is 15,022,400 kilograms or daily production is 41,157.26 kilograms, and demand data from merchants both collectors and retailers is 48,000 kilograms per day, so the opportunities that are still available for cultivators to meet the demand from collecting merchants and retailers is 6,842.74 kilograms.

Based on the information from the cultivator, usually every time the harvest cultivator will be directly exhausted, and even many are collecting merchants and retailers who come directly to harvest to buy catfish run out of harvest stock. This is in line with catfish production and demand data, which shows the difference between demand and supply (production) of 6,842.74 kilograms. This means that farmers still have the opportunity to produce and market their catfish by 6,842.74 kilograms per day or 2,497,600 kilograms of catfish every year, and of course, this is a considerable opportunity.

The catfish marketing channel in Banjar Regency has four types of distribution chains, namely:

Type 1. Cultivators – Retailers – End Consumers
Type 2. Cultivators – Collecting Merchants – Retailer Merchants – End Consumers
Type 3. Cultivators – Collecting Traders – Traders outside the Province
Type 4. Cultivators – Collecting Merchants – Traders outside the District

Marketing efficiency is a goal you want to achieve in a marketing activity. One approach that can measure marketing efficiency is operational efficiency as measured by marketing margins, farmer's share, and profit-to-cost ratio [18, 6].

Summary of the efficiency analysis results based on the type of catfish marketing chain in Banjar Regency is presented in Table 2.

The margin value of catfish marketing in Banjar Regency in the type 1 marketing chain is IDR 6,000.00; type 2 is IDR 7,000.00; type 3 is IDR 4,500.00 and type 4 for IDR 3,000.00 (Table 2). The value shows that the largest margin occurs in the type 2 supply chain because the selling price of catfish at retailers who get supplies from collecting merchants is higher than the selling price of catfish in retailers who get supplies from cultivators. Judging from the two patterns of marketing channels, it can be said that the increasing number of institutions involved in marketing activities will add value to each actor, the greater the marketing margin will affect the selling price at the consumer level so that the selling price will be higher. Marketing margins on type 3 and type 4 marketing chains were lower, as the study did not track selling prices from out-of-province and out-of-county merchants.

Table 2. Efficiency based on Patin Fish Marketing Chain Type in Banjar Regency

Businessmen	Type 1	Type 2	Type 3	Type 4
Cultivator				
- Selling price	19,000	19,000	19,000	19,000
Collector Merchant				
- Purchase price	-	19,000	19,000	19,000
- Selling price	-	21,500	23,500	22,000
Retailer				
- Purchase price	19,000	21,500	-	-
- Selling price	25,000	26,000	-	-
Traders outside the province				
- Purchase price	-	-	23,500	-
- Selling price	-	-	-	-
Traders outside the district				
- Purchase price	-	-	-	22,000
- Selling price	-	-	-	-
Final Consumer				
- Purchase price	25,000	26,000	-	-
Marketing margin	6,000	7,000	4,500	3,000
Share	76.0%	73.1%	80.9%	86.4%
Criteria	>40%	>40%	>40%	>40%
Category	Efficient	Efficient	Efficient	Efficient

Source: Primary data processed, 2021.

The farmer share value obtained in all types of catfish marketing chains in Banjar Regency

shows a figure of more than 40%, meaning that the catfish supply chain activities in Banjar Regency are efficient. Marketing efficiency is one of the indicators to determine the success rate of a supply chain [24]. The value of marketing efficiency is a percentage of the division of the total cost by the total value of the product. An efficient supply chain system can optimize profits and provide a fair share of the overall price paid by consumers to each supply chain actor.

CONCLUSIONS

The conclusions drawn from this study are: catfish cultivation in ponds in Banjar Regency has implemented good cultivation techniques starting from the preparation stage for cultivation in the form of pond soil processing, fertilization, seed stocking, feeding to harvesting activities. The catfish marketing system implemented so far is efficient in terms of marketing margins and farmer share value. Financially, the catfish farming business is feasible to run and develop.

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