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Article

Financial Feasibility Study of Tuna Fish Sauce Product Development with Bromelain Enzyme as Fermentation Catalyst

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Abstract

Indonesia has great potential in the fisheries sector, especially in processing tuna fish which has high economic value. However, most of the products are still marketed in the form of raw fillets without further processing. This study aims to analyze the financial feasibility of developing tuna fish sauce products using crude bromelain enzyme as a fermentation catalyst. This study uses a financial analysis approach with the Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP) methods to assess business profitability. The results of the analysis are expected to provide a comprehensive picture of the potential added value, cost efficiency, and business prospects of this fishery product diversification. Thus, this study can be an important reference in making investment decisions in the fishery product processing sector.

INTRODUCTION

Indonesia as an archipelagic country has enormous marine and fisheries potential. One of the leading commodities from this sector is tuna, which not only has high nutritional value but also has significant economic value. In West Sumatra, PT. Dempo Andalas Samudera is one of the companies that produces tuna fillets for export, with a production capacity of 21-30 tons per month. However, most of the products are still marketed in raw form (fillets), without further processing that can increase economic added value (KKP, 2020).

One form of product diversification that has high potential is the processing of tuna into fish sauce. Fish sauce products are high-value commodities that are in high demand, both in the domestic and international markets, especially due to the increasing trend of healthy food consumption (FAO, 2021). Processing tuna fillets into fish sauce not only has the potential to produce products with better nutritional quality, but also opens up opportunities for increasing economic value through downstream industries (Rahardjo & Nugraheni, 2022).

In the context of industrial development, one important aspect that must be analyzed in depth is the financial feasibility of the fish sauce production process. Investment in advanced processing requires careful consideration of cost structure, revenue projections, added value generated, and calculation of business feasibility through financial analysis methods such as Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP) (Gittinger, 1986). This analysis is needed to ensure that the tuna fish sauce processing business is economically feasible and can

compete in the market (Sugiarto et al., 2021).

The use of crude bromelain enzyme from pineapple as a catalyst in the fish sauce fermentation process also needs to be studied in terms of cost efficiency and effectiveness of the results. Although the use of pure enzymes has the advantage of accelerating the fermentation process, the high price is a major obstacle to its widespread application in small and medium-scale industries (Putra & Handayani, 2020). Therefore, the use of natural enzymes such as bromelain must be evaluated not only from a technical aspect, but also financially, to determine the extent to which its use is able to reduce production costs without reducing the quality of the final product.

Through a comprehensive financial analysis approach, the development of tuna fish sauce products can be directed to become a business that is not only strategic in terms of food security and nutrition, but also has profitable and sustainable business prospects (Yuliana et al., 2023).

EXPERIMENTAL SECTION

Materials

The main material used in this study was yellowfin tuna fillet obtained from PT. Dempo Andalas Samudera, Bungus Padang. The materials for making crude bromelain enzyme were queen pineapple obtained from Banda Buat Padang Market, NaCl salt, 90% ethanol and distilled water, and materials for other analyses.

Procedure

The data collection technique used in this study was to conduct a trial of the fish sauce production process with the help of bromelain enzyme to determine the needs of raw materials, machine tools, electricity, water, and other factors that affect the production process. From the trial of the production process, information and production data needed to calculate financial feasibility can be obtained. Semi-variable costs, capital/investment costs, fixed costs, production costs, variable costs, and other information related to the financial feasibility study of establishing a fish sauce business are important information.

Methodology

The information is transformed into tabulations, after which it is quantitatively assessed by using the financial feasibility incremental rate of return (IRR), analysis's break-even point (BEP), ratio B/C calculations, payback period, and net present value (NPV). The total production cost or total cost is calculated using fixed costs and variable cost data as follows:

$$\mathbf{TC = VC + FC} \qquad \mathbf{(1)}$$

Where :
TC = Total Cost
VC =Variabel Cost
FC = Fixed Cost

Assumptions are determined to aid in data processing, determining the Cost of Production (HPP), and cash flow. The assumptions consist of the number of working days of team members, the selling price of the product, the anticipated increase in production capacity, the cost of basic materials, and the duration of the project.

In investment expense cost calculations, fixed costs, variable-semivariable costs, and other costs are accounted for. Investment costs are the capital or expenses used to establish or expand a business. Variable expenses are incurred routinely by every production company, with the amount contingent on the number of products to be produced. Another type of expense that a business incurs routinely in the course of its production activities is fixed costs. However, the number of fixed expenses is unrelated to production capacity.

Installed or actual HPP capacity is computed by establishing the selling price among producers and computing revenue using the following equation (Idham, 2010):

HPP = Total Cost / Actual Capacity **(2)**

Revenue = Selling Price x Total production **(3)**

Determine the prospective development of financial flows by calculating cash flow. The analysis of financial viability comprises the following investment criteria. BEP is the quantity of production or sales required to recoup expenses or the point at which SMEs earn no profit.

$$\textbf{BEP Unit} = \frac{\textbf{FC}}{\textbf{P}-\textbf{VC}} \textbf{ or } \textbf{BEP Rupiah} = \frac{\textbf{FC}}{1-(\frac{\textbf{VC}}{\textbf{P}})} \quad \textbf{(4)}$$

Where :
FC= Fixed Cost
P= Selling price per unit
VC = Variable Cost per unit

A Net Present Value analysis s calculated using a Net Present worth analysis in order to account for changing currency prices. The difference between the current value of income and costs is known as net present value (NPV).

$$\boldsymbol{NPV} = \sum_{t=1}^{n} \frac{(Bt-Ct)}{(1+i)^t} \quad \textbf{(5)}$$

Where :
Bt = t-year gross receipts
N = Economic age
Ct = t-year gross cost
I = interest rate
Criteria used:
NPV > 0, the business is feasible to run
NPV = 0, the business returns the same amount of money invested
NPV < 0, the business is not feasible to run

The discount rate that shows the present value (NPV) of the whole project investment is the investment return rate, or IRR. A company concept is presumably viable when the Internal Rate of Return (IRR) number exceeds the Marginal Average Revenue Return (MARR). (MARR). The following formula may be used to determine the MARR:

MARR = (1 + i) (1 + f) - 1 **(6)**

Where :
i = investment interest rate
f = the highest inflation

Calculating the estimated repayment term for an industry's investment may be done using the payback time calculation. The payback period is the smallest amount of time required to recover the initial investment in cash flow, based on all revenues minus all costs.

$$\textbf{PBP} = \frac{\textbf{initial investment}}{\textbf{payback period}} \textbf{ x 1 year} \quad \textbf{(7)}$$

If the payback period for a business is less than or equal to the investment period, the firm is feasible. The value of receipts collected per rupiah spent is calculated by comparing total receipts to total expenses. If the B/C ratio is less than 1, the project is regarded as viable**.**

$$\frac{B}{C}\text{Ratio}\sum_{t=1}^{n}(Bt-Ct)/(1+IRR)^{t} \quad (8)$$

Where :
Bt = t-year gross profit
N = Economic age
Ct = t-year gross cost

RESULT AND DISCUSSION

1. Assumptions and Parameters for Financial Analysis

The feasibility analysis uses assumptions regarding process technology parameters and costs which can be seen in Table 1. These assumptions were obtained based on a study of the tuna fish sauce manufacturing process that was conducted in this study and compared with fish sauces circulating on the market.

Table 1. Assumptions for Financial Analysis

No	Assumption	Unit	Value/Amount
1	Project period	Year	3
2	Working month of the year	Month	12
3	Working days in a month	Day	14
4	Output, production and prices		
	a. Average fish sauce production per year	Bottle	20160
	b. Average fish sauce production per month	Bottle	1680
	c. Average fish sauce production per day	Bottle	120
	d. Average sales price of fish sauce/bottle	Rp	25.000
	f. Long wait for revenue	Month	2
	e. Yield of fish sauce per kg of fish	Bottle	8
	f. Fish needs/bottle of fish sauce	kg fish	0,13
5	Average labor requirement per month	People	5
6	Input use and price		
	a. Average fish raw material requirements per year	Kg	2.520
	b. Average purchase price of fish raw materials per year	Rp/kg	50.000
7	Interest rate per year	%	14
8	Capital Proportion:		
	a. Credit	%	40
	b. Own capital	%	60
9	Investment Loan Term	Year	3
	Working capital loan term	Year	1

The tuna fish sauce business is assumed to be carried out by a group with a monthly fish sauce production of 1,680 bottles of 500 ml which will be worked on by 5 workers, assuming an average of 14 working days per month.

This assumption is taken because the fish sauce making process is carried out continuously with a fermentation process of 20 days so that for the day after the initial product fermentation there is still product to be produced on the next day. Determination of the project age for 3 years is based on the economic life of the equipment used, a maximum of 3 years.

2. Cost Components and Structure

The cost components in the feasibility analysis of tuna fish sauce processing business are divided into two, namely investment costs and operational costs. Investment costs are cost components needed to meet the initial funding needs for production activities which include production equipment. Operational costs are costs that must be incurred in the production process.

a) Investment Costs

The investment costs required in the initial stage of the tuna fish sauce production process are used for the provision of production equipment and other equipment and buildings amounting to Rp 174,000,000.00, consisting of supporting equipment, land and production buildings in producing tuna fish sauce. Investment costs can be seen in Table 2.

Table 2. Requirements for Machines, Production Equipment, Land and Buildings for Tuna Fish Sauce Production

No	Cost Component	Unit	Physical Quantity	Price/unit (Rp)	Total cost (Rp)	Economic life (year)	Deprecitation value (Rp/ bulan)
1	Production and Packaging Equipment						
	a. Pressto	Unit	8	550.000,00	4.400.000,00	3	1.466.667,00
	b. Basin	Unit	10	100.000,00	1.000.000,00	3	333.333,00
	c. Scales	Unit	2	750.000,00	1.500.000,00	3	500.000,00
	d. Pressing and filtering	Unit	2	1.500.000,00	3.000.000,00	3	1.000.000,00
	e.Blender	Unit	2	1.000.000,00	2.000.000,00	3	666.667,00
	f.Fermenter	Unit	10	910.000	9.100.000	3	3.033.333

b) Operational Costs

Operational costs in the tuna fish sauce processing business include variable costs and fixed costs. The average total operational costs per month are Rp24,619,071.33 or in one year Rp295,428,856 with the assumption that since the first month this business has been able to operate fully with a capacity of 100%. The operational costs per year consist of variable costs of Rp250,428,856 and fixed costs of Rp45,000,000.00.

Table 3. Composition of Operating Costs

No	Cost Component	Average Monthly	Yearly
1	Fixed Cost	Rp 3.750.000	Rp 45.000.000
2	Variable Cost	Rp 20.869.071,33	Rp 250.428.856
3	Total Operating Expenses	Rp 24.619.071,33	Rp 295.428.856

3. Investment Fund and Working Capital Needs

The total initial project cost requirement for investment is Rp183,100,000 and Rp73,240,000 (40%) comes from bank credit, with a loan period of 3 years and an interest rate of 14% per year. Working capital needs are calculated based on production needs for 2 months where the operational costs per month are Rp24,619,071.33 or Rp49,238,142.66 for 2 months. The determination of the time period is based on the calculation of the processing time of tuna fish sauce until the product is sold. As much as 40% or Rp19,695,257 of the planned working capital needs come from credit, with a loan period of one year and an interest rate of 14%. Details of project needs and financing sources can be seen in Table 4.

Table 4. Components and Structure of Project Cost Requirements

No	Project cost components	Persentase	Total cost (Rp)
1	Investment cost		Rp183.100.000,00
	a. Credit	40%	Rp73.240.000
	b. own capital	60%	Rp109.860.000

2	Working capital cost		Rp49.238.142.66
	a. credit	40%	Rp19.695.257 Rp
	b. own capital	60%	29.542.886
3	Total Project cost		Rp 295.428.856
	a. credit	40%	Rp 118.171.542.4
	b. own capital	60%	Rp 177.257.313.6

The entrepreneur's obligation to make principal and interest installments is carried out every month during the credit period.

4. Production and Income

Based on the existing capacity, the production of fish sauce processing business per month averages 1,680 bottles. This business is projected to be able to produce throughout the year (12 months) with a production volume of 20,160 bottles per year, with an average selling price of fish sauce per month of Rp 25,000.00 per bottle. So for one month of production it is projected to earn an income of Rp 504,000,000.00 per year. Projected production and business income and selling prices are presented in Table 5.

Table 5. Production and Revenue Projections

Product	Total/year
Total product (botol)	20.160
price per bottle (Rp)	25.000,00
Total (Rp)	504.000.000

5. Projection of Business Profit and Loss and Break Even Point (BEP)

Projection of business profit and loss shows that the tuna fish sauce processing business has generated an average annual profit of Rp152,335,932 with an average profit on sales value per month of 30.23%. The summary of the profit and loss projection data can be seen in Table 6.

Table 6. Projected Business Income and Profit and Loss

No	Description	Average per Year
1	Income (Rp)	504.000.000
2	Expenses (Rp)	324.781.256
3	Profit/loss before tax (Rp)	179.218.744
4	Tax (15%) (Rp)	26.882.812
5	Profit after tax	152.335932
6	*Profit on sales* (%)	30.23
7	BEP : Rupiah	179.218.744
	%	35.56

Comparing the expenditure for fixed costs to variable costs and total revenue, the BEP for this business occurs at sales worth an average of Rp179,218,744 or 35.56% of the production capacity per month.

6. Cash Flow Projection and Project Feasibility

Cash flow in data analysis on the tuna fish sauce project is divided into two flows, namely cash inflow and cash outflow. Inflow is obtained from the sale of fish sauce for one year. Outflow includes investment costs, variable costs, and fixed costs, including principal installments, interest installments and income tax.

Evaluation of the profitability of the tuna fish sauce business plan is carried out by assessing the business feasibility criteria, namely NPV (Net Present Value) and Net B/C Ratio (Net Benefit-Cost Ratio). The tuna fish sauce processing business using the existing assumptions gets an NPV value of Rp176,711,530 with an IRR (Incremental Rate of Return) of 61% and a Net B/C of 2.01 times, this can be seen in Table 7. Based on the existing criteria or assumptions, it shows that this business is feasible to be implemented with a Pay Back Period (PBP) of 2 years or the capital invested in this business can be returned before the project ends (3 years).

Table 7. Feasibility of Tuna Fish Sauce Processing Business

No	Criteria	Value	Justification of eligibility
1	NPV (14%)	Rp 176.711.530	>0
2	IRR	61%	>14%
3	Net B/C ratio	2,02	>1
4	Pay Back Period	2 years	< 3 years

CONCLUSION

Based on the results of the economic feasibility analysis of tuna fish sauce with the addition of crude bromelain enzyme using existing assumptions, the Net Present Value (NPV) value is Rp 176,711,530 with an Incremental Rate of Return (IRR) of 61% and a Net B/C of 2.02 times. Based on the existing criteria or assumptions, it shows that this business is feasible to be implemented with a Pay Back Period (PBP) of 2 years or the capital invested in this business can be returned before the project ends (3 years).

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