Financial Feasibility Analysis of Using Fish Drying System to Improve the Efficiency of Salted Fish Production with the Hybrid Method

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ABSTRACT
Increasing efficiency in the salted fish manufacturing process is a challenge that needs to be overcome in order to support the sustainability of the fisheries industry. This study aims to analyze the financial feasibility of using a hybrid-based fish drying system as an innovative solution to optimize the drying process. The hybrid approach integrates traditional and modern technologies that can improve time efficiency, product quality, and reduce operational costs. The research method includes technical aspect evaluation, cost and benefit analysis, and measurement of economic impact on business actors. The results of the study indicate that this system has significant potential in improving the efficiency and profitability of small and medium enterprises in the salted fish processing sector, with a profitable cost benefit ratio. These findings are expected to be the basis for the wider application of hybrid technology in the fish processing industry, while supporting the development of the local economy. The dryer can prevent dust, dirt, and flies from sticking to fish. Drying fish using a solar dryer can speed up the drying time by up to 4 hours compared to traditional drying (Hantoro, et al., 2018). requires a high initial investment for the community. This study is to help the community consider investing in fish drying equipment in terms of financial feasibility with the criteria of Break Even Point (BEP), Net Present Value (NPV), Payback Period (PP), and Incremental Rate of Return (IRR). The data collection method for this study is a literature study and field observation, to determine the design of the fish drying equipment, drying time, and the percentage of water content reduction in fish, by collecting information on investment costs, production costs, variable costs, fixed costs, labor costs. The sample in this study were Small and Medium Enterprises and those responsible for salted fish production. From the results of the calculation of the breakeven value/Break Event Point quantity (Q) and price (P), the results were 647.83 kg or Rp36,677,792. The use of a fish drying system with a hybrid method is feasible to implement because the NPV is more than 0. In addition, the B/C ratio is more than 1, the PP result is one year and four months and the IRR obtained is 6%, meaning that the decision on the financial feasibility analysis in using a salted fish drying system with a hybrid method is feasible to be implemented to increase the efficiency of salted fish production in the Brondong Paciran Lamongan area.

Keywords: *Financial Feasibility, Drying equipment system, Production efficiency, Hybrid Method.*

1. INTRODUCTION

The salted fish processing industry plays an important role in supporting the economy of coastal communities, especially in Indonesia which is known as a maritime country. Indonesia is located at 94o 40' BT-141o BT and 6o LU – 11o LS. Indonesia is also located between the Pacific Ocean and the Indian Ocean and between the Asian Continent and the Australian Continent. Indonesia as the largest archipelagic country in the world, has around 17,508 islands, and 81,290 coastlines united by a sea area of 5.8 million km2. Indonesia has enormous potential for fishery resources. This potential is divided into 2, namely sustainable potential and potential that can be utilized. For sustainable potential, capture fishery resources in Indonesia are 6.4 million tons per year. The potential that can be utilized is 5.12 million tons per year (Yahya, 2001). For the East Java region, the amount of production and proportion of fish per year is 338,915.2 tons. The production and proportion of fisheries in Lamongan regency are 99,415.6 tons per year (Lamongankab.BPS, 2023). The types of fish that are usually dried are mackerel, squid, small mackerel, blambangan fish, and anchovies in Lamongan regency which is located in the northern part of the Java Sea. The total land area of Lamongan Regency is 1,812.8 km2 and the water area is 902.4 km2 (Lamongankab, 2021). The water area is used as the main land to meet the daily needs of the surrounding community, where the area covers two sub-districts, namely Brondong sub-district and Paciran sub-district. So that the average community in Brondong and Paciran sub-districts

works as fishermen. the total population working as fishermen is 14,036 people (Lamongankab.BPS, 2023) (Bpslamongankab.go.id, 2016). According to Daryanto (2007), resources in the fisheries sector are one of the important resources for the livelihood of the community and have the potential to be used as the main driver (prime mover) of the national economy. Indonesia's great potential in the fisheries sector is expected to become a leading sector of the national economy. The drying system is one of the preservation methods by reducing the water content contained in a material to a certain water content. The water contained in fresh fish is 70-80% of the weight of the fish (Prasetyo, 2013). There are many experiments on solar-powered fish drying devices, by drying fish using a tool that utilizes the heat of sunlight to the maximum. In addition, by using a drying tool to avoid dust, dirt, and flies sticking to the fish. Drying fish using *a solar dryer* can speed up the drying time by 24 hours compared to traditional drying (Taviv, 2018). The traditional drying process that is still widely used often faces various obstacles, such as dependence on weather conditions, long drying times, and the risk of contamination. These obstacles not only affect production efficiency, but also the quality and selling value of the final product. Along with the development of technology, a drying system based on a hybrid method has emerged as a potential solution to overcome these challenges. The approach using a

hybrid method combines modern technology with a traditional approach, which aims to increase efficiency, reduce operational costs, and maintain product quality. A hybrid dryer is a dryer that utilizes solar energy with other energy such as electricity, fuel. It is called hybrid because the two energy sources work together to help each other in the drying process. Energy waves from the sun's rays will fill the room through the collector glass. The waves will be transmitted to all parts of the dryer where all components in the room can radiate energy, so that the temperature in the fish dryer can increase. The electricity in this dryer is used to turn on the blower with the aim of removing moisture in the drying room. Water Content in Dried Fish. Direct utilization of solar energy can be increased by using heat collectors called collectors. Heating systems using collectors have various types, such as from mirror collectors and flat collectors that absorb heat.

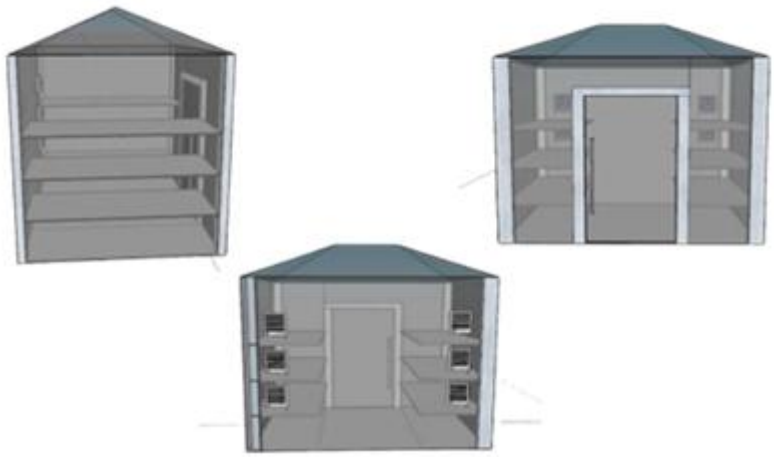

Figure 1 Fish Drying Place

The direct heating system has an efficiency of 30-40% (Erlinawati, 2013). Before this technology can be widely applied, a financial feasibility analysis is needed to ensure that investment in this system provides significant economic benefits for business actors. This study aims to examine the financial feasibility of using a hybrid-based fish drying system in the salted fish production process. Thus, this study is expected to contribute to the development of a more efficient and sustainable fish processing industry.

2. RESEARCH METHODS

This study uses the stages of research methods in conducting financial feasibility analysis with a fish drying system using the Hybrid method as follows:

1. Calculate investment costs
2. Production costs
3. Financial structure
4. Sales estimates

5. Production cost estimation
6. Cash flow
7. Financial feasibility analysis (BEP, NPV, IRR, PBP, and B/C ratio)

Financial feasibility is an evaluation process to determine whether an investment or project is financially feasible (Puji et al, 2024). In this analysis, the elements that are usually considered include: Income that will be generated from the investment, costs required to run and manage the project, financial risks that may arise. Time Value of Money such as NPV (Net Present Value), IRR (Internal Rate of Return), or Payback Period to analyze the return on investment. Before entering the financial feasibility analysis method, variable cost and fixed cost data are needed. Variable costs are costs that are routinely incurred every time a production effort is carried out where the amount depends on the number of products to be produced (Ardana, 2008). Fixed costs are other types of costs that are routinely incurred by the company as long as the company carries out production activities, but the amount of fixed costs does not depend on production capacity, to find out the total production cost or total cost, with the following calculation:

$$TC = VC + FC \quad (1)$$

TC = Total Cost

VC = Variable Cost

FC = Fixed Cost

Investment costs are a sum of capital or costs used to start a business or develop a business (Pujawan, 2008). The calculation of HPP (cost of goods sold) is done by setting the selling price among producers and calculating revenue through the following equation (Pujawan, 2008). The calculation uses the following formula:

$$HPP = TC / Capacity\ Actual \quad (2)$$

$$R = \text{Price (P) x Total production (Q)} \quad (3)$$

2.1. BEP (Break Even Point)

The Break Event Point (BEP) method is used to determine the breakeven point where expenses and income are in the same amount so that there is no profit or loss. BEP is often referred to as breakeven analysis, according to (Kusuma, et al., 2014) the formula used to determine the breakeven value is as follows:

$$BEP\ (Q) = FC / (P - VC) \quad (4)$$

$$BEP\ (P) = FC / (1 - (TC / TR)) \quad (5)$$

FC = Total fixed costs

VC = Variable cost per unit of product

TC = Total Cost

TR = Total revenue

P = Selling price per unit of product

Q = Number of Product Units

2.2. Net Present Value (NPV)

The Net Present Value (NPV) method is a method carried out by comparing the present value of net cash inflows (proceeds) with the present value of the costs of an investment (outlays). Therefore, to calculate the feasibility of an investment using the NPV method, data on initial cash outflows, future net cash inflows, and the desired minimum rate of return are required (Giatman, 2022). The Net Present Value (NPV) formula is as follows:

$$NPV = -C_0 + \Sigma\ (C_i / (1 + r)_i) \quad (6)$$

C_0 is the initial cost of the investment, C_i is the cash flow in year i, and r is the discount rate. NPV calculates the present value of future cash flows after taking into account the interest rate.

The criteria for the NPV value according to (Pujawan, 2008) is that if the NPV value is > 0 then the business is worth running, if < 0 the business is not worth running.

2.3. Payback Period

Pay Back Period (PBP) shows how long the invested capital will be returned. This return on capital is seen from the cash inflow. An investment is accepted or feasible if the payback period is lower than the time required. If alternative cash flows are obtained from the proposed business again, the alternative that provides the shortest period is the best (Harahap, 2002).

$$Payback\ Period = Investment\ /\ Proceeds \quad (7)$$

The initial investment value with the net cash flow received from the investment each year. In this formula, it is assumed that the amount of cash received each year is constant. If the cash flow is not always constant. If the cash flow changes from year to year, the Payback Period formula can be calculated as follows:

$$\text{Payback Period (PP)} = n + (a - b) / cx\ 1\ \text{year} \quad (8)$$

n = investment payback period.

a = cumulative amount of cash flow in the last year (n).

b = cash flow in the year following the cumulative year of current cash flow (n + 1).

c = the difference between the cash flow in the last year (n) and the cash flow in the following year (n+ 1).

2.4. Internal rate of return (IRR)

Internal Rate of Return (IRR) is used to calculate the interest rate of income. The IRR of investment rate is the prevailing interest rate (discount rate) that shows the present value (NPV) equal to the total amount of project investment. A business plan is said to be feasible when the IRR value is greater than the Marginal Average Revenue Return (MARR), (Kusumanto, 2008)

$$MARR = (1 + i)(1 + f) - 1 \quad (9)$$

i = investment interest rate

f = inflation highest **Benefit Cost Ratio (B/C)**

The calculation of the B/C ratio is a comparison between total revenue and total costs, which shows the value of revenue obtained from each rupiah spent. The project is declared feasible if the B/C ratio >= 1, to calculate the Benefit Cost Ratio, the data needed is the total costs incurred, and the income earned per year. More clearly, here is the mathematical formula for calculating the B/C Ratio.

BCR = Benefit Cost Ratio

FI = Total Income (Rp)

TC = Total Cost (Rp)

If the B/C Ratio is more than 1, then the benefits of the project are greater than the expenses so the project can be accepted or is worth continuing. If the B/C Ratio is less than 1, then the benefits of the project are less than the expenses, so the project is not feasible and needs to be reviewed. If the B/C Ratio is equal to 1, then the profits and expenses are said to be balanced or break even. The calculation of the B/C ratio is a comparison between total revenue and total costs, which shows the value of revenue obtained from each rupiah spent. A project is declared feasible if the B/C ratio >= 1.

$$Bt = 1\ (1+IRR)\ t \quad (10)$$

Bt = Gross profit in year t

N = Economic age

Ct = Gross cost of year t

3. RESULTS AND DISCUSSION

Table 1. Cost Analysis Making Fish drying tool

No	Price Material	Volume	Unit	Price per Unit	Total Price
1	Hollow Aluminum size 20x10	6	Stem	Rp 250,000	Rp 1,500,000
2	List U	8	Stem	Rp 60,000	Rp 480,000
3	Hollow Aluminum size 3x4	12	Stem	Rp 60,000	Rp 720,000

No	Price Material	Volume	Unit	Price per Unit	Total Price
4	Hollow Aluminum size 5 x 6	1	Stem	Rp 140,000	Rp 140,000
6	Net Aluminum	15	m2	Rp 40,000	Rp 600,000
7	Glass size 6mm	43.125	m2	Rp 150,000	Rp 6,468,750
8	Blower (Exhaust fan)	6	seed	Rp 300,000	Rp 1,800,000
9	Service Making And installation	1	Ls	Rp 1,820,000	Rp 1,820,000
Amount					Rp 13,528,750

From the total analysis cost investment Rp. 13,528,750 mentioned above accumulated costs depreciation of equipment per month Rp. 255,479 per month. With cost maintenance 10% from cost depreciation which is Rp. 25,500 per month.

Table 2. Costs Operational

No	Price Material	Amount	Unit	Cost/day	Cost /Month
1	Wet fish	50	kg	Rp 750,000	Rp 22,500,000
2	Salt	8	Kg	Rp 32,000	Rp 960,000
3	Cost Electricity	3.24	kWh	Rp 6,480	Rp 194,400
4	Cost Power Work	10	Person	Rp 250,000	Rp 7,500,000
Amount				Rp 1,038,480	Rp 31,154,400

Based on predetermined assumptions and technical parameters, the fish production capacity dry using a tool of 1050 kg per month with a selling price/kg of Rp 56,616. Price determination The sale is calculated from the production cost of Rp. 35,385 plus a profit of 60% of the production cost. production. From the calculation of dried fish product sales, the income/month is Rp. 59,447,040. The sales proceeds will be reduced by the capital price, tax calculations, and maintenance costs tool for get total net profit.

Table 3. Details Price Sell

No	Details	Amount
1	HPP	Rp 35,385
2	Margin 60%	Rp 21,231.09
		Rp 56,616

3.1. IRR and MARR

Based on criteria eligibility on IRR, if IRR not enough from MARR so can it is said No worthy, And conversely, if the IRR is greater than MARR then the business can be said to be feasible. *Discount factor* or something also known as *Marginal Average Revenue Return* (MARR) the value used is 9.46%, referring to equality 7, Where mark ethnic group flower loan from bank as big as 14% per year And inflation highest year 2025 is 3.69%. In the application of the hybrid method fish drying tool, it can be said to be feasible because the IRR value is greater big from MARR or 14% > 9.46%.

3.2. BEP (Break Event Point)

To find out the break-even point where expenses and income are the same amount so that there is no profit or loss. Projection profit and loss done For know level profitability from plan activity investment. Calculation profit and loss got from difference reception And expenditure. From calculation profit and loss plan investment tool For The implementation of the hybrid fish drying machine produces a profit of Rp. 19,614,970 per month. Break-even point is a point in the amount of production or sales that must be made so that the costs incurred can be covered. covered back or the value where the profit received by the SME is zero. From the calculation of the break-even value/BEP The results obtained: the feasibility of investing in a fish drying machine using the hybrid method can be done when producing and selling dried fish. as many as 647.83 kg or worth Rp. 36,677,792.

Table 4. Projections There Loss (L/R)

No	Description	Avg	
1	Revenue	Rp	59,447,040
2	Charge Operational	Rp	37,154,400
3	There dirty	Rp	22,292,640
4	Charge depreciation	Rp	225,479
5	Profit hit tax (11%)	Rp	19,840,450
	Rp. 2,452,190.40		
6	Profit clean	Rp	19,614,970
	Profit margin		33.00%

3.3. Cash flow And Eligibility Criteria

Table 5. Flow Cash and Criteria Investment

Cash Flow Year	Cash Flow (Rp)	
0	-Rp	13,528,750
1	Rp	183,884,770
2	Rp	206,612,928
3	Rp	219,006,761
NPV	Rp	541,243,268
IRR		6%
MARR		9.46%
Ratio B/C		1.55
Payback period		14 Months
Keputusan	Layak	

Based on the cash flow and eligibility criteria above, which shows the cash flow for 3 years and also the eligibility criteria such as NPV, MARR and IRR, B/C Ratio and Payback Period. Based on the NPV criteria, the application of this tool can be done because the NPV value is greater than 1, it is feasible to do. The feasibility criteria for the B/C ratio are the value is greater than 1, while the calculation results show 1.55, so the application of the tool can be said to be worthy. The final criterion is the payback period criterion, which can be said to be feasible if the time the return is faster, in the application of hybrid powered fish dryers, a period of time is needed return for 14 month.

4. CONCLUSION AND SUGGESTIONS

Conclusion from results calculation analysis eligibility financial from implementation tool dryer fish method hybrid is as follows:

1. Mark average IRR more big from MARR that is 14 > 9.46, so implementation tool dryer fish This can said to be worthy
2. Based on criteria eligibility NPV (*Net Present Value*) implementation tool dryer fish can it is said worthy because of value NPV more bigger than 0
3. Based on criteria eligibility B/C ratio obtained results calculation 1.55, It means system usage fish dryer said to be worthy because more from 1
4. Time Which needed For return or payback period is 14 month,

Suggestion in study furthermore that is, can done analysis eligibility with compare income results drying manual and the results drying use tool dryer method hybrid.

REFERENCE

Eternal, N. I. (2020). Analysis Performance Tool Dryer Fish Power Sun Studies Case in Bawean. *Thesis* i. University International Cement Indonesia.

BSN.go.id. (2022). Indonesian *National Standard* , Retrieved from https://www.bsn.go.id/main/sni/isi_sni/5 .

Daryanto, A. (2007). From Clusters Towards Increasing Competitiveness of the Fisheries Industry. January Edition Erlinawati. (2013). Technique Burning. Polytechnic Country Srivijaya.

Fauzy, AT (2019). Design of a fish drying room based on thermal collectors and solar panels. Gresik: *Thesis* , University International Cement Indonesia.

Garist S. T, RA Djazuli, and O. Wijaya (2022), feasibility of salted fish processing business using solar cell drying machine (Case Study: Tanjung Binga Village, Sijuk District, Belitung Regency), *AgribiSains Journal* . Vol. 8:

(2); 34-41.

Giatman, M. (2022). *Engineering Economics* . First edition, first printing of Rajawali Press.

Harahap. (2002). *Accounting Theory of Financial Report* . First edition, first printing Bumi Aksara

Lamongan Regency. (2021). Retrieved from Lamongankab.go.id: Lamongankab.go.id

Lamongan Regency.BPS. (2023). *Subdistrict Couple And Youngster in Number.* Retrieved from *https://lamongankab.bps.go.id/publication/2023/09/26/e37f41bf5840e7ea18c0f61c/kecamatan-paciran-innumbers-2023.html*

Lamongan district.fisheries. (2022). *Service Fishery Regency Lamongan* . Retrieved from *https://lamongankab.bps.go.id/publication/2023/09/26/e37f41bf5840e7ea18c0f61c/kecamatan-paciran-innumbers-2023.html*

Prasetyo, D. (2013, October 10). *Chemical Composition of Fish.* Retrieved from Blog Universitas Brawijaya: http://blog.ub.ac.id

Poetry, I. N. (2008). *Economy Technique.* Second edition, Institute of Technology, November 10. Raja Wali Press.

Puji, AA, ZH Zen, HT Hinggo, PD Annisa, SM Afraah, M. S, R. Rayendra, R. Nasirly, AM Putri, M. Rachman, RN Kartika. (2024) *Business Feasibility Study* , first edition, Wedina Media Utama, Bandung.

Taviv. (2018). Experiment Drying Fish Use Method Hybrid with Collector Thermal and Suryadi Panel Village TPI Mud Gresik. *Thesis.* Gresik.

Younce M B, d. (2013). Construction And CapacityTools Dryer Fish Power Sun with System Overhaul. *Journal Media Results Fisheries* , Vol 1, (2) :40-43.