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Feasibility Study of Potential Utilization of Tofu Industry Waste Into Cat Fish Feed

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Abstract

Cat fish is one of preferred food for most Acehnese people, particularly in Lhokseumawe regions. This is the motive of most people are interested in cultivating such fish; beside the selling price is relatively high, it also has increasing ramp of demand every year. In order to meet the increasing demand, the fish farms are in need of appropriate feed aiming for upgrading cat fish growing rate. Around Lhokseumawe region, despite of numerous tofu industries the dregs are still not well utilized. The waste of tofu industries, which is tofu dregs, functions as cat fish feed. Tofu dregs made cat fish feed has numbers of advantages, such as accelerating the fish growth until 17-18%. This is due to the coarse fiber protein contain to be 7.11%, fat 4.93% and BETN 44.50%. Beside its nutritional advantages as alternative cat fish feed raw material, tofu dregs as cat fish feed material should be examined in technical and financial aspects so that it is guaranteed to be implemented. Hence, in this research the feasibility study was conducted on technical aspects of processing solid tofu dregs to be cat fish feed by using BEP and PP analysis methods. According to Payback Period (PP) value, the business has three months and six days period of time in order to return the initial investment capital. The production rate in one months must be above 542 kg in order to avoid from being lost. With the existing production capacity (1.092 kg/month), the cat fish feed price must be above IDR 6.116/kg in order to cover all expenditure in the time period.

Keywords: BEP; Fermentation; Livestock Feed; Payback Period; Tofu Dregs

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1. Introduction

Tofu industries are commonly available not only in Indonesia but also in other south east Asia countries. Lhokseumawe as one of the most populated regions in Aceh has several tofu industries that acts as supplier to surrounding region. In spite of its high protein content that is useful, the waste from production process usually becomes environmental problems (Hartami & Rusydi, 2016). Lhokseumawe city offers high potential of income for its people in fisheries; one of them is cat fish farming that its consumption rate is increasing. Cat fish farming is developing steadily due to its disease resistance, high tolerance to varying environmental conditions, high quality of meat, relatively high growing rate and capability to be farmed in highly dense environment. With the growing rate 17-18%, it is expected higher rate to reach 38% target.

Tofu dregs has been known as a good pellet substitution. Tofu dregs that is the tofu production residue contains high nutrition especially protein, beside carbohydrate, fat and fibers. Thus, it is potential to be utilized for cat fish farming feed substitution. As it is known, there are two types of cat fish feed; natural and synthetics. Natural feed is meat and vegetable residue, while synthetic feed is the mixture of substances that are rich in nutrition such as tofu dregs, bran, fish flour and water hyacinth (Efawani et al., 2019). In order to synthesize cat fish feed, tofu dregs usually are combined with other alternative materials. Several researches combining tofu dregs with other materials are as follows. Hartami & Rusydi (2016) reported that tofu dregs was found to be the most effective substitution for industrial pellets in utilizing

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nutrition and fish growing rate. Nur Anggraeni & Rahmiati (2016) tried to combine tofu dregs with other three materials; fish head, shrimp and bran aiming for evaluating growing level and fish life. In the community service activity, evaluated feed production capital and the harvesting period using combination of tofu dregs and water hyacinth combination as feed. The utilization of tofu dregs as cat fish feed was found to cut the expenditures by 50 to 60%, reducing farmers dependency on industrial feed (Sari et al., 2014).

Payback period (PP) is a period of time that is necessary to cover all capital invested (Gallo, 2016). payback period can also be understood as the the time period for the return of investment through profit. This analysis is usually applied on large and small investments. The advantages of this analysis area time period investment return information, simple and considerable number of risks are considered. This analysis method also assists in deciding on business to be invested (Lin et al., 2015) beside upgrading existing proses to be more efficient (Yang, 2018).

Break Even Point (BEP) is the condition when a company's income equals to its capital invested; no profit or loss. Break Even Point is used to have the projection on how much money must be made by the company in order to prevent from being lost (Sayuti, 2008) or analyzing number of units being produced to be at the balanced condition (Potkany & Krajcirova, 2015; Sayuti et al., 2019). BEP analysis can also be conducted for economic analysis considering environmental aspect (Cottafava et al., 2021).

Considering past researches, the utilization of tofu dregs as cat fish feed in Lhokseumawe region is considerably potential. Hence, in this research its economic feasibility of tofu dregs utilization as feed pellet substitution material for cat fish farm to industrial pellet.

2. Methodology

This research was done at campus with area 100 m2 (10 m x 10 m). no specialized building was necessary during the research. The main need was place for drying under the sun. production and observation process were conducted on 10 kg tofu dregs as raw material usage in one production cycle and produced 21 kg ready used cat fish feed. One production cycle took 8-12 days, depending on daily temperature and fermentation period decision.

2.1. Feed Production Process

1) **Pellet Dough Production**. The first step was to produce cat fish feed dough with tofu dregs as raw material. The purpose of making it was to achieve pellet raw material, which is the dough, with proper composition for cat fish feed. The dough making is crucial in the pellet production process since the produced pellet depends on the dough quality and ingredients. The procedure in making the dough was by mixing the main raw materials; pellets and bran with supporting raw materials such as pro-biotics, molasse, yeast, fish and shrimp paste. Bran is side products/waste from rice process. Its nutrition is high, that has protein 11.3-14.4%, fat 15-19.7%, fiber 7-11.4%, carbohydrates 34.1-52.3% and ash 6.6-9.9% (Wizna & Muis, 2012). Bran nutrition can be rich by utilizing bacteria as inoculum fermentation and nutrition supplement. Bran assists the feed texture to be better and acts as additional source of protein, fat, calcium and phosphor. Pro-biotics is agricultural culture technology aimed to upgrade health and fertility of lang and plants by utilizing microorganisms that benefit plant growth. EM4 is mixture of microorganism from Indonesia nature, favorable for lant fertility and plant, and environment friendly. EM4 contains fermentation microorganism and synthetics consists of lactic acid bacteria (Lactobacillus Sp), fotosynthetic bacteria (Rhodopseudomonas Sp), Actinomycetes Sp, Streptomyces Sp, yeast and cellulose breaking down fungi for soil organic material fermentation process.
2) **Dough Fermentation**. In food management, beside feed preference, application of fermentation process before being used to increase its digestive value also used as technics in food processing. Fermentation is carbohydrates and amino acid breaking down process in anaerobic condition. Enzymatic activity is what makes the chemical change in the food during fermentation process (Rachmadiarti et al., 2019). The aim of fermentation process is to cut protein peptide bond in protein long bond so that bacteria colony develops by consuming the protein so that the nutrition of the food increases (Abdul Kari et al., 2021; Wang et al., 2021). In this research, the fermentation process was conducted by adding 40 ml pro-biotics and 0.5 units yeast in one kilogram of tofu dregs then placed in isolated vessel for 7-10 days.

3) **Pellet Moulding**. Having the dough fermented, the wet dough was moulded to be pellets. The motor was a modification of mincemeat machine that worked in 220 Volt voltage assembled with blade and the machine support framework. After the observation, the machine was capable of moulding 5-6 kg of fermented cat fish feed pellet.

4) **Pellet Drying**. The moulded pellets were then naturally dried under the sun. This process took one to three days. The dying process was aimed to increase the pellet preservation. Dried feed can withstand in dry condition up to two months. Moreover, the more dried the pellet, the longer floating time of pellet in water (Anam et al., 2019; Kurniawan & Lestariadi, 2017; Yulianto, 2018). The only obstacle during this process was animal pest disturbance attracted by the smell of the pellets.

2.2. Break Even Point (BEP) Calculation

1) **Total Cost (TC) Calculation**. Total cost is the total capital needed to produce readily selling cat fish feed. Total cost consists of fixed cost (FC) and variable cost (VC) (Pujawan, 2009). Total cost for utilizing tofu dregs into cat fish feed was calculated with equation (1).

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

where:

TC : Total Cost (IDR /month)

FC : Fixed Cost (IDR /month)

VC : Variable Cost (IDR /month)

2) **Total Revenue (TR) Calculation**. The revenue in this business is achieved through produced and sold products with certain selling price. Total revenue was calculated by multiplying produced products in one month period with its selling price. Total revenue was calculated with the following equation.

$$TR = P \times Prod \quad (2)$$

where:

TR : Total Revenue (IDR/month)

P : Cat fish selling price (IDR/Kg)

Prod: Amount of tat fish feed produced in one month period (Kg/month)

3) **Production BEP Calculation.** Production BEP wass calculated in order to comprehend the minimum cat fish feed had to be produced to cover all capital expenditure by selling the products. Production BEP was calculated with equation (3).

$$BEPprod = FC/ (P – VC/Prod) \quad (3)$$

4) **BEP_{Rupiah} Calculation**. BPEP calculation is conducted aiming for revaling the selling price with current production capacity covering all capital expenditure. BEP rupiah value was calculated by using equation (4).

$$TR = TC$$

$$P \times Prod = FC + VC$$

$$BEP_{rupiah} = P = (FC + VC)/Prod \quad (4)$$

2.3. Payback Period (PP) Calculation

1) **Total Commencing Investation (FC) Calculation**. Total Commencing Investation is calculated by summing all expenditures that are categorized as fixed costs. The commencing investment includes machine buying cost and tools that are used more than one times.

2) **Net Income (NI) Calculation**. The amount of net income is determined by reducing the total cost in a month from revenue in the same period of time. Net income in producing cat fish feed is determined with equation (5).

$$NI = TR – VC – FC + Depreciation \quad (5)$$

3) **Payback Period (PP) Calculation**. Payback period implies necessary period for a business to return all commencing investment. The assumption made in the calculation is uniform mothly rate income and cost in one year. The payback period was calculated according to equation (6).

$$PP = FC / NI \quad (6)$$

3. Results and Discussion

3.1. Feed Processing

One designed production batch needed 10 kg of tofu dregs as raw material and 10 days for fermentation to produce 21 kg cat fish feed. In one day, two batches production was able to be conducted, hence with 26 days of working days in one month could produce 1092 kg of cat fish feed.

3.2. Break Even Point (BEP) Analysis

1) **Total Cost (TC) Calculation**. Total cost in producing cat fish feed consists of fixed cost and variable cost. Using equation (1), total cost was calculated and TC was found to be IDR 6.678.333/month.

TC = FC + VC

TC = 2.024.333 + 4.654.000

TC = IDR 6.678.333/month

Table 1. Operational Cost Details

NO.	COST	QTY	PRICE	TOTAL
I	**Fixed Cost**			
1	Employee 1 Salary	1	1.000.000	1.000.000
2	Employee 2 Salary	1	800.000	800.000
3	Maintenance	1	200.000	200.000
4	Depreciation	1	24.333	24.333
	Total Fixed Cost			**2.024.333**
II	**Variable Cost**			
1	Electric Cost	104	1500	156.000
2	Tofu Dregs	520	1.000	520.000
3	Yeast	208	500	104.000
4	Bran	520	4.500	2.340.000
5	Molasse	52	3.000	156.000
6	EM4	21	25.000	520.000
7	Fermented Shrimp	52	2.000	104.000
8	Anchovies	26	8.000	208.000
9	Packaging	1.092	500	546.000
	Total Variable Cost			**4.654.000**
	Total Cost			**6.678.333**

According to the above total cost calculation, it was concluded that the business unit expended IDR 6.678.333 for 1092 kg cat fish feed production.

2) **Total Revenue (TR) Calculation**. Revenue was earnt through 1092 kg cat fish feed selling with IDR 8.000 per kg price. By using equation (2), TR was determined as follows.

TR = P x Prod

TR = IDR 8.000 / kg x 1.092 kg / month

TR = IDR 8.736.000 / month

3) **BEP Production Calculation.** BEP value was determined by usgin equation (3).

BEP_{prod} = FC/ (P – VC/Prod)

BEP_{prod} = 2.024.333 / (8.000 - 4.654.000/1.092)

BEP_{prod} = 542 kg/month

It was found out that the unit business needed to produced 542 kg cat fish feed monthly to avoid being lost. For every kilogram produced exceeding the BEP value delivers more marginal profit to the business unit.

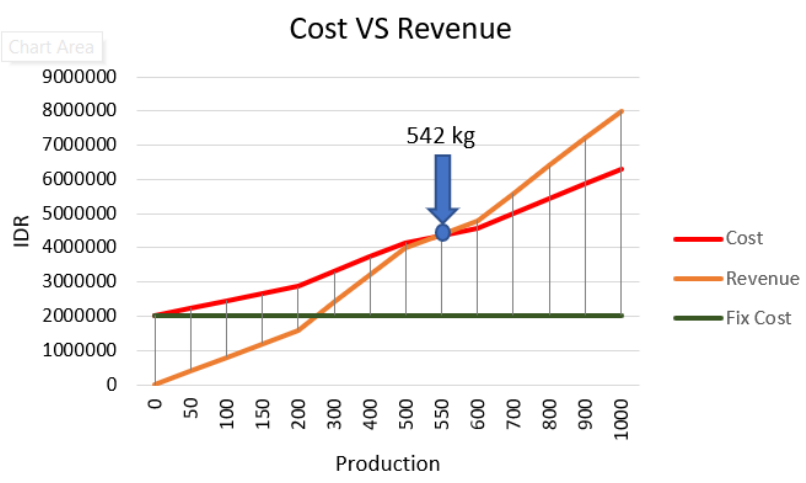

Fig 1. Break even point based on production level

4) **BEP Rupiah Calculation**. Selling price is an essential factor in products marketing. Many factors affecting the selling price, such as expected profit by the company, raw material price, labor cost, selling mechanism, distribution system and other factors. The following equation was conducted to determine the BEP Rupiah.

TR = TC

BEP_{rupiah} = P = (FC + VC)/Prod

BEP_{rupiah} = 6.678.333 / 1.092

BEP_{rupiah} = IDR 6.116/kg

BEP rupiah calculation plays crucial role as it acts as benchmark for a business unit in setting the selling price. With the current production capacity, which was found to be 42 kg daily and 1092 kg in a month, the least selling price was determined to be IDR 6.116 per kilogram in order to cover all expenditures in the period of time.

3.3. Payback Period (PP) Analysis

1) **Total Commencing Investation (FC) Calculation.** Goods categorized into investating goods were mixer, pellet molding machine and other tools for dough fermentation process. Total commencing investation cost was found to be **IDR 6.656.000** (as shown in **Table 2**).

Table 2. Investment Details

NO.	GOODS	QTY	PRICE	TOTAL PRICE	ECO TIME	DEPRECIATION/MONTH
1	Mixer	1	2.900.000	2.900.000	2	120.833
2	Pellet Molding Machine	1	3.200.000	3.200.000	2	133.333
3	Tarpaulin 2 m	8	20.000	160.000	1	13.333
4	Bucket 26 liter	2	30.000	60.000	1	5.000
5	Hose	2	4.000	8.000	1	667
6	Solder	1	18.000	18.000	2	750
7	Scale 15 kg	1	190.000	190.000	2	7.917
8	Drum	2	60.000	120.000	1	10.000
			TOTAL	**6.656.000**		

2) **Net Income (NI) Calculation**. Net income produing 1092 kg cat fish feed monthly (assuming all products to be sold) was determined with equation (5).

NI = TR – VC – FC + Depreciation

NI = 8.736.000 – 4.654.000 - 2.024.333 + 24.333

NI = IDR 2.082.000

3) **Payback Period (PP) Calculation**. Time period needed for business unit to return all commencing investation.

PP = FC / NI

PP = IDR 6.656.000 / 2.082.000

PP = 3,20 months (3 months and 6 days)

Table 3. Payback Period Calculation

Months	Net Income	Commencing Investment	Cash Flow
0		**6.656.000**	**-6.656.000**
1	2.082.000		-4.574.000
2	2.082.000		-2.492.000
3	2.082.000		-410.000
4	2.082.000		1.672.000
		Payback Periode	**3,20** (3 months and 6 days)

4. Conclusion

Tofu industry solid waste possess high potential for cat fish feed utilization. In order to establish business unit of cat fish feed with 42 kg capacity demanded IDR 6.656.000 investment. The business unit potentially produced the feed with net income IDR 2.082.000 per month. According to Payback Period (PP), the commencing investment was found

to be 3 months and 6 days. The least production rate was 542 kg per month to avoid being lost. In accordance with the production capacity, cat fish feed price was found to be at least IDR 6.116/kg to cover all expenses in one month period of time.

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