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INCOME ANALYSIS OF DEMERSAL FISH BONE FLOUR AND NANOCALCIUM OF HOME INDUSTRY SCALE BANGGAI CENTRAL DISTRICT

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ABSTRACT

Demersal fish bone waste obtained from processed fish fillets is used by a home industry-scale business group in Central Banggai District to produce flour and nanocalcium. Demersal fish bone product as raw material for making fish, shrimp and livestock feed. Demersal fish bone nanocalcium product as a fortification product in food and non-food. This study analyzes the income or profits from the flour and nanocalcium fishbone waste demersal business so that it is feasible or not the business can be developed. The method used is purposive with data collection techniques based on interviews at the flour and nanocalcium business of demersal fish bone waste. The data analysis is descriptive quantitative. The results showed that the income or profit of the flour business was Rp. 939.574 and the R/C Ratio value was 2.27 and the nanocalcium demersal fish bone waste generated Rp. 246.791 income and the R/C ratio value was 1.39. The Break Even Point (BEP) of flour is BEP (Q) Rp. 10.51 and BEP (Rp) Rp. 315.316. BEP (Q) for nanocalcium BEP (Q) 6.30 and BEP (Rp) is 409.748. So that the business of flour and nanocalcium from demersal fish bone waste is feasible and developed. The business development of demersal fish bone flour and nanocalcium waste depends on the availability of raw materials for demersal fish bone waste, promotion and marketing techniques, reduced production costs, more adequate equipment and technology.
Keywords: Break even point, bone, demersal fish, effort, R/C ratio

1. Introduction

The potential of marine fisheries resources located in the waters of Banggai Laut Regency, is used by some people who work as fishermen as a livelihood from fish catches to be sold in the hope of earning income. This is supported by the geographical condition of the Banggai archipelago with a water area of ± 6,671.32 km^2 and a land area of 725.67 km^2 dominated by demersal fish because the coral reef ecosystem is still maintained as a place for biota and the presence of demersal fish (Banggai Regency in Figures 2018).

The demersal sea area is a area leading to the seabed with continental slopes in the mesopelagic and bathypelagic zones with sea level depths from > 100 m to < 4000 m. (Nair, 2022). Types of demersal fish including snapper (*Lutjanus* sp.) in Indonesian waters are 33 species and

most of them live around coral reef areas (Oktaviyani, 2018). Demersal fish are active predators looking for food at night and are categorized as carnivorous fish (Allen *et al.*, 2003).

One of the companies in Banggai Laut Regency is a non-fish company, namely frozen octopus (*Octopus* sp.) and frozen demersal fish fillet. The acquisition of raw materials for demersal fish comes from fishermen who are sold to collectors and then sold to companies based on supply and demand. Demersal fish production data in 2019 was ± 498.466 tons and frozen demersal fish fillets ± 182.209 tons. The by-product of processed demersal fish fillet is fish bone waste up to ± 62%. (Sun *et al*., 2020) said that fish processing produces various types of fish products and the by-product is fish waste ± 45% for disposal.

The by-product of processed demersal fish fillets is fish bone waste which can be processed into flour as an additional raw material in the manufacture of fish, shrimp and livestock feed because it has the mineral nutrients needed to support the growth of fish, crustaceans and livestock. Based on the research results of Putra *et al*. (2018) anchovy waste in the form of fish bone has the potential as a substitute for the manufacture of artificial feed for quail with a protein content of 44.5%. The calcium mineral content found in snapper (*Lutjanus* sp.) using the deproteinase method obtained a calcium content of 29.42% (Marasabessy *et al*., 2018). Calcium mineral levels using the experimental method on catfish meal (*Clarias* sp.) and Sembilang fish meal (*Plotosus* sp.) obtained calcium at 51.3%, 65.9%, and 38.4% (Angraini *et al*., 2019).

The increasing world population growth causes an increase in fish production due to demand so that the volume of fish processing by-products increases. Improved management of processed fish by-products is needed as a value-added product (Sun *et al*., 2020).

The demand for fish bone generally comes from outside the region from Banggai Laut district and depends on the availability of raw materials for demersal fish bone waste. The business of demersal fish bone is still classified as a small scale, namely the household scale by a group of fishermen as a side business in addition to the processing of smoked julung fish (*Hemiramphidae*), stingrays (*Batoidea*) and dried squid (*Cephalopoda*) and seaweed. Demersal fish bone flour can be made into very small flour (nano) which can increase income by using technology that can be applied to small-scale businesses. According to Greiner (2009), nanoparticles are 1-1.000 nm in size.

Based on the research results of Suptijah *et al*. (2012) ; Prinaldi *et al*. (2018) ; Harmain *et al*. (2018) nano-sized fish bone has a fairly high bioavailability which is more easily absorbed in the body than still in the form of micro-sized flour. Demersal fish bone nanocalcium as one of the nutritional mineral products is high enough so that when added to food products it can meet the nutritional needs of minerals, especially calcium for the prevention of *osteoporosis* and *osteomalacia* in the elderly and support the growth of bones and teeth at the growing age of children and adolescents (Greiner, 2009).

The business of flour and nanocalcium demersal fish bone on a home industry scale in Central Banggai District has just been initiated and is relatively new. Analysis of income or profits from the flour and nanocalcium fishbone waste demersal business needs to be done to get an idea that the business can be developed based on the results of the analysis obtained. The business of

producing demersal fish bone meal and nanocalcium is still experiencing obstacles, especially demersal fish raw materials obtained according to climatic conditions, fishing equipment, processing technology facilities that are still minimal and capital and market networks are still weak. Analysis of income or profits in the demersal fish bone flour and nanocalcium business needs to be carried out to determine whether or not the business is feasible to be further developed as a by-product that can be applied to food and non-food consumption products. The purpose of this study was to analyze the income or profit and whether or not the flour and nanocalcium business from demersal fish bone waste was feasible or not.

2. Matrials and Methods

2.1 Study area

The research location is in Central Banggai District, Banggai Laut Regency, Central Sulawesi Province. Determination of the location purposively based on the characteristics of the previously known location based on certain considerations. The research location is in Banggai Laut (Fig.1) because most of it is the livelihood of fishermen including demersal fish fishermen because the location still has coral reefs and has a fairly high biodiversity of reef fish or demersal fish and in that location there is one company that processes fresh demersal fish into fish fillets. and sent to other regions in accordance with the demand for the product.

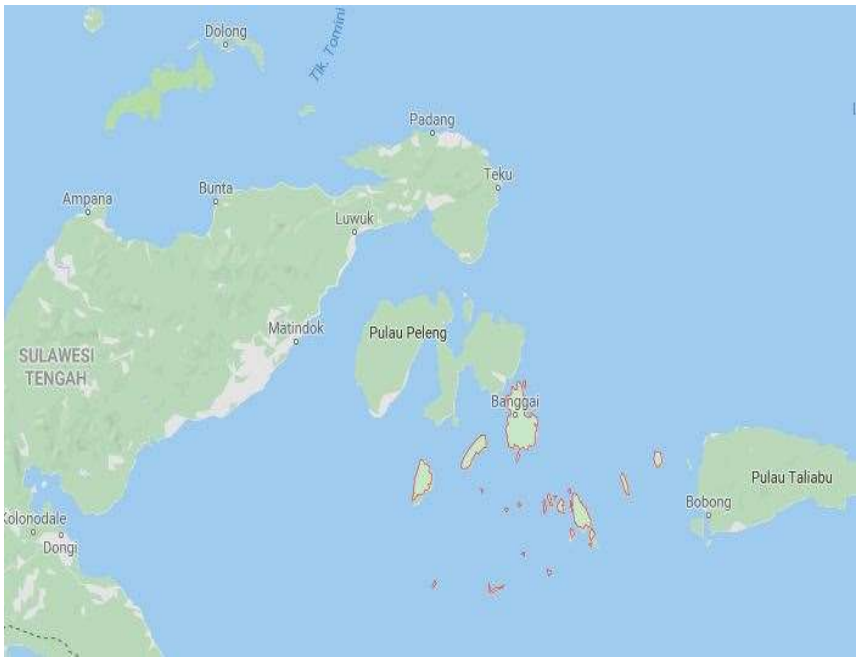

Fig. 1. Location of Banggai Laut Regency, Central Sulawesi Province is located at 1°26'0" South Latitude to 2°18'0" South Latitude and 123° 0'0"E to 124°20'0" East Longitude in the Northeast of Sulawesi Island.

2.2 Procedure

2.2.1 Sampling method

Is an interview method for employees of home industry scale demersal bone flour and nanocalcium in November – January 2019.

2.2.2 Data collection method

Data collection consists of primary data and secondary data. Primary data is sourced from interview data for household scale businesses. Secondary data from research journals, literature, observations and literature studies (Sugiyono, 2012).

2.2.3 Data analysis method

The data analysis used is descriptive quantitative. Quantitative data is data that can be calculated in the form of numbers with certain units (Arikunto, 2002) ; (Taherdoost, 2017) ; (Fish *et al.*, 2019).

To obtain the value of income or profit of demersal fish bone flour and nanocalcium with the formula:

$$\pi = TR - C$$

Description: π = Business Profit
TR = Total Revenue (total revenue)
TC = Total production cost (total cost)

3. Results

3.1 Description of home industry scale in Central Banggai sub-district

Home industry-scale businesses include small-scale businesses located in Central Banggai District and are independent. Business in the form of a group of fishermen mothers as a side business of making demersal fish bone in addition to marketing business of fresh fish and non-fish and processed fish such as salted fish, dried squid and stingray, smoked julung julung fish and dried seaweed. This type of business depends on the demand of collectors or consumers and the availability of raw materials. The marketing of these business products, apart from local sub-districts, is also marketed outside the Banggai Islands area and outside the province.

Availability of raw material for demersal fish bone waste originating from demersal fish fillet companies such as several types of fish such as red and white snapper (family *Lutjanidae*), cockatoo (family *Scaridae*), kaci fish (family *Haemulidae*). Demersal fish bone flour as a product that requires skill and perseverance during the demersal fish bone flour process.

The use of fish meal equipment technology which is still simple and workers without formal education can carry out the demersal fish bone flour process. The process of processing fish bone into nanocalcium flour products requires special skills. Means of equipment for making demersal fish bone nanocalcium flour are slightly adequate and the workforce is still a little bit affected the production.

3.2 Business Revenue of Demersal Fish Bone Flour and Nanocalcium Flour Demersal Fish Bone Flour

The value of income or business profits is obtained from total revenue minus total production costs (Ikan *et al*., 2019), based on the formula:

$$\pi = TR - C$$

Description: π = Business Profit
TR = Total Revenue (total revenue)
TC = Total production cost (total cost)

The total cost of production (total cost) is obtained from the total sum of fixed costs and variable costs. Variable costs consist of variable costs of flour and variable costs of nanocalcium demersal fish bone. Production costs consist of identification of fixed costs and variable costs in producing demersal fish bone meal and demersal fish bone meal nanocalcium. What affects production costs are the components of production inputs and the price of production inputs. Fixed costs and variable costs are operational costs as costs used in the production process (Ikan *et al*., 2019).

3.2.1 Fixed cost

Fixed costs are costs whose total amount remains constant, not affected by changes in activity or activities to a certain level (Ikan *et al*., 2019).

Tab.1. Fixed costs of demersal fish bone and nanocalcium

Number	Tool Type	Amount (Unit)	Depreciation Cost/Month (Rp)
1	Big bucket	2	30.000
2	Baking pan	6	40.000
3	Dipper	2	2.500
4	Bag	6	12.500
5	Gauze	2	1.667
6	Packaging	6	75.000
7	Strainer	6	3.375
8	Presto	2	3.000
9	Cool box	2	20.833
10	Mortar and pestle	2	5.208
11	Flour grinder	2	9.259
12	Wooden spoon	6	7.500
13	Tax		12.500
		Total twice production	434.185
		Total one production	217.093

Source : processed from primary data, 2019

Tab.1 showed that fixed costs in the business of demersal fish bone flour and nanocalcium which are the same for two times of production are Rp.434.185 and one production is Rp.217.093 in every month.

3.2.2 Variable cost

Variable costs are costs that can change in proportion to changes in the number of activities but the cost per unit is fixed, which means that if the volume is doubled, the total variable costs will be doubled (Ikan *et al*., 2019).

Tab.2. Variable Costs of Demersal Fishbone Flour

Number	Activity Name	Volume	Amount (Rp)	Total (Rp)/year	Total (Rp)/month
1	Demersal fish bone collector	1	30.000	30.000	
2	Flour production	4	50.000	200.000	
3	Packaging	1	100.000	100.000	
4	Transportation	4	100.000	400.000	
5	Labor wages	4	1.000.000	4.000.000	
6	Electric	1	350.000	350.000	
7	Kerosene	10	30.000	1.200.000	
	Total			6.280.000	523.333

Source : processed from primary data, 2019

The variable cost of demersal fish bone is Rp. 6.280.000 every year and Rp. 523.333 every month (Tab. 2). At this variable cost of flour production, employee salaries or labor and kerosene which changes according to the amount of production and the increase in the price of kerosene at any time. The production of flour depends on the availability of raw material for demersal fish bone waste, which comes from the availability of demersal fish raw material stocks for processed demersal fish fillets.

Tab. 3. Variable Costs of Demersal Fish Bone Nanocalcium

Number	Name of Activity	Volume	Amount (Rp)	Total (Rp)/Year	Total (Rp)/Month
1	Production of nanocalcium	2	5.000	10.000	
2	Packaging	1	100.000	100.000	
3	Saguer vinegar	1	100.000	100.000	
4	Transportation	1	100.000	100.000	
5	Aquades	1	2.000.000	2.000.000	
6	Labor wages	1	1.000.000	1.000.000	
7	Electricity	1	350.000	350.000	
8	Kerosene	10	30.000	300.000	

9	NaOH	1	980.000	980.000	
	Total			4.940.000	411.667

Source : processed from primary data, 2019

The variable cost of demersal fish bone nanocalcium is Rp.4.940.000 in every year and variable cost in month is Rp.411.667 (Tab.3). Total cost of production (Total Cost) is generated from the number of fixed costs with variable costs. (Fish *et al*., 2019)

Tab. 4. Total production costs of demersal fish bone flour and nanocalcium

Number	Fee Type	Value (Rp) / Month	
		Demersal fish bone flour	Nanocalcium
1	Fixed cost	217.093	217.093
2	Variable cost	523.333	411.667
	Total production cost	740.426	628.759

Source : processed from primary data, 2019

Tab.4 showed that the total production cost of demersal fish bone flour is Rp. 740.426 and nanocalcium effort is Rp.628.759 every month.

3.3 Revenue and Revenue of Demersal Fish Bone Flour and Nanocalcium

Revenue is the amount of money received from product sales (Ikan *et al*., 2019). The revenue from demersal fish bone flour is Rp.1.680,000 every month and nanocalcium demersal fish bone is Rp.875.550 every month. The total cost of demersal fish bone flour production each month is Rp. 740.426 and nanocalcium is Rp.628.759. So, to obtain the income value of demersal fish bone flour and nanocalcium, it can be calculated using the formula:

$$\pi = TR - TC$$

Total Revenue (TR) = Rp. 1.680.000

Total Production Cost of demersal fish bone flour (TC) = Rp. 740.426

Income or profit of demersal fish bone flour :

$$\pi = TR - TC$$
$$= \text{Rp. } 1.680.000 - \text{Rp. } 740.426$$
$$= \text{Rp. } 939.574.$$

The income or profit of demersal fish bone nanocalcium is obtained based on the formula :

$$\pi = TR - TC$$

Total Revenue (TR) = Rp. 875.550

Total Production Cost of demersal fish bone nanocalcium (TC) = Rp. 628.759

Revenue or profit of demersal fish bone nanocalcium:

$$\pi = TR - TC$$
$$= \text{Rp. } 875.550 - \text{Rp.}628.759$$
$$= \text{Rp. } 246.791$$

Based on this formula, it shows that the income of fish bone flour is greater than that of demersal fish bone nanocalcium. Fish meal includes fish bone as an additive in the manufacture

of fish, shrimp and livestock feed and has long been practiced by fish farming and animal husbandry entrepreneurs. Fish bone nanocalcium in the form of flour is not yet known due to limited knowledge and product marketing. However, this demersal fish bone nanocalcium product has the potential to be developed considering the benefits of its mineral content and better bioavailability than fish bone. In addition, this product can be added to the manufacture of fish, shrimp or livestock feed, it can also be used as a fortification product in food to meet the needs of mineral nutrients, especially calcium.

Calcium that can be applied to food in the form of supplements to meet daily calcium mineral needs. The mineral content of bone nanocalcium of skipjack tuna (*Katsuwonus pelamis* L) is phosphorus 6.841%, calcium 2.935%, magnesium 0.528%, mangan 0.014%, iron 0.016%, potassium 0.002% and zinc 0.0089% (Harmain *et.al*., 2018). The highest mineral compounds in fish bone calcium have high bioavailability (Greiner, 2009); (Prinaldi *et al*., 2018) (Sun e*t al*., 2020).

Income or profit is the difference between total revenue and total costs incurred by the business industry each time it is produced.

Calculation of R/C Ratio with the formula:

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

The R/C Ratio obtained is a Total Revenue (TR) divided by Total Cost (TC).

R/C Ratio of demersal fish bone flour is Rp. 1.680.000 / Rp.740.426 is 2.27. This means that every Rp. 1.00 spent will generate revenue of 2.27 and experience a profit. R/C Ratio of demersal fish bone nanocalcium is Rp. 875.550 / Rp. 628.759 is 1.39. which means that every Rp. 1.00 spent will generate revenue of 1.39 and experience a profit.

The business of demersal fish bone flour in the home industry in Central Banggai District is still very dependent on the demand for demersal fish bone and the availability of demersal fish bone waste obtained from collectors in the processed fish fillet industry. The influencing factor is the lack of promotion and active supply and marketing, especially for fish and livestock farming businesses. Demersal fish bone flour as a finished material for the manufacture of demersal fish bone nanocalcium flour is still little done because of the lack of skills and information on knowledge of nanocalcium flour to fish and livestock cultivators and can be consumed as a food additive. The business activities of demersal fish bone and nanocalcium at variable costs, especially the use of solvents, can be replaced with solvents that are more economical and easy to obtain so that they can cover the costs of business activities and earn income.

The revenue obtained from the demersal fish bone flour business is Rp. 1.680.000 with an income of Rp. 939.574 and demersal fish bone nanocalcium with an income of Rp. 875.550 with an income value of Rp. 246.791 one production every month. Revenue results at this demersal fish bone business are lower than the *Toman* fish bone *(Channa micropeltes*) research from Oktawati *et.al*., (2019) which received an income of Rp. 4.787.400. But the income or profit obtained from demersal fish bone flour in this study is higher than the income from Toman fish bone which is Rp.560.317 every month.

The result of Revenue Cost Ratio (RCR) analysis on demersal fish bone flour is 2.27 and demersal fish bone nanocalcium is 1.39. The RCR of the Toman fish bone was obtained 1.13 (Octawati *et al*., 2019). Although the demersal and nanocalcium fish bone businesses are larger, the two fish bone businesses provide benefits so that both businesses are feasible to be developed based on the RCR criteria.

3.4 Break Even Point (BEP)

Break Even Point (BEP) is a measuring tool to determine the sale of an item that does not generate a profit but also does not experience a loss. A business is feasible or not if it is economic or can be profitable. This can be seen from the BEP obtained and provides information that the volume of activities assessed from sales results does not provide profits or profits but does not experience losses. BEP is also called break-even analysis which is useful for predicting an unknown factor to make a decision (Fish *et al*., 2019).

Tab. 5. Break Even Point (BEP) of demersal fish bone flour and nanocalcium

Number	Break Even Point (BEP)	Value (Rp)	
		Fish bone flour	Nanocalcium
1	BEP (Q)	10.51	6.30
2	BEP (Rp)	315.316	409.748

Source : processed from primary data, 2019

The results of the Break Even Point (BEP) analysis or the break-even point of demersal fish bone flour were 10.51 (Q) and 315.316 (Rp). The results of BEP analysis on demersal fish bone nanocalcium were 6.30 (Q) and 409.748 (Rp). This means that in BEP flour (Q) the break-even point means that the production is 10.51 for flour and 6.30 for demersal fish bone nanocalcium, the business is not experiencing profits and losses.

4. Discussion

According to Schuhbauer & Sumaila (2016), small-scale fisheries can be considered economically viable and beneficial to the community, the number of jobs, the level of dependence and costs associated with fishing must be identified. Diversification as an economic activity is characteristic of small-scale fishermen because they carry out high-risk fishing and depend on the location of the availability of fish stocks. The average monthly income for the lowest category of fishermen in Brazil is US$694.60 and the lowest is US$4.167.61. Compared to the income in Caraguatatuba, the monthly per capita income in Brazil in 2013, the fishing entrepreneur profession is slightly higher than twice the national per capita income indicating that this profession has high financial returns (Peixer & Neto, 2020).

Fish meal, including fish bones, one of which comes from trash fish or small fish and is economically important to be used as an additive in the manufacture of feed. Fish bone as a source of animal protein and a determinant of the quality of artificial fish feed and as one of the fishery products is needed in large quantities as a raw material for the needs of the animal feed industry,

fish and shrimp. Fish meal contains protein, -3 fatty acids, vitamins and minerals (Rangkuti *et al*., 2022).

5. Conclusions

Business analysis of demersal fish bone flour and nanocalcium in home industry businesses in Central Banggai District based on the Revenue Cost Ratio (RCR) value for demersal fish bone flour is 2.27 and nanocalcium is 1.39, it can be said that the business of demersal fish bone flour and nanocalcium earns income. or profit and deserves to be developed. The income or profit received in the home industry business of Central Banggai District depends on the availability of raw material for demersal fish bone waste which affects production revenues and costs. The higher the selling price and the higher the production, the higher the revenue and income. Conversely, if the production cost is higher and the selling price is low, the income received will decrease.

Suggestions

a. The availability of raw materials for demersal fish bone waste in storage containers, especially during the harvest of demersal fish by fish fillet companies, is very important.

b. It is necessary to increase the production of demersal fish bone meal and nanocalcium flour by contributing to better promotion and marketing so that product offerings increase.

c. More adequate and modern processing equipment that supports increased production of demersal fish bone and demersal fish bone nanocalcium.

d. Increasing the amount of production not only for demersal fish species but also for economically important fish species such as pelagic fish.

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