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# The Capture Fishery Based Small Pelagic Business Development Opportunities Analysis with Purse Seine Fishing Gear in Maluku (*Case Study on Financial Aspect in West Seram Regency*)

Steven Siaila[1]

[1] Departement of Economic and Management, Patimura University, Ambon, Indonesia

Correspondence: Steven Siaila, Departement of Economic and Management, Patimura University, Ambon, Indonesia. E-mail: steven.siaila@yahoo.com

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**Abstract**

The study aims to find out and analyze the influence of running cost, shore cost, fishing duration and seasonal climate on profitability of purse seining small pelagic fishery business group in West Seram Regency in purpose to find out capture fishery development prospect by using such equipment in West Seram Regency. The data used in this study is primary data, i.e. a data collected from respondents through interview. Respondents are selected purposively from population of purse seining capture fishery business group. Multiple linear regression analysis method is applied to estimate the influence of running cost, shore cost, fishing duration and seasonal climate on the profitability variables (ROA). The findings reveal that running cost affects positively profitability, shore cost affects negatively and significantly profitability, fishing duration affects negatively and significantly profitability. On the contrary, seasonal climate does not affect profitability of purse seining capture fishery. Further, it is said that there is still a chance to develop purse seining small pelagic fishery business group under the condition that the activity has to be accompanied with control over running cost, shore cost, and fishing duration.

**Keywords:** fishing, running cost, shore cost, fishing duration and seasonal climate, profitability and development opportunity

## 1. Introduction

Fishery activity relates to all fish-based activities, including fish production either by fish catch (capture fishery) or cultivation and/or fish processing to fulfill human needs on food as protein sources and non-food products (tourism, ornamental fish, etc.). **Important concern relating to capture fishery has been proposed by Deputy Minister of the Natural Resources and Environmental Affairs, Directorate General for Maritime Affairs and Fisheries in 2001 entitled** "*Management and Utilization Strategy for Marine and Fishery Sources*"

West Seram Regency has an area width 84,181 km², consisting of 79,005 km² or 93.85% and the remaining area 6.15% is land or 5,176 km². This regency is surrounded by Seram Sea in the north, Banda Sea in the south, Buru Sea in the west, and Central Maluku Regency in the east. Almost all coastal areas in this regency have sizable fishery potential, especially capture fishery, but it has not been utilized in optimal. It is observable from a fact that small pelagic fish potential in West Seram Regency can reach 379,460 ton per year, while it was just utilized 14,436.7 ton or 3.8% (West Seram Statistics, Sentral Bureau of Statistics, 2012).

Fishing gear of purse seine or known as pukat cincin in Indonesian is a fishing gear which generally used by fishermen in West Seram Regency to catch small pelagic fishes. Purse seining vessels belongs to vessel operating equipments by encircling school fish (schooling fish). In West Seram Regency, most fishermen use fishing vessel from 5 to 6 GT, and fishing vessel owner has only 1 unit vessel in average. According to Sinaga (1978), purse seine has ideal prospect in the future as it makes employment for many manpower. Besides, this fishing gear has high efficiency in capital use and produce great income as well.

Definitely, production, income and profit are the three most important things in business. Accordingly, if production is high, it can make profit and income high that business stability will stand fast and make development effort. Therefore, the use of production factors resulting in maximum output is important to support business activity fluency. Sinaga (1978) states that technical factors commonly affecting catch quantity are

fishing vessel size, actuating device and fishing gear size. Although biological and technical principles take important role, the success of fishing is also highly determined by economic principles. Output of capture fishery production by using purse seine depends on the input and refers to function of capture fishery production where some or all variables that affect output quantity shall be considered in operating the productive function. The input constitutes effort factor in capture fishery; it is also known as fishing effort, i.e. combination of elements consisting of capital, manpower, the time spent on board, the time spent to catch fishes and weather condition on land and sea. Capital is divided into cost for fishing gear and fishing vessel (gear and craft), fishing gear maintenance, types of craft, and depreciation. Manpower involves number of labors, experience of fisherman, etc. (Jinadu, 1991).

According to Bambang (2006), cost for fishing tails theory of cost, i.e. fixed cost and variable cost. Fixed cost consists of depreciation/fisheries assets depreciation and interest payment for external equity. Variable cost covers: Running cost (cost for fishing) consisting of cost for fuel, victuals, ice cubes depending on how long the trip will be held. Labor cost is calculated on every time the trip is taken and it is shared by usual income sharing system. Shore cost consists of packaging, marketing, retribution, while cost of porter depends on catch quantity.

This article aims to attain some goals as follows: To analyze and find out the influence of running cost, shore cost and fishing duration on the profitability of purse seining small pelagic fishery business group.

This article also aims to find out development prospect of this capture fishery business by using purse seine in West Seram Regency.

## 2. Methodology

It is descriptive quantitative research. It applies survey method to analyze population by selection and to analyze the chosen sample taking out from the population in purpose to find indention, distribution and relative interrelation of research variables. It aims to make an accurate estimation on characteristic of overall population. Purposely, it will be possible to figure description of every research variable and relationship of variables (Widodo, 2005: 103). To find out relationship of variables, it applies correlational technique.

Data types and sources used in this study are primary data, i.e. the data collected from the field through interview with related people, and secondary data, i.e. the data processed and collected from local government or related parties.

This study is treated to some purse seining capture fishery business groups existing in some sub-districts. The districts are area where purse seine fishery business groups are distributed in West Seram Regency. Based on the criteria of sample determination above, there are only 5 of 7 potential sub-districts which are suitable for being research location, they are: West Kairatu Sub-district, West Seram Sub-district, Huamual Sub-district, Huamual Belakang Sub-district and Manipa Island Sub-district.

Population of the study is purse seining capture fishermen group consisting of 70 groups. Sample collection process in this study applies purposive sampling to find out to which population the study will be carried out. Then, simple random sampling is also applied that gives the same opportunity to all population to be chosen as the sample.

In research analysis, descriptive analysis technique is applied to reveal or describe accurate condition or facts found in the observed object in accordance with the applicable and approved theory or proposition. This technique is also applied to cast about solution of the problems existing and relating to the factors that affect profitability of fishermen group.

Analysis model is developed from the function of fisheries production as follows

$$Y = F(X1, X2, X3, X4, ) \quad \ldots (1)$$

$$Y = \beta o\, X1^{\beta 1}\, X2^{\beta 2}\, X3^{\beta 3}\, X.4^{\beta 4}\, e^{\mu} \quad \ldots (1.2)$$

If unit of every variable is plural, it shall be made into lo.garithm and natural to make it linear, thus new equation will be:

$$\ln Y = \beta o + \beta 1 \ln X1 + \beta 2 \ln X2 + \beta 3 \ln X3 + \beta 4 X4 \quad \ldots (1.3)$$

Information: Y = Income (IDR/month)

βo = Constant number

β1 = Coefficient of Running Cost

β2 = Coefficient of Shore Cost

β3 = Coefficient of Fishing Duration Count

β4 = Coefficient of Seasonal Climate

X1 = Running Cost (IDR/month)

X2 = Shore Cost (IDR/month)

X3 = Fishing Duration (Hour/month)

X4 = Seasonal Climate (Trip/year)

μ = Error term

## 3. Findings

### *3.1 Capture Fishery Resources*

Small pelagic fish resource potential in 4 miles offshore in West Seram Regency is about 5,562.71 ton. Based on the potential count, MSY (Maximum Sustainable Yield) is 2,781.35 ton/year and TAC (Total Allowable Catch) is 2,225.08 ton/year. Small pelagic fishes species commonly caught by fishermen in Piru Bay are small tuna/komu (auxis thazard), mackerel scad/momar (decapterus sp), yellowtail scad/ kawalinya (selar sp), mackerel/lema (rastrellinger sp), sardine/make (sardinela, sp), and anchovy (stolephorus sp). Estimated potential resource of small pelagic fish in the waters is 1,127.77 ton with MSY 588.63 ton/year and TAC 470.91 ton/year.

In Huamual Belakang waters, frequently caught small pelagic fishes are small tuna (auxis thazard), yellowtail scad (Selar, sp), mackerel (rastrellinger sp), mackerel scad (decapterus sp), and some other species. Estimated potential resource of small pelagic fish in Huamual Belakang waters is 1,576.5 ton with MSY 788.25 ton/year and TAC 630.6 ton/year.

Small pelagic fish frequently caught in North West Seram waters are small tuna (auxis thazard), yellowtail scad (Selar, sp), mackerel scad (decapterus sp), and other species. Estimated potential resource of small pelagic fish in North West Seram waters is 1,304.33 ton with MSY 652.16 ton/year and TAC 5,221.73 ton/year.

By utilizing purse seine to catch fishes in West Seram Regency waters, frequently caught fish are small tuna/komu (auxis thazard) and mackerel scad/momar (decapterus sp).

### *3.2 Descriptive Analysis of Respondent*

Descriptive analysis is the first must step to find out general overview of the data collected from respondents. Respondents in this study are fishing vessel owners, who are actors in capture fishery business with purse seine as the fishing gear.

#### 3.2.1 Running Cost (Per Month)

Distribution of respondents with the highest running cost between IDR10,000,000–20,000,000 per month is about 74% or 22 business groups; these groups are from West Kairatu, Huamual Belakang and Manipa Island. Huamual Sub-district gets frequency 4 with running cost between IDR30,000,000–40,000,000 per month, and West Seram Sub-district gets frequency 4 with running cost between IDR50,000,000–60,000,000 per month.

Accordingly, the need of too high runningcost or cost for fishing between IDR50,000,000–60,000,000 per month is found in West Seram Sub-district. For fishermen from West Seram Sub-district, the high cost is spent for fuel consumption per trip. One time trip requires 20–30 liter gasoline, 200–300 liter kerosene and 9–13 liter oil. Comparing West Seram Sub-district to others, fuel consumption per trip spent by other sub-districts only needs 5–10 liter gasoline, 60–80 liter kerosene and 3–4 liter oil. Fuel consumption quantity is influenced by long distance between landing place and capture fishing spot or location where fish aggregating device is sunk under water.

#### 3.2.2 Shore Cost (Per Month)

Shore cost between IDR8,000,000–10,000,000 per month is the highest respondent distribution, i.e. 90% or 27 business groups, and the highest frequency for shore cost from IDR8,000,000 to 10,000,000 per month is spent by business groups in West Seram, Huamual, Huamual Belakang and Manipa Island Sub-districts West Kairatu Sub-district spend lower shore cost between IDR2,000,000–4,000,000 per month with frequency 3 or 10%. This low cost is caused by preference of West Kairatu business groups who tend to market the fishes to Gemba market. Fairly close distance from and to Gemba market takes lower cost about IDR250,000 per trip, and if the fishes are marketed to Ambon market plus some cost for cold storage, it only needs IDR300,000 per trip. Business groups from West Seram, Huamual, Huamual Belakang and Manipa Island Sub-districts need a higher cost for marketing. From their fishing port to Gemba/Piru market, it needs IDR500,000–600,000 per trip, while

if the fishes are marketed to Ambon/Hitu market with additional cost for cold storage, they shall spend IDR500,000–1,000,000 per trip.

3.2.3 Fishing Duration (Per Month)

Fishing duration 80–100 hours in a month is the highest respondent distribution, by 64% or 19 business groups. The distribution is dominated by business groups from Huamual Belakang and Manipa Island Sub-districts. Fishermen from West Kairatu Sub-district need 111–140 hours with frequency of 3 business groups, West Seram Sub-district need 141–170 hours with frequency of 3 business groups and 171–200 hours if the frequency is only 1 business group. Huamual Sub-district needs 201–230 hours with frequency of 4 business groups. Accordingly, it indicates that, for fishermen from Huamual Belakang and Manipa Island Sub-district, the distance between landing place and capture fishing spot or fish aggregating device location is closer, so fishing duration is relatively shorter.

3.2.4 Seasonal Climate

West and east seasonal climate also determine offshore fishing process. Consequently, movement of fishing spot or fish aggregating device location to avoid high wind and billow is choice the business group has. Based on the table above, it clearly shows that business groups from West Kairatu, West Seram, Huamual and Manipa Island Sub-districts prefer original fishing spot, but they go fishing to other capture fishing spots twice in average to outside of fish aggregating device. During west seasonal climate, groups from Huamual Belakang Sub-district are looking for fish aggregating device surrounding Siri Island, with frequency of more than 10 trips. Even if west monsoon blows, these business groups keep fishing in their original fishing spot because they are attached to the fish aggregating devices they had sunk. Besides, skill of fishing vessel crews allows them to go fishing. When condition at sea can threaten their safety, they prefer not going fishing to moving capture fishing spot. It is different from behavior of business groups from Huamual Belakang Sub-district who move to other capture fishing spots during west monsoon and stop fishing when condition at the sea can threaten their life.

3.2.5 Profitability (ROA)

Value of ROA 311–400% is the highest respondent distribution that reaches 46% or 14 business groups. This value is dominated by 3 business groups from West Kairatu Sub-district, 1 business group from West Seram Sub-district, 6 busines groups from Huamual Belakang Sub-district and 4 business groups from Manipa Island Sub-district. Lower ROA value is found in 4 business groups from Huamual Sub-district, but the highest ROA value is shown by 2 business groups from West Seram Sub-district and 3 business groups from Huamual Belakang Sub-district. The table above shows that by having a number of assets, business groups in West Seram and Huamual Belakang Sub-districts can gain great profit, or in other word, if only they have asset of IDR1, they still can get good luck by IDR4.01–4.9. This luck is triggered by catch quantity or production level that is usually higher than average assets they own. Tendency of the assets are not higher or lower than assets value owned by other business groups.

*3.3 Regression Analysis*

Based on the multiple linear regression analysis, the estimation wil be:

$$\mathbf{Ln\ Y = - 5.275 + 2.945lnX1 – 2.282lnX2 – 0.042lnX3 + 0.016X4 + e}$$

In conformity with the proposed hypothesis, regression above shows that regression coefficient $\beta_0$ is 5.275. If running cost, shore cost, fishing duration and fishing location movement trip (as the effect of seasonal climate) are constant, profitability will be at negative position. Accordingly, fishing activity by using purse seine in West Seram Regency will suffer a loss.

Running cost affects positively and significantly profitability. In this case, ROA with regression coefficient of 2.945 signifies a change when running cost increases one unit level, it will also increases profitability by 2.945 unit.

Based on the calculation, shore cost variable affects negatively and significantly profitability at coefficient value of 2.282. Accordingly, if shore cost increase one unit level, it will decrease profitability by 2.282 unit level on condition that other variables are constant.

Fishing duration affects negatively and significantly profitability at regression coefficient value 0.042. It signifies that if there is additional fishing duration by one unit level, it will decrease profitability by one unit level.

As the last variable, seasonal climate does not affect significantly profitability gained by purse seining capture

fishery business groups in West Seram Regency. By having regression coefficient value of 0.016, if seasonal climate changes, it will increase profitability on condition that other variables are constant.

3.3.1 Partial Test Analysis (t-Test)

A statistics t-Test is basically pointing out to what extend the influence of every independent variable in individual to explain variation of dependent variable. Calculating regression with partial test analysis lets us know the influence of running cost, shore cost, fishing duration, and seasonal climate on profitability of purse seining capture fishery business groups in West Seram Regency. By making use of SPSS version 20.0, it displays that:

1. *Running Cost ($X_1$),* statistical calculation found that t-count is 4.297 and significance of t is 0.000. By taking significance α (5%) and df (degree of freedom) 95, value of t-table is 1.661. Accordingly, if t-count (4.297) is higher than t-table (1.661), running cost affects significantly profitability of purse seining capture fishery business groups from West Seram Regency at confidence level 95%.
2. *Shore Cost ($X_2$),* statistical calculation finds t-count 3.458 and significance of t 0.002. By taking significance α (5%) and df (degree of freedom) 95%, t-table will be 1.661. If t-count (3.458) is higher than t-table (1.661), it signifies that shore cost variable affects significantly profitability of purse seining capture fishery business group in West Seram Regency at confidence level 95%.
3. *Fishing Duration ($X_3$),* statistical calculation found t-count 6.265 and significance of t 0.000. By having significance α (5%) and df (degree of freedom) 95%, t-table is found 1.661. When t-count (6.265) is higher than t-table (1.661), this calculation reveals that fishing duration affects positively profitability of purse seining capture fishery business groups from West Seram Regency at confidence level 95%.
4. *Seasonal Climate ($X_4$),* statistical calculation found that t-count is 0.861 and significance of t is 0.397. By having significance α (5%) and df (degree of freedom) 95, t-table is found 1.661. If t-count (0.861) is lower than t-table (1.661), it signifies that fishing duration does not affect significantly profitability of purse seining capture fishery business groups in West Seram Regency at confidence level 95%.

3.3.2 Coefficient of Determination Analysis (R2 or R-square)

Coefficient of determination (R2) essentially measures to what extend the capability of model to explain variation of dependent variable. Value of coefficient of determination is between 0 and 1. The lowest R2 value signifies capability of independent variable to explain variation of dependent variable that is very limited. Value going to one signifies that independent variables can provide almost all information that are needed to predict variation of dependent variable.

Based on the regression result, the influence of running cost, shore cost, fishing duration and seasonal climate variables on profitability found $R^2$ by 0.633. It indicates that variation of independent (free) variables may explain variation of profitability gained by purse seining capture fishery business group in West Seram Regency by 63.3%, and the remaining percentage is explained by other variables out of estimated model.

## 4. Discussion

### *4.1 The Influence of Running Cost on Profitability*

The observed running cost or cost for fishing is calculated based on monthly cost spent by purse seining capture fishery business in West Seram Regency. There are differences in price for fuel, differences in fuel-mixture, differences in fuel usage for every fishing activity, even differences in duration people spend to catch fishes, and also duration people take to go and come back from fishing based to fishing ground.

The findings indicate that running cost affects positively and significantly profitability (ROA) of business group. Accordingly, if there is running cost escalation, profitability will also increase. Running cost is calculated monthly that it highly depends on running cost per trip and trip count per month.

According to bioeconomic model in fisheries **open access, also known as** Bioeconomic Model of Gordon-Schaefer (Anderson, 2002), it is assumed that function of fisheries production is in biologically balance, thus net income (**π**) received from fishing is the difference between **total revenue** (TR) **and total cost** (TC). If **TR** =**TC**, it indicates production equilibrium where net income or economic rent of the fish resource is zero, (**π**) = 0. If biomass is in equilibrium state, production will be biologically and economically balanced, and it is called as **bioeconomic equilibrium**. Furthermore, if such equilibrium state happens on a long term period, fishing effort will decrease or being stopped when value of **TR** ≤ **TC**. This condition can happen if business earnings are equal with fishing cost or even lower than it. Consequently, stimulation to join with fishery industry is decreasing, or none. In this condition, fishing unit will suffer a loss. Then, if TC curve intersects TR curve on

the fishing effort level that is higher than the effort needed to reach MSY, this condition indicates **over-exploitation**. If the fishing effort level is on the left side of the fishing effort needed to make **TR** = **TC**, average revenue (AR) per unit of the fishing effort is higher than average cost (AV) per unit of the fishing effort, or **AR**>**AC**. This condition stimulates fishing unit to enlarge fishing effort, and also motivates new fishing unit to join with them in fishing business. For details, see the bioeconomic model below:

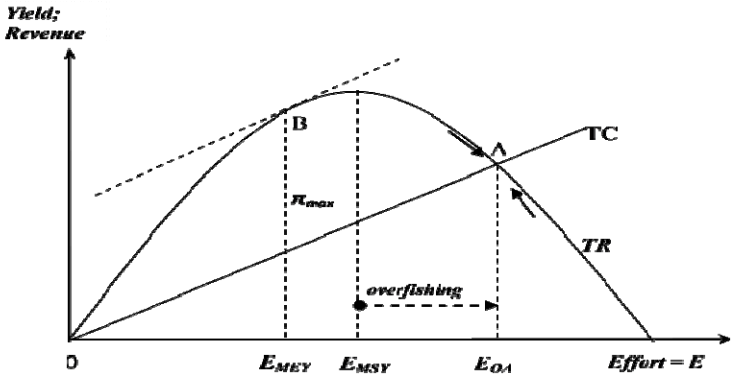


Figure 4.1. Bioekonomic Model

Figure above affirms the left side area starting from point $E_{MSY}$ that the higher cost spent for fishing process, profit tendency is likely going up, and this condition is called *Under Exploited or Under Fishing*. Thereby, the findings stating that running cost affects positively and significantly profitability (ROA) of business group is actually strengthening a proof occurred in West Seram Regency where the condition is on under exploited or under fishing state, especially for purse seine with small pelagic fishes as the fishing target.

*4.2 The Influence of Shore Cost on Profitability*

Shore cost or cost for loading process on land dominated by small pelagic fish marketing cost in West Seram Regency is varied between sub-districts. This variation of cost is made by differences between market target and distance from fishing based to the market. Marketing target of every sub-district is considered based on close distance to make the cost low. Besides, plenteous catch at some moment during peak fishing times, so called "*Mass Fish Die-Off*", has effect on decreasing fish price, so fishermen are prone to put the fishes into the closest cold storage. Their preference is triggered by purchasing power of cold storage which is higher than local market or inter-island market, in addition to a more stable price.

According to the findings stating that shore cost affects negatively and significantly profitability, if shore cost is increasing, it will cut down profitability. It is caused by a condition when increasing catch quantity coerces high shore cost, i.e. marketing cost. At this condition, price of fish is likely falling down, while fishermen's revenue is relatively constant and they are also still burdened by increasing marketing cost. As the consequence, their profit will be diminishing.

*4.3 The Influence of Fishing Duration on Profitability*

Fishing duration per month is total fishing duration per trip multiplies by trip count per month. Fishing duration per trip in this context is sum of round-trip duration and fishing duration in fishing ground. Thereby, fishing duration per month is determined not only by the fishing duration per trip, but also the trip count carried out per month.

Determination of trip count is calculated in one month by fishing community in West Seram Regency. Depart for going fishing is still grounded in natural signs, and the signs are becoming fishing schedule. For example, moon's appearance in the sky. The brighter moonlight at night sky (full moon) will disperse the light intensity on the sea and will cloud the light intensity on fish aggregating device. This condition stimulates the fishes attracted by the light to spread throughout sea waters, or the fishes will not focus on the light in fish aggregating device. The phenomenon affirms opinion of some previous researchers;

- Subani (1972) states that during full moon phase, achievement grade of catch with the help of lamp is usually low. This low catch quantity is caused by evenly distributed light at which the fishing activity at dark with the help of lamp is required to attract fishes to come near to the bright light.

- According to Ben Yami M. (1976), the moonlight gives negative effect on light fishing since the moonlight makes fishes reluctant, even the fishes will not interested in the lamp light. Consequently, the lamp light will be definitely diminished by the moonlight.

*4.4 The Influence of Seasonal Climate on Profitability*

West and east monsoon in West Seram Regency usually drives purse seining fishing vessel to find a more secure fishing ground to make fishing activity operational. The findings found that seasonal climate variable does not affect significantly profitability gained by purse seining capture fishery business group in West Seram Regency.

The findings are affirmed by a condition where most of fishing grounds or fish aggregating device locations are placed in areas which are likely closed from high sea. However, business groups from Huamual Belakang Sub-district will move to Siri Island during west monsoon, even they do it at low trip frequency. For fishermen from other sub-districts, they are prone to go fishing to the original fishing ground. If it really threats their life, fishing vessel will be directed to a more secure spot at very low trip frequency about 1–2 in a year.

The findings affirm a very widely opened opportunity for small pelagic fishery development in West Seram Regency. When seasonal climate does not have any influence on the profit, simply put, small pelagic fish supply is guaranteed; there will not be any obstacle as the effect of seasonal climate, or in the other words, fish stock reserve for a year-round is good and it will not be affected by any seasonal climate.

Negative constants value (-5.275) indicates the need of small pelagic fish handling in the effort of reducing loss rate faced by purse seining fishermen for their capture fishery business in West Seram Regency. At least, it needs a little more attention to post-fishing management. As explained above, this disadvantageous condition is affected by incapability of managing the catch. Consequently, all fishermen put the fishes they caught into local markets, and the price falls down. To prevent collapsing price, the catch shall not be traded to the local markets only, but there must be any possibility where the fishes can be stored in cold storage to be kept or packaged and then traded to other areas in Maluku Province or exported.

Therefore, it is urgent for local government in West Seram Regency to pay more attention to small pelagic fishery business group.

## 5. Conclusion

Based on the findings, it can be concluded that:

1. Running cost affects positively and significantly profitability (ROA) of business group. It means that if there is running cost escalation, profitability will also increase.
2. Shore cost affects negatively and significantly profitability. In the other words, the higher shore cost, the lower profitability rate.
3. Fishing duration affects negatively and significantly profitability; or in the other words, additional fishing duration will have effect on profit reduction gained by purse seining capture fishery business group in West Seram Regency.
4. The findings prove that seasonal climate variable, in fact, does not affect significantly profitability of purse seining capture fishery business group in West Seram Regency.

Based on the study conclusion, the following are suggestions for the government and purse seining capture fishery business group in West Seram Regency:

1. Considering total catch or production quantity, it indicates that the government shall build fishery facility, i.e. "cold storage" to reduce marketing cost or "shore cost".
2. Following up the plenteous catch quantity, it is the perfect moment for the government to work closely with coastal community to empower them and also to handle post-fishing output together.
3. It needs any training or counseling on how to manage finance of purse seining capture fishery business group to make them keep existing and developing.

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