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Production Optimalization Analysis and Maximization Profit of Salt Farmers on the Madura Island

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***Abstract*—This study aims to analyze: 1) Is the production of salt farmers on the Madura island is optimal or not, and 2) Is the salt farmers on Madura Island in production has reached maximum profit or not. The population in this research is all the people salt farmers that exist in 4 districts in Madura Island namely Bangkalan, Pamekasan, Sumenep and Sampang 220 people who are drawn based on Slovin method. Optimal production is determined by criteria comparison MPK/MPL = r/w. While the maximum profit is determined based on MR and MC criteria. The results concluded that: 1) Salt production on Madura Island has not reached optimal condition. This is evident from MPK/MPL < r/w (0.652 <1.22). The profit from salt production on Madura Island does not reach the maximum condition because the value of MR > MC (2,550,84 Rp/month > 128,67 Rp/month). Based on the results of the research, the suggestions that can be proposed are 1) Conducting land integration effort among the people salt farmers to reach the minimum production scale of 10 hectares. And 2), the role of PT Garam (Perseoro) as a processor institution (salt processor) is also necessary in order to strengthen the role of price stabilizer and increase the added value of salt commodity.**

Keywords—maximization, salt; optimalization; production; profit

I. INTRODUCTION

Indonesia is a maritime country. Indonesia is called a maritime country because Indonesia is the largest archipelago in the world. There are around 17,000 islands spread throughout Indonesia. Around 13,466 islands have been recorded and there are still around 3,000 who do not have names or have not recorded the coordinates [1-5]. As a country with the largest archipelago in the world, Indonesia is in a vast territorial sea area. Indonesia has the second longest coastline in the world (after Canada) with a length of about 93,000 Kilometers. With these geographical conditions, Indonesia has the potential of very valuable natural wealth, namely salt commodities [6].

But ironically in recent years Indonesia has imported salt. This condition is because Indonesian salt production is not sufficient for consumption. On average national salt needs from 2009-2016 amounted to 3,439,225 tons and production was only 1,464,233 tons. To overcome this imbalance between needs and availability, the government was forced to import. On average national salt imports amounted to 1,974,992 tons [7].

One of the salt producing regions in Indonesia is Madura Island. According to the Central Bureau of Statistics, in 2013 there was a production decline of -16.53%. This decline in production was also followed by a decrease in the area of salt production area in the year amounting to -0.78%. In 2014 and 2015 salt production showed an increase of 13.25% and 18.81% respectively. Weather anomalies with high rainfall have caused salt production in Madura Island to drop dramatically in 2016 to -95.41%. This decline was also followed by a decrease in the area of salt production area for the year by -0.07%. The decline in production and the area of people's salt farm land eventually resulted in a decrease in the productivity of the people's salt farmers in producing salt on Madura Island. In 2016 the productivity of the people's salt farms in Madura Island decreased by -95.41% [8].

The decline in the production of popular salt farmers in Madura Island is allegedly caused by several factors. These factors include the production of popular salt farmers in Madura Island so far not optimal. From the results of interviews while the writer with salt farmers shows that 70% of farmers stated that their production was not optimal. Only 30% of salt farmers say their production is optimal. This condition clearly shows that salt production cannot reach the desired target [9].

In addition, from the results of interviews, it was seen that salt farmers who get the maximum profit from this business are 45%. While 55% of salt farmers said they did not get the maximum benefit from this business. This condition means that so far the salt business in Madura Island has not provided maximum benefits to the salt farmers themselves.

Based on the above conditions, this study tries to analyze whether the people's salt farmers on the island are in optimal production or not, and whether the people's salt farmers on the island of Madura have reached maximum profit or not.

II. METHOD

The population in this study is the community salt farmer. In 2017, the number of community salt farmers on Madura Island was 9,217 people. The number of farmers is spread in 4 districts on Madura Island. While the sample in this study amounted to 220 people [9]. The sampling method used was Slovin.

The form of salt production function in this study is in the form of Cobb-Douglas production function [10, 11]:

$$Q = AK^{\alpha} L^{\beta} \quad (1)$$

The estimation of the above equation can be done by transforming the model in logarithmic form. The logarithmic form of the above equation is:

$$\text{Log } Q = \log A + \alpha \text{ Log } K + \beta \text{ Log } L \quad (2)$$

Where:

Q = salt production

K = capital

L = labor

e = error term

In the concept of production optimization it is necessary to determine the constraint function of a production function. The constraint function of the production function is the cost function. The form of the production cost function is written based on the following identity equation [12, 13]:

$$C = r K + w L \quad (3)$$

Where;

C = production cost

r = capital cost

w = labor cost

In determining the production criteria for an optimal or not commodity, it is necessary to know the concept of Marginal Propencity of Capital (MPK) and Marginal Propencity of Labor (MPL). MPK and MPL are the slope of the production function Isoquant curve above. MPK is the first derivative of production against capital in the production function while MPL is the first derivative of production against labor in the production function. MPK and MPL values are obtained in the following ways [14, 15]:

$$MPK = \delta Q/\delta K = AK^{(\alpha-1)} L^{\beta} \quad (4)$$

$$MPL = \delta Q/\delta L = AK^{\alpha} L^{(\beta-1)} \quad (5)$$

Whereas the cost function slope (Isocost) is r and w. A production is said to be optimal if the slope of the Isoquant curve = the slope of the Isocost curve. The production criteria for an optimal commodity or not can be written completely as follows [16]:

- If MP_K/MP_L <r/w then the production can be said to be not optimal so the solution is to increase production.
- If MP_K/MP_L =r/w then the production can be said to be optimal.
- If MP_K/MP_L >r/w then the production can be said to be not optimal so the solution is to reduce production.

Profits are the results that must be achieved in each production process. Profit is defined by the difference between total revenue and total costs [17]. Mathematically the profits are calculated by the formula:

$$\pi = TR - TC \quad (6)$$

Where:

π = profits

TR = total revenue

TC = total cost

The total revenue function in this study is:

$$TR = a + bQ + cQ^2 \quad (7)$$

Where;

TR = total revenue

Q = production

While the total cost function is shaped:

$$TC = d + eQ + fQ^2 \quad (8)$$

Where:

TC = total cost

Q = production

To determine whether a production is maximum or not, it is necessary to know the Marginal Revenue (MR) and Marginal Cost (MC) value of the revenue function and cost function.

Marginal Revenue is a change in revenue due to changes in production. Likewise with Marginal Cost which is a change in costs due to changes in production. MR and MC are mathematically the first derivatives of total revenue and total costs of production. Thus MR of equation (9) is:

$$MR = b + (c .2) Q \quad (9)$$

While the MC of equation (8) is:

$$MC = e + (f .2)\ Q \quad (10)$$

Maximum profit criteria are:

- If MR > MC, then the production profit is not maximal. The solution to this situation is added production.
- If MR = MC, then production is said to achieve maximum profit
- If MR < MC, then the production is said to have not reached maximum profit. Thus the solution reduces production.

III. Results and Discussion

The estimation results of salt production on Madura Island can be seen in the following equation:

$$Log\ Q = 10,759^{***} + 0,320^{***}\ Log\ K + 0,414^{***}\ Log\ L \quad (11)$$

Adjusted R-squared = 0,435144

Prob (F-statistic) = 0,00000

Or

$$Q = 10,759\ K^{0,320}\ L^{0,414} \quad (12)$$

The regression results above have been tested for classical assumptions (normality, multicollinearity, heteroscedasticity). Thus the regression results have fulfilled the assumption of Best Linear Unbiased Estimator (BLUE).

Based on the data collected, the average total cost of salt production is 807,296 IDR / Month. While the average cost for capital is 444,013 IDR / Month and 363,283 IDR / Month for labor. Thus, the equation for the cost of producing salt can be written as follows:

$$807.296 = 444.013\ K + 363.283\ L \quad (13)$$

This means that to produce salt as much as one kilogram of salt requires a cost of 807,296 Rp / month with a capital cost of 444,013 Rp / month and a workforce of 363,283 Rp / month.

MPK and MPL values can be found by determining the first derivative of the production function in equation 12 as follows:

$$MP_K = \delta Q/\delta K = 3,443\ K^{-0,68}\ L^{0,414} \quad (14)$$

By entering the average value of capital and labor in the MPK equation above, the MPK value is as follows:

$$MP_K = 3,443\ (319)^{-0,68}\ (269)^{0,414} = 0,692 \quad (15)$$

Whereas MPL is obtained as follows:

$$MP_L = \delta Q/\delta L = 4,454\ K^{0,320}\ L^{-0,586} \quad (16)$$

By entering the average value of capital and labor in the MPL equation above, the MPL value is as follows:

$$MPL = 4,454\ (319)^{0,32}\ (269)^{\wedge -0,586} = 1,062 \quad (17)$$

The values of r and w based on equation (13) were 444,013 and 363,283 respectively. Thus, whether salt production in Madura Island is optimal or not, a comparison can be made as follows:

$$MP_K/MP_L < r/w = 0,692/1,062 < 444.013/363.283 = 0,652 < 1,22 \quad (18)$$

From the results of the comparison above, it can be seen that the MP_K / MP_L value is 0.652 small from the value of r / w = 1.22. Thus it can be concluded that salt production in Madura Island is not optimal.

The regression results of total salt reception on Madura Island in this study are as follows:

$$TR = 1.083.054 + 2.564,99\ Q + 0,00453\ Q^2 \quad (19)$$

Adjusted R-squared = 0.331236

Prob(F-statistic) = 0.000000

From equation 19, we get the MR value by reducing the TR equation to Q:

$$\delta\ TR/\delta\ Q = MR = 2.564,99 - 0,00906\ Q \quad (20)$$

While the total cost of salt on Madura Island is:

$$TC = 998.737,7 + 135,98\ Q - 0,002338\ Q^{\wedge 2} \quad (21)$$

Adjusted R-squared = 0.101649

Prob(F-statistic) = 0.000003

The value of MC is obtained by decreasing the TC equation against Q:

$$\delta\ TC/\delta\ Q = MC = 135,98 - 0,00468\ Q \quad (22)$$

To see whether salt production in Madura Island has reached maximum profit or not, it is necessary to know the value of MR and MC. If the MR value = MC, then it can be said that salt production in Madura Island has reached maximum profit. However, if MR ≠ MC, it is said that salt production does not reach the maximum profit.

As explained above, the MR equation = 2,564.99 - 0.00906 Q. The Q value used is the average value of the salt production of 1,562 Kg / Month. Thus the MR value is:

$$MR = 2.564,99 – 0,00906\ Q \quad (23)$$

$$MR = 2.564,99 – 0,00906\ (1.562) \quad (24)$$

$$MR = 2.550,84 \quad (25)$$

So the MR value of salt production in Madura Island is 2,550.84 Rp / Month.

Then, the equation MC = 135.98 - 0.00468 Q. The Q value entered is also the same as the average value of salt production. Thus the MC value is:

$$MC = 135,98 – 0,00468\ Q\ (1.562) \quad (26)$$

$$MC = 128,67 \quad (27)$$

So the MC value of salt production in Madura Island is 128.67 IDR / Month.

From this result it can be seen that the value

$$MR = 2.550,84 \neq MC = 128,67 \quad (28)$$

Or

$$MR = 2.550,84 > MC = 128,67 \quad (29)$$

Thus, it can be said that salt production in Madura Island does not reach maximum profit because MR>MC. This situation is more precisely due to the very high phenomenon of salt prices in its history when the research was conducted. This high salt price makes the receipt of salt farmers far increased dramatically from the previous time. So that when the interview and survey of salt farmers hope that the price of salt will continue to survive at this level. This high salt price has made salt farmers feel prosperous from the previous conditions. On the other hand, the costs incurred for salt production can still be said to be relatively the same from the previous time. Thus it can be concluded that the revenue from salt production is greater than the costs incurred so that the profits of salt farmers become less than optimal.

IV. CONCLUSION

This study concludes that:

- Salt production in Madura Island has not reached optimal conditions. This can be seen from MPK / MPL <r / w (0.652 <1.22).
- The advantage of salt production in Madura Island does not reach the maximum conditions because of the value of MR> MC (2,550.84 Rp / Month> 128.67 Rp / Month). This phenomenon is because the price formed at the time of the study is a higher price than normal conditions.

Based on the results of the research, the suggestions that can be raised are:

- Conducting business integration of land between community salt farmers to achieve a minimum production scale of 10 hectares.
- The government needs to set the upper and lower limits of the salt price. Thus, if the government sets the benchmark price, the salt price should move between the upper and lower limits.
- It is necessary to add the function of PT Garam (Persero), which is a salt stock buffer body whose duty is to buy people's salt when prices are low and sell to the market (market operations) when the price of salt is high.
- In addition, the role of PT Garam (Persero) is also needed as a processor (salt processing) institution in order to strengthen the role of price stabilizers and increase the added value of salt commodities.

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