Income analysis of seaweed agribusiness in Ma’rang District, Pangkep Regency

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Abstract. South Sulawesi is the province with the largest contributor to national seaweed production with an increase in production reaching 300 thousand tons per year. Efforts to increase seaweed production are highly achievable, because the area of South Sulawesi is considered to have a large enough potential for coastal fisheries resources, cultivation and post-harvest technologies are easy to implement and do not require large capital. In Ma’rang Subdistrict, Pangkep Regency, this seaweed cultivation activity has been used by farmers. However, in fact seaweed farming has problems, namely the low price of seaweed received by farmers and low production yields. This study aims to Analyze the factors that affect the income of seaweed farming in Ma’rang sub-district, Pangkep district. The analytical method used is quantitative analysis in the form of multiple linear analysis with a total of 85 respondents. The results showed that the factors affecting the income of seaweed farming in Ma’rang sub-district, Pangkep district were influenced by the selling price of IDR 21,552.94/kg, production 29,085/kg, seedlings IDR 2,063,558.82/cycle, and the number of stretches is 191.88 units.

1. Introduction
South Sulawesi is the province with the largest contributor to national seaweed production with an increase in production reaching 300 thousand tons per year. The South Sulawesi region has considerable potential for fisheries resources, technology and post-harvest cultivation is easy to implement and does not require large capital [1]. Based on a report from the South Sulawesi Fisheries and Marine Service in 2019, the national seaweed production reached 1,728,475 wet tons in 2007 or the equivalent of 172,847.5 dry tons. Meanwhile, seaweed production in South Sulawesi has reached 670,740 wet tonnes, equivalent to 63,074 dry tonnes (36.5%). The widespread use of seaweed has attracted farmers to cultivate this commodity and make it an agribusiness sector that supports farmers’ main income.

Besides being famous for its milkfish development area, Pangkep Regency is also one of the areas for seaweed commodity in South Sulawesi. In Ma’rang District, Pangkep Regency, seaweed farmers are trying to increase the production of seaweed which is considered a suitable marine environment for cultivating seaweed. The achievement of seaweed cultivation production and capacity will be able to be achieved if the main players and business actors are economically able to reach the optimal point of business feasibility. While business feasibility is of course very dependent on the running of the interacting subsystems starting from activities from upstream (on farm) to downstream activities (off farm), this is because the existence of subsystems in an effective cycle will be able to increase...
production efficiency. The determination of seaweed commodity as a superior commodity is based on several considerations, including: (1) the land resources that are owned are very broad which are supported by several characteristics that are very prospective for the development of seaweed cultivation, (2) various mineral sources contained in seaweed products and are widely used in food, pharmacy, microbiology, and medical. As well as feed, cosmetics, fertilizers, and the packaging industry [2]. The purpose of this study was to analyze the factors that influence the income of seaweed farming in Ma’rang sub-district, Pangkep district.

2. Literature review
Agribusiness is a process starting from production, processing results, marketing and other activities related to agricultural activities [3]. Agribusiness changes the perspective on agricultural (rural) development which is not only oriented towards primary production (plants and animals), but also market potential and big business on the basis of more efficient primary products [4].

Agribusiness activities in Indonesia are still marked by limited accessibility of farmers to the market due to the small scale of the business, inefficient marketing institutions and the investment climate and capital that are not yet conducive to business in agriculture. According to [5], in the development of seaweed agribusiness, it is necessary to establish a harmonization system between the supply of raw materials, human resources, capital, law, institutions and a marketing system. The production potential and development potential of seaweed from the downstream subsystem to the upstream subsystem need to be empowered. Seaweed (Eucheuma cottonii) is a commodity that has economic value, this is because seaweed has a high carrageenan content. Therefore, seaweed is a commodity for international trade. Currently seaweed cultivation has become one of the livelihoods of coastal communities, so management or planning is needed for its development.

In planning, developing and utilizing coastal areas for seaweed cultivation, an accurate estimation of the potential carrying capacity is needed so that the planning can be precise, especially if it is to be developed to the level of the processing industry. In the technical aspect of cultivation, according to [6], the method of cultivating seaweed type Eucheuma cattoni in Mandalle Village, Pangkep Regency which is very suitable is the long line method, which is a long rope stretched consisting of several stages starting from land preparation and seedlings for 5-7 days, planting seeds for 2-3 days, maintenance is carried out three times a week, harvesting after 45 days and drying or drying the seaweed for 3 days depending on the heat of the sun. Financially seaweed cultivation in Mandalle Village, Pangkep Regency is profitable and feasible to be developed as a fishery business activity. The development of seaweed in Pangkep Regency is growing rapidly in three villages, namely Pitusunggu Village, Ma’rang District, Tamarrupa Village and Boddie Village, Mandalle District. In Pitusunggu Village, Ma’rang District, the majority of the residents work as seaweed farmers. Generally, seaweed farmers (producers) in Pangkep district cultivate one type of seed, namely Eucheuma cottonii [7]. In the aspect of processing, several processed products contain seaweed with high economic value such as agar, carrageenan and alginate which can be used both on an industrial and household scale. The regional potential and biodiversity of seaweed is one of the keys to support the development of seaweed in Indonesia, however the mastery of technology in processing the various benefits of seaweed in Indonesia is still very low when compared to the Philippines and China. Seaweed processing traditionally processes seaweed into ready-to-consume foods such as dodo, sweets and seaweed meatballs.

3. Research method
This type of research is quantitative. The research was conducted in Ma’rang District, Pangkep Regency with the consideration that Pangkep Regency is one of the areas designated as a Minapolitan area. This research was conducted for 3 months starting from October to December 2019. The samples were determined based on the Slovin formula, namely as many as 85 farmers. Data and information were collected by interview using a questionnaire. Data analysis used quantitative analysis, namely multiple linear regression with the following formula:
\[
Y' = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + e
\]  

Information:
\( Y' \) = The income of seaweed farmers  
\( \beta_0 \) = Constant  
\( \beta_1-\beta_4 \) = Regression coefficient  
\( x_1 \) = Selling price (IDR/kg)  
\( x_2 \) = Seaweed production (kg/1000 m\(^2\))  
\( x_3 \) = Cost of seeds (IDR/1000 m\(^2\))  
\( x_4 \) = Number of Spans (m\(^2\))

4. Results

4.1. Factors affecting seaweed agribusiness income

4.1.1. Selling price of seaweed (\( x_1 \)). Collector traders sell dried seaweed to the factory at a price that varies between IDR 25,000/kg to IDR 30,000/kg (depending on the quality of the seaweed). The distribution of respondents based on the selling price of seaweed collectors to dominant factories is IDR 25,000/kg (51 farmers or 60.00%), and IDR 39,000 (23 farmers, 27.06%). The average selling price of dried seaweed from 85 farmers to collectors is IDR 26,705.88. The seaweed that has been purchased is then transported and carried using a pick-up truck which is transported by collectors to the factory (the export company) in Makassar City.

| No. | Selling Price (IDR) | Amount (Soul) | Percentage (%) |
|-----|--------------------|---------------|----------------|
| 1.  | 18,000             | 1             | 1.18           |
| 2.  | 20,000             | 50            | 58.82          |
| 3.  | 22,000             | 1             | 1.18           |
| 4.  | 24,000             | 33            | 38.82          |
|     | Amount             | 85            | 100.00         |

Source: Primary Data Processed in 2020

Based on the table, farmers sell dried seaweed to collector traders at various prices, depending on the quality of the dried seaweed that is sold. The selling price of dried seaweed ranges from IDR 18,000 to IDR 24,000. The average selling price of dried seaweed from 85 farmers to collectors is IDR 21,552.94/kg.

4.1.2. Seaweed production (\( x_2 \)). Farmers in Ma’rang District produce seaweed 8 times a year. In marketing seaweed, farmers only concentrate on the cultivation aspect, because the marketing aspect is carried out by collectors to the factory. The production of dry seaweed per cycle in Ma’rang District can be shown in table 2. The production of dry seaweed per cycle was 29,085 kg with an average of 342.18 kg from the 85 respondents observed. When viewed from the data on the distribution of the number of respondents based on dry seaweed production, it is known that the production varies, but the dominant production is in the amount of 300 - 400 kg, as many as 61 people (71.76%). This is because each farmer has a different number of stretches.
Table 2. Distribution of number of respondents based on seaweed production per cycle in Ma'rang District

| No. | Production (Kg) | Amount (Soul) | Percentage (%) |
|-----|----------------|---------------|----------------|
| 1.  | ≤ 200          | 24            | 28.24          |
| 2.  | 300 - 400      | 61            | 71.76          |

Amount 85 100.00

Source: Primary Data Processed in 2020

4.1.3. Cost of seeds (X3). Seaweed seeds are initially obtained by buying from seaweed farmers outside the area, namely Takalar District, then later the seeds are obtained from the harvest intended for seedlings, or there are also spans that are devoted to the development of seaweed seeds.

Table 3. Distribution of number of respondents based on cost of grass seeds per sea cycle in Ma'rang district.

| No. | Cost of Seeds (IDR in million) | Amount (Soul) | Percentage (%) |
|-----|--------------------------------|---------------|----------------|
| 1.  | ≤ 1                            | 39            | 45.88          |
| 2.  | ≥ 2                            | 33            | 38.82          |
| 3.  | ≥ 3                            | 13            | 15.30          |

Amount 85 100.00

Source: Primary Data Processed in 2020

The cost of seaweed seedlings incurred by farmers per cycle in Ma'rang District is IDR 175,402,500 with an average of IDR 2,063,558.82 from 85 respondents who were observed. If we look at the data on the distribution of the number of respondents based on the cost of seaweed seeds (table 3), it is known that they vary, but the dominant one is in the amount of IDR 1,000,000 to IDR 1,355,000 as many as 39 people (45.88%).

4.1.4. Number of expanses (X4). Based on the results of interviews in the field with seaweed farmers, it is known that the length of the stretch for each farmer is different, ranging from 20-25 meters per stretch, with the distance between the seaweed seeds tied 30 cm, so that each stretch contains between 67 - 84 grass seeds wet sea. The number of wet seaweed seeds required per stretch is 5 kg.

The total stretch of seaweed in Ma'rang District was 16,310 units, with an average of 191.88 units from the 85 respondents observed. If we look at the data on the distribution of the number of respondents based on the number of seaweed stretches, it is known that they vary, but the number of dominant stretches ranges from 200 - 325 units of a stretch of 47 people or 55.29% (table 4).

Table 4. Distribution of the number of respondents based on the amount of seaweed in Ma'rang District

| No. | Amount of Stretch (Unit) | Amount (Soul) | Percentage (%) |
|-----|--------------------------|---------------|----------------|
| 1.  | ≤ 100                    | 38            | 44.71          |
| 2.  | 200 - < 300              | 47            | 55.29          |

Amount 85 100.00

Source: Primary Data Processed in 2020

Analysis of the factors that affect profits using SPSS 25 gives the following results (table 5). The average profit observed for the 85 seaweed farmers was IDR 2,641,110.62. The average selling price of seaweed is IDR 21,552.94, the average seaweed production was 342.18 kg, the average cost of seeds is IDR 16,508,470.59 and the average number of stretches is 191.88 units.
Table 5. Analysis of the factors that affect profits

|                      | Mean   | Std. Deviation | N  |
|----------------------|--------|----------------|----|
| Advantage            | 264110.62 | 915431.234   | 85 |
| Selling Price        | 21552.94   | 1985.099    | 85 |
| Production           | 342.18    | 72.170       | 85 |
| Cost of Seeds        | 16508470.59 | 6809601.328 | 85 |
| Amount of Stretch    | 191.88    | 70.436       | 85 |

The magnitude of the relationship between the dependent variable (profit) and the independent variable (selling price) calculated by the correlation coefficient is 0.186; production 0.334; seed costs 0.246; and the number of stretches -0.133 (table 6). Thus it can be understood that the correlation between the dependent variable (profit) and the independent variable (production) is greater, so the independent variable (production) can be said to be more influential on the dependent variable (profit) compared to other independent variables (selling price, cost of seeds, and the number of stretches).

Table 6. Correlation between dependent variable and independent variable.

|                      | Advantage | Selling Price | Production | Cost of Seeds | Amount of Stretch |
|----------------------|-----------|---------------|------------|---------------|------------------|
| Pearson Correlation  | Advantage | .100          | .186       | .334          | .246             | -.133            |
|                      | Selling Price | .186      | 1.000     | -.217         | .109             | .099             |
|                      | Production  | .334        | -.217     | 1.000         | .473             | .691             |
|                      | Cost of Seeds | .246      | .109     | .473          | 1.000             | .511             |
|                      | Amount of Stretch | -.133    | .099     | .691          | .511             | 1.000             |
| Sig. (1-tailed)      | Advantage | .044          | .001      | .012          | .113             |
|                      | Selling Price | .044     | .023     | .161          | .184             |
|                      | Production  | .001        | .023      | .000          | .000             |
|                      | Cost of Seeds | .012     | .161     | .000          | .000             |
|                      | Amount of Stretch | .113    | .184     | .000          | .000             |

The correlation between the independent variables (selling price, production, seed price, and number of stretches) can be understood that there is a fairly strong correlation between the independent variable (production) and the independent variable (number of stretches), namely 0.691; the independent variable (cost of seeds) and the independent variable (number of stretches), namely 0.511; the independent variable (production) and the independent variable (cost of seeds) is 0.473. This indicates multicollinearity, or correlation between independent variables.

The significance level of the correlation coefficient which is measured from the probability between the dependent variable (profit) and the independent variable (selling price, production, and seed price) results in a sig <0.05, so the correlation between the dependent variable (profit) and the
independent variable (selling price, production, and seed prices) were very significant, except for the number of stretches with a sig value of 0.113 > 0.05.

Likewise with the level of significance of the correlation coefficient between the independent variables, which is measured by the probability between selling price (X1) and production (X2); production (X2) with the total cost of seeds (X3); production (X2) with the number of stretches (X4); The cost of seedlings (X3) and the number of spans (X4) resulted in a sig < 0.05, so the correlation between these variables was very real (table 7).

Table 7. The numerical value of R square

| Model Summary | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---------------|---|----------|-------------------|---------------------------|
| 1             | .788a | .621    | .602              | 577511.318               |

a. Predictors: (Constant), The Amount of Strecth, Selling price, Cost of Seeds, Production

The R square number is 0.621, this means that 62.10% of the dependent variable (profit) can be explained by the independent variable (selling price, production, cost of seeds, and number of stretches). While the remaining 37.90% is explained by other factors outside the factors examined in this study.

Table 8. Anova test.

| ANOVA* | Sum of Squares | df | Mean Square | F | Sig. |
|--------|---------------|----|-------------|---|------|
| 1 Regression | 437116590878 | 4  | 10927914771 | 32.765 | .000b |
| Residual | 266815457765 | 80 | 33351932220 | 6.767 |
| Total   | 703932048643 | 84 | 81.950      |

a. Dependent Variable: Advantage
b. Predictors: (Constant), The Amount of Strecth, Selling Price, Cost of Seeds, Production

Anova test or F test obtained F count of 32.765 with a significance level of 0.000 < 0.05, then the regression model can be used to predict profits, or it can be said that the selling price, production, cost of seeds, and the number of stretches together (simultaneously) have an effect to the profits of seaweed farmers in Ma'rang District, Pangkep Regency (table 8).

Table 9. Result of coefficient analysis.

| Coefficients* | Unstandardized Coefficients | Standardized Coefficients | t | Sig. |
|---------------|-----------------------------|---------------------------|---|------|
|              | B                           | Std. Error                | Beta |      |
| 1 (Constant) | -4627162.042                | 899394.493                | -5.145 | .000|
| Selling Price| 223.592                     | 35.197                    | .485 | 6.353 | .000|
Based on the results of the coefficients analysis (table 9), the regression equation is obtained as follows:

\[ Y = -4627162.042 + 223.592X1 + 13051.321X2 + 0.029X3 - 13042.610X4 \]  

(2)

- The X1 regression coefficient of 223,592 states that each additional Idr. 1, - The selling price of seaweed will increase the profit of seaweed farmers by IDR. 223,592, -
- The X2 regression coefficient of 13051.321 states that every addition of 1 kg of seaweed production will increase the profit of seaweed farmers by IDR. 13051.321, -
- The X3 regression coefficient of 0.029 states that each additional IDR. 1, - the cost of seaweed seeds will increase the profit of seaweed farmers by IDR. 0.029,-
- The X4 regression coefficient of -13042.610 states that each additional 1 unit stretch of seaweed will reduce the profit of seaweed farmers by IDR. 13042.610,-

The t test to test the significance of the constants and independent variables is seen at the sig number of 0.000 <0.05, and 0.010 <0.05, it can be concluded that the independent variables (selling price, production, seed price, and number of stretches) really have an effect. significant to the dependent variable (profit) of seaweed farmers in Ma'rang District, Pangkep Regency.

The results of this study found that the factors that are thought to affect the profits of seaweed farmers in Ma'rang District, Pangkep Regency are the selling price (X1), production (X2), seed costs (X3), and the number of stretches (X4), so that the hypothesis is made. is H0 accepted, namely the income of seaweed farmers in Ma'rang Subdistrict, Pangkep Regency, influenced by factors of selling price, production, seeds, and the number of stretches.

Based on the analysis above, it can be understood that if the farmers want to increase the profits of seaweed cultivation in Ma'rang District, Pangkep Regency, what needs to be the main concern of farmers are: 1) maximizing the selling price by increasing the quality of the dried seaweed sold; 2) increasing seaweed production by using good quality seeds; and 3) increase the cost of purchasing quality seeds. Generally sell their harvest to collectors around the village, because they no longer bother to bring the produce to traders in the city and do not need to spend a lot of money and time and energy. However, basically the farmers are in a difficult position because the traders determine the selling price. However, farmers feel that this is not a problem because most farmers tend to sell their produce immediately because they are pressed by economic needs. The selling price of seaweed is a set price for seaweed collectors. The low price of seaweed received by fishermen is because fishermen do not have a bargaining position in determining prices, where commodity prices are set by buyers or traders who collect seaweed. According to [7], the factors that affect the risk of production level and income of E. cottonii seaweed farming in Baruga Village, Mangarabombang District, Takalar Regency are influenced by erratic weather factors that greatly affect the increase in the amount of seaweed production. In addition, the unit price of dry seaweed per kilo has decreased which greatly affects the income level of seaweed farmers. The increasing of the production of seaweed (Eucheuma cottonii sp.) Can be done by using seaweed seeds that have good quality, proper and good care and planting methods or seaweed cultivation methods. This was supported by the extension officers who were assigned to the research locations that in order to get optimal growth, the seaweed seeds used had to be of high quality. Therefore, it is necessary to select the seeds with the following criteria: 1) The seaweed thallus is morphologically clean and fresh (characterized by a hard and brightly colored

| Production | 13051.321 | 1355.22 | 1.029 | 9.630 | .000 |
|------------|-----------|---------|-------|-------|------|
| Cost of Seeds | .029 | .011 | .219 | 2.648 | .010 |
| Amount of Strech | -13042.610 | 1356.75 | -1.004 | -9.613 | .000 |

a. Dependent Variable: Advantage
thallus); 2) Age 25 - 35 days; 3) Free from disease (no spots, no peeling, bright specific color); 4) The thallus has many branches, lush and tapered slightly; 5) Uniform seeds and not mixed with other types; 6) Initial seed weight should be uniform 50 - 100 grams per bunch.

5. Conclusion
Based on the analysis that has been carried out using multiple linear regression analysis methods on the factors that affect the income of seaweed in Ma'rang sub-district, Pangkep district, are: The selling price factor is IDR 21,552.94/kg, production 29,085/kg, seeds IDR 2,063,558.82/cycle, and the number of stretches is 191.88 units. For this reason, the efforts made to increase the income of seaweed farmers in Ma'rang sub-district are to increase productivity in terms of quality and quantity, and create price stability, by (1) selecting superior seeds, (2) intensive seaweed care, (3) innovation to add to the economic value of seaweed, and (5) the role of the government to determine the ideal price.

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