ECONOMIC ANALYSIS AND WATERS QUALITY SEAWEED FARMING (*Eucheuma cottonii*) IN THE DISTRICT OF BANGKEP

*Saharia Kassa*¹, *Bakri Hasanuddin*², *Madinawati*³

¹) Lecturer and Researcher at Department of Agribusiness Faculty of Agriculture. University of Tadulako. Palu. e-mail: saharia_kassa@yahoo.com

²) Lecturer and Researcher at Department of Economics. Faculty of Economic. University of Tadulako. Palu.

³) Lecturer and Researcher at Faculty of Animal Husbandry and fisheries. University of Tadulako. Palu.

ABSTRACT

Seaweed farming development received support from local government with “Gema Biru Sulawesi Tengah” which makes seaweed commodities became the competitive commodity across sectors in the region. Nowadays, the demand of the dried seaweeds as well as semi-finished products (semi-finished carrageenan) tends to be increased rapidly because they are classified as healthy food. On the other hand, the farmer in the district of Bangkep relatively still being traditional by planting in the territorial which estimated suitable for seaweed. The Study aims to identify the water potential of seaweed farming and to analyze the economic variables that affecting the production of seaweed based on its deployment area. This research is conducted in Bangkep in 4-sub-districts area i.e. Bulagusub-district (Peling Peasa, Bulagi and Kambal village), South Bulagi District (Bulagi, Palabatu, and Lolantang village), South Tingkung district (Tinangkung, Bobu and Gangsal village) and Liang district (Apal, binatuli and Liang village). The determination of locations is done purposively with 56 respondents. The data Analysis used are suitability analysis with water measurement and testing of water sample as well as regression analysis. The research shows that the locations of the farms have water quality which suitable with the seaweed, which shown by the result of the physical-chemical measurement parameters that meet with the growing requirements in the range of achievement 74.00–82.67%. Economic aspects show the average income of the seaweed farmers are Rp. 1,614,434. Further variables simultaneously independent (age, education, number of dependents, experience, the amount of expanses, and prices) that affect the production of seaweed, while partially only age, experience, amount of expanses, and prices significantly affect the production on the t value of each are 2.57; 3.69; 2.49; and 2.33.

Key Words: Economic variables, farming, seaweed, waters.

INTRODUCTION

Seaweed (*Eucheuma cottonii*) has high economic value and very popular in both domestic and export trade because of its usefulness as a raw material that is diverse, both for the pharmaceutical, cosmetics and pharmaceuticals. In addition, seaweed also serve as the source of nutrition that contains carbohydrates (vegetable gum), protein, fat, vitamins and minerals, especially iodine. The problem is that the seaweed cultivation in this area include in the District of Bangkep relatively still traditional with low productivity, the planting is done in the territorial waters that are deemed appropriate and within easy reach of the coastal settlements.

Central Sulawesi province that has a long coastline about 4,013 km and an area of 89,865 km² of the sea, one of the coastal area is waters where the cultivation of seaweed for the coastal communities is in Bangkep district. The potential of the economic opportunities for the development of seaweed, which is currently a small part has been started to be used by the coastal communities. Total production of seaweed in 2014 amounted to 164,927.50 tons of wet, this production puts Bangkep district
as the biggest producer of seaweed in Central Sulawesi province after Parimo, Morowali and District Touna (Kadiskanlut, 2014). Seaweed cultivation development supported by local government with “Gema Biru Sulawesi Tengah” it is also in accordance with the research results of Bank Indonesia that seaweed commodity’s position as one of the leading commodity sector in the District of Bangkep (KBI, 2011).

Regarding to the position, at this point seaweed productivity tends to be decreased, area planted to stagnate, even some farmers did not plant at the time of collecting data. The reduced area of people’s cultivation in the study area is because the price of the seaweed that very low, it is only about Rp 5,000-Rp 6,000/Kg (Interviews with respondents, 2016).

In line with efforts to accelerate economic development associated with “Gema Biru Sulawesi Tengah”, basically the farmers of seaweed requires the support information about suitability or the quality of the waters where they cultivate the seaweed in the District of Bangkep. In addition, the market price as a decisive determinant of farmer's income are also important, because it is directly related to the acceptance and feasibility of seaweed farming. The important thing that also important to know, is what are the factors affecting the production of seaweed produced in the research area, therefore, an article on "Economic Analysis and Waters Potential on Cultivation Seaweed (Eucheuma cottonii) in the district of Bangkep" is interesting to be analyzed. This analysis will be very beneficial for the local government, encouraged farmers community in improving productivity, while strengthening the economic fabric of coastal communities to the expansion of plantations and seaweed.

METODOLOGY OF RESEARCH

The first year of the research aims to get the physical data and chemistry of the waters cultivation of seaweed and to determine the feasibility of their business and what factors influence the production of seaweed. This research is implemented in the District Bangkep in 4 sub-districts, namely District Bulagi represented by (Village Peling Peasa, Village Bulagi, and Village Kambal), Bulagi South (Village Bulagi, Village Palabatu I and the Village Lolantang), South Tinangkung (Village Tinangkung, Bobu, and Village Gangsal), and the District Liang (Apal Village, Liang Village, and Village Binantuli).

The determination of location is done with consideration of proposals on education purposive SKPD Diskanlut District of Bangkep that the site has been being the largest region to produce seaweed in the District of Bangkep. Furthermore, the existing condition of seaweed cultivation time of data collection is also taken into account in determining the location of the research with the hope representation of coastal areas Bangkep district. When referring to the Strategic Plan of Bangkep district, then almost all the coastal district is prepared as a center for the cultivation of seaweed on a regional scale potential development of coastal resources, but only five in districts of the populations grow seaweed at the time when collecting data. The development of seaweed become one of the commodities considered strategic to choose to accelerate the development of Parimo Economic District and Central Sulawesi province, which is also in line with the corridor of MP3EI.

The data field collection is in March-August 2016. Respondents were determined by purposive randomized stratified (stratified random sampling), but still need to be find the respondents who do the planting in the last 4 months, and ultimately the number of respondents from each sample village as much as 4 people bringing the total respondents as many as 56 people. The primary data for social and economic aspects obtained through interviews and observation, and the water quality is obtained by direct
measurement at the site by taking two points of observation on each of the waters of seaweed farming in 14 sample villages, so the total sample is 28. Secondary data needed either obtained through literature searches and Periodic Annual Research Reports of relevant agencies, among others SKPD Diskanlut and BPS.

Furthermore, analysis of water quality data continued by test in Agrotechnology laboratory, Tadulako, while the economic analysis conducted by the formula (equation) as following:

1. Analysis of Income of Seaweed Farming,
   \[ \Pi_i = TR_i \cdot TC_i \]
   where \( i \) = amount of farmers /Cultivators
   \[ \Pi_{tot} = \sum \pi_i \]

2. Analysis of Regression:
   \[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_1 + \beta_5 D_2 + e_i \]
   Where:
   \( Y \) = Seaweed production (Kg)
   \( \beta_0 \) = Intersep
   \( \beta_0 - \beta_0 \) = Regression coefficient
   \( X_1 \) = Farmers age (Years)
   \( X_2 \) = Education (Years)
   \( X_3 \) = Amount of independent (people)
   \( X_4 \) = Experience (years)
   \( X_5 \) = Amount of expanses (buah)
   \( X_6 \) = Price (Rp)
   \( e_i \) = Error term

To see the effect of simultaneous F test with the following formula:

\[ F = \frac{KTR}{KTS} \]

Where:
\( F \) = Uji Fisher (Fisher test)
\( KTR \) = Central Squares Regression
\( KTS \) = Central Squares Time

**Analysis of Waters Suitability of Seaweed Farming.** The analysis is intended to determine the suitability of the waters of waters area suitability for cultivation of seaweed using water suitability indicators. This concept is based on the parameters of biology, physics, and chemistry of water (hidrooceanografi) ecologically is a prerequisite eligibility in seaweed cultivation. Determining the level of water suitability for cultivation of seaweed determined by calculation feasibility level by giving weight to each parameter measured by the results of the literature study and information from experts.

**RESULTS AND DISCUSSION**

Bangkep district has been established as one of the location of seaweed farming *Eucheuma cottoni* in Central Sulawesi province with most communities in the coastal district cultivate seaweed, empirically productivity is still low, as well as advanced level of technology among peasant farmers, as well as its market reach is limited to primary commodities with volatile prices, even at the time of field research undertaken tended to decrease (the result observation researcher. 2016). Analysis of economic variables in the cultivation of seaweed *Eucheuma cottoni* begins with discussion of water quality measurements as follows.

**Characteristic of Waters Quality Research Location.** Data characteristics of physical and chemical of water quality cropping seaweed in 4 (four) districts in the region of Bangkep each presented in Table 1 and Table 2.

Table 1 shows the results of the physical quality analysis of water that will be outlined as follows:

1. Current velocity

   Flows are very helpful in supplying and increasing the diffusion of nutrients into plant tissue and cause fluctuations in salinity and small temperature. Besides the strength of the current direction should also be known to determine a general overview of the cultivation area so that the water circulation remains smooth and in control.

   The current velocity measurement results are listed in Table 1 by using a kite show flow velocity varies between 0.1 m/s to 0.39 m/sec. As seen from the result data obtained current velocity is still in the category of needed for the growth of seaweed. This is accordance
with Anggadireja et al., (2006) that the current speed for seaweed cultivation ranges from 0.2-0.4 m/sec so that the plant can be cleaned from dirt and nutrient supply can work well.

2. Waters deepness

In addition, the current velocity water depth is another important determinant of physical quality of waters, as they relate to the level of acceptance or the penetration of sun light to support photosynthesis process of plants seaweed. The depth of waters in accordance will facilitate the absorption of food and protected from damage caused by the absorption of direct sunlight (Sudarmi., 2012). The location of seaweed farming in Bangkep district has a very varied water depths (Table 1) they are in between 3.0 to 35.0 m started in the village of Pelingpeasa to Bobu village.

Kadi and Atmadja (1988) reported the results of their research that the ideal depth for the growth of seaweed is in Kepulaun Seribu with the basic method is 0.3 to 0.6 m at the lowest tide. This shows that the depth of the location of seaweed farming in the study site from the sites were partially has a depth of water of seaweed cultivation are in the category of eligible (appropriate) for the growth of seaweed.

3. Waters Brightness

Brightness in the waters of Bangkep District looks different from the relatively brightness level of 3 m - 20 m (Table 1), it indicates that there is a difference in brightness at various locations cultivation for each sampling point. This condition is suspected because some locations are at a level sufficient depth within and partly is at a level somewhat shallow depths. However, the brightness level is still very good for seaweed cultivation, as proposed by Mubarak et al. (1990) that for seaweed farming activities are ideal, when the brightness level of the water is >5 m.

4. Temperature

Temperature directly affects the lives of seaweed, especially in the process of Photosynthesis, the process of metabolism, and reproductive cycles, fluctuations in very high temperatures will make the plants become stressed and affect the growth rate (Mayunar et al., 1995). The temperature of the water at the sampling point for seaweed cultivation in the District of Bangkep obtained using a temperature gauge thermometer. Data obtained ranged from 31°C to 33,7°C with average values varied for all sampling locations consisting of 31°C to 33,7°C. The lowest temperature result is in the village of Liang while the highest temperature obtained in the village Binuntuli. In general, the water temperature in the District of Bangkep still within the range of temperatures that promote the carrying seaweed farming activities.

The measurement visually results to the chemical waters quality in aquaculture, seaweed locations can be seen in Table 2.

The results data analysis of chemical quality of the waters in the study area will be described as follows:

1. Nitrat

Table 2 shows the levels of nitrates in the waters of seaweed farming locations ranged from 1.59 to 2.97 ppm, which indicates that the nitrogen content is in the range of suitable for seaweed cultivation. Joseph (2004) suggested that the nitrate content range which good for seaweed growth ranged from 0.1 to 3.5 ppm while Kamlasi (2008) states that nitrate can be a limiting factor if the concentration <0.1 ppm and >4.5 ppm. Based on the data obtained in this study showed levels of nitrate found is relatively small and it is in category of eligible for seaweed cultivation.

2. Phosfat

Table 2 shows the phosphate levels at each site ranged from 0.009 to 0.012 ppm. The results of the study in line with the opinion of Simanjuntak
(2006) found relatively fertile waters if the range of nutrient phosphate in sea water normally is 0.10 to 1.68 ppm. This shows the locations of seaweed farming in the District of Bangkep especially in some rural locations are in the category of research is still feasible for seaweed cultivation.

3. Salinity
Salinity measurement results of the study sites showed values ranging between 32-34 ppt with the average 33.21ppt, salinity in the area is relatively high and uniform. It is because there is no streams found that will affect the salinity and low rainfall at the time of sampling. The range of salinity obtained in research in all these locations are still in a reasonable range to support the growth of seaweed. This is in accordance with the opinion of Kadi (2006) which states that the range of growth of seaweed in order to thrive in the tropics should have ranged between 32-34 ppt salinity.

4. pH
Measurement of pH value of waters in District of Bangkep using a portable pH meter, indicates the range within 7.46 to 7.90 with the lowest average value is 7.46 while the highest average value is 7.90. The pH value Tinangkung is low for the village while the highest values is in the Village Bulagi. The results showed that pH values vary at each sampling location, but the overall value of the average utilization of waters of seaweed farming zone, is within the range that is supportive to undertake cultivation of seaweed.

Analysis of Various Factors that Influencing Seaweeds Production.
Regression analysis is used to determine the effect of independent variables (age, education, Number of Dependents Family, Experience, Total Landscape, and Price) on the production of seaweed. This study uses a significance level of 5%. The results of the data analysis are shown in Table 3.
Table 1. Waters Physical Quality Data of Seaweed Farming Area in the District of Bangkep

<table>
<thead>
<tr>
<th>No</th>
<th>Variabels Measurements</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Peling</td>
</tr>
<tr>
<td>1.</td>
<td>Current Velocity (m/det)</td>
<td>0,15</td>
</tr>
<tr>
<td>2.</td>
<td>Deepness (m)</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Brightness (m)</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Temperature (°C)</td>
<td>31,5</td>
</tr>
</tbody>
</table>

Source: Analysis Result of Primer Data, 2016.

Table 2. Waters Chemical Quality Data of Seaweed Cultivation Area in District Bangkep

<table>
<thead>
<tr>
<th>No</th>
<th>Variabels Measurements</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Peling</td>
</tr>
<tr>
<td>1.</td>
<td>Nitrat (ppm)</td>
<td>2,23</td>
</tr>
<tr>
<td>2.</td>
<td>Fosfat (ppm)</td>
<td>0,011</td>
</tr>
<tr>
<td>3.</td>
<td>Waters Salinity (ppt)</td>
<td>32</td>
</tr>
<tr>
<td>4.</td>
<td>pH</td>
<td>7,74</td>
</tr>
</tbody>
</table>

Source: Analysis Result of Primer Data, 2016.
Table 3 shows that the value of $F_{count} = 23.81$ with sig value = 0.000 < 0.01, means that the independent variables simultaneously significant effect on the production of seaweed. The coefficient of determination $R^2$ worth 0.745 or 74.5% indicates that the variation amount of seaweed production ($Y$) is influenced by age, education, number of dependents, experience, and the amount of expanses; while 25.5% is determined by other factors not included in the model. Furthermore, to determine the influence of each independent variable of the production can be seen in Table 4.

Referring to Table 4, the results of the analysis can be written in mathematical models as follows:

$$Y = 295.81 - 0.255X_1 + 0.046X_2 + 0.054X_3 + 0.361X_4 + 0.240X_5 + 0.231X_6$$

The resulting mathematical equations indicate that if $X_1$, $X_2$, $X_3$, $X_4$, $X_5$, $X_6$ (age, education, number of dependents, the experience, the amount of expanses, and price) = 0 then the production of seaweed produced = 295.81 Kg seaweed dry/planting season. Table 4 also shows that the partial age ($X_1$) negatively correlated to the production of seaweed with the coefficient of -0.255, which means that each additional 1% age would reduce production by 25%. Variable experience ($X_4$) significantly affected the production of seaweed with the coefficient of 0.361, which means that each additional experience trying seaweed 1% would increase production by 36%. Similarly, the amount of expanses ($X_5$) and price ($X_6$) that affect the production of seaweed indicated by the regression coefficient each worth 0.240 and 0.231, which means that every additional amount of expanses of 1% would increase production by 24% and prices gives an indication that any seaweed prices rose by 1% would increase production of seaweed as 23%. This is confirmed by field observations that the seaweed farmers will be motivated to increase the amount of expanses of seaweed cultivated along with rising prices of seaweed.
CONCLUSION AND RECOMMENDATION

Based on the results of water quality analysis and economic analysis seaweed farming in the District of Bangkep the coastal district in 4 district of Bangkep result that water quality complies with the requirements for seaweed cultivation characteristics shown by figures from 74.00 to 82.67%. The economic analysis shows the average production of seaweed produced a crop cultivators for 430.73 kg of dried seaweed with an average price of Rp 5,594/kg, then the income of Rp 2411.143.

The analysis showed also that the simultaneous variables of age, education, number of dependents, the experience, the amount of expanses, and prices affect the production of seaweed, but only partially age, experience, the amount of expanses, and prices showed significant effect on the production of seaweed. Further recommended that no guidance is integrated in optimizing the potential of coastal resources in the cultivation of seaweed such as the availability of seeds when needed, as well as more favorable market access of farmers and appropriate cultivation techniques.


REFERENCES


