13. SEAWEED

13.1. Overview of Seaweed Industry in South Sulawesi

South Sulawesi Province has already declared as one of the centre for seaweed production in Indonesia. They supply and sell dried seaweed, especially *Euchema spp.* and *Gracilaria* spp with some product specifications. Product area center in South Sulawesi and Center Sulawesi, where 70% of product from Palopo and around (Kabupaten Luwu, North Luwu, East Luwu), 30% from Regency of Takalar, Bone, Sinjai, Bantaeng dan Center Sulawesi.

Farmer in Kabupaten Takalar do culture and post-harvest processing (drying and packing) and trade. Product quality control cooperates with Local government (Fisheries and Trade Agencies). Business development of them gets support from SeaNet and Industrial Agency. It also member of Gerbang Emas Program (Community Economic Development Action) of South Sulawesi for seaweed commodity.

Seaweed production in South Sulawesi has amazingly increased for the last five year from only about 12,000 MT in 2004 to nearly 100,000 MT in 2008. This brings seaweed as one of important commodity in South Sulawesi. With contribution to national seaweed production of about 45%, S Sulawesi is also the second world largest seaweed producer after Chili. Seaweed has contributed to South Sulawesi economic development, poverty alleviation and unemployment reduction.

The seaweeds of commerce are macroscopic algae. They, along with the other forms of algae, provide the base of the food chain for the reef and open sea organisms. Traditionally, seaweeds are categorized as “blue-greens”, “reds”, “greens” or “browns” based on their predominant or unique pigments. Industrial interest in seaweeds is largely for the colloids, gels and gums that can be extracted from them.

Although interest in seaweeds as a direct source of human food is not as great in other countries, seaweed (mostly from farming) is the world's sixth largest aquatic crop. Currently, seaweed is produced from South Sulawesi largely for two categories, agars (*Gracillaria*) and carrageenans (*Euchema*) from red algae. Carrageenans are highly sulphated poly-d-galactans. The three kinds in commercial use are lambda-, iota-, and kappa-carrageenan. The former two contain 30 to 40 percent sulfate. The latter two are the kinds obtained from South Sulawesi. Each is derived from a separate species complex within the genus *Eucheuma*. Most carrageenans wholesale from Rp.6.000 – Rp. 11.000/kg.

For humans who eat those algae have their values. These values are more likely to be in the provision of essential minor elements in the diet, and perhaps vitamins, rather than being sources of carbohydrates, fats or proteins. They do add variety and delicate flavors which Indonesian peoples relish. Kabupaten Takalar peoples, utilize some very strongly and uniquely flavored seaweed as food. For example, *Dodol*, *Manisan* and other food that sometimes eaten pickled.

The report of Jasuda Net reported that as of early April 2008 the price at farm level hit almost Rp. 8000/kg. in South Sulawesi (MC 35%, DC2-3%). In January 2008 the price hit Rp. 6200/kg. This price was 65% above the price of January 2007. The trend toward increasing dried cottonii seaweed prices is happening not only in South Sulawesi but also in seaweed growing areas throughout Indonesia. Price increase reflect a growing shortage of supply versus demand. Seasonal factors such as the timing of monsoons are thought to
be one factor limiting demand and commercial factors effecting farmers. These factors all together could possibly decrease the volume of seaweed production. Meanwhile demand has been increasing due to carrageenan market growth especially in China. This has led to a proliferation of new traders. With increasing prices it is easy to understand that the farmers are getting excited with the seaweed farming business and many are expecting that the price will continue go rise. Many farmers do not realize that rocketing prices are not always a good sign, especially when it is accompanied by a decline in product quality that seems to be taken for granted by many of the new-comer traders. They are willing to pay high prices for low-quality products including young plants with high moisture and a high level of contaminants.

13.2. Product Characteristics

Seaweed that produced in Takalar district is commonly *Graciliria* and *Euchema* species. *Gracilaria* is well known as a gelatin (agar-agar) producer. The production of gracillaria is ± 1720 tons / year. The other species of seaweed that produced in Takalar is *Euchema*. *Euchema* is well known as a carrageen producer with around 5664 tons / year production (source: Department of Trade Kab. Takalar). Agar-Agar and carrageenan are most in demand in the domestic & export markets. Eucheuma can be farmed commercially almost anywhere in the South Sulawesi Province coastal areas including in Takalar. As a binder, moisture holder, and gelling agent it is used by food processors all over the world. To enhance the quality of poultry, hams, sausages, and other meat products. Sauces, salad dressings and dips require carrageenan to impart body, provide thickness and stabilize emulsions. It creates a stable gel for canned meat products and shrimp or fish gels, and in dairy and dessert products. Whipped creams and toppings retain their stable form due to carrageenan. It gives body to acid milk products such as cheese and, in yogurt, improved fruit suspension. In ice cream, carrageenan prevents whey separation and ice crystal formation. It is also used in puddings and pie fillings as it creates a stable gel. Even chocolate drinks maintain quality with the aid of carrageenan. Non-food products also benefit from carrageenan. Beauty care products and pharmaceuticals make use of the seaweed derivative. Shampoos have acquired improved foam stability and thickness due to carrageenan. Lotions and creams use it for body, slip, and improved "rub-out" sensation. Even in toothpaste, carrageenan is very much at work acting as a binder while improving foam stability in the product.

In Takalar, seaweed processing has made into food products, products Medicines and other industrial products. Like *dodol*, candy, pudding and candy and others. However, still a lot of seaweed exported in the raw material. It is also still processed in a simple stove that is just simply and directly sell it to traders. One of the seaweed home industries in Takalar is
Sakinah Group. It has been successfully produce seaweed into pudding, *dodol*, confectionery and even though its production scale is not fixed (depending on demand). The production of seaweed by Sakinah group as follow:

a. *Dodol*

One kg of seaweed can produce 10 packages, that one package have 10 of dodol. Every package is wrapped by plastic. It is mean one kg of seaweed could produce 1000 dodol and one package price is Rp. 6000. Expire time of dodol will be 3 - 4 weeks

b. *Pudding*

One kg of seaweed can produce 50 plastic glass of pudding. The price of one glass of pudding is Rp.5,000. This product could be used only for 1 day if stored at room temperature and one week when it stored in the refrigerator

c. *Manisan (Sweet)*

One kg of seaweed can produce four topples that the price of one topples is Rp.15,000. This product could keep and used for 2 -3 months

13.3. Procurement of raw materials

Two districts in Takalar that produced seaweed are:

1. Kecamatan Mangarabombang
   - Desa Cikoang
   - Desa Punaga
   - Desa Laikang

2. Kecamatan Mappakasunggu
   - Desa Takalar
   - Desa Lagaruda

Sakinah groups are buying the seaweed direct from the seaweed farmers The price of one kg of dry seaweed are Rp.4000-Rp.5000/kg. The amount of seaweed that will be purchased by Sakinah groups is depending on market demand.

Table 13.1. Areal Number of Production and Sea Grass *Grastilaria* Cultured Farmen in Takalar Regency

<table>
<thead>
<tr>
<th>Kecamatan</th>
<th>Areal (Ha)</th>
<th>Production (ton)</th>
<th>Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grasilia</td>
<td>Eucema</td>
<td>Grasilia</td>
</tr>
<tr>
<td>Mangarabombang</td>
<td>369</td>
<td>686</td>
<td>698</td>
</tr>
<tr>
<td>Mappakasunggu</td>
<td>888</td>
<td>1.082</td>
<td>1.287</td>
</tr>
<tr>
<td>Total</td>
<td>2007</td>
<td>1.257</td>
<td>1.768</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>2.145</td>
<td>2.850</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>405</td>
<td>4.208</td>
</tr>
</tbody>
</table>

*Source: Statistik Takalar Regency*
13.4. Distribution and trading

Sales marketing of Sakinah group’s product is very simple that they only sell it if there is only order from the buyer.

13.5. Buyer Position and Role

In general, the marketing chain of the seaweed and its product in kabupaten Takalar as follow:

- **Farmer**
  
  Seaweed farmer have sold the dry seaweed to the traders or home industry groups. The price of the dry seaweed around Rp.4.000–Rp.5.000/ kg.

- **Trader**
  
  The traders are not only selling the dry seaweed to the home industry groups, but also to the medium scale industry like PT. Giwang Citra Takalar. The sell it around Rp.6.000–Rp.7.000 per kg.

- **Home industry**
  
  As well as traders, home industry groups buying the dry seaweed directly from the farmers with price around Rp.4000 - Rp.5.000 per kg.

13.6. Processing and value addition

Seaweed processing can be made into food products, such as dodol, candy, pudding and others. The Group of Sakinah said that the value-added of dry seaweed could be increased by 400%. For example as follow:

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>One kg of dry seaweed</td>
<td>Rp. 5.000</td>
</tr>
<tr>
<td>One kg of Sugar sand</td>
<td>Rp. 8.000</td>
</tr>
<tr>
<td>One spoon of salt</td>
<td>Rp. 100</td>
</tr>
<tr>
<td><em>Perasa</em></td>
<td>Rp. 1.000</td>
</tr>
<tr>
<td>One liter coconut milk</td>
<td>Rp. 900</td>
</tr>
</tbody>
</table>

| Total                     | Rp.15.000 |
As mentioned before that one kg of dry seaweed can produced is 1000 dodol that every 10 dodol put in one package. The price of one package is Rp. 6.000,-. It means one kg of dry seaweed could be produced Rp.60.000. In other words, the net profit of dodol will Rp.45.000. The other advantage value is could be keep until 3 months. The most important is seaweed having a rich with vitamin that it is good for health.

13.7. Processing technology, recent innovation

a. Farmer level

Still many ways of handling the seaweed after harvest, that produces less quality. For example, age has not been a harvest time, drying to less perfect, and the number of foreign substances that cause the decrease in the quality of processed seaweed. In Takalar, some farmers already use advantaged dryer that installed on the sea.

b. Home industry level

Tools that used are simple like a blender, mixer, knives, basin, filter, and the stove. The product does not use a chemical preservative

13.8. Further processing opportunities and challenges

The stock and availability of dry seaweed is abundant. The investment prospects of the seaweed commodity are prospect able. Most of the seaweed production in Takalar Regency still sold in the form of a dry (not yet processed). Its mean the value obtained is relatively low. There are some products of seaweed processed that can be developed in the Takalar, as follow:

1. Permen Jelly

![Permen Jelly Flowchart]

- Seaweed
- Washing
- Soaked in water for 1 hr
- Re-Washing
- Dried Thoroughly
- Soaked in sugar-liquid
- Citric acid 0.5% -paste/color essence 1%
- Jelly Candy
2. **Dodol**, in general, dodol circulating in the market using the main raw material rice sticky rice flour. It is quite different with seaweed dodol that processed using seaweed as basic material.

- **Seaweed dodol**
  - Soaked in lime juice
  - Blended
  - Cooked into dough
  - Shaped into squares
  - Dried
  - Cut into pieces
  - Sun-dried for 3-4 days
  - Seaweed dodol

- **Coconut-oil 25% sugar and salt**
  - Boiled

- **Rice dodol**
  - Washed
3. Pudding

- Dried-seaweed
- Soaked in water for 2-3 and washed every 12 hrs and replaced the water
- Boiled in water+milk+vinegar+paste+essence
- Pour into shaped
- pudding
- Package in a glass

13.9. Potential markets and Competition

Takalar can produce agar using low technology methods but the product would need to be consumed in the home country, it is unlikely to be competitive in the international market. The alginate and carrageenan industries are in the hands of a very limited number of producers who have strong control of the markets and can afford to supply specialized customer support for their sales. Customers are often reluctant to change suppliers because of the variability that can occur between brands, since the final properties of these natural products depend on both the source of the raw material and the nature of the extraction and refining processes. While they have developed extraction methods and sales to suit their own internal market, they often find it difficult to compete in the long term when international processors move into their market. They also produce seaweeds for their own local markets that are often for coastal people who have consumed seaweeds over a long period.

Consumption level of carageenan in the world more than 100,000 tons (dry weight) per year. Indonesia must compete with the Philippines, especially as the main producers Euchemea. Philippines and Indonesia supplied the world carageenan demand about 21% and 15%, respectively. Total seaweed production of South Sulawesi has an opportunity to develop seaweed farming.

Surabaya is well known as a center for marketing of seaweed production. Seaweed production from South Sulawesi, Bali, NTB, Central Sulawesi, Southeast Sulawesi, North Sulawesi and Maluku send their products to Surabaya. During the year 2000-2005,
seaweed domestic consumption increased an average of 20.14% per year and continues to increase during the following year. It is caused by increasing demand from the production of seaweed industry to produce dairy products, jelly, crackers, and others. Export volume is also increasing at an average of 24.56% per year (2000-2005) to Asia, Europe and the United States. On the other hand Indonesia also importing seaweed proceed from China, Honking, Korea, Spain and Denmark, are 35.99%, 12.11%, 7.42%, 6.84%, and 5.42 %, respectively.

Tabel 13.2 Indonesia Seaweed Export Growth Various Destination Countrie, 2000 – 2005 (tons)

<table>
<thead>
<tr>
<th>Country</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hongkong</td>
<td>9,157.40</td>
<td>7,808.80</td>
<td>7,164.50</td>
<td>7,867.00</td>
<td>8,984.50</td>
<td>8,384.61</td>
</tr>
<tr>
<td>China</td>
<td>1,211.60</td>
<td>1,603.00</td>
<td>4,186.90</td>
<td>9,337.00</td>
<td>13,471.70</td>
<td>24,926.42</td>
</tr>
<tr>
<td>Philippines</td>
<td>139.60</td>
<td>1,522.80</td>
<td>1,471.90</td>
<td>4,573.90</td>
<td>5,301.50</td>
<td>8,060.28</td>
</tr>
<tr>
<td>Korea</td>
<td>638.80</td>
<td>605.40</td>
<td>229.40</td>
<td>1,510.40</td>
<td>952.00</td>
<td>5,142.81</td>
</tr>
<tr>
<td>Japan</td>
<td>305.30</td>
<td>187.70</td>
<td>178.90</td>
<td>391.70</td>
<td>184.80</td>
<td>375.32</td>
</tr>
<tr>
<td>USA</td>
<td>979.90</td>
<td>1,661.60</td>
<td>1,704.40</td>
<td>2,127.80</td>
<td>1,749.80</td>
<td>1,064.75</td>
</tr>
<tr>
<td>Chile</td>
<td>200.00</td>
<td>1,360.00</td>
<td>340.00</td>
<td>1,116.80</td>
<td>2,360.80</td>
<td>1,696.74</td>
</tr>
<tr>
<td>Denmark</td>
<td>2,573.50</td>
<td>3,953.90</td>
<td>3,947.70</td>
<td>4,499.00</td>
<td>6,249.20</td>
<td>3,754.05</td>
</tr>
<tr>
<td>Spain</td>
<td>3,838.30</td>
<td>4,359.30</td>
<td>4,700.00</td>
<td>3,363.60</td>
<td>4,716.20</td>
<td>4,736.98</td>
</tr>
<tr>
<td>France</td>
<td>1,216.60</td>
<td>1,617.10</td>
<td>1,832.70</td>
<td>1,355.00</td>
<td>1,556.60</td>
<td>2,919.37</td>
</tr>
<tr>
<td>Other</td>
<td>2,812.40</td>
<td>3,194.50</td>
<td>2,703.60</td>
<td>4,019.90</td>
<td>4,591.10</td>
<td>8,202.92</td>
</tr>
<tr>
<td>Total</td>
<td>25,073.40</td>
<td>29,875.10</td>
<td>30,462.00</td>
<td>42,165.10</td>
<td>52,122.20</td>
<td>71,269.25</td>
</tr>
</tbody>
</table>


13.10. Linkage /Cooperation with Supporting Institutions

Department of Marine and Fisheries affair of South Sulawesi have decided three regency including Takalar as the center for seaweed production. It is expected to increase the number of seaweed production and processing industries. To support that program, local government of Takalar provide some supporting facilities as good road that linking from production area to Makassar as capital of South Sulawesi

13.11. Training of Human Resources

a. In farmer level
   The farmer’s group is infrequently get a briefing from the agency of fisheries and marine of Kabupaten Takalar, Hasanuddin University and other NGO’s

b. In Home industry
   In Takalar, there are home industry groups that have 10 employees. Most of them are housewives and graduated from Junior high school. Hasanuddin University and Jasuda Net had helped them with capital working and equipment for improving the quality of their product.
13.12. SWOT Analysis

Below is an analysis of the strengths, weaknesses, opportunities and threats (SWOT analysis) relating to the Takalar seaweed industry

**Strength**
- The seaweed resource itself.
- Harvesting experience.
- Local knowledge and enthusiasm.
- Clean waters, minimal pollution.
- Variety of support mechanisms – Hasanuddin University, SieNet, Local Government

**Weaknesses**
- Distance from central markets and transport costs.
- Heavy dependence on one sales outlet.
- Lack of seaweed infrastructure including R & D.
- Some skepticisms regarding seaweed products in fisheries sector.
- Supply of seaweed (wet and processed) exceeds demand in many markets - alginates, fertilizers, animal feed, cosmetics

**Opportunities**
- Integrated approach to marine resource management including seaweed - obtain funding to this end from Ministry of Marine and Fisheries in Jakarta.
- Obtain NGO’s funding for R & D e.g., for processing innovation - PENSA schemes.
- Utilize more seaweed properties in processing.
- Reduce dependence on one market. Integrate harvesting/processing activities to cover different products/markets.
- Exploit high value (if low volume) markets - i.e. specialist/health foods, cosmetics.
- Innovative marketing – e.g., promote clean, natural Takalar environment.
- Exploit market trends – e.g., interest in health foods, move towards organic fertilizers.
- Integrate marketing of seaweed products with other marine produce, especially in food sector.

**Threats**
- Pollution of the seaweed resource (eg via oil spill, organic matter from Tambak).
- Public perception of pollution and its effect on seaweed products.
- Response of established competitors to attempts to penetrate new markets – eg undercutting on price, ensuring lack of access to best distribution channels, etc.

13.13. Recommendations
The following recommendations are based on the above discussion and the principle of maximizing strengths, minimizing weaknesses/threats and exploiting opportunities as identified in the SWOT analysis above.

1. Incorporate funding for seaweed development within local and regional resource/business development initiatives. Where appropriate, integrate within the marine resource management package when seeking external support, i.e. with aquaculture.

2. Review existing seaweed processing methods/technologies and evaluate potential for innovative energy centered approach integrating different processing activities. Utilize local ideas and external scientific expertise like from Hasanuddin University.

3. Hold strategic discussions with local government and NGO’s regarding future developments in the Takalar. Focus on Strategic Planning and long-term plans and ways in which the quality of the product can be improved to fit their processing requirements.

4. If an integrated seaweed processing unit is feasible, obtain funding for technology/process development, eg via NGO’s schemes or even via Local Government.

5. Aside from business start-up grants/loans, local government and agencies should consider support for seaweed initiatives in three key areas where they tend to fail: research and product development · quality assurance/control · marketing.