Feasibility of ATC (Alkali Treated Cottonii) Agroindustry in Southeast Sulawesi

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Abstract. Seaweed produced in Southeast Sulawesi Province is generally still marketed in the form of dried seaweed or has not been processed into finished products or semi-finished products in agroindustry. This condition makes the price of seaweed at the level of farmers is very unstable so that the increase in welfare for farmers and regional income is not realized. This study aims to analyze the feasibility of seaweed agroindustry investment that produces a carrageenan type of ATC (Alkali Treated Cottonii) in Southeast Sulawesi Province and design a feasibility development scenario. The feasibility of ATC agroindustry investment is analyzed by Net Present Value (NPV) Analysis, Net Benefit-Cost Ratio (NBCR), Internal Rate of Return (IRR), Pay Back Period (PBP), Break-Even Point (BEP) and sensitivity analysis in various scenarios. The results showed that: (1) Seaweed Agroindustry in Southeast Sulawesi Province, which produces carrageenan type of ATC, is feasible to be developed because it has an NPV value of Rp.25,860,430,430,- NBCR 4.46, IRR 50.04 and PBP 1.90. Based on the results of sensitivity analysis on several scenarios of changes in agroindustry conditions, it is suggested that agroindustries must be able to maintain the stability of the selling price of ATC and the amount of production due to the changes that occur in these aspects have the most significant impact on agroindustry profits.

1. Introduction
Seaweed is an abundant biological resource in Indonesian waters that is important and commercially valuable, especially in the food, beverage, cosmetics, pharmacy, textiles, bioenergy, and others [1,2]. The function of seaweed as a processed raw material in the food and non-food industries makes seaweed widely cultivated and traded in local and international markets [2]. Southeast Sulawesi is one of the seaweed producers in Indonesia, wherein 2013 Southeast Sulawesi's seaweed production
The past seaweed industry development is one that is believed to be able to contribute significantly to accelerating the achievement of national development goals, especially in the fisheries sector. This is closely related to the function and role of agroindustry in economic development, where the existence of agroindustry can create added value and competitiveness, open employment and reduce the amount of unemployment, increase foreign exchange, increase income and welfare of the community, and accelerate industrialization in the fisheries sector [8]. However, the realization of a seaweed processing agroindustry is not a simple thing because it requires the support of many factors and the involvement of many parties, this is because the carrageenan agroindustry like other agriculture-based businesses require close links between upstream and downstream [downstream] [9]. Sustainability of seaweed availability as raw material for agroindustry can be realized if there is proper attention to small-scale seaweed cultivators in the aspects of funding, innovation, marketing, education, and social justice [10] and market orientation has a significant influence on industry performance [11].

Based on the description above, the research objective is to analyze the feasibility of ATC agroindustry investment in Southeast Sulawesi Province and design a feasibility development scenario.

2. Methods
This research was carried out in Southeast Sulawesi Province with a focus on two districts, namely South Konawe Regency and Kolaka Regency, to obtain a picture of the conditions of seaweed in Southeast Sulawesi Province. These two districts were chosen because they are one of the seaweed production centers in the Southeast Sulawesi Province. The population in this study are the actors (stakeholders) of seaweed business, namely direct actors (cultivators, seaweed traders, and managers of the seaweed industry) and indirect actors (local governments, research institutions/universities, and experts who are considered to have the ability and know problems related to the development of seaweed agroindustry.

In solving the first problem, a financial feasibility analysis is used. The analysis process is also supported by data assumptions that are based on literature review and expert information. The investment feasibility model is carried out with Net Present Value (NPV) analysis, Net Benefit-Cost Ratio (NBCR), Internal Rate of Return (IRR), and Pay Back Period (PBP).
a. Net Present Value (NPV) is the present value of the difference between the total benefit and the total cost at a specific discount rate over the life of the investment [10]. The NPV equation is as follows:

\[
NPV = \sum_{t=0}^{n} \left( \frac{B_t - C_t}{(1+i)^t} \right)
\]

Note:
- NPV = The net present value of the difference between total benefit and total cost
- B_t = Benefit in the t year
- C_t = Costs spent in the year t
- t = Investment year
- n = Economic year of the main asset
- i = Applicable interest rate

If the calculation results are obtained:
- NPV > 0 means a worthy or profitable investment
- NPV < 0 means investment is not feasible or detrimental
- NPV = 0 The investment means Break-Even Point, meaning that the project is not a loss but also the lack of benefits.

b. After knowing the net profit/value of the agroindustry, then a comparison is made between the benefits obtained and the costs incurred to determine the net profit generated by the agroindustry from every single rupiah invested carried out by an analysis of the Net Benefit-Cost Ratio (NBCR) [12]. The NBCR equation is:

\[
NBCR = \frac{\sum NPV^+}{\sum NPV^-}
\]

Note:
- If NBCR > 1 means a worthy investment
- If NBCR < 1 means a loss investment
- If NBCR = 1 The investment means Break-Even Point

c. The next financial aspect analysis is the Internal rate of Return (IRR). This is used to determine the percentage of profits obtained from investments each year during the operation of agroindustry. The IRR results are then compared with the applicable bank interest rates or as a reference to determine the feasibility of agroindustry [12]. The IRR equation is:

\[
IRR = D_f^+ + \frac{NPV^+}{NPV^+ - NPV^-} \left( D_f^- - D_f^+ \right)
\]

Note:
- D_f = Discount factor
- Jika IRR > bank interest means a worthy investment
- Jika IRR < bank interest, means a loss investment
- Jika IRR = bank interest means Break-Even Point

d. The subsequent analysis is the Pay Back Period (PBP) analysis, which is an analysis to determine the return on investment in the ATC agroindustry [13]. The PBP equation is:

\[
PBP = (t - 1) + \left[ CF - \sum_{i=1}^{n} At \right] \left( \frac{1}{At} \right)
\]
Note:
\[ C_f = \text{Investment Cost} \]
\[ A_t = \text{Cash flow in the } t\text{-year} \]
\[ T = \text{Return year plus 1 (the period during which the first positive cumulative net cash flow occurs)} \]

The second problem is analyzed by simulating through several scenarios of changing conditions in the agroindustry financially. Simulations in the scenario of change in agroindustry are carried out by retesting the analysis of Net Present Value (NPV), Net Benefit-Cost Ratio (NBCR), Internal Rate of Return (IRR), Pay Back Period (PBP). These scenarios are presented in table 1.

| Scenario     | Description                                                                 |
|--------------|-----------------------------------------------------------------------------|
| 1st Scenario (S1) | An increase in raw material prices by 10% and 20%                          |
| 2nd Scenario (S2) | There was a decrease in production by 10% and 20%                          |
| 3rd Scenario (S3) | An increase in production costs by 10% and 20%                             |
| 4th Scenario (S4) | ATC sales prices decreased by 10% and 20%.                                 |
| 5th Scenario (S5) | An increase in raw material prices, a decrease in the number of production, and a decrease in ATC selling prices simultaneously by 10% and 20%. |

For the sake of simplifying and for the sake of accuracy in data processing, the data analysis is performed using DSS (Decision Support System Agro-Industry) software.

3. Results and discussion
The calculation of the financial feasibility analysis is done using assumption data and based on survey results. The data and assumptions are:

a. The price of raw materials for dried seaweed is Rp. 12,000 / kg.
b. The carrageenan agroindustry produced is Alkali Treated Cottonii (ATC) because ATC is the most priority product to be produced in Southeast Sulawesi Province and is a product of Kappaphycus alvarezi seaweed which is dominantly cultivated in Southeast Sulawesi Province [6,14]. Another advantage when producing carrageenan type of ATC, especially for seaweed producing countries, is in the form of reduced export volume up to ¼ of the volume of dried seaweed [15].
c. The selling price of the product (ATC) is Rp. 110,000 / kg.
d. Production Capacity of 14.4 tons/month or 172.8 tons/year.
e. KOH material used as much as 6% of the total raw material, this is based on the results of an analysis of the content of carrageenan, where the use of KOH with a concentration of 6% showed the best carrageenan [16].
f. Agro-Industry starts producing in the first year with a production capacity of 60%, in the second year producing 80% and in the third to the 10th years producing 100%.
g. The cost of repairing and maintaining investment items is 1% per year.
h. The life of the investment is ten years, and the residual value is calculated from the investment value that has an economic value of more than ten years.
i. Capital comes from one party, namely private or government.
j. The base discount factor is set at 10 percent, and changes to the discount factor will be made by calculation in the IRR analysis.
k. Production is carried out from year 1 to year ten, according to the agreed investment age or based on the age of the primary investment goods and equipment.
l. Agroindustry operationalization per day for 8 hours with 24 working days per month.
3.1. Costs
The results of the cost analysis show that the costs required in the establishment of ATC agroindustry with a production capacity of 172,800 kg/year are Rp.13,077,716,000. The amount of the cost is used for the initial costs of establishing agroindustry, which is classified as investment costs and operational costs.

3.1.1. Investment Costs. Investment costs include the cost of land acquisition and preparation, building costs, machinery and equipment costs, transportation equipment, office equipment, and all pre-operational costs. The total investment cost needed in the establishment of ATC agroindustry in Southeast Sulawesi Province is Rp.7,045,750,000.

3.1.2. Operational Costs. Operational costs are the working capital costs needed by agroindustry to finance operational activities in the first year to the 10th year, where in the first year, it is assumed that the agroindustry has been able to use its receipts to carry out its operations in subsequent years. The total operational costs required by scale seaweed agroindustry is Rp. 11,692,165,000 / year divided into fixed costs of Rp. 99,000,000 / year and variable costs Rp. 10,702,000 / year. The recapitulation of ATC agroindustry operational costs in Southeast Sulawesi Province is presented in table 2.

| Description | Value (Rp)              |
|-------------|-------------------------|
| Licensing, Land, and Building | 2,630,000,000 |
| Machinery and Equipment | 2,130,750,000 |
| Electrical | 300,000,000 |
| Installation | 350,000,000 |
| Laboratory Equipment | 250,000,000 |
| Office Supplies and Stationery | 1,335,000,000 |
| Operational Costs | 11,692,165,000 |

3.2. Production and revenue
ATC production is done every day except Sundays so that the production process of agroindustry in a month is 24 days. The amount of ATC production produced by agroindustry is 600 kg/day or 172,800 kg/year. A detailed description of seaweed agroindustry production, prices, and revenues in Southeast Sulawesi Province are presented in table 3.

| Description | Unit | Per Day | Per Month | Per Year |
|-------------|------|---------|-----------|----------|
| Production | Kg   | 600     | 14,400    | 172,800  |
| Price      | Rp/Kg| 110,000 | 110,000   | 110,000  |
| Revenue    | Rp   | 66,000,000 | 1,584,000,000 | 19,008,000,000 |

3.3. Investment feasibility assessment
The feasibility of seaweed agroindustry investment in this study was assessed using financial feasibility criteria and did not conduct assessments on social, environmental, and economic aspects. This is done because social, environmental, and economic aspects have become part of the determination of agro-industrial locations, waste management, and development priorities. The results of NPV, NBCR, IRR, and PBP are being presented in table 4.
Table 4. Results of NPV, NBCR, IRR, and PBP Agroindustry ATC analysis in Southeast Sulawesi.

| Description | Unit  | Value     | Criteria |
|-------------|-------|-----------|----------|
| NPV         | Rp.000| 25,860,286| Feasible |
| NBCR        | Rp    | 4.46      | Feasible |
| IRR         | %     | 50.04     | Feasible |
| PBP         | Year  | 1.90      | Feasible |

Based on the results of NPV, NBCR, IRR, and PBP analysis, as shown in Table 4, shows that the development of ATC agroindustry in Southeast Sulawesi Province is feasible. These results are not much different from the results of research conducted on the ATC Chips industry with a capacity of 1,000 kg/day with an investment cost of Rp. 2,160,000,000, showing the NPV value at a 20% discount rate of Rp. 2,126,807,350, IRR 40.39%, Net B/C Ratio 1.98 and PBP 2.93 [17].

3.4. Agroindustry operationalization scenarios

The ATC agroindustry scenario is carried out by changing the agroindustry conditions by 10% and 20% in each scenario. Determination of the percentage of these scenarios is carried out with the consideration that the purpose of the scenario is not only to see the agroindustry's resilience to changes in financing and revenue conditions but also to determine the conditions that will have the worst impact on the agroindustry if this occurs so that the agroindustry actors can make various anticipatory efforts. The results of the analysis in each scenario are presented in Table 5.

Table 5. Results of the ATC Agro-Industry Feasibility Scenario in Southeast Sulawesi

| Scenario Description | Feasibility Criteria |
|---------------------|----------------------|
|                     | NPV (Rp.000) | NBCR (Rp) | IRR (%) | PBP (Year) |
| Basic Value         |             |           |          |            |
| S-1                 | 25,860,286  | 4.46      | 50.04    | 1.90       |
| S-2                 | 21,750,165  | 3.69      | 43.59    | 2.13       |
| S-3                 | 20,265,694  | 3.61      | 42.72    | 2.26       |
| S-4                 | 19,279,845  | 3.28      | 39.77    | 3.28       |
| S-5                 | 15,346,188  | 2.81      | 34.85    | 2.66       |
| S-6                 | 7,103,397   | 1.77      | 22.28    | 3.88       |
| S-7                 | 17,640,044  | 3.03      | 37.25    | 2.41       |
| S-8                 | 14,671,101  | 2.82      | 34.93    | 2.79       |
| S-9                 | 12,699,403  | 2.35      | 29.72    | 2.87       |
| S-10                | 4,832,090   | 1.51      | 18.50    | 4.42       |
| S-11                | -8,727,648  | 0.27      | -8.57    | 0.27       |

The results of the sensitivity analysis in Scenario 1 (S-1) show that if the agroindustry ATC operates with the conditions that there is an increase in raw material costs by up to 20%, then the agroindustry is still feasible to run. Table 5 shows that for the increase in raw material prices by 20%, the NPV value was still positive, namely Rp.1,764,004,400, NBCR 3.03, IRR 37.25%, and PBP 2.41 Year. The cause of the increase in raw material prices in the form of dried seaweed caused by a decrease in aquaculture production or failure in the cultivation process in the future is very likely to occur. This can be caused by climate change and water pollution by economic activities in the mainland. The increase in the price of dried seaweed due to a large number of exports in the form of dried seaweed in the future is not expected to be realized; this is due to the need for the export market for products from Eucheuma cottonii type seaweed which will be dominated by ATC (Alkali Tread Cottonii) products, SRC (Semi-Refined Carrageenan) or RC (Refined Carrageenan) [18].

The results of the sensitivity analysis in Scenario 2 (S-2) show that if there is a decrease in the amount of production up to 20%, the seaweed agroindustry is still feasible. Table 5 shows that at a
20% reduction in production, the NPV value was still positive, namely Rp.14,671,101,000 - NBCR 2.82, IRR 34.93%, and PBP 2.79 Years. The decline in ATC production is possible due to the scarcity of raw materials and the decrease in product demand. However, the potential reduction in demand for ATC products has a slighter possibility as long as the agroindustry can produce ATC according to consumer needs because world demand for carrageenan products is expected to increase around 4-6% per year [19].

The results of the analysis in Scenario 3 (S-3) show that if the seaweed agroindustry experiences an increase in production costs up to 20%, then the agroindustry is still feasible to run. Table 5 shows that at an increase in production costs by 20%, the NPV value was still positive, namely Rp.12,699,403,000, NBCR 2.35, IRR 29.72%, and PBP 2.87 Year.

The results of the analysis in Scenario 4 (S-4) shows that if seaweed agroindustry experiences a 10% decrease in product selling price (ATC), agroindustry is still feasible to run. Table 5 shows that at an increase in production costs by 10%, the NPV value was still positive, namely Rp.15,346,000 NBCR 2.81, IRR 34.85%, and PBP 2.66 Years. Different results can be seen in a change of 20% where in this condition, the ATC agroindustry is already in a vulnerable condition of loss if it is carried out where the NPV value of Rp. 4,832,090,000, NBCR of 1.51, IRR of 18.50%, and PBP of 4.42 years.

The results of the financial feasibility analysis in Scenario 5 (S-5) show that at a change of 10% agroindustry is still feasible on all criteria analysis, but at a change of 20%, the agroindustry is not feasible to run because of the value of NPV -8,727,648-, NBCR 0, 27 and IRR-8.57 and PBP 0.27 years. Changes in conditions experienced by agroindustry can co-occur as Scenario 5, but can also occur un-simultaneously as scenarios 1, 2, 3, and 4.

To find out which conditions have the most impact on agroindustry profits in scenarios 1, 2, 3, and 4, presented in figure 1.

![Figure 1. ATC comparison of each ATC agroindustry financial feasibility scenario.](image-url)

The scenario results as Figure 1 shows that the most sensitive aspects are the decrease in the selling price of ATC (S4) and an increase in production costs (S3). The results of the sensitivity analysis do not differ greatly from the results of research conducted on the ATC-Chips industry, where the results of the sensitivity analysis with an increase in raw material prices by 35% showed a decrease in IRR to 20.71% and PBP up to 4.64 years [17].

The amount of production produced by seaweed agroindustry is certainly very dependent on the availability of raw materials, namely dried seaweed, if the available raw materials are limited, it can be ascertained that the amount of ATC production produced by agroindustry also decreases. therefore, it
is hoped that agroindustry can maintain the availability of raw materials and always produce optimally so that the cost per unit of product can be lowered so that the price of ATC can compete with similar products from other industries or countries. Competitiveness can be realized through a competitive advantage strategy that is creating cost advantages, product differentiation, and focus on the market as well as an emphasis on competitiveness to the company's ability to compete with its environment [20,21].

Industries operating below the economies of scale make production costs relatively high, especially for fixed costs or investment costs caused by the depreciation of equipment, capital costs, and fixed labor costs. Industries operating below economies of scale, based on market prices, can only cover variable costs such as the cost of raw materials, electricity, and daily labor. In addition to this, industries that do not operate optimally cannot sell their products at low prices because of relatively high production costs [22]. Highly competitive agroindustry fisheries are characterized by high productivity values, adequate labor skills, efficient technology, and quality products [23].

4. Conclusion
The conclusion from the results of this study is seaweed agroindustry that produces carrageenan type of Alkali Tread Cottonii (ATC) in Southeast Sulawesi Province is feasible to be developed because the analysis shows that the NPV value of Rp.25,860,286,430, - NBCR 4,46, IRR 50,04 and PBP 1,90. Agroindustry must be able to maintain the stability of the selling price of ATC and the amount of production because the changes that occur in both aspects have the greatest impact on agroindustry profits.

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