Determination of the cost of patchouli oil production in South Aceh using break-even analysis

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Abstract. This paper uses break-even analysis to determine the cost of producing patchouli oil in Kete Nilam Hijo (KNH). KNH is an industry engaged in the refining process of patchouli oil, located in South Aceh Regency, Indonesia. One obstacle faced by the KNH is that the costs of producing patchouli oil are not yet known. So far, KNH has never made economic calculations in producing patchouli oil. KNH only relies on production based on profit so that profits are not maximized and always fluctuates. In addition, the break-even point for the production of patchouli oil is also not known with certainty. To determine the break-even point, total costs and total revenue will be calculated first. This research was conducted in several stages, namely preliminary study, data collection, data processing, analysis of results, and finally concluding the results of the study. The results showed that the total production cost of patchouli oil refining at KNH in one year was 1,120,018,250 rupiah. Meanwhile, KNH had to sell 1,600 kilograms of patchouli oil to break-even.

1. Introduction
Patchouli oil industry is one industry that has good potential to be developed in Indonesia. Indonesia has a comparative advantage both in the procurement of patchouli raw materials and patchouli distillation technology. Patchouli raw materials in Indonesia are still largely supplied by smallholder plantations. Patchouli oil refining can utilize local resources and export market oriented. Patchouli oil refining is not only economically beneficial, but also able to create jobs, while supporting the productivity of the plantation sector. Even so, there are not many patchouli oil refiners in Indonesia.

Patchouli oil exports contribute more than fifty percent to the total value of Indonesia's atsiri oil exports. In addition, Indonesia also controls about ninety percent of the world's patchouli oil production. However, the quality of Indonesia's patchouli oil production is still low so the selling price is relatively low and tends to fluctuate. Patchouli which is often also called Pogostemon cablin benth is a plant that is not widely known by the public. Patchouli is a shrub-shaped plant, not so tall, grows clumps and reddish green leaves [1].

South Aceh Regency is part of the Aceh Province which has great potential for patchouli business. The natural conditions in South Aceh Regency strongly support the success of patchouli cultivation. Seeing the potential that exists in South Aceh Regency, the patchouli oil refining business is worth developing. This effort can increase industrial growth and automatically also increase the quantity of production. This effort will be able to increase industrial growth and automatically also increase the amount of production. One of the businesses engaged in the patchouli field is the patchouli oil refining
business Kete Nilam Hijo (KNH). KNH is located in Ladang Teungoh Village, Pasie Raya Sub-District, South Aceh Regency, Indonesia.

There are many obstacles faced in its implementation, especially for patchouli oil entrepreneurs. One obstacle faced by the KNH business is that the costs of producing patchouli oil are not yet known. So far, KNH has never made economic calculations in producing patchouli oil. KNH only relies on production based on profit so that profits are not maximized and always fluctuates. In addition, the break-even point for the production of patchouli oil is also not known with certainty. The use of break-even analysis is needed to determine the total cost and break-even point of patchouli oil production. Several previous studies relating to production costs using the total cost and break-even method can support this research [1-4]. Study of costs and production scheduling also supports this research. [5-6]. Some research has also been carried out related to patchouli oil, such as the supply chain and content contained in patchouli oil [7-9].

The purpose of this study is to determine the cost of producing patchouli oil in Kete Nilam Hijo (KNH) using break even analysis.

2. Methods
This research was conducted at the Kete Nilam Hijo (KNH) Village Business located in South Aceh Regency, Aceh Province, Indonesia. Data collection methods used in this study are through direct observation and interviews with business owners. The research procedure is used to describe the steps that will be carried out in the study. The procedure of this research can be seen in Figure 1 below.

The first stage of data processing in this study is to determine variable costs and fixed costs. Variable costs consist of patchouli raw material prices and variable overhead costs. Meanwhile, fixed costs consist of direct labor costs, equipment costs, overhead costs, and other fixed costs. After knowing all the costs required, the next step is to calculate the total costs and total revenue. Total cost is the economic resource for acquiring assets, while total revenue is the product price per unit multiplied by the number of products sold. The last stage is to calculate the break-even point, which is useful for knowing the break-even point of the issued capital.

![Figure 1. Procedure of research](image)
3. Result and Discussion

3.1. Variable Costs
This variable cost will provide preliminary data that affect the total costs incurred, including the amount of raw materials, raw material prices, and variable overhead costs. Table 1 shows the amount and price of patchouli raw materials obtained from KNH.

| No | Raw Material | Amount/Year (Kg) | Unit Price (IDR) | Total Cost (IDR) |
|----|--------------|------------------|-----------------|------------------|
| 1  | Patchouli    | 54,000           | 15,000          | 810,000,000     |

These variable overhead costs consist of fuel, firewood, coconut shells, and electricity usage costs. Table 2 shows variable overhead costs.

| No | Utilities          | Variable Cost/Year (IDR) | Variable Cost/Month (IDR) |
|----|--------------------|--------------------------|----------------------------|
| 1  | Fuel               | 13,200,000               | 1,100,000                  |
| 2  | Firewood           | 36,000,000               | 3,000,000                  |
| 3  | Coconut shells     | 4,800,000                | 400,000                    |
| 4  | Electricity usage  | 6,000,000                | 500,000                    |

| No | Cost Type          | Total Cost/Year (IDR)   |
|----|--------------------|-------------------------|
| 1  | Raw material       | 810,000,000             |
| 2  | Variable overhead  | 60,000,000              |
|    | Total              | 870,000,000             |

3.2. Fixed Costs
Fixed costs will provide preliminary data that affect the costs of the patchouli oil production process. Fixed costs include direct labor costs, equipment costs, overhead costs, and other fixed costs.

3.2.1. Direct Labor Costs. Direct labor is needed in every production process. Direct labor in this study were labor in production and maintenance. Tables 4 and 5 show direct labor costs of production process and labor costs of maintenance.

| No | Activity          | Amount | Cost/Month (IDR) | Total Cost/Year (IDR) |
|----|-------------------|--------|------------------|-----------------------|
| 1  | Production process| 4 labor | 1,200,000         | 57,600,000            |
|    | Total             |        |                  | 57,600,000            |

| No | Utility           | Maintenance | Cost/Month (IDR) | Total Cost/Year (IDR) |
|----|-------------------|-------------|------------------|-----------------------|
| 1  | Panther car       | Routine service | 300,000         | 3,600,000             |
| 2  | Thresher machine  | Routine service | 150,000         | 1,800,000             |
|    | Total             |             |                  | 5,400,000             |
3.2.2. Equipment Costs. Equipment is needed to support the production process so that there is no production delay. Table 6 shows the equipment costs.

| No | Utilities | Amount | Cost (IDR) | Total Cost (IDR) | Depreciation (IDR) | Depreciation/Year (IDR) |
|----|-----------|--------|------------|------------------|--------------------|------------------------|
| 1  | Cart      | 1 unit | 350,000    | 350,000          | 175,000            | 175,000                |
| 2  | Axe       | 2 unit | 150,000    | 300,000          | 150,000            | 300,000                |
| 3  | Hoe       | 2 unit | 120,000    | 240,000          | 120,000            | 240,000                |
| 4  | Shovel    | 2 unit | 120,000    | 240,000          | 120,000            | 240,000                |
| 5  | Water hose| 15 meter| 2,500     | 37,500           | 18,750             | 281,250                |
| 6  | Machete   | 3 unit | 60,000     | 180,000          | 90,000             | 270,000                |
| 7  | Scissor   | 5 unit | 20,000     | 100,000          | 50,000             | 250,000                |
| 8  | Weigher   | 1 unit | 2,500,000  | 2,500,000        | 1,250,000          | 1,250,000              |
| 9  | Water pump| 1 unit | 400,000    | 400,000          | 200,000            | 200,000                |
|    |           |        |            |                  | Total              | 3,206,250              |

3.2.3. Overhead Costs. Overhead costs in this study include labor costs in maintenance and equipment costs. Table 7 shows overhead costs.

| No  | Cost Type                   | Overhead Cost (IDR) |
|-----|-----------------------------|---------------------|
| 1   | Labor cost of maintenance   | 5,400,000           |
| 2   | Equipment cost              | 3,206,250           |
|     | Total                       | 8,606,250           |

3.2.4. Other Fixed Cost. Other fixed costs are costs incurred regularly by the company each month including indirect labor costs, vehicle depreciation, vehicle tax fees, and administrative and marketing costs.

- **Indirect Labor Costs**
  Indirect labor is labor that works outside of direct labor. Table 8 shows the indirect labor costs.

| Job           | Labor | Cost/Month (IDR) | Total/Year (IDR) |
|---------------|-------|------------------|------------------|
| Driver        | 1 Labor          | 1,200,000        | 14,400,000       |
| Assistant driver | 1 Labor       | 720,000          | 8,640,000        |
|               | Total           |                  | 23,040,000       |

- **Vehicle**
The type of vehicle owned by Kete Nilam Hijo (KNH) was a Panther car in 2,000 that was bought at a price of IDR. 60,000,000. Working period of ten years with a monthly depreciation of vehicles IDR. 600,000 and total annual depreciation of IDR. 7,200,000.

- **Chopped Machine**
The type of machine owned by Kete Nilam Hijo (KNH) was a chopped machine in 2,012 that was bought at a price of IDR. 12,000,000. Working period of 10 years with a monthly depreciation of machine IDR. 120,000 and total annual depreciation of IDR. 1,440,000.

- **Boiler**
Kete Nilam Hijo (KNH) owned two boilers in 2,012 which were bought at a price of IDR. 60,000,000. Working period of ten years with a monthly depreciation of machine IDR. 600,000 and total annual depreciation of IDR. 7,200,000.
• Condenser
Kete Nilam Hijo (KNH) has a condenser tub made at a price of IDR 10,000,000. Working period of 20 years with a monthly depreciation of machine IDR 25,000 and total annual depreciation of IDR 300,000.

• Vehicle Tax Fees
Vehicle tax fees are included in the fixed costs that must be incurred by the company every year. Tax fees incurred by the company of IDR 1,000,000 / year, or IDR 1,000,000 / 12 months = 83,333.33 / month

• Administrative and Marketing Costs
Administrative and marketing costs are costs that affect the price of the final product. Table 9 shows administrative and marketing costs.

Table 9. Administrative and marketing costs

| No | Utilities       | Cost/Month (IDR) | Total Cost/Year (IDR) |
|----|----------------|------------------|-----------------------|
| 1. | Telephone      | 50,000           | 600,000               |
| 2. | Office stationery | 50,000         | 600,000               |
| 3. | Drinking water (12 gallon) | 36,000     | 432,000               |
|    | Total          |                  | 1,632,000             |

Total fixed costs include overhead costs and other fixed costs. Table 10 shows a recapitulation of total fixed costs.

Table 10. Recapitulation of total fixed costs

| No | Costs Type                | Total Cost/Year (IDR) |
|----|---------------------------|-----------------------|
| 1. | Direct labor              | 57,600,000            |
| 2. | Fixed overhead            | 8,606,250             |
| 3. | Indirect labor            | 23,040,000            |
| 4. | Administrative and marketing | 1,632,000        |
| 5. | Panther car               | 60,000,000            |
| 6. | Depreciation of Panther car | 7,200,000        |
| 7. | Chopped machine           | 12,000,000            |
| 8. | Depreciation of chopped machine | 1,440,000        |
| 9. | Boiler                    | 60,000,000            |
| 10. | Depreciation of boiler    | 7,200,000             |
| 11. | Condenser                 | 10,000,000            |
| 12. | Depreciation condenser    | 300,000               |
| 13. | Vehicle tax               | 1,000,000             |
|    | Total                     | 250,018,250           |

Table 11 shows the recapitulation of total fixed costs and variable costs in the Kete Nilam Hijo (KNH)

Table 11. Recapitulation of total fixed costs and variable costs

| No | Costs Type | Total Cost/Year (IDR) |
|----|------------|-----------------------|
| 1. | Fixed cost | 250,018,250           |
| 2. | Variable cost | 870,000,000   |
|    | Total      | 1,120,018,250         |

Table 12 shows the amount of patchouli oil production in Kete Nilam Hijo (KNH)
Table 12. Amount of patchouli oil production in Kete Nilam Hijo (KNH)

| Product Type   | Production Amount/Month (Kg) | Selling Price/Kg (IDR) |
|----------------|-----------------------------|------------------------|
| Patchouli Oil  | 210                         | 700,000                |

3.3. Calculation of Total Cost (TC) and Total Revenue (TR)

The total cost is an economic source to get assets. While in the broadest sense, cost is the sacrifice of economic resources that can be measured in units of money that have occurred, or potentially will occur to achieve certain goals.

Total revenue is the result of the price of the product per unit multiplied by the number of products sold. To increase total revenue, a production manager must strive to make product sales also increase. The results of the calculation of total costs and total revenues are as follows [10]

\[ TC = fc + vc \tag{1} \]

3.4. Calculation of Break-Even Point (BEP)

Break-even point where the conditions for the amount of income and costs are the same or balanced so that there are no gains or losses. Break-even point is used to predict the number of units produced, or how much money must be received to break-even or return capital. Break-even point consists of two, namely BEP units and the BEP rupiah. The results of the break-even point calculation are as follows [10].

\[ \text{BEP units} = fc + vc = c \times n \tag{2} \]

Figure 2 shows the break-even point (BEP) of patchouli oil production in Kete Nilam Hijo (KNH).

Figure 2 explains that KNH must sell patchouli oil products as much as 1,600 kg of patchouli oil to get a turnover of IDR 1,120,000,000. Meanwhile, assuming the average monthly patchouli oil sales are 50 kg, the return on capital can be predicted to return in the 33rd month. This means that from the 33rd month onwards, KNH has received a net profit. To increase production capacity in the future, KNH needs to increase the investment value in the form of additional production equipment. In addition, improving the quality will also increase the selling value of the patchouli oil produced.

4. Conclusion

The results showed that the total production cost of patchouli oil refining at Kete Nilam Hijo in one year was IDR 1,120,018,250. Meanwhile, Kete Nilam Hijo had to sell 1,600 kilograms of patchouli oil to break-even.
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