Journal of Systems Engineering and Management

journal homepage: https://jurnal.untirta.ac.id/index.php/JOSEAM

e ISSN 2964-0040

Financial feasibility analysis of establishing a red ginger essential oil agro-industry

Isni Nurfauziah[a*], Sarifah Nurjanah, Ahmad Thoriq, Nurul Ainina

[a] *Department of Agricultural and Biosystem Engineering, Universitas Padjadjaran*

ARTICLE INFO

Article history:
Received 02 Maret 2023
Received in revised form 14 Maret 2023
Accepted 23 Maret 2023
Available Online 05 April 2023

Keywords:
Red Ginger Essential Oil
Agro-Industry
Financial Feasibility

ABSTRACT

Red ginger is a commodity that is capable of producing antioxidants which can also be processed into various kinds of products, one of which is red ginger essential oil. Red ginger oil production business has good prospects, with the reason that not many producers produce red ginger essential oil, the possibility of profit is quite large, and the nature of red ginger which is an antioxidant commodity increases the opportunity for red ginger essential oil to be needed in the community. The purpose of this research is to analysed the financial feasibility of establishing a red ginger essential oil agro-industry. The method used in this research is descriptive quantitative. Data processing carried out in this study uses three working capital scenarios, namely 100% personal capital, conventional bank loans with a ratio of 50:50, and Islamic bank loans, with the NPV feasibility parameter (Net Present Value), IRR (Internal Rate of Return), BCR (Benefit Cost Ratio), and PBP (Payback Period). The results of this study indicate that all scenarios have NPV values of IDR 46.333.705.188, IDR 44.872.421.424, and IDR 46.386.954.684 respectively, IRR values of 14,29%, 13,37%, and 13,77%, BCR were 2,06, 1.92 and 1.98, and PBP values were 8 months, 8 months and 8 months. These values indicate that the establishment of this essential oil agro-industry is feasible, with the best planning falling into a scenario with the entire working capital of the founder. However, if personal capital financing has problems, funding from Islamic banks could be set as net profit sharing can be an alternative.

1. Introduction

Red ginger is an herbal plant that widely used for health purpose. Red ginger is commonly used as spicy or medisinal plant in traditional medicine. The part of the red ginger plant that is used as medicine is the rhizome [1]. As an aromatic herbal plant, red ginger produces secondary essential oils which have a synergistic effect based on the desired results with various uses and advantages [2]. Mbaveng and Kuete explained that "red ginger rhizome contains fatty oil (3-6%), protein (9%), carbohydrates (60-70%), crude fiber (3-8%), ash (8%), water (9-12%), and essential oils (2-3%)" [3].

Red ginger essential oil has many uses and benefits, both for health purposes and beauty treatments. The use of essential oils for aromatherapy or cosmetics is still rare both in the health and beauty industries. Products based on red ginger oil are still very limited in the market. In health products, ginger can be found in herbal medicines in liquid or tablet form, as well as in massage oils. However, there are still opportunities for ginger-based beauty products such as soap, facial masks, and other beauty care products that contain ginger essential oil.

Red ginger essential oil is obtained from red ginger rhizome distillation with an oil yield of 2.58 – 3.90% [4]. Red ginger essential oil is clear yellow to dark yellow. Main component of red ginger essential oil causes a special smell which can be smelled from red ginger essential oil. Red ginger essential oil can be used to relieve pain, improve respiratory circulation, and improve the digestive system [5].

In recent years, the need for red ginger essential oil has continued to increase along with the outbreak of the Covid-19 pandemic. Most people need an increase in immunity to maintain a healthy body, so the establishment of the red ginger industry has good prospects. In addition, the tendency of consumers to switch from a lifestyle of consuming ingredients containing synthetic compounds to natural ingredients has also boosted the demand for essential oils [6]. In this regard, the establishment of a red ginger essential oil agro-industry has good prospects, on the grounds that not many producers produce red ginger essential oil, the possibility of profit being quite large, and the nature of red ginger as an antioxidant commodity increases the opportunity for the need for oil. red ginger essentials in the community.

Before setting up an industry, there are several aspects that need to be analyzed and taken into account in order to know

. Corresponding author
e-mail address: izni.nurfauziah@gmail.com
http://dx.doi.org/10.36055/joseam.vxix.19333

whether the business to be carried out is feasible to continue or not. Feasibility analysis is carried out on the condition that the company wants to know how much profit or benefit from business activities, the level of business success, as well as business development decisions as well as increasing or repairing these business facilities. Aspects of the feasibility analysis are divided into several aspects, one of which is the financial feasibility analysis [7]. Financial feasibility analysis is used to avoid economic disadvantage because it is caused by the exhaustion of relatively large funds. In addition, this financial feasibility analysis also aims to determine the investment plan by calculating the expected costs and benefits.

Septiviana explained that "a financial feasibility analysis is carried out by comparing expenses and income, such as the availability of funds, the cost of capital, the project's ability to repay these funds within a predetermined time and assess whether the project will continue to develop" [8]. If the business is declared feasible, the business can be carried out and then continued, whereas if the business is declared not feasible, it is necessary to make changes including cost efficiencies incurred.

The purpose of this study was to analyze the financial feasibility of establishing a red ginger essential oil agro-industry. The limitation of this study is that this study only analyzes the financial aspects of planning red ginger oil agro-industry using steam distillation technology.

2. Methods

This research was conducted at the Biosystems Engineering Laboratory, Department of Agricultural and Biosystems Engineering, Padjadjaran University. The tools used in this research are*software* data processor Ms. Excel, whereas what is used is in the form of observational data and literature data from various sources such as books, journals, agency reports, and news. The method used in this study is to use a quantitative descriptive method. According to Sugiyono, a quantitative descriptive research method is "a method that uses numbers to create an objective picture of a situation, starting with data collection, data interpretation, and appearance and results" [9]. This research begins with the collection and tabulation of data obtained from observation and review of the literature, then a financial analysis is carried out to obtain the minimum selling price and financial feasibility of the company.

2.1 Data Collection and Tabulation

Data collection was carried out through literature studies and interviews. Literature study was conducted to obtain secondary data, by searching government publications, books, journals, theses, theses or dissertations, websites, articles and related research reports. Interviews were conducted to obtain primary data with informants who were able to provide information related to red ginger essential oil agro-industry.

2.2 Processing and analysis of data

Data processing carried out in this study uses three working capital scenarios, namely:

1. Scenario 1, where the entire capital used to finance investment in year 0 and operational costs in year 1 uses personal capital;
2. Scenario 2, where capital comes from personal capital and conventional bank loans with a debt ratio of 50: 50;
3. Scenario 3, where capital comes from personal capital and Islamic bank loans with a debt ratio of 50: 50.

Each scenario is analyzed for its financial aspects which include the calculation of production costs, cost of goods manufactured (HPP), BEP (Break Even Point), NPV (Net Present Value), IRR (Internal Rate of Return), BCR (Benefit Cost Ratio), , PBP (Payback Period), and the minimum selling price of the product. Financial analysis assumes a 10-year project life at an interest rate of 14% and the planned agro-industry location is in the Cianjur region, West Java. The equation used in financial analysis is as follows:

$$\text{HPP} = \frac{BP}{PT} \quad (1)$$

$$NPV = \sum_{t=1}^{n} \frac{\text{Bt}-\text{Ct}}{(1+\text{i})^t} \quad (2)$$

$$\text{IRR} = \text{i}' + \frac{NVP'}{NPV'-NPV''}(\text{i}'' - \text{i}') \quad (3)$$

$$\text{BCR} = \frac{\sum Benefit}{\sum Cost} \quad (4)$$

$$BEP = \frac{FC}{PVC} \quad (5)$$

$$\text{PBP} = \frac{ACF}{ANCF} \text{ x } 12 \quad (6)$$

Information:

HPP	= Cost of Production (IDR)
BP	= Cost of Production
PT	= Total Product
Bt	= Income every year (IDR/year)
Ct	= Initial investment/capital (IDR)
i	= Set interest rate (%)
n	= Number of times
t	= Time period (year)
i'	= discount rate which results in a positive NPV
i''	= discount rate which results in a negative NPV
NPV'	= positive net present value
NPV''	= negative net present value
BCR	= Benefit Cost Ratio
Benefit	= Profits earned (IDR)
Cost	= Expenses incurred (IDR)
FC	= Fixed Cost/Fixed fee (IDR/year)
P	= Price/Product selling price (IDR)
VC	= Variable Cost/Variable Cost (IDR)
PBP	= Refund period (years)
ACF	= Accumulated Cash Flow (IDR/year)
ANCF	= Accumulated Net Cash Flow (IDR/year)

A business is said to be feasible if: NPV and BCR have a value > 0, and the IRR has a value greater than the interest rate.

3. Result and Discussion

3.1. Raw Material Aspect

The red ginger essential oil agro-industry plan uses red ginger from Mande District, Cianjur Regency as its raw material. The total production of red ginger plants in Cianjur Regency in 2021 will reach 15,176,178 Kg, while for Mande

District it will reach 1,350,000 Kg or the equivalent of 8.8% of the total production in Cianjur Regency [10]. Based on the interview results, red ginger in Mande District, Cianjur Regency has a price of IDR 9,200

3.2. *Location Aspect*

Industrial location in this study was considered based on the availability of raw materials, ease of access to transportation, as well as geographical and community conditions [11]. Based on this, Mande District was chosen as the location for the establishment of the industry, because Mande District together with Cikalongkulon District will be used as a special industrial zone area, besides that Mande District is in the golden triangle area which is the toll road node between Sukabumi, Cikarang and Jakarta. .

3.3. *Essential Oil Manufacturing Process*

The process of producing red ginger essential oil can be done using three types of distillation, namely steam, steam, and water. The method chosen in this industry is the steam distillation method. Based on research conducted by Tritanti and Pranita, essential oils produced by the steam distillation method have a more pungent aroma, clearer colors, and higher yields than other methods [2]. Broadly speaking, the process of making essential minuak is described in Figure 1.

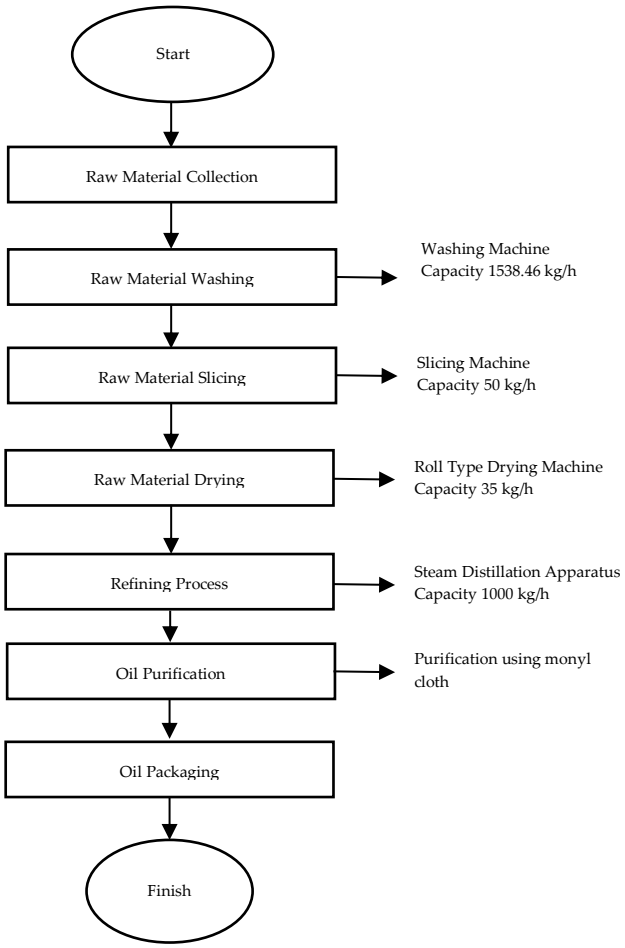

Figure 1. Red Ginger Essential Oil Production Process

3.3.1. *Raw Material Collection*

The process of collecting raw materials is done by collecting raw materials in the storage warehouse. The collected raw materials are placed in a sack or on a tarpaulin. The raw materials contained on the tarpaulin will be directly processed further.

3.3.2. *Washing Process*

The washing process is carried out with the aim of removing the soil attached to the red ginger rhizome, this is because the soil can reduce the quality of the red ginger oil, especially on the color part. If the raw material is still dirty, the resulting oil will have a darker or darker color [12]. This washing process is carried out on a machine made from*stainless steel* with an input capacity of 1538.46 Kg/hour. The washing process with this machine is driven by an electric motor so that it has a washing efficiency of 90.51%.

3.3.3. *Slicing Process*

The process of slicing red ginger aims to reduce the size of red ginger so that it can speed up the drying process. Reducing the size by slicing can increase the yield of red ginger essential oil [13]. The machine used in the slicing process has an input capacity of 50 kg/hour. This machine is able to adjust the thickness of the slices between 1-6 mm so as to allow the ginger to be sliced with the optimum thickness. The optimum thickness of red ginger slices for essential oils is 2.5 mm [14].

3.3.4. *Drying Process*

The next process is drying which aims to reduce the water content contained in the red ginger rhizome slices. In general, the initial water content of red ginger is 81.55% (wet basis) [15], the water content is reduced to 12-15%. The drying process can be carried out using a rack-type machine or a drying-type machine*roll*. Rack type dryer gallop on*batch*, so the capacity is smaller than the dryer type*roll* which is continuous. In this industry used type dryer*roll* for a larger capacity. Dryer type*roll* which is used in this Agro-industry with a capacity of 35 kg/hour.

3.3.5. *Refining Process*

The distillation process of red ginger essential oil uses the steam distillation method. The process of making oil is carried out in a distillation apparatus with a capacity of 1200 kg */batch* with a production input capacity of 500 Kg/*batch.* The yield of red ginger essential oil reaches 2.4-3.6% according to research conducted by the Bogor Agricultural Products Industry (BBIHP). Based on this, it can be concluded that the industrial production of essential oils is one-time*running* ±12 kg of red ginger essential oil will be produced, equivalent to ±9.4 L (based on the minimum density of SNI, namely 0.8720).

3.3.6. *Purification Process*

After being refined, red ginger essential oil products need to be purified by filtering using a cloth*monyl*. This process is carried out with the aim of filtering water and impurities that are dissolved in the distillation process [16].

3.3.7. *Packaging Process*

After the purification process has been carried out, the product will be sold in packaged form with a label and trademark registered at the Directorate General of Intellectual

Property. The packaging used is an amber bottle. Amber bottles are used due to the volatile nature of essential oils, thus they should be stored in a dark, tightly closed and cool bottle. Amber bottles are also used to maintain the quality of the oil so it is not damaged by sunlight [2].

3.4. *Financial Analysis*

Financial feasibility analysis is carried out to find out whether the business is feasible or not. Financial feasibility analysis is calculated based on the amount of money that comes in and goes out of a business, in this study, namely red ginger essential oil agro-industry. A business can be said to be feasible to run if the financial feasibility parameters meet the requirements. These parameters are if NPV > 0, BCR > 1, IRR > MARR interest rate, and a relatively fast return on investment. The calculation of this financial feasibility analysis refers to several costs, including investment costs, fixed costs, and variable costs. The investment costs can be seen in Table 1.

Table 1
Business Investment Costs

No	Cost component	Total Cost (IDR)
1	Land	472,500,000
2	Building	3,672,000,000
3	Tools and Machines	373,519,500
4	Pre Operation	24,500,000
5	Office inventory	I172,200,000
6	Operational Vehicle	IDR 408,550,000
7	General Equipment	IDR 580,000,000
	Total	**IDR 5,703,269,500**

The amount of investment costs for all scenarios is the same. The difference is in the fixed costs and variable costs that are affected by the production of the product. According to Khotimah and Sutiono, "fixed costs are costs that are not affected by changes in inputs and outputs generated in the business" [17]. In setting up a red ginger essential oil agro-industry, the fixed costs that must be incurred by the company consist of salaries for permanent employees, machine and building maintenance, depreciation, taxes, and loan repayments with details as written in Table 2.

Table 2
Fixed Cost of Business

No	Component	Scenario (IDR/Month)		
		1	2	3
1	Depreciation of Buildings and Equipment	25.415.313	25.415.313	25.415.313
2	Building and Equipment Maintenance	4.744.125	4.744.125	4.744.125
3	Permanent Employee Wages	71.300.000	71.300.000	71.300.000
4	Loan Returns	0	62.477.166	33.737.670
Total		101.459.438	163.936.606	135.197.110

Based on the abovethe smallest fixed costs are in scenario one with a total fixed cost of IDR 101,459,438, this is because in scenario one there is no loan repayment due to working capital. Scenario two has a higher fixed cost value than the other scenarios because in scenario two there is a cost of return to the bank as a result of working capital with a 50:50 ratio between personal capital and conventional banks with an interest of 14% referring to BRI's Micro Credit Interest Year 2022. Total fixed costs in the second scenario is IDR 163,936,606. The third scenario has a higher fixed cost value than scenario one but smaller than scenario two. In the third scenario, there is a cost of return to the bank as a result of musyarakah or profit sharing, the profit sharing ratio for Islamic banks is 30% referring to the calculation of the profit sharing ratio. The total fixed costs in scenario three is IDR 135,197,110.

The largest fixed cost component is found in the wage component for permanent employees, amounting to IDR 71,300,000. Work wages are based onThe minimum wage for Cianjur Regency is IDR 2,893,299 (Cianjur Manpower and Transmigration Office, 2023). While the smallest component is in the maintenance component of IDR 4,744,125. This component is calculated based on the maintenance assumption of 1% of the purchase price.

Variable costs are costs whose amount is determined by the number of product units or activity levels, meaning that if the product unit or level increases, the variable costs will also increase. Variable costs in each working capital scenario are different because they are affected by income-adjusted taxes. In detail, variable costs can be seen in Table 3.

Table 3
Business Variable Costs

No	Component	Scenario (IDR/Month)			Information
		1	2	3	
1	Electricity	1.646.022	1.646.022	1.646.022	It is calculated using the power calculation multiplied by the price per kWh, which is IDR 1800
2	Packaging Fee	44.616.000	44.616.000	44.616.000	It is calculated using the production capacity multiplied by the yield multiplied by the packaging price of IDR 11,000
3	Red Ginger Raw Materials	206.233.333	206.233.333	206.233.333	It is calculated using the calculation of production capacity multiplied by the price of red ginger per kg of IDR 9,200.
4	Fuel	50.437.500	50.437.500	50.437.500	It is calculated using the multiplication of the amount of fuel used (used oil) multiplied by the price of used oil of IDR 3,500.
5	ATK	5.000.000	5.000.000	5.000.000	Assumptions based on research at PT Musim Harvest Harmonis
6	Tax	312.962.312	294.219.162	302.841.010	Calculated using the calculation of the total income of the taxpayer multiplied by the applicable tax (30%)
	Total	**620.895.167**	**602.152.017**	**610.773.866**	

Based on Table 5, the total variable costs from scenarios 1, 2, and 3 are IDR 620,895,167, IDR 602,152,017 and IDR 610,773,866, respectively.There is a significant difference in the numbers from the three scenarios, the thing that makes the difference in fixed costs is taxes. The tax that must be paid under Article 17 paragraph (1) of the HPP Bill is 30% of the total taxable income.

The biggest variable cost component is the tax component. The tax component for each scenario respectively from scenarios 1, 2, and 3 amounted to IDR 312,962,312, IDR 294,219,162 and IDR 302,841,010. Meanwhile, the lowest cost is for the ATK component of IDR 5,00,000. Another component with a fairly large percentage in the variable cost calculation is raw materials amounting to IDR 206,233,333. The price of red ginger raw materials on the market fluctuates quite a bit, ranging from IDR 9,000 – IDR 15,000, but in Mande District, according to interviews with local farmers, the prevailing price is IDR 9,200.

3.5. Cost of goods sold

The cost of production or HPP is based on production costs and production capacity. The production capacity of red ginger essential oil in this study was 1000 kg/day. The cost of production for each scenario is shown in Table 4.

Table 4
Cost of goods sold

No	Scenario	Cost of Production (IDR/10 mL)
1	1	13.427
2	2	14.220
3	3	14.855

Based on Table 6, the cost of production from lowest to highest is in scenarios 1, 3, and 2 with a COGS value ofRp13.427, Rp14.220, andRp13.855. The difference in cost of production is due to differences in sources of capital which affect production costs as one of the components in the COGS calculation. Production costs in scenario 1 have a lower value than scenarios 2 and 3. This is due to the absence of loan repayments which have a major effect on the total production costs that must be incurred.

The cost of production is then used as a material consideration in determining the selling price.In this study, taking into account the cost of production obtained and the prevailing market price, red ginger essential oil in this agro-industry is set at IDR 30,000/10 mL.

3.6. Break Even Point (BEP)

Break even point (BEP) is a condition in which a company does not make a profit or make a loss in its operations. This BEP value states that at what level of production the business will reach a breakeven point. BEP is expressed in product units, in this study the red ginger essential oil product unit is the selling unit. BEP in this study is shown in Table 5.

Table 5
Break Even Point

No	Scenario	*Break Even Point* (Liters/Month)
1	1	42
2	2	67
3	3	55

The difference in BEP values in this study is due to differences in the fixed costs of each scenario, so it can be concluded that these two things affect the return on capital.

3.7. *Income*

The income generated is the multiplication of the total production sold with the price per kg of red ginger essential oil. The selling price of red ginger essential oil is adjusted by taking into account the cost of production and market prices, which is IDR 30,000/10mL. The sales value is obtained by multiplying the annual production capacity by the selling price so that the capacity scenario has a different sales value. In detail, the sales value of each scenario can be seen in Table 6.

Table 6
Business Income

Component	Scenario (IDR/Month)		
	1	**2**	**3**
Gross Income (Sales Value)	1.452.600.000	1.452.600.000	1.452.600.000
Taxable Income	730.245.395	686.511.377	706.629.024
Net income	511.171.776	480.557.964	494.640.317

3.8. *Financial Feasibility Analysis*

The financial feasibility analysis is calculated based on the income and expenses of the red ginger essential oil production business. Revenue is obtained from the sale of red ginger essential oil, while expenses are derived from red ginger essential oil production costs. An effort is said to be feasible if the NPV value is > 0 (positive value); IRR > MARR interest rate and B/C Ratio > 1. The table for calculating financial feasibility for all scenarios can be seen in Table 7.

Table 7
Calculation Results of Financial Feasibility Analysis

No	Component	Scenario		
		1	**2**	**3**
1	***Net Present Value* (IDR)**	46.333.705.188	44.872.421.424	46.386.954.684
2	***Benefit Cost Ratio***	2,06	1,92	1,98
3	***Internal Rate of Return* (%)**	14,29	13,37	13,77
4	***Payback Period* (Moon)**	8	8	8

Information:
Scenario 1: 100% working capital from industry founders
Scenario 2: 50:50 working capital with conventional banks
Scenario 3: 50:50 working capital with Islamic banks

After analyzing scenarios 1 to 3, it can be seen that scenario 1 results in the greatest net cash flow compared to the other scenarios. The results of the analysis in scenario 1 which includes NPV, IRR, BCR and PBP are the largest among other scenarios, with an NPV value of IDR 46,333,705,188, an IRR of 14.29%, a BCR of 2.06, and a payback period of 8 month. This is because scenario 1 has no obligations in repaying loans and profit sharing as in the second and third scenarios, so that scenario provides the maximum profit results compared to the other two scenarios, but for scenario 1 the overall capital issued by companies in setting up the industry all of them come from private funds so that it requires quite large funds at the start of the industry establishment.

Whereas in scenario 2, with capital sourced from personal funds and conventional banks with a debt ratio of 50:50, the income and business feasibility values are the smallest compared to the other scenarios. The results of the analysis in scenario 2 found that the NPV was IDR 44,872,421,424, the IRR was 13.37%, the BCR was 1.92, and the payback period was 8 months. However, scenario 2 still produces feasible criteria or the industry continues to provide positive benefits.

The last scenario, namely scenario 3 with capital sourced from personal funds and Islamic banks with a financing ratio of 50:50, obtains income and business feasibility values that are smaller than scenario 1 and greater than scenario 2. The results of analysis in scenario 3 show the NPV value figure of IDR 44,872,421,424, IRR is 13.37%, BCR is 1.92, and the payback period is 8 months. However, similar to scenario 2, scenario 3 still produces feasible criteria and provides positive benefits to the industry. Scenario 3 has a better value than scenario 2 with the same loan and financing ratio. Thus, procurement of capital with Islamic bank financing provides better benefits than conventional banks.

Based on the above, in order to provide maximum benefits, the choice of personal capital financing is the most appropriate, this is because in this scenario there is no obligation to repay the loan and profit sharing as in the second and third scenarios, but the total capital issued by the company in the establishment of the industry comes entirely from private funds so that it requires quite a large amount of funds at the start of the industrial establishment. However, if personal capital financing has problems, borrowing through Islamic banks is the method*net profit sharing* can be an alternative by considering the input capacity because not all capacity scenarios have a positive value.

3.9. *Sensitivity Analysis*

Increases in raw materials, increases in interest rates, and decreases in yields produced in the production process result in values from the NPV, IRR, and BCR that are different from the financial feasibility results directly from the actual situation. Results aSensitivity analysis shows that agro-industry is not feasible if the capacity decreases to 300 kg/day, the price of raw materials increases to IDR 45,000, the yield

decreases to 1.2%, the percentage of sales decreases to 50%, and the selling price of the product decreases to IDR 13,000/10mL.

4. Conclusions

Financial feasibility analysis which includes NPV, IRR, BCR and PBP, the best results are obtained in scenario 1 with an NPV value of IDR 46.333.705.188, IRR: 14,29%, BCR: 2,06, and PBP: 8 months. This is because this scenario has no obligations in repaying loans and profit sharing as in the second and third scenarios, so that this scenario provides the maximum profit results compared to the other two scenarios, but the total capital issued by companies in establishing an industry is entirely from private funds so that it requires a sizable fund at the start of the establishment of the industry.

Capital financing with personal funds does provide the best results, but apart from having to prepare a large amount of capital, a big risk will occur if the company suffers a loss because only the company will bear the risk, whereas in Islamic banks the risk will be shared according to the amount of capital contribution. implanted because of the method used*net profit sharing*.

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