



FINANCIAL FEASIBILITY AND SENSITIVITY OF ARABICA COFFEE FARMING IN SIMALUNGUN DISTRICT, SUMATRA UTARA

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ABSTRACT

Arabica coffee productivity in Simalungun Regency has the highest value, namely 1.25 tons/ha, among other arabica coffee producing districts in Sumatra Utara Province. However, the level of feasibility of return on investment made by farmers of arabica coffee has not been measured. The research method used to determine the feasibility and sensitivity of arabica coffee farming is Net B/C ratio, Gross B/C ratio, Profitability Ratio, Net Present Value and Internal Rate of Return. The results of the research show that arabica coffee farming is financially feasible based on the criteria of Net B/C Ratio (2.33), Gross B/C Ratio (1.38), Profitability Ratio (2.31), NPV (Rp. 23,194,329), and IRR (25.06%). The sensitivity of arabica coffee farming occurs if fertilizer and labor costs increase by 55% and production prices fall, then arabica coffee farming is not worth pursuing. Arabica coffee farming in Raya Huluan Village is financially feasible but farmers have not been able to independently cultivate arabica coffee properly. Therefore, farmers are given assistance on how to cultivate arabica coffee farming, types of fertilizer and dosage of fertilizer, timing of fertilizer application so that the economic life of arabica coffee is more than 10 years.

INTRODUCTION

Arabica coffee productivity in Simalungun District has the highest value, namely 1.25 tons/ha, among the other arabica coffee producing districts in Sumatra Utara Province. The area of productive arabica coffee land in Simalungun District reaches 8,217 hectares with production of 10,324 tons. The number of coffee farmers involved was 17,487 families. One of the arabica

coffee centers in Simalungun District is Raya Huluan Village. As many as 70% of the population grows Arabica coffee which has been cultivated for generations. Techniques used in arabica coffee cultivation, such as the plant varieties chosen, planting patterns, maintenance and weeding, fertilization and post-harvest handling carried out, influence the production and productivity of arabica coffee. Production facilities include seeds, fertilizer, pesticides and also labor. Capital is a very important part of running a farming business. Small farmers who have little capital tend to carry out traditional farming with minimum use of technology. The age of coffee plants varies greatly so the costs incurred by farmers to run arabica coffee farming are different. Farmers tend to incur greater costs for plants aged 0-2 years. According to the community, investment in arabica coffee farming in Raya Huluan Village is profitable and worth pursuing, but the level of return on investment has not yet been measured as to how financially feasible it is. This research aims to analyze the level of financial feasibility of arabica coffee farming in Raya Huluan Village using several financial feasibility criteria namely *Net B/C ratio*, *Gross B/C ratio*, *Profitability Ratio*, *Net Present Value* and *Internal Rate of Return* (Sobana, 2018).

RESEARCH METHODS

This research was conducted in Raya Huluan Village, Dolog Masagal Sub-District. This village was chosen deliberately as one of the production centers for arabica coffee farming in Simalungun District. From a population of 108 Arabica coffee farmers, the sample in this study was farmers who owned arabica coffee plants with varying ages of cultivated plants ranging from 0 years to 10 years. Using the *Stratified Random Sampling technique*, the number of samples of Arabica coffee farmers in each stratum is presented in Table 1.

Table 1. Sample of farmers

No	Age of coffee plant (years)	Level	Number of samples (people)
1	0-1	1	4
2	2-4	2	9
3	5-7	3	13
4	8-10	4	15
Total Sample			41

The data in this research is in the form of primary data obtained directly from respondents and secondary data obtained from village monographs, agriculture and plantation services, central statistics agencies, and the results of other research and literature. The data that has been obtained is analyzed to determine the financial feasibility and sensitivity of arabica coffee farming (Sobana, 2018). As presented in Table 2, the formula and several assumptions in

the financial feasibility analysis where benefits and costs are assessed starting from 0 - 10 years and an interest rate of 6%

Table 2. Methods and criteria for financial feasibility of Arabica coffee farming

No	Method	Formulas	Eligibility Criteria
1	Net Benefit Cost Ratio (Net B/C).	$\text{Net } \frac{B}{C} = \frac{\sum_{t=0}^n \frac{B_t - C_t}{(1+i)^t}}{\sum_{t=0}^n \frac{B_t - C_t}{(1+i)^t}}$	A net B/C ratio >1 means that arabica coffee farming is worth pursuing. Net B/C ratio <1 means that arabica coffee farming is not worth pursuing. Gross B/C ratio > 1 means that arabica coffee farming is profitable
2	Gross Benefit Cost Ratio (Gross B/C)	$\text{Gross B/C Ratio} = \frac{\sum \frac{B_t}{(1+i)^t}}{\sum \frac{C_t}{(1+i)^t}}$	Gross B/C ratio < 1 means that arabica coffee farming is not profitable
3	Profitability Ratio	$PV''/K = \frac{\sum_{t=0}^n \frac{B_t - O \& M}{(1+i)^t}}{\sum_{t=0}^n \frac{it}{(1+i)^t}}$	If PR >1 means arabica coffee farming is worth pursuing If PR <1 means arabica coffee farming is not worth pursuing
4	Net Present Value (NPV)	$NPV = \sum_{i=1}^n \frac{B_t - C_t}{(1+i)^t}$	NPV > 0 means that arabica coffee farming is worth pursuing. NPV < 0 means that arabica coffee farming is not worth pursuing.
5	Internal Rate of Return (IRR)	$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} (i_2 - i_1)$	IRR > i means that arabica coffee farming is feasible IRR < i means that arabica coffee farming is not feasible

Where B = benefit, C = cost, B_t = benefit at time t, C_t = cost at time t, i = interest rate, t = time, n = long of business cycle time, O & M = operational & maintenance

The feasibility of arabica coffee farming is very dynamic if there are changes in economic conditions, for this reason it is necessary to know the level of sustainability of this farming business. The changes in conditions referred to include the occurrence of 1) an increase in the cost of production factors, 2) changes in production quantities, and 3) fluctuations in selling prices. Criteria

are used to find out what percentage of price changes, either price decreases or costs increase, which results in changing the feasibility criteria for an investment used from feasible to unfeasible, which still meets the minimum eligibility criteria that provide normal profits. Normal profits occur when the NPV value is equal to zero (NPV=0). When NPV is zero, IRR = interest rate, Net B/C Ratio = 1 (*ceteris paribus*). That is, what is the tolerance level for input prices to increase or decrease and output prices and quantities to increase or decrease.

RESULTS AND DISCUSSION

Feasibility of Arabica Coffee Farming

The interest rate will affect the value of the investment eligibility criteria. Based on the research results, the respective investment criteria values are presented in table 3 .

Table 3. Details of the Feasibility of Investing in Arabica Coffee Farming in Raya Huluan Village for 10 Years

No	Description	Amount(Rp)	Criteria	Mark
1	Gross benefits	117,707,456.2	Net B/C Ratio	2.33
2	Cost (Cost)	79,016,282.45	Gross B/C Ratio	1.38
3	DF 6 %	8.3596	Profitability	2.31
4	Investment	17,935,833.4	NPV	23,194,329
5	O&M	61,080,449.45	IRR	25.06%
6	PV Gross B	84,149,445.28		
7	PV Gross C	60,955,116.24		
8	PV Net BC (+)	40,518,165.9		
9	PV Net BC (-)	17,323,836.85		
10	Net benefits	23,194,329.05		
11	DF 25 %	4,567		
12	DF 26 %	4,461		
12	NPV 25 %	40,030.22		
13	NPV 26 %	-616,238.26		
14	PV Gr (B-OM)	40,795,289.4		
15	PV Invest	17,600,960.65		

Source: Processed Primary Data (2021)

The following description explains the achievement of the financial feasibility criteria for arabica coffee farming. Net B/C Ratio is a comparison of positive PV with negative PV. In order to obtain the Net B/C Ratio value, the difference between benefits and costs must first be obtained so that the net benefits can be calculated. The net benefit is then multiplied by an interest rate of 6%. Table 3 shows that the amount of positive PV is IDR 40,518,165.9 and the amount of negative PV is IDR 17,323,836.85, resulting in a Net B/C Ratio of 2.33. This means that every Rp. 1 spent on investment will have benefits worth Rp. 2.33. In other words, the benefits provided are worth 2.33 times the expenditure. This value is greater than 1 (>1) so that Arabica coffee farming in Raya Huluan Village provides profits and is worth pursuing. This value biggest compare to feasibility value that is founded by others such as Kusmiati (2015) explained that the Net B/C value in the period from year zero to year 25 of arabica coffee farming in Karang Pinggir Village was 1.25, therefore the farming was feasible to continue. Zakaria (2019) explained that the Net B/C ratio of arabica coffee farming in Suntenjaya Lembang Village was 1.98, so the farming business was worth continuing. Even though, life time cycle of their business longer than arabica coffee farming in Raya Huluan Village. It is mean that at long run, the arabica coffee farming at raya huluan village have to improve their cultivating management.

The value of the Gross B/C ratio is obtained through the comparison value between the PV of the gross benefit flow and the PV of the cost flow. The first thing to do is to add the flow of benefits and the flow of gross costs to the present value , then add up each of these flows. Table 3 shows that at an interest rate of 6%, the PV of benefit flows is IDR 84,149,445.28 and the PV of cost flows is IDR 60,955,116.24. So we get a GrossB/C Ratio value of 1.38, which means that every Rp. 1 invested can provide benefits worth Rp. 1.38. In other words, the benefits obtained are worth 1.38 times the sacrifice costs incurred. This value is greater than one (>1) so that arabica coffee farming in Raya Huluan Village is worth pursuing because the investment made provides profits. The Gross B/C value of the arabica coffee farming at raya huluan village higher than Gross B/C founded by Kusmiati (2015) explains that the Gross B/C value of Arabica coffee farming in Karang Pinggir Village is 1.16, which means that the farming business is worth continuing.

Profitability ratio is a comparison of the present value of the remaining flow of benefits minus routine costs (operational and maintenance costs) with capital or investment costs. Table 3 shows that the PV Gr (B-OM) value is IDR 40,795,289.4 and the PV investment is IDR 17,600,960.65, so the Profitability value obtained is 2.31. This means that for every IDR 1 spent you get a benefit worth IDR 2.31. This value is greater than 1 (>1) so that Arabica coffee farming is worth pursuing because the investment made provides profits. The profitability value of the arabica coffee farming at raya huluan village lower

than Gross B/C founded by Wahyuni (2012) explained that Arabica coffee farming in Bandung Baru Village has a Profitability Ratio value of 3.8, which means the value is more than 1 so that Arabica coffee farming is worth continuing. The difference was risen from product price, there is competition among arabica producer, so the profit margin was tiny.

Net Present Value (NPV) is obtained from the difference between the PV amount of benefit flows and the PV amount of cost flows or the difference between the Positive Net PV amount and the Negative Net PV amount and also the difference from the PV amount (Gr OM) minus the investment PV amount . Table 3 shows that the PV value of the benefit stream is IDR 84,149,445.28 and the PV value of the cost stream is IDR 60,955,116.24 at an interest rate of 6% so that the NPV yield is IDR 23,194,329 . This value is greater than zero (>0), therefore arabica coffee farming in Raya Huluan Village, Dolog Masagal Sub-district, Simalungun District is worth pursuing because the investments made will make a profit. Kusmiati (2015) explained that arabica coffee farming in Karang Tepi Village has an NPV value of IDR3,690,704, which means the farming is feasible to continue. However, farmers do not get very high profits because the arabica coffee farming is at medium altitude, and arabica coffee can produce more at higher altitude. This NPV value was lower than NPV value founde by Wahyuni (2012) that arabica coffee farming in Bandung Baru Village has an NPV value of IDR18,874,733, which means that the farming is worth continuing. It is mean that at long run, the arabica coffee farming at raya huluan village have to improve their cultivating management.

IRR value is obtained by means of the value of the first interest rate (the interest rate that produces a positive NPV) plus the NPV value of the positive interest rate divided by the difference between the NPV value of the positive interest rate minus the NPV of the negative interest rate multiplied by the difference between the positive interest rate and the negative interest rate. Table 3 shows that the NPV of interest rates is positive with a 25% DF of IDR 40,030.22 and the NPV of interest rates is negative with a 26% DF of IDR 616,238.26, so that an IRR value of 25.06% is obtained. The IRR value is greater than the interest rate or 25.06%, greater than 6%, therefore arabica coffee farming in Raya Huluan Village is said to be feasible to continue. This means that 25.06% of farmers' ability to repay loans against loan interest is 6%. This value biggest compare to feasibility value that is founded by otherssuc as Kusmiati (2020) explains that robusta coffee farming in Kalibaru Manis Village has an IRR value of 23.24% with an interest rate of 7% so that the farming is feasible to continue. Zakaria (2019) explains that the IRR value of farming in Suntenjaya Lembang Village is 21.44%, which is higher than the interest rate used of 14%, therefore farming is feasible to continue.

Sensitivity of Arabica Coffee Farming

Changes in production costs and revenues greatly determine the feasibility of investing in Arabica coffee farming, this can be observed through sensitivity analysis. There are three aspects assumed in this sensitivity analysis, namely 1) Increase in production costs, especially operational costs which include fertilizer costs and labor costs. It is assumed that production costs will increase in the future, which is calculated assuming changes of 10 percent, 20 percent, 30 percent, 40 percent, 50 percent and 55 percent, 2) Decrease in product selling prices. It is assumed that the selling price of the product will decrease in the future by assuming changes of 10 percent, 20 percent, 20 percent, and 30 percent, and 3) A decrease in the amount of production. It is assumed that the amount of production will decrease in the future by assuming changes of 10 percent, 20 percent and 30 percent. Based on the simulation of these changes to the level of feasibility of Arabica coffee farming, the results obtained are as presented in table 4.

Table 4. Sensitivity of Arabica Coffee Farming to Costs, Prices and Production Amounts

No	Information	Investment Criteria					Information
		Net B/C	Gross B/C	PR	NPV (Rp)	IRR	
1	Production costs increase by 10%	2.03	1.28	2.02	18,743,142	23%	Worthy
	Production costs increase by 20%	1.77	1,2	1.76	14,534,733	20.58%	Worthy
	Production costs increase by 30%	1.54	1.14	1.55	10,969,423	18.05%	Worthy
	Production costs rise 40%	1.21	1.06	1.23	4,783,505	12.38%	Worthy
	Production costs increase by 50%	1.04	1.01	1.05	1,118,399	7.73%	Worthy
	Production costs increase by 55%	0.95	0.98	0.95	-984.114	4.33%	Not feasible
	2	Output prices down 10%	1.86	1.24	1.83	14,779,275	21.38%
Output prices fall 20%		1.35	1.1	1.36	6,364,342	15.05%	Worthy
output prices fell by 30%		0.89	0.96	0.88	-2,050,589	1.39%	Not feasible
3	Production down 10%	1.86	1.24	1.83	14,779,275	21.38%	Worthy
	Production down 20%	1.35	1.1	1.36	6,364,342	15.05%	Worthy

No	Information	Investment Criteria					Information
		Net B/C	Gross B/C	PR	NPV (Rp)	IRR	
	production down 30%	0.89	0.96	0.88	-2,050,589	1.39%	Not feasible

Source: Processed Primary Data (2021)

The following description explains the sensitivity of the feasibility of arabica coffee farming due to changes that occur which can be observed from changes in the feasibility criteria used. The simulation results indicate that production costs (fertilizer and labor) have increased respectively by 10%, 20%, 30%, 40% and 50% from the conditions when the research took place. The investment criteria *Net B/C*, *Gross B/C*, *PR*, *NPV*, and *IRR* produce value to strive for. This means that Arabica coffee farming in Raya Huluan Village is not at risk of increasing production costs. However, if production costs increase by 55%, then the *Net B/C value* is 0.95, *Gross B/C* is 0.98, *Profitability Ratio* is 0.95 so the value of these three criteria is < 1 . Likewise, the *Net Present Value value* is IDR -984,113.84 < 0 . This means that Arabica coffee farming is experiencing losses. The *IRR value* is 4.33% $<$ interest rate. This means that Arabica coffee farming is unable to cover loan interest. The indications obtained from all the feasibility criteria mean that Arabica coffee farming is sensitive to changes in production costs of 55%.

Net B/C, *Gross B/C*, *PR*, *NPV*, *IRR* and *PP* values in the criteria worth cultivating. This means that Arabica coffee farming in Raya Huluan Village is not at risk of changes in the price of production output. However, if the output price of Arabica coffee production falls by 30%, the *Net B/C value* is 0.89, *Gross B/C* is 0.96, *Profitability Ratio* is 0.88, the value of these three criteria is < 1 . This means the benefit obtained cannot cover expenses. Meanwhile, the *NPV value* is IDR-2,050,589 < 0 and the *IRR value* is 1.39%, this value is $<$ the applicable interest rate. These two criteria provide information that the Arabica coffee farming is experiencing losses and is unable to cover loan interest.

The decrease in the amount of Arabica coffee production by 10% to 20% results in the *Net B/C*, *Gross B/C*, *PR*, *NPV*, *IRR* and *PP* values still being in the criteria of being worth cultivating. This means that Arabica coffee farming in Raya Huluan Village is not at risk of changes in the decline in production. However, if there is a change in the amount of Arabica coffee production by 30% from the conditions when the research took place, the *Net B/C value* has a value of 0.89, *Gross B/C* has a value of 0.96, *Profitability Ratio* has a value of 0.88, the value is < 1 , which means means that the benefits are not able to cover expenses. *Net Present Value* has a value of IDR -2,050,589, this value is < 0 , which means that the Arabica coffee farming is experiencing a loss. *The Internal Rate of Return* has a value of 1.39, the value is $< i$, which means that the Arabica coffee farming is unable to cover the loan interest.

If the price of the product decreases, farmers cannot do anything about that price, because the price of the Arabica coffee commodity is greatly influenced by market conditions and the marketing institutions involved in it. To overcome the decline in production output prices, what farmers can do is increase production so that revenues remain high. The decrease in production was caused by pests and diseases as well as changes in climate and weather in the research area. If this happens, what farmers do is carry out routine maintenance on Arabica coffee, such as spraying Arabica coffee plants that are attacked by pests and diseases. Pay attention to the weather and climate and how to care for Arabica coffee so that it continues to grow well in response to changes in weather and climate. Wahyuni (2012) explains that production costs have increased by 29%, production prices have decreased by 22% and production has decreased by 22%, so Arabica coffee farming is no longer feasible to continue in Bandung Baru Village in terms of the Net B/C Ratio, Gross B/C Ratio values . .

Profitability is less than one (<1), the NPV value is less than zero (<0) and the IRR value is less than the interest rate. In contrast to research in Raya Huluan Village, if production costs increased by 30%, Arabica coffee farming had not experienced a loss. Likewise, the Arabica coffee business at Kalisat Jampit Plantation is still in the feasible category. On the other hand, Zulfiqoh (2017) explains that if production falls by 30%, then the Arabica coffee business in Kalisat Jampit Plantation will not be feasible, where the maximum limit for reducing Arabica coffee production so that farming remains viable is 21%. If production costs increase by 30% in Arabica coffee plantations, it shows that the farming business is still feasible. The Arabica coffee business in the Kalisat Jampit plantation is included in PTPN still working on it. The same is true for smallholder arabica coffee farming in Raya Huluan Village, if there is a large enough change in production volume of up to 30%, farming in that village will no longer be worth running. If production costs increase by 30%, farming is still worth pursuing. An increase in the production costs of fertilizers and pesticides by 30% means that Arabica coffee farming in Raya Huluan Village is still worth pursuing. This means that farming is not at risk of changes in production costs of 30%. This is because if the cost of purchasing fertilizers and pesticides increases, farmers will continue to purchase these inputs because if fertilizers and pesticides are not provided for Arabica coffee farming, this will result in the amount of production being reduced, if the amount of production is reduced, farmers' income will also decrease. So farmers must continue to purchase fertilizers and pesticides so that the amount of Arabica coffee production remains and increases, so that the 30% increase in production costs can be covered by farmers' income.

CONCLUSIONS

The results of the research and discussion indicate several conclusions, namely 1) cultivating Arabica coffee cultivated by farmers in Raya Huluan Village, Dolog Masagal Sub-district, Simalungun District is worth cultivating. This is based on the *Net B/C Ratio* (2.33), *Gross B/C Ratio* (1.38), *Profitability Ratio* (2.31), and NPV (Rp. 23,194,329), and IRR (25.06%), and 2) the sensitivity of Arabica coffee farming occurs, if production costs increase by 55%, Arabica coffee farming is not worth running. And if arabica coffee production and prices fall by 30% then arabica coffee farming is not worth pursuing. Suggestions resulting from this research include that Arabica coffee farming in Raya Huluan Village is financially feasible, but from the research results it was found that farmers have not been able to cultivate arabica coffee well independently. This can be seen from field data that there are still several arabica coffee plants that are attacked by pests and diseases, resulting in a decrease in the amount of arabica coffee production. The government is expected to be able to help farmers in providing knowledge and learning about how to cultivate arabica coffee farming better, so that the economic life of arabica coffee is more than 10 years.

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