

Financial Feasibility Study of Arabica Coffee: A Case Study in Poetete Village, Ermera District, Timor Leste

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Abstract

Coffee is not only the main export product in Timor Leste, but also a source of income for farmer household. The importance of coffee for Timor Leste community should be developed through market oriented farm management on coffee farming. The aim of this research was to analyze financial feasibility of Arabica coffee farming at farmer level; analyze sensitivity of coffee farming toward change in coffee productivity and price; and analyze correlation between productivity with socio-economic characteristics of farmers. This research was carried out at Poetete Village, Ermera Sub-district, Ermera District, Timor Leste. Primary and secondary data were collected in this research. Respondents were selected by stratified random sampling method. Financial feasibility study on coffee farming were analyzed by using Net Present Value (NPV), Internal Rate of Return (IRR) dan Net Benefit Cost Ratio (NBCR). Rank Spearman test was used to analyze the correlation between productivity with variable of production factors and socio-economic characteristics of farmers. The results showed that Arabica coffee farming was financially feasible to be develop with NPV of USD 205,291,130; IRR of 17.449%; and Net B/C ratio of 2.911 at discount factor 10%. Arabica coffee farming at Poetete Village was classified less responsive toward productivity increasing at 10% and price decreasing at 10% with NPV of USD 37,367,151; IRR of 25.95%; and Net B/C ratio of 3.862 at discount factor 1%. The correlation between productivity with land ownership (0.965), experience of farmers (0.613), age of farmers (0.663), farmers education level (0.748) and household size (0.791) were categorized as strong to very strong.

Keywords: feasibility, financial, sensitivity analysis, coffee, Arabica, Timor Leste

INTRODUCTION

Organic Arabica coffee is considered as a commodity with high economic value in terms of its contribution to the household income of farmers and national income. This opportunity needs to be utilized to develop the coffee commodity that is oriented to agribusiness and has high competitiveness in the international market. Coffee is not only

developed in Indonesia but also expanded to other developing countries such as Timor Leste which is one of developing countries that has a high potential to develop coffee both Arabica and Robusta coffees. Considering the potential of its region, the development of Arabica coffee has a greater opportunity than Robusta coffee, because most areas, particularly the highlands, have developed Arabica coffee either by using monoculture

or agroforestry system (Deutsh, 2004). The dominance of Arabica coffee development can be seen from its farming area of 53,816 Ha (Henriques *et al.*, 2012). The cultivation of Arabica coffee in Timor Leste is carried out traditionally since most are managed by smallholders.

The history of coffee development in Timor Leste has begun since the early 1800s in which it was initially introduced by the Portuguese. In the mid of 19th century, the coffee farming concession was taken over by sandalwood, the largest exporter in Timor Leste (Deutsch, 2004; Henriques *et al.*, 2012). In 1929, coffee growing area was in Fatubesi Village, Hatulia Sub-district, Ermera District. The region was at an altitude of 1,250 m above sea level. Based on that fact that coffee began to be known and cultivated by rural communities who lived at an altitude of 1,000–2,000 m asl. In general, the community still managed coffee farming subsistently, particularly to meet the household economic needs of farmers (Nevins, 2003; Deutsch, 2004). On the other hand, farmers also have not applied good agricultural practices on their coffee farms, such as weeding, pruning, plant rejuvenation, and others. Under this management, the productivity of coffee in smallholder plantations was still relatively low (Amaral, 2003). Some efforts to increase the productivity can be conducted by establishing cooperation among stakeholders, including farmers, government, private sectors, investors and research institutes/universities, and other parties through the establishment of a coffee-based economic cluster.

The development of coffee in Timor Leste was recorded at 53,806 ha with the Arabica coffee percentage of 86.63% and the rest 16.37% of Robusta coffee. These coffee plantations has been spread in six districts, namely Ermera, Liquica, Aileu, Ainaro, Same (Maun-Fahe) and Bobonaro.

According to Sulistyio *cit.* Hartobudoyo (1985), the land ownership of coffee farmers ranges from 0.5 to 10 ha. The area of the land ownership indicated that the coffee farming scale carried out by the farmers was still relatively small and the management was not market oriented. Coffee farming is also a source of household income for farmers. By looking at the coffee management at smallholder level, it is known that farmers generally have a limited capital particularly for developing their farming scale. It has been proved by the behavior of farmers who minimize the use of production factors in their farming activities. In order to develop the coffee farming scale, it is important to know the financial performance of the coffee farming that has been proceeded by the farmers. This will reflect the amount of production costs and benefits received by the farmers. The ultimate goal was to assess the feasibility of the coffee farming at smallholders level. Considering the importance of coffee for farmers, it is necessary to review the business performance and profitability obtained by farmers. Saptana (2008) stated that the assessment of the financial feasibility of farming activities can improve the competitiveness of coffee products. This study was aimed to analyze the financial feasibility of coffee farming at the level of smallholders; to analyze the sensitivity of coffee farming to productivity and price changes, and to analyze the correlation between the productivity of coffee farming and the socio-economic characteristic of farmers.

MATERIALS AND METHODS

Location, Data, and Sampling

This research was conducted in Poetete Village, Ermera District in April 2011. The location of research was determined purposively, considering that the village was one

of the Arabica coffee production regions located in Ermera District. In addition, the pattern of coffee farming was categorized as subsistence farming system, and the technology applied was still traditional. The coffee cultivation in the selected location varied in plant ages, that was more than 10 years. In 2006, the productivity of coffee in Emera was about 184 kg/ha. Farmers generally sold coffee to various buyers such as the Cooperativa Coffee Timor (CCT), Timor Global, Timor Cooperation, ELSAA Café, NGOs, and others. Furthermore, the buyers export the coffee to various export destinations such as the United States of America, Germany, Portugal, Indonesia, Japan, Australia, and several other importing countries. Most of the coffee is sold with Organic and Fair Trade certification labels to get the premium price by accessing the labeled market (DICA, 2009).

Data were collected by survey method. The method was conducted through direct observation in the field and in-depth interview with the respondents by using questionnaire. The activities were aimed to explore the information of coffee farming at the level of smallholders and simultaneously describing the conditions occurring in the field. The data collected included primary and secondary data. The primary data were obtained through an interview with the farmers regarding farmer characteristic, the use of production factors, production, prices, revenue, and others. The secondary data covered statistical data and articles related to the performance of the coffee sector in Timor Leste. In particular, the data of lending interest rates in Timor Leste were sourced from IndexMundi (2011). The other secondary data such as productivity and market information were traced by accessing information from internet, journals, and related agency reports.

The population being studied was all the coffee farmers located in Poetete Village, Ermera Sub-district, Ermera District. The respondents were determined by using stratified random sampling method because the research population was divided into several groups based on land ownership, farmer age, farmer experience, household size, and farmer education level. The respondents were selected randomly in each group (Christensen *et al.*, 2012; Dhermawan *et al.*, 2012; Wahyuni *et al.*, 2012; Rahardja, 2008; Widyatmini & Hakim, 2008). The number of respondents taken in each group was 10% of the respondents representing the population. This method was used because the respondents in the population of this research were homogenous, so grouping the respondents could improve the effectiveness and efficiency in selecting the respondents (Rahardja, 2008).

Analysis Method

In this research, the feasibility aspect studied was the financial aspect. Therefore, the components that should be considered were the investment cost, production cost, production projection, and benefit on the coffee farming activity. The projection on the cost, production, and benefits should take into account the characteristics of the coffee trees. Regarding of that coffee trees are divided into the phases of immature plants, productive plants and old/less productive plants. This financial feasibility study would use an investment assessment method that considered the time value of money, The coffee farming will assessed by Net Present Value (NPV), Internal Rate of Return (IRR), and Net Benefit Cost Ratio (NBCR). The mathematical equations in each method are outlined as follows (Adiguna *et al.*, 2014; Tiara *et al.*, 2013; Warsika, 2009):

a. Net Present Value (NPV)

$$NPV = \sum_{t=0}^n \frac{R_t}{(1+i)^t} = \sum_{t=0}^n \frac{B_t - C_t}{(1+i)^t} \dots\dots\dots (1)$$

- Notes:
 R_t : Net cash flow at period-*t*
 B_t : Benefit at year-*t*
 C_t : Cost at year-*t*
 i : Discount rate
 t : The time of the cashflow or business period (at year-*t*)
 n : The duration of farming project or the economic life of coffee plants

Assessment of farming investment is divided into three categories, namely: (i) NPV > 0, meaning that the farming investment is feasible to run; (ii) NPV < 0, meaning that farming investment does not make profits; (iii) NPV = 0, meaning that farming investment is at a break-even point.

b. Internal Rate of Return (IRR)

$$IRR = i_1 + \frac{NPV_1}{(NPV_1 - NPV_2)}(i_2 - i_1) \dots\dots\dots (2)$$

- Notes :
 NPV₁ : Positive NPV value equal to zero with capital interest of i₁ percent
 NPV₂ : Negative NPV value equal to zero with capital interest of i₂ percent
 i₁ : Discount rate resulting in positive NPV
 i₂ : Discount rate resulting in negative NPV

Assessment of investment is divided into two criteria, namely (i) IRR > the applicable interest rate when investment is executed, meaning that the investment is profitable and feasible to be implemented; and (ii) IRR < interest rate, meaning that the investment is not feasible to run.

c. Net Benefit Cost Ratio (NBCR)

$$NetB/C = \frac{\sum_{t=1}^n \frac{B_t - C_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t - B_t}{(1+i)^t}} \dots\dots\dots (3)$$

- Notes:
 B_t : Benefit at year-*t*
 C_t : Cost at year-*t*
 i : Discount rate
 t : Time of a farming project or business period (year-*t*)
 n : Duration of farming project or economic life of coffee plants

Investment criteria are assessed in two categories, namely (i) the value of Net B/C > 1, meaning that the investment is feasible to be implemented; and (ii) the value of Net B/C < 1, meaning that the investment is not feasible to be implemented.

The sensitivity analysis was conducted to find out the performance of smallholder coffee farming as the result of the changes of productivity and price (Aklimawati & Hartatri, 2016). Simulation on the sensitivity analysis was 10% of productivity increase and 10% of price reduction. This was done to find out the performance of smallholder coffee farming investment to the benefits change. The assessment of the coffee farming investment can be used as a reference for developing coffee commodity and to increase coffee competitiveness in Timor Leste, especially improving the performance of smallholder coffee plantations. It is necessary to be observed because coffee is one of the main export products that contribute to national revenues (Amaral, 2003; Deutsch, 2004).

The correlation analysis was performed to study the correlation between the productivity factor and socio-economic characteristics of farmers. The correlation coefficient between the variables was obtained by Rank Spearman test. This analysis was done by using SPSS Statistic Program Version 15. The socio-economic characteristics of farmers included the variables of land area, farmer experience, farmer age, farmer education level, and house hold size.

RESULTS AND DISCUSSION

The assessment coffee farming investment, was calculated at discount rates of 10%, 15%, and 20%. The results of the financial feasibility of the coffee farming system are presented in Table 1. It was known that NPV value was higher than zero (NPV > 0) at 10%

discount rate. It indicated that the capital investment in Arabica coffee plantation would provide a profit (DF 10%) over the economic life of coffee trees according to the present value. The IRR value at the discount rate of 10% reached 17.449%, which presented the IRR value was higher than the lending interest rate of 11.04%. The Net B/C ratio was 2.911 at 10% discount rate, indicating that any present value of the cash out flow of USD 1.00 would provide a benefit of USD 2.911. The results of NPV, IRR, and Net B/C ratio at a 10% discount rate showed that the Arabica coffee plantation management could be considered feasible and profitable to cultivate.

The analysis of NPV, IRR, and Net B/C ratio at 15% discount rate, expressed that the value of its assessment method was decreasing. The NPV value decreased, although the NPV value was still higher than zero ($NPV > 0$). The value of IRR also decreased to 6.622%, indicating that the IRR value was lower than the lending interest rate. Nevertheless, the value of Net B/C ratio reached 1.120 which indicates that the benefit earned amount to USD 1.120 and the cash flow needed is USD 1.00 at present value.

The change of the discount rate at 20%, made the NPV value was positive and higher than zero ($NPV > 0$). The IRR of this investment was 2.3737%, which means that the management of Arabica coffee plantation had an IRR value below the lending interest rate. The analysis of Net B/C ratio gave a result of 1.004, meaning that present value of the

cash out flow of USD 1.00 would make a benefit of USD 1.004.

Based on the three methods of the assessment at 15% and 20% discount rate it can be concluded that the management of Arabica coffee plantation in Potete Village, Ermera District, was less feasible to be cultivated and financially less profitable. Looking at the percentage of IRR, this investment had a value below the lending interest rate. Based on these results, business actors will take the initiative to choose a more profitable investment. It occurs while social opportunity cost of capital becomes higher, so the return of its investment cannot cover the social cost during the implementation of investment. In other words, coffee farming does not have the capability to repay capital investment or working capital during its economic life (25 years) (Alam, 2007). The management of Arabica coffee farming in Poetete Village still achieved low profits as a result of less intensive in plant maintenance. Subsistent farming encourage the farmers to minimize the use of production inputs such as fertilizer and labor. Therefore, the productivity of coffee plants has not reached the optimal limit or the productivity is relatively low.

The result of sensitivity analysis showed that the investment on Arabica coffee farming would be analyzed for its sensitivity with the assumption of productivity increase at 10% and coffee price reduction 10%. Changes were emphasized on the variables that affected the farming revenue for knowing

Table 1. Financial feasibility study on Arabica coffee farming at Poetete Village, Ermera District

Discount factor (%)	Method of investment analysis			Result
	NPV (USD)	IRR (%)	Net B/C Ratio	
10	205,291,130	17.449	2.911	Feasible
15	104,789,120	6.622	1.120	Not feasible
20	72,706,295	2.374	1.004	Not feasible

Note: Lending interest rate in 2011 was 11.04%.

the production capacity and the selling price that could provide benefits to the farmers. The increase in production costs was considered constant because the management of Arabica coffee farming was still traditional so that the maintenance of the plantation was considered less intensive. Besides, the social cost of capital paid by the farmers on the coffee farm management was decreased to 1% (DF 1%). The use of 1% discount factor rate assumed that the farmers got a loan with a 1% interest rate to run the farming. Using IRR method on the assessment, it would be compared with the lending interest rate in Timor Leste in 2011 which was up to 11.04%. By knowing this, there were some efforts that could be done to increase the productivity and coffee selling price at the smallholder level. The sensitivity analysis results of the smallholder Arabica coffee farming can be seen in Table 2.

Based on Table 2, the increased productivity of 10% at the discount rate of 1% obtained a positive NPV value which indicated that the Arabica coffee farming was feasible to run because NPV value was higher than zero ($NPV > 0$). Meanwhile, the IRR value reached 25.95%, indicating that the value exceeded the lending interest rate. The Net B/C ratio also showed a value of more than one, that was 3.862. This indicated that any present value of the cash out flow of USD 1.00 would give a benefit of USD 3.862. On the other hand, the decreased selling price of 10%, gave the same result as an increased of productivity at 10%, including the values of NPV, IRR and the Net B/C ratio. In general, the Arabica coffee farming was considered

feasible to be implemented and able to produce financial benefits despite some changes in production volume and coffee selling price. It could happen whether the benefits forfeited by farmers in running Arabica coffee become lower. In other words, the low opportunity cost of the return on Arabica coffee farming investment will increase the profit earned by the farmers. Nevertheless, the minimum social opportunity cost of capital used for the analysis of coffee farming investment should consider in the amount of cost of capital. The results of the sensitivity analysis showed that Arabica coffee farming in Poetete Village, Ermera District, was less responsive to the changes of 10% production increase and 10% price reduction. The assumption of an increase in production and a decrease in the selling price of coffee has not gained a higher financial return to the farmers compared to normal condition. The lack of responsiveness of coffee farming can be seen from the NPV value that was lower than the NPV value under normal conditions at DF 10%. On the other hand, the IRR and Net B/C ratio values became higher using the assumption that a 10% DF value under normal conditions was reduced to a DF value of 1%.

As an effort to increase coffee productivity at smallholders level, this research also examined the level of correlation between the productivity and socio-economic characteristics of farmers. The strength of the correlation could be known from the value of correlation coefficient on each variable. The correlation coefficient of each variable is presented in Table 3. It can be seen that the correlation coefficient between the productivity and land

Table 2. Sensitivity analysis of Arabica coffee farming at Poetete Village, Ermera Sub-district

Assumption	Method of investment analysis			Result
	NPV (USD)	IRR (%)	Net B/C Ratio	
Constant productivity and prices, DF 10%	205,291,130	17.449	2.911	Feasible
Productivity increased at 10% and constant prices, DF 1%	37,367,151	25.95	3.862	Feasible
Constant productivity and prices decreased at 10%, DF 1%	37,367,151	25.95	3.862	Feasible

Note : Lending interest rate in 2011 was 11.04%.

ownership was 0.965 and positive-signed. The value indicated that the productivity had a very close correlation with the area of land ownership. The positive sign of the correlation coefficient indicated that the increasingly widespread coffee land ownership could increase the coffee productivity of the farmers (Mudakir, 2011; Suratiyah, 2015). As one of the production factors, the area of land ownership has an important contribution in farming related to the efficiency of land use for the production process. Increasing land ownership does not mean to make farming efficient. Conversely, relatively small land ownership also does not mean to make farming inefficient. This depends on the management of production factors and the application of the cultivation technology used in farming. Land management, technologies implementation, and allocation of production inputs will affect the level of land productivity, resulting in an increase in the production of coffee plants.

The value of the correlation coefficient between the productivity and farmer experience also showed a strong correlation with a value of 0.613. In this variable, the correlation coefficient was also marked positive, indicating that the longer the farmer experience in farming activities would have an impact on improving skills and knowledge of farmers. This will encourage farmers to make improvements on the plantation to increase coffee productivity. Mahananto *et al.* (2009) mentioned that experience is one of the proxy variables of information. In farming, the length of experience relates to the ability of farmers to absorb information on cultivation techniques, marketing, and other technologies. The higher capability of farmers in accumulating the information will affect the behavior of farmers in allocating the production factors to improve coffee plants productivity.

A strong relationship was also shown between the variables of productivity and

the farmer age. The correlation coefficient between the two variables was 0.663 and marked a positive value. This indicated that the older age of farmers would increase the farmer experience regarding coffee farming. Increasing the capacity of farmers will bring positive impact in terms of increased productivity because farmers will do more intensive coffee plant maintenance. However, it cannot remain that way because the older the age of farmers will also affect the ability and capacity of farmers in conducting production activities (Mahananto *et al.*, 2009)

The correlation coefficient between the productivity and farmer education level valued at 0.748, indicating that the correlation between the two variables was strong. The high capacity of farmers in carrying out coffee farming management would result in an increased productivity of their coffee farming. Farmers who have higher education are generally more open to receiving information and innovating new technologies. The level of education will also affect the behavior of farmers in adopting the technologies. Moreover, farmers with higher education will more easily adopt technology to increase production. Farmers can increase their self-capacity by having a formal or informal education (training, mentoring, etc.) (Kusnadi *et al.*, 2011). It is aimed to increase household income from coffee farming.

Meanwhile, the correlation coefficient between the productivity and the household size of farmers was 0.791, indicating that the correlation between the two variables was categorized into a strong correlation. The positive value indicated that the greater number of family members could increase the coffee productivity. In that cases, the family members should be a productive labor, resulting in working activities on coffee farming could be handled (Fitriani, 2013) and giving a contribution to the maintenance of coffee plantation. In this condition, the family members are the production

Table 3. Coefficient of correlation between productivity with socio-economic characteristics of farmers

Variable	Coefficient correlation		Probability	Correlation level
	Productivity			
Productivity	1			
Land ownership	0.965		0.0000	Very strong
Experience of farmer	0.613		0.0000	Strong
Age of farmer	0.663		0.0000	Strong
Farmers education level	0.748		0.0000	Strong
Household size	0.791		0.0000	Strong

factor or asset for the farmers whose capability can be utilized to manage coffee farming. Most farmers assume that the use of family labor can save labor costs because they do not need to hire workers from outside the family (Suratiah, 2015). In addition, farmers will feel more motivated to increase their coffee productivity because the number of family members which is covered is increasingly greater (Purwanti, 2007).

CONCLUSIONS

Arabica coffee farming in Poetete Village, Ermera District, is financially considered feasible to be cultivated with NPV value of USD 205,291,130; IRR value of 17.449%; and Net B/C ratio of 2.911 at 10% discount rate. Arabica coffee farming in Poetete Village, Ermera District, is also less responsive to the change of 10% productivity increase and 10% selling price reduction with the NPV value of USD 37,367,151; IRR value of 25.95%; and Net B/C ratio value of 3.862 at 1% discount rate. Meanwhile, the correlation between the coffee productivity and some variables namely land ownership (0.965), farmer experience (0.613), farmer age (0.663), farmer education level (0.748) and household size (0.791) were categorized into a strong to a very strong correlation.

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