Financial analysis of RGL citrus (*Citrus reticulata*) farming in Rejang Lebong Regency Bengkulu

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Abstract. RGL Citrus is a new commodity that was developed in Rejang Lebong Regency Bengkulu. This commodity increased fastly since 2014, primarily in Pal 7 village, Bermani Ulu subdistrict. Therefore need to analyze RGL citrus financial feasibility for agribusiness development. The purpose of this study is to analyze the financial feasibility of RGL citrus farming in Pal 7 village. The study was conducted from January to March 2020 by interviews with 10 RGL citrus farmers. Data collected were production cost, quantities of production, and price. Data Analyzed with Net B/C value, NPV, IRR, and Payback period in 6 years citrus cultivation. The results showed that RGL Citrus farming feasible with net B/C is 1.44, NPV 71,599,830, IRR 20.23% and PP in 5 years 6 months citrus old. An increase in production costs, a decrease in production, and a decrease in prices individually by 20% and changes together of the three criteria of 10% are still feasible in RGL citrus farming.

1. Introduction

Financial analysis is very important in assessing the feasibility of farming [1]. The financial analysis aims to determine the benefits obtained during the economic life of the business by calculating the flow of capital, costs incurred, time to return on investment, and benefits obtained from a business [2].

Citrus is one of the horticultural commodities that requires a relatively large cost in one production period [3]. Therefore, it is necessary to analyze the economic feasibility before investing in citrus farming. The feasibility analysis considers investment costs, fixed costs, variable costs, and plant productivity [4].

The development of citrus farming at the farmer level is encouraged by the government because the national citrus production is still not able to meet domestic needs so it is still imported [5]. The strategy for citrus development is carried out by the government by developing area-based commodities that meet the economies of scale of the business. The Ministry of Agriculture of the Republic of Indonesia has determined citrus development areas throughout Indonesia based on Decree of the Minister of Agriculture number 18 of 2018, one of them is Rejang Lebong regency.

RGL citrus is a type of tangerine that is widely developed in Rejang Lebong regency [6]. The price is relatively high and the demand for local and regional consumers continues to increase, making this citrus cultivation attractive to farmers [7]. In addition, RGL citrus are also able to bear fruit throughout the year and well adapted to the highlands of Bengkulu [8].
According to Ishak et al. (2020) [9] there are 5 subdistricts as citrus development areas in Rejang Lebong regency with a planting area of 286.5 hectares which has been developed since 2014, which shows the high interest of farmers in cultivating RGL citrus. The production center area is mainly in Bermani Ulu Raya subdistrict with an area of 240 hectares. RGL citrus plant development is mostly carried out in Rejang Lebong regency, especially in Pal 7 village, Bermani Ulu Raya subdistrict. The area of RGL citrus planted in Pal 7 village was 198 hectares.

The high interest of farmers to plant citrus in Pal 7 village without being supported by adequate financial capacity can have a negative impact on the citrus area. The Citrus plants that are not cultivated properly will be easily attack pests such as CVPD, fruit fall, and stem fungi [10]. In addition, plants that are not properly maintained will reduce productivity and fruit quality [11]. Therefore, the interest of farmers to cultivate citrus needs to take into account financial capacity so that the plants can produce optimally with good quality. The purpose of this study was to analyze the financial feasibility and sensitivity of RGL citrus farming.

2. Materials and Methods

The research was conducted from January to March 2020 in Rejang Lebong regency. Data collection through individual interviews involving 10 RGL citrus farmers. The data collected is the structure of costs incurred (investment costs, fixed costs, and variable costs), the amount of fresh citrus production, and the selling price. Data were analyzed using Net B/C ratio, Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP). The formula for analyzing investment feasibility criteria [12, 13, 14, 15].

\[
Net \, B/C = \frac{\sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t - B_t}{(1+i)^t}}
\]

where:
- \(B_t\) = Gross receipts in year-\(t\)
- \(n\) = Project economic life
- \(C_t\) = Gross cost in year-\(t\)
- \(i\) = The prevailing interest rate (12%)

Decision making criteria:
- Net B/C > 1 = feasible
- Net B/C = 1 = break event point
- Net B/C < 1 = not feasible

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

where:
- \(B_t\) = Acceptance of farm in the year-\(t\)
- \(C_t\) = farm costs in year-\(t\)
- \(n\) = Project economic life (6 years)
- \(i\) = The prevailing interest rate (12%)

Decision making criteria:
- NPV > 0 = feasible
- NPV = 0 = break event point
- NPV < 0 = not feasible

\[
IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} (i_2 - i_1)
\]

where:
- \(NPV_1\) = Positive NPV
- \(NPV_2\) = Negative NPV
\( i_1 \) = The interest rate when the NPV is positive

\( i_2 \) = The interest rate when the NPV is negative
decision making criteria :

\[ \text{IRR} > \text{Interest rate} (12\%) = \text{feasible} \]

\[ \text{IRR} < \text{Interest rate} (12\%) = \text{not feasible} \]

\[
PP = \frac{1}{\text{Ab}} \times 1 \text{ year} \tag{4}
\]

where:

\( I \) = Investation

\( \text{Ab} \) = net cash in flow that have discount

In addition to calculating the investment criteria, it is also necessary to conduct a sensitivity analysis. This analysis is used to determine the eligibility criteria in case of an increase in production costs, a decrease in prices and a decrease in production volume. Sensitivity analysis is performed to determine if there is an error or change in the basis for calculating costs or benefits, which will help minimize uncertainty [2].

3. Results and Discussion

3.1. Costs and income of RGL citrus farming

RGL citrus in Rejang Lebong regency are planted on upland dry land with a spacing of about 6 x 6 meters. RGL citrus cultivation requires a relatively large investment cost which includes land preparation, fencing, seed procurement, building huts and two-wheeled vehicles. In addition, it also requires the purchase of agricultural equipment such as hoes, crowbars, water drums, and wheelbarrows. Farming costs in the initial stage are IDR 143,770,000/hectare (Table 1).

| Year | Investment cost (IDR) | Fixed cost (IDR) | Variable cost (IDR) | Production (Kg/Ha) | Revenue (IDR) | Benefit (IDR) |
|------|-----------------------|------------------|--------------------|-------------------|--------------|--------------|
| 0    | 127,850,000           | 9,750,000        | 6,170,000          | -                 | -            | -143,770,000 |
| 1    | -                     | -                | 8,208,000          | -                 | -            | -8,208,000   |
| 2    | -                     | -                | 13,886,000         | -                 | -            | -13,886,000  |
| 3    | -                     | -                | 18,774,000         | 1,890             | 17,955,000   | -819,000     |
| 4    | -                     | -                | 21,229,000         | 8,100             | 76,950,000   | 55,721,000   |
| 5    | -                     | -                | 24,562,000         | 20,250            | 192,375,000  | 145,848,000  |
| 6    | -                     | -                | 27,178,500         | 27,000            | 256,500,000  | 229,321,500  |
| Total| 127,850,000           | 31,715,000       | 120,007,500        | 58,050            | 543,780,000  | 264,207,500  |

Table 1 shows that RGL citrus began to bear fruit at 3 years old. Compared to other types of tangerines in Indonesia, such as "Madura" citrus which started production at 3 years old [3], "Selayar" citrus at 4 years old [16], the “SoE” citrus at 5 years old [17], and the "Borneo Prima" citrus at 3 years old [18], the RGL citrus is one of the fast fruiting types of tangerines.

The costs incurred by farmers up to 6th years were IDR 279,572,500 which consists of investment cost, fixed cost and variable cost. Investment costs are incurred by farmers at the beginning of the year, fixed costs are incurred before planting and when the plants 5 years old. Meanwhile, the variable cost incurred will be greater according to the age of the plant (Figure 1).
RGL citrus cultivation is quite intensive from planting to harvest, so the costs incurred by farmers are relatively large. The three main activities in RGL citrus cultivation are pruning, fertilizing, and controlling plant disturbing organisms [11]. Costs incurred in plant maintenance were variable cost such as the purchase of fertilizers, pesticides, fuel, and payment of labor wages, in addition to fixed cost for equipment replacement and taxes (Table 2).

Table 2. The use of variable costs for farming RGL citrus (IDR/ha).

| Year | Fertilizers| Pesticides | Fuel oil | Labor costs |
|------|------------|------------|----------|-------------|
| 0    | 0          | 1,300,000  | 1,000,000| 3,870,000   |
| 1    | 858,000    | 1,580,000  | 1,000,000| 4,320,000   |
| 2    | 2,159,000  | 2,823,000  | 1,200,000| 7,254,000   |
| 3    | 4,185,000  | 3,765,000  | 1,500,000| 8,874,000   |
| 4    | 5,940,000  | 3,965,000  | 2,000,000| 8,874,000   |
| 5    | 8,407,000  | 3,931,000  | 2,000,000| 9,774,000   |
| 6    | 9,984,000  | 4,051,500  | 2,100,000| 10,593,000  |
|      | Total costs| 31,533,000 | 21,415,500| 10,800,000  | 53,559,000  |
|      | Total      | 117,307,500|          |             |

Labor costs contributed the greatest value to the variable cost structure of RGL citrus farming, which were 45.66% (Figure 2). It is because the farmers do the maintenance of RGL citrus plants quite intensively, so they also use quite a lot of labor. Tangerines require good maintenance for optimum growth [11], because optimal cultivation will provide greater financial feasibility for farmers [19].

Figure 2. Components of variable cost of RGL citrus farming.
RGL citrus had started producing at the age of 3 years old with an average production of 2,700 kg/ha and tend to increase to 27,000 kg/ha at the age of 6 years old (Figure 3). The average production of RGL citrus at the age of 6 years old is equivalent to 100 kg/stem.

![Figure 3. Average of RGL citrus production per stem and hectare.](image)

The average selling price of citrus is IDR 9,500 per kilogram so that in 1 hectare the farmer can get a total income of IDR 543,780,000 during the plant production period from the age of 3 to 6 years, with a total income of IDR 264,207,500/ha. Farmers began to enjoy income from RGL citrus cultivation in the fourth year amounting to Rp.55,721,000/ha. The income in the fourth year is also obtained by citrus farmers “batu 55” [20], one year earlier than the “Selayar” citrus farmers [16]. The income continues to increase in line with increased fruit production [18].

### 3.2. Financial feasibility and sensitivity

The financial feasibility of RGL citrus farming at the age of 6 years was assessed using the Net B/C Ratio, NPV, IRR and PP indicators. The loan interest rate used is the bank interest rate in effect at the time of the study which is 12% per year. The results of the analysis show that RGL citrus farming is financially feasible because it has a Net B/C value (1.44)>1, NPV (IDR 71,599,830) is positive, IRR (20.23%) is above the bank interest rate 12%, and payback period was 5 years 6 months old (Table 3).

| Feasibility criteria | Value         | Conclusion |
|----------------------|---------------|------------|
| Net B/C              | 1.44          | Feasible   |
| NPV (IDR)            | 71,599,830    | Feasible   |
| IRR (%)              | 20.23         | Feasible   |
| PP                   | 5 years 6 months |           |

Several research results showed that the NPV values of tangerine varieties in Indonesia reaches IDR 22,020 to IDR 118,342,271 such as SoE citrus the NPV value is IDR 22,020, Borneo Prima citrus NPV is IDR 7,514,440, and Madura citrus NPV is IDR 118,342,271 [17, 18, 3]. The payback period of tangerine citrus varieties between 5 and 9 years, namely SoE citrus at year 5 [17], Borneo Prima citrus at the age of 7 years 7 months [18] and Madura citrus at the age of 9 years [3]. This indicates that RGL citrus has a great opportunity to be developed in Indonesia because of the speed of return on farming capital with a payback period of 5 years 6 months.

### 3.3. Sensitivity analysis

Sensitivity analysis is used to measure the sensitivity of RGL citrus farming in the event of changes in production costs, production prices and production quantities. This condition can occur if there is an increase in the price of production facilities, for example, an increase in fertilizers and pesticides, an increase in labor wages and the use of inefficient production facilities and changes in technology.
Production decline can occur if maintenance is not carried out optimally, especially on old plants. For this reason, preventive efforts are needed, especially in terms of cultivation, to overcome the decline in production both in terms of quantity and quality. The sensitivity of RGL citrus farming showed in Table 4.

Table 4. Sensitivity analysis of RGL citrus farming.

| Criteria | Value | Conclusion |
|----------|-------|------------|
| Production costs increased by 20% | | |
| Net B/C | 1.32 | Feasible |
| NPV (IDR) | 54,515,245 | |
| IRR (%) | 18.32 | |
| Production decreased by 20% | | |
| Net B/C | 1.10 | Feasible |
| NPV (IDR) | 11,441,279 | |
| IRR (%) | 13.47 | |
| Price reduction by 20% | | |
| Net B/C | 1.04 | Feasible |
| NPV (IDR) | 6,519,810 | |
| IRR (%) | 12.77 | |
| Production costs increased, production decreased, and price reduction by 20% | | |
| Net B/C | -0.22 | Not Feasible |
| NPV (IDR) | -53,770,147 | |
| IRR (%) | 4.13 | |
| Production costs increased, production decreased, and price reduction by 10% | | |
| Net B/C | 1.04 | Feasible |
| NPV (IDR) | 5,096,914 | |
| IRR (%) | 12.76 | |

Based on the results of calculations above, it can be concluded that RGL citrus farming is more sensitive to a price reduction and production decreased than production costs increased at level 20%, but still feasible to cultivate. However if the criteria changes at level 20% together, then RGL citrus farming is not feasible. This is because the Net B/C and NPV values are negative. The Net B/C value is feasible if it is more than 1, while the NPV value is feasible if it is more than 0 [12,14,15]. If the sensitivity level of the three criteria changes by 10%, RGL citrus farming is still feasible.

4. Conclusions
RGL citrus farming at the age of 6 years is feasible with net B/C value of 1.44, NPV of IDR 71,599,830, and IRR of 20.23%. An increase in production costs, decrease in production, and decrease in prices individually by 20% and changes together of the three criteria of 10% are still feasible in RGL citrus farming.

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