The Feasibility Study of Palm Oil Replanting Using Chipping Technique

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Abstract This study aims to determine the feasibility of palm oil replanting using the chipping technique. The data were obtained through interview, observation and secondary data collection. The study is using NPV, Net B / C, IRR, Payback Period and sensitivity analysis for data analysis. The results indicate that the palm oil replanting using chipping technique is financially feasible to run. The results of the feasibility analysis show that the chipping technique generate financial benefits of Rp. 24,241,138 / ha per planting period with Net B/C ratio at 1.5. The payback period is 10 years and 7 months. This study also indicates that loan interest greater than 12.98% will not be feasible for palm oil plantation. The sensitivity analysis shows that the change in productivity has greater impact on profitability compared to the change in cost. Thus, palm oil plantation should focus on maintaining high level of crop productivity.

1. Introduction
The productivity of palm oil plant varies based on age and variety. The replanting program for palm oil plantation are mandatory to maintain plantation profitability as the crop productivity will decline rapidly when the age is being matured until a certain stage of palm oil growth. Furthermore, the palm oil replanting program will not produce any revenue until the crop reaches 3-4 years of age so that replanting program should be planning considering the company cash flow.

The replanting program should be implemented if the palm oil crop had across its economic productive ages. The productivity standard for implementing replanting program is if an average of crop production are below 14 tons per hectare per year. Another consideration for replanting program other than crop age is crop height and density. Crop height more than 12 meter and crop density less than 80 plant per hectare are considered not economically efficient so that the replanting program should be commence immediately. This study examines the replanting program using chipping technique. The benefit of chipping technique is the soil preparation are much intensive which provide better media for crop growth. Other benefit of chipping technique are the increase in the rate of plant weathering, maintaining the soil moisture, slower the risk of O.rhinoiceras pest infection spread and decrease the risk of plant disease, Ganoderma sp. This study aims to see the financial feasibility of chipping technique for replanting program. The sensitivity analysis on profitability will be analyzed with the scenario of changing in production and cost.

2. Methods
This study was conducted at Afdeling II PT X, Padang Lawas Regency, Sosa District in September – December 2019. The data used for the analysis comprises primary and secondary data. The primary data is obtained through interview with top company management. The secondary data are collected from various resources likewise Dinas Perkebunan Provinsi Sumatera Utara and Badan Pusat Statistik (BPS).
This study uses financial analysis includes Net Present Value (NPV), Internal Rate of Return (IRR), Net Benefit Cost Ratio (Net B/C), and sensitivity analysis (Gittinger, 1986) as follows:

2.1 Net Present Value (NPV)
NPV is the difference between benefit and cost valuing the time value of money. The NPV analysis are using discount rate from Bank of Indonesia, 11%, for calculating the present value over time. The NPV analysis is estimated with a 24 years' time frame. There are three criteria for NPV analysis as follows:
- NPV > 0, means that the business is feasible to run
- NPV = 0, means that the benefit are equal with social opportunity cost
- NPV < 0, means that the business is not feasible to run

The formula of NPV is:

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

(1)

Where:
- \(B_t\) = Benefit at time \(t\)
- \(C_t\) = Cost at time \(t\)
- \(i\) = discount rate (11%)
- \(t\) = time with \(n\) at 24 years

2.2 Internal rate of Return (IRR)
IRR is a discount rate which makes the NPV of all cash flows from a business project equal to zero. IRR estimation rely on the same formula as NPV does. There are three criteria for IRR analysis:
- IRR > discount rate, means that the business is feasible to run
- IRR = discount rate, means that the benefit are equal with social opportunity cost
- IRR < discount rate, means that the business is not feasible to run

The formula of IRR is:

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

(2)

2.3 Net Benefit Cost Ratio (Net B/C)
Net B/C is a ratio used in a cost-benefit analysis to summarize the overall relationship between the relative benefits and cost of business project. Net B/C can be exhibited in qualitative terms. If a business project has a Net B/C greater than 1.0, the business project is expected to generate a positive net present value. If a Net B/C equal to 1.0, the business project only generates net benefit which equal with social opportunity cost. Net B/C less than 1.0 means the business project is not feasible to run. The formula of Net B/C is:

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

(3)

2.4 Payback Period
The payback period is the time duration in which an investment reaches a breakeven point. Shorter payback period means that the investment has higher desirability. The formula of payback period relies on the initial investment and annual cash flow. The annual cashflow are the difference between benefit and cost for each period. The payback period is not including the time value of money on the estimation.
3. Result and Discussion

PT X, company which used as a study case, is located at Siborna Bunut Village, Sosa District, Padang Lawas Regency, North Sumatera Province. PT X is a modern palm oil plantation enterprise that impose ISO 9001:2008 and ISO 14001:2004 on management. PT X has plantation area of 1,495.68 Hectares that splits into 3 different areas comprises Afdeling I (399.65 Ha), Afdeling II (629.02 Ha) and Afdeling III (536.01 Ha). PT X were implementing replantation program when the age of the tree are above 27 years and the height of the tree are higher than 12 meters.

The revenue generated for PT X are from the selling of palm oil fresh fruit bunch. The projection of the 24 years fresh fruit bunch revenue is from the historical data of the company. The price assumption is Rp 1,100 per kg, which generated from average historical palm oil fresh fruit bunch price. The company is assumed to borrow Rp 20,200,000,000 from Bank Rakyat Indonesia (BRI) with interest rate of 11% per year and payback period of 8 years.

The projection of operational cost per hectare for 24 years at table 1 is generated from historical operational cost of Afdeling II at PT X. The plantation area of Afdeling II is 629.02 Ha, which is the biggest among plantation area that PT X owned. The biggest operational cost is fertilizer as shown at table 1, followed by harvest and transportation cost. The loan and interest cost are relatively high as it constituted 11.44% of total operational cost. The high loan and interest cost because of the high debt that company borrow from BRI, in which the debt settlement need to be finalized in 8 years. Another big spending is on tax cost that accounts for 18.60% of total operational cost. The total operational cost of PT X per year is Rp 680,141,272.

| No | Harvest and Item | Rupiah Cost | Percentage |
|----|-----------------|-------------|------------|
| 1  | Transportation  | Rp 151,189,500 | 22.20% |
| 2  | Replanting     | Rp 4,040,000 | 0.59% |
| 3  | Cultivation    | Rp 7,335,188 | 1.08% |
| 4  | Legumes maintenance | Rp 5,640,000 | 0.83% |
| 5  | Tree maintenance | Rp 911,330 | 0.13% |
| 6  | Sodding        | Rp 32,997,662 | 4.85% |
| 7  | Pest and disease maintenance | Rp 5,493,436 | 0.81% |
| 8  | fertilizer     | Rp 244,607,552 | 35.96% |
| 9  | Sprout maintenance | Rp 7,155,000 | 1.05% |
| 10 | Machine and building | Rp 16,457,335 | 2.42% |
| 11 | Loan dan interest | Rp 77,831,182 | 11.44% |
| 12 | Tax            | Rp 126,483,088 | 18.60% |

TOTAL Rp 680,141,271 100.00%

The income statement is a report that shows the amount of revenue earned and expenses, costs incurred in each period. The income statement can describe the performance of companies in each period. Components of income statement derived from the sale (income), cost of goods sold, operating expenses, interest and tax expense. The projection of income statement for Afdeling II PT X is shown in table 2. Table 2 shows that the plantation gain positive net income after 7 years of production. Total net income for 24 years, without including time value of money, is Rp 330,032,929.

| Period | Year | Net Income (Rp) | Period | Year | Net Income (Rp) |
|--------|------|-----------------|--------|------|-----------------|

Table 2. Income statement projection of Afdeling II PT X per hectare
TBM 1  2017  Rp, (24,422,599)  TM 12  2031  Rp 18,409,293  
TBM 2  2018  Rp, (7,870,126)  TM 13  2032  Rp 19,685,976  
TBM 3  2019  Rp, (7,944,358)  TM 14  2033  Rp 20,653,965  
TM 1  2020  Rp, (9,461,111)  TM 15  2034  Rp 21,591,878  
TM 2  2021  Rp, (3,193,626)  TM 16  2035  Rp 22,127,029  
TM 3  2022  Rp, (1,484,552)  TM 17  2036  Rp 26,074,023  
TM 4  2023  Rp, 1,330,754  TM 18  2037  Rp 26,383,273  
TM 5  2024  Rp, 1,608,840  TM 19  2038  Rp 26,788,074  
TM 6  2025  Rp 3,363,461  TM 20  2039  Rp 27,907,920  
TM 7  2026  Rp 4,488,608  TM 21  2040  Rp 25,893,822  
TM 8  2027  Rp 6,123,771  TM 22  2041  Rp 26,913,510  
TM 9  2028  Rp 17,174,533  TM 23  2042  Rp 32,114,486  
TM 10  2029  Rp, 18,426,400  TM 24  2043  Rp 20,144,952  
TM 11  2030  Rp, 17,204,729  TOTAL  Rp 330,032,929  

The results of the feasibility analysis shows that the replantation program using chipping technique generate NPV of Rp. 24,241,138 / ha per planting period, 24 years, with Net B/C ratio at 1.5. Net B/C ratio is 1.5 which implies for every Rp 1,000 in cost will generate a benefit of Rp 1,500. This study also indicates that loan interest greater than 12.98% will not be feasible for palm oil plantation to borrow. The payback period is 10 years and 7 months, which point out a loan from BRI with payback period of 8 years are not financially feasible to borrow. So that PT X should find a debt that offer longer payback period.

**Table 3. Financial Feasibility Analysis**

| Investment criteria | Value          | Decent / Not Decent |
|---------------------|----------------|---------------------|
| Net Present Value   | Rp, 24,241,138| Decent              |
| Net B / C           | 1.5            | Decent              |
| IRR                 | 12.98%         | Decent              |
| Payback Period      | 10.2           | Not Decent          |

The sensitivity analysis is conducted by simply changing the size of important variables and determine how the results of calculations are changing (Kadariah, 1988). The sensitivity analysis are conducted by applying a scenario of change in crop production up to ±10% and change in production cost up to ±30%.

**Table 4. The sensitivity analysis with the scenario of changing the crop production**

| Change in production | NPV       | Investment criteria |
|----------------------|-----------|---------------------|
|                      | Net B / C | IRR                 | PP |
| Down 10%             | Rp, (5,940,385) | 0,9 | 9,54% | 12,8 |
| Down 7.5%            | Rp, 1,618,343  | 1  | 10,43%| 12    |
| Down 5%              | Rp, 9,177,071  | 1,2| 11,30%| 11,3  |
| UP 5%                | Rp, 39,411,985 | 1,8| 14,60%| 9,3   |
| UP 7.5%              | Rp, 46,970,713 | 2  | 15,40%| 8,9   |
| UP 10%               | Rp, 54,529,442 | 2,1| 16,17%| 8,6   |

The sensitivity analysis results in table 4 and 5 shows that the impact of change in crop production is higher.
than the impact of change in production cost to the profitability. The decrease in crop production at 10% has generated a negative NPV and Net B/C lower than 1.0. The palm oil plantation is no longer financially feasible to run if the decrease in crop production has reached 10%. Based on net B/C criterion, palm oil plantation is not financially feasible to run if the crop production is decreasing by 7.5%.

Table 5. The sensitivity analysis with the scenario of changing the production cost

| Change in cost | NPV  | Net B / C | IRR    | PP  |
|----------------|------|-----------|--------|-----|
| Down 30%       | Rp, 39,674,418 | 1.8      | 14.69% | 9.2 |
| Down 20%       | Rp, 34,547,788 | 1.69     | 14.12% | 9.5 |
| Down 10%       | Rp, 29,421,158 | 1.57     | 13.55% | 9.8 |
| UP 10%         | Rp, 19,167,898 | 1.36     | 12.41% | 10.6|
| UP 20%         | Rp, 14,041,268 | 1.26     | 11.84% | 11  |
| UP 30%         | Rp, 8,914,638  | 1.16     | 10.32% | 11.5|

Palm oil plantation profitability is less sensitive to the change in production cost. The palm oil plantation is still feasible to run even though the production cost is increase by 30%. The decrease in production cost also has moderate effect on the profitability, which shown by the decrease in production cost by 30% will only increase the Net B/C ratio by 0.3 point. Results in table 4 and table 5 shows that PT X should maintain the crop production to have high productivity by increase the optimality of plant maintenance program. PT X should not rely its profitability strategy on production cost efficiency.

4. Conclusion

The financial feasibility results indicate that the palm oil replanting program using chipping technique is financially feasible to run. The results of the feasibility analysis shows that the chipping technique generate NPV of Rp. 24,241,138 / ha per planting period with Net B/C ratio at 1.5. The debt from the bank that has payback period less than 10 years and 7 months is not financially feasible to borrow. This study also indicates that loan interest greater than 12.98% will not be feasible for palm oil plantation to borrow. The sensitivity analysis shows that the change in crop productivity has greater impact on profitability compared to the change in cost. Palm oil plantation profitability is less sensitive to the change in production cost. Thus, palm oil plantation should focus on maintaining high level of crop productivity and not rely its profitability strategy on production cost efficiency.

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