

# Feasibility Study of PT. XYZ Palm Oil Plantation and Processing Plant

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**Abstract**—The purpose of this research is to examine the factors which should be considered in establishing palm oil plantation and processing plant; it analyzes project feasibility and provides project sensitivity and scenario analysis. The study employs descriptive analysis through a literature review, content analysis, observation and interviews. The object of the research is PT. XYZ, companies engaged in the plantation and palm oil industry in Sijunjung Regency, West Sumatra Province. The feasibility criteria for the projected palm oil plantation and construction of processing plant by PT. XYZ are based on the payback period/discounted payback period, net present value, profitability index and internal rate of return. Project for new palm oil plantation are feasible depending on three conditions : base, optimistic and pessimistic conditions, in which the Net Present Value (NPV) is positive. Processing plant construction project are feasible in base and optimistic conditions, but are rejected in pessimistic conditions. Based on the results of the sensitivity analysis, it can be seen that the factor which has the greatest effect on the net present value of new palm oil plantation is the selling value of FFB (Fresh Fruit Bunch). The factors that have the greatest effect on the net present value of palm oil processing plant construction are the selling points of CPO (Crude Palm Oil) and PKO (Palm Kernel Oil).

**Index Terms**—feasibility study, capital budgeting, sensitivity analysis, scenario analysis

## I. INTRODUCTION

Indonesia's trade balance in 2016 recorded a surplus of 8.78 billion US dollars, an increase on the 2015 figure of 7.67 billion US dollars. (<http://www.bi.go.id/>). According to the Indonesian Economic Report (2016) compiled by Bank Indonesia, this increase was driven by various factors, namely a rise in the non-oil and gas trade balance surplus, a decline in the oil and gas trade balance deficit and a decrease in the service account deficit of 25.4% compared to 2015. The non-oil and gas trade balance surplus was supported by the improvement in the performance of non-oil and gas exports, mainly from exports of manufactured and exported vegetable oil and coal products [1]. Exports of vegetable oil are mostly crude palm oil, otherwise known as CPO.

Palm oil exports fluctuate annually, due to various influencing factors such as weakening global market demand, declining global CPO prices, natural conditions, mandatory biofuel policies (B15 and B20), the meeting of domestic needs, and negative issues related to palm oil. However, palm oil exports have shown an increasing trend over the past ten years.

This increase has also been followed by an increase in the number of palm oil plantations in Indonesia.

The palm oil industry is one of the national strategic industries. Palm oil products control about 39% of the world's vegetable oil products, making it the world's largest vegetable oil commodity [2]. According to GAPKI (Indonesian Palm Oil Association), currently the world's largest palm oil producer is Indonesia, a position it has held since 2006.

High demand for CPO and its derivatives needs to be addressed by the opening of new palm oil plantations. Based on this fact, one of the plantation companies of PT. XYZ plans to open new palm oil plantation and palm oil processing plant, so a feasibility study of the project is required. A business feasibility study is an activity that analyses an activity or proposed business, in order to determine whether it should be run or not [3]. Zubir states that there are four aspects involved in the preparation of a business feasibility study, namely the common and organization aspect, market aspect, technical aspect and financial aspect [4].

Based on the data collection and observations made through interviews with PT. XYZ personnel, the formulation of the problem in this study includes the following questions: 1) What are the eligibility criteria for consideration by PT. XYZ to open palm oil plantation and processing plant in Sijunjung District?; 2) Is the investment in the opening of new plantation and palm oil processing plant feasible?; and 3) What is the Sensitivity Analysis and Scenario Analysis of the project?

In the study, scenario analysis is conducted based on three basic conditions (base, optimistic and pessimistic). These three conditions can provide an idea of what might happen to the project if the factors that affect it change.

## II. LITERATURE REVIEW

A business feasibility study is an activity that studies a proposed activity or business, in order to determine whether it should be run or not [3]. This study can be defined as the preparatory activities undertaken by the company before implementation of projects in the field, and is a step to assess the profitability of the resources owned by it. In the study, the company expects to run a project that has been assessed as being feasible and be able to operate in the projected condition.

The failure of a business can be due to various factors, such as incomplete data and information, incorrect calculations, less intentionally. Therefore, before a business feasibility study is conducted, attention must be paid to the completeness and accuracy of the data and information obtained, experts owned in business feasibility studies, the determination of appropriate methods and measuring tools, and loyalty feasibility study team business. This is done to predict and minimize risks.

Zubir (2006) states that various aspects are involved in preparing a business feasibility study, such as the common and organization aspect, market aspect, technical aspect and financial aspect [4]. According to Ross, et al., the process for evaluating long-term projects with capital budgeting is as follows [5]:

- Conduct a cost of capital analysis, which determines the required rate of return required by the parties involved in the funding structure of the project's investment.
- Prepare an estimated cash flow which consists of initial cash flow, operational cash flow and cash flow terminal.
- Evaluate the use of common analytical techniques to evaluate the feasibility of a business, namely Net Present Value (NPV), Discounted Payback Period, Internal Rate of Return (IRR), and Profitability Index (PI).

Net Present Value (NPV) is a measurement value created or added today by making an investment. The next measurement is the discounted payback period. This can be ascertained by calculating and discounting the cash flow received by the company from a business. Next, the length of time needed by the company to achieve break-even point (BEP) should be established by calculating the cut-off period. After the BEP occurs, cash flow is not calculated.

Another criterion used in assessing business feasibility is the Internal Rate of Return (IRR). This is the discount rate that causes the present value of the cash inflows to be equal to the present cash value of the outflow cash flow. Therefore, the discount rate of IRR will cause the value of NPV to equal zero [4].

Another ratio is the Profitability Index (PI), which shows the ratio between the present value of the cash flow projection received by the firm and the initial investment amount incurred to fund the project [5].

The sources of funds used by companies, either loans or their own capital, bear the burden called the cost of capital. Borrowing costs are called the cost of debt and the cost of capital itself is called the cost of equity [4]. According to Ross, et al., cost of capital analysis can be calculated using the weighted average cost of capital (WACC) approach [5].

Cost of equity is more difficult to determine, because the cost of capital is an opportunity cost of the company owner if the fund is invested in another business or project. One approach used to determine the cost of equity is using the capital asset pricing model (CAPM), in which the cost of equity is equal to the risk free rate plus the risk premium to cover investment risk.

The cost of debt is the level of costs that must be incurred by the company if funding through debt. It can be said to be

the interest rate on the debt incurred [5]. In practice, the cost of debt of a new business is equal to the interest rate on the loan charged by the creditor.

All the criteria used in assessing the feasibility of a business use the present value of incoming and outgoing cash flows. Since all cash flow calculations, especially cash inflows in the future, always contain uncertainty, sensitivity analysis is needed. This is intended to establish how sensitive the feasibility of business to change every assumption made, such as demand, selling price, raw material price, interest rate and inflation. The sensitivity analysis is also known as the what-if analysis, and can be combined with three possible conditions: base, optimistic (good) and pessimistic (bad).

### III. RESEARCH METHODOLOGY

#### A. Research Design

The research is descriptive; that is, it describes a phenomenon that exists in a certain period. In this case, the researcher wishes to conduct a feasibility study on the opening of plantation and palm oil processing plant by PT. XYZ.

#### B. Object of Research

The object of the research is PT. XYZ, one of the companies engaged in the palm oil plantation industry in Indonesia.

#### C. Research Framework

The framework of the research is shown in the following chart:

#### D. Data Sources and Period

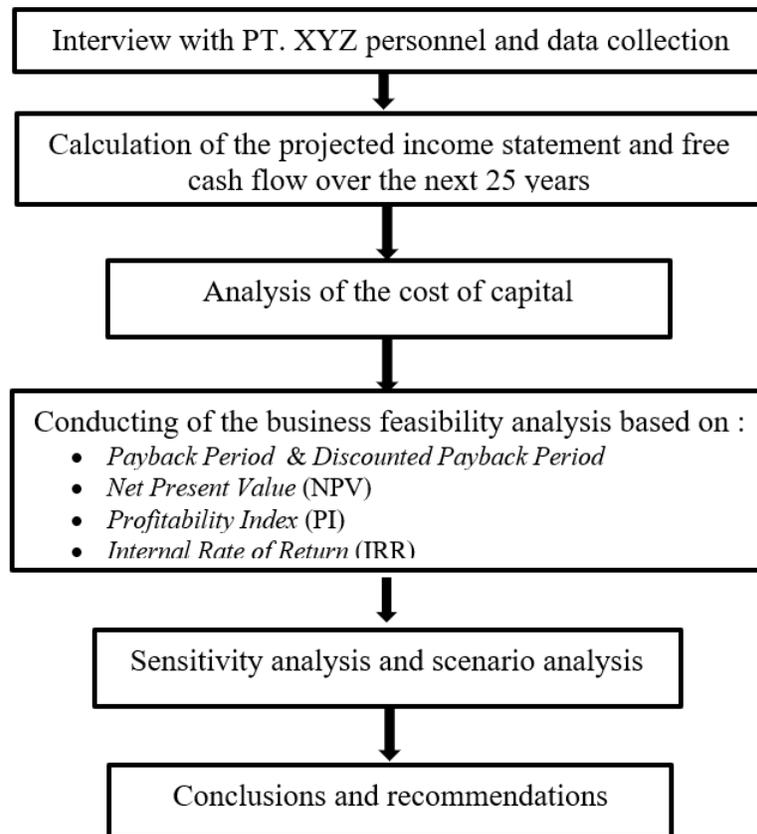
The data needed to conduct the research are primary and secondary data. The primary data are the data obtained directly from informants determined at the time of observation activities at PT. XYZ, represented by the Assistant Director and the Secretary of the Director of PT. XYZ. The secondary data were obtained from company reports and a literature review related to the research. In the study, the researchers will conduct an analysis on the company's financial statements, supported by theory from reference books and scientific journals.

PT. XYZ is one of the domestic investment companies engaged in the operation of palm oil plantation and the processing plant. To be able to survive in the palm oil industry, the holding company, through PT. XYZ, plans to expand its plantation area by opening palm oil plantation and processing plant in new location. The locations of the new palm oil plantation to be opened are in the villages of Maloro, Kamang, Kunangan, Parik Rantang, Sungai Lansek and Muara Takung, in the Kamang Baru sub-district, Sijunjung District, West Sumatra.

### IV. RESULTS

#### A. Estimation of Initial Outlay

The initial investment in the opening of this palm oil plantation includes the cost of land acquisition or compensation for community land as well as plant investment costs consisting of land clearing (LC) costs; plant costs not generating 0



years/TBM 0; plant costs not generating 1 year/TBM 1; plant costs which have not yielded 2 years/TBM 2; and plant costs which have not yielded 3 years/TBM 3. The core land that can be managed by the company is 65% of total area (about 3,000 hectares). Total initial outlay in the opening of this palm oil plantation is Rp 142,691,022,000; PT. XYZ assumes the initial investment in the plant to be built which will have a capacity of 30 metric tons/hour, will be Rp. 90,000,000,000. The amount of investment to purchase some vehicles is Rp. 600,000,000.

#### B. Estimation of Cash Flow

- Sales or revenue  
TBS production takes into account the correction factors of crop topography, rainfall, fertilization, presence of plant pests and diseases, and upkeep. The production of palm oil/CPO and core oil/PKO depends on the condition of FFB as the raw material for CPO and PKO. The average amount of palm oil/CPO that can be produced is 25% of FFB, while core oil/PKO is an average of 4% of FFB. The assumptions used for the sale value of FFB in this project are based on the average FFB price per kilogram in Riau Province over a 3-month period (August-October 2017).
- Production costs and other assumptions

The FFB production costs of PT. XYZ are assumed to be Rp. 700 per kg produced. As for the cost of producing CPO/PKO, PT. XYZ assumes this to be Rp. 100 per kg of raw material for processed FFB. The amount of income tax, in accordance with Law No. 36 of 2008 concerning the Fourth Amendment to Law Number 7 of 1983 concerning Income Tax, is 25%. The increase in selling prices and production costs per year is calculated at the rate of inflation that has normally occurred during the last 10 years, which is 3% per year ([http // www.bps.go.id](http://www.bps.go.id)) [6].

- Scenario analysis  
The scenario analysis was based on three condition assumptions, namely base conditions, optimistic conditions and pessimistic conditions. These assumptions are the basic assumptions of base conditions in preparing profit and loss and cash flow projections. The optimistic and pessimistic scenarios of the project for opening palm oil plantation assume a change in the selling price of FFB and changes in production costs. Moreover, the optimistic and pessimistic scenarios of the palm oil processing plant construction project assume a change in the selling price of CPO and PKO and changes in production costs. The intended price change is 10%, with the aim of observing the situation of the project in the event of an economic

crisis, such as that of 2008, when the inflation rate reached 10%.

Cash flows in the base, optimistic and pessimistic conditions of the project for opening palm oil plantation show a positive value from the first year of harvest (third year of the project) until the end of the project period, which is 2043. This gives a positive signal that the company has a good financial condition. Cash flows increase in size from the first year. They are then relatively stable at TM10 to TM20, before showing a decrease until the end of the project.

Cash flows in the palm oil processing plant construction project in base, optimistic and pessimistic conditions also show positive values from the first year of the project, and increase in size after the first year. They tend to decline from the seventh year of the project, at which time the price of TBS is reaching its peak. In the 23rd year or at the end of the project, cash flow becomes high due to the terminal value of the factory. Estimation of terminal cash flow

Terminal cash flow is received when the project ends. In situations where the estimated residual value is significant, the net residual value (after deducting the elimination and tax costs) is inflows and is discounted in line with other cash inflows [7]. For the project to open palm oil plantation, at the end of the project these cannot be resold, so the project will not have terminal cash flow. The assets of the construction of palm oil processing plant, factory assets in the form of buildings and machinery, are projected to be worth 25% of the initial investment value. After deducting the tax value of 25%, it is estimated that the terminal value of the machinery and factory buildings will be Rp. 16,875,000,000.

- Cost of capital estimation

For the opening of the new palm oil plantation and processing plant, PT. XYZ will only use one source of financing, namely equity capital. The cost of equity of the project is the amount of return the company expects, which PT. XYZ has set at a minimum of 10%. However, it is more appropriate if the cost of capital is calculated based on the Weighted Average Cost of Capital/WACC approach. Because all funding sources come from their own capital, the WACC value will be equal to the cost of equity ( $K_e$ ), which is calculated based on the Capital Asset Pricing Model/CAPM method. The value of the risk free rate ( $r_f$ ) used for the calculation is the interest rate of Bank Indonesia Certificates (SBI) with a 12-month tenor of 6%. The beta value is assumed to be the same as that of a similar company in the same industry. Based on the Beta Pefindo data (October 13, 2017 Edition) of four companies in the palm oil industry, the average beta value was 1.106 [9]. The Market Risk Premium is the value of the Total Equity Risk Premium from the Damodaran Online website [8], which is 8.82% (updated January 2017). Using the equation  $K_e = r_f + \beta(r_m - r_m)$ , the cost of equity can be calculated at 15.76%.

## V. DISCUSSION

### A. Feasibility Evaluation

Various studies on business feasibility evaluation have been conducted. Valerie G. Caryer Cook and Ahad Ali in 2009 used net present value methods to evaluate quality improvement projects; their conclusion was that the NPV method provides a more accurate calculation of the expected results of the project [10].

The assumptions used in this feasibility evaluation are given in Table I.

TABLE I: Project assumptions

| NO | Activity                    | Assumption    | Unit       |
|----|-----------------------------|---------------|------------|
| 1  | Area of land                | 3,000         | Ha         |
| 2  | Land compensation costs     | 500,000       | Rp/Ha      |
| 3  | Licensing and legality fees | 1,250,000,000 | Rp/project |
| 4  | LC                          | 15,056,363    | Rp/Ha      |
| 5  | TBM 0                       | 10,913,673    | Rp/Ha      |
| 6  | TBM 1                       | 6,313,005     | Rp/Ha      |
| 7  | TBM 2                       | 7,138,748     | Rp/Ha      |
| 8  | TBM 3                       | 7,641,885     | Rp/Ha      |
| 9  | Production Cost of FFB      | 700           | Rp/Kg FFB  |
| 10 | Production Cost of CPO      | 100           | Rp/Kg FFB  |
| 11 | Harga TBS                   | 1,430-1,997   | Rp/Kg      |
| 12 | Initial outlay of plant     | 3,000,000,000 | Rp/ton     |
| 13 | Selling price of CPO        | 8,500         | Rp/kg      |
| 14 | Selling price of PKO        | 5,100         | Rp/kg      |
| 15 | Project                     | 25 years      |            |

Based on the eligibility criteria for the Payback Period/Discounted Payback Period, Net Present Value, Profitability Index and Internal Rate of Return in the three base, optimistic and pessimistic scenarios, the conclusion for the palm oil plantation project is as follows:

For the palm oil processing plant construction project, the conclusion is shown in Table III:

- Sensitivity Analysis

In the sensitivity analysis, it is assumed that only one factor changes, while the other factors remain the same. In palm oil plantation, the factors that influence the value of the project are the selling price of FFB, and the cost of producing it. As for the palm oil processing plant construction project, the factors that influence the value of the project are the selling price of CPO and PKO, and the cost of producing them.

Sensitivity Analysis Based on Changes in the Selling Price of FFB

Any decrease in the selling price of FFB by 5% will result in a decrease in NPV of 13.61%. From Figure 2, it can be seen that the decline in the FFB selling price by 36.57% will cause the project's NPV value to be zero.

Sensitivity Analysis Based on Changes in FFB Production Costs

An increase in FFB production costs of 5% will result in a decrease in the NPV value of 5.20%. From the Graph, it can be seen that the project's NPV value will be zero if there is an increase in FFB production costs of 95.44%. It can be concluded that the factor that has the greatest effect on the

**TABLE II: Feasibility evaluation for the opening of palm oil plantation**

| Criterion                 | Base              | Optimistic        | Pessimistic       |
|---------------------------|-------------------|-------------------|-------------------|
| Payback Period            | 6 years 9 months  | 6 years 3 months  | 7 years 5 months  |
| Discounted Payback Period | 8 years 10 months | 7 years 10 months | 10 years 5 months |
| Net Present Value         | 193,465,417,529   | 266,230,610,459   | 120,572,449,543   |
| Profitability Index       | 2.36              | 2.87              | 1.84              |
| Internal Rate of Return   | 29.08%            | 33.13%            | 24.62%            |
| <b>Conclusion</b>         | <b>Accepted</b>   | <b>Accepted</b>   | <b>Accepted</b>   |

**TABLE III: Feasibility evaluation for palm oil processing plant**

| Criterion                 | Base              | Optimistic       | Pessimistic      |
|---------------------------|-------------------|------------------|------------------|
| Payback Period            | 5 years 8 months  | 4 years 4 months | 22 years         |
| Discounted Payback Period | 14 years 3 months | 6 years 6 months | -                |
| Net Present Value         | 13,112,615,983    | 82,216,382,828   | (57,599,540,015) |
| Profitability Index       | 1.14              | 1.91             | 0.36             |
| Internal Rate of Return   | 17.89%            | 27.09%           | 2.34%            |
| <b>Conclusion</b>         | <b>Accepted</b>   | <b>Accepted</b>  | <b>Rejected</b>  |

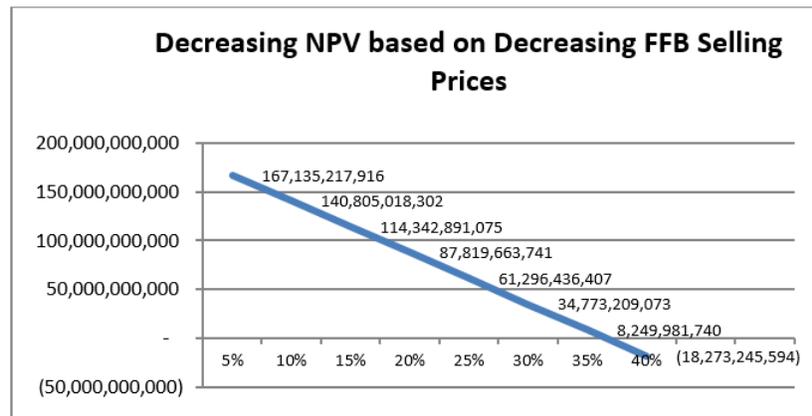


Fig. 2: Decreasing NPV based on decreasing selling price of FFB.

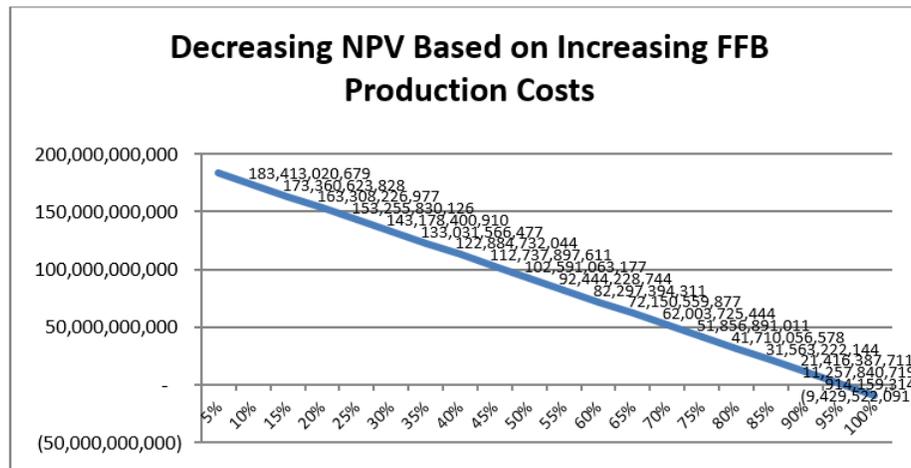


Fig. 3: Decreasing NPV based on increasing FFB production costs.

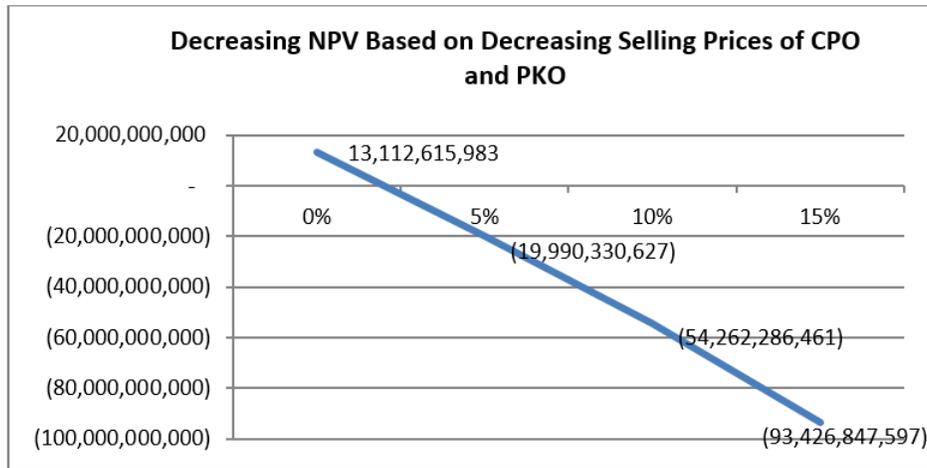


Fig. 4: Decreasing NPV based on decreasing selling prices of CPO and PKO.

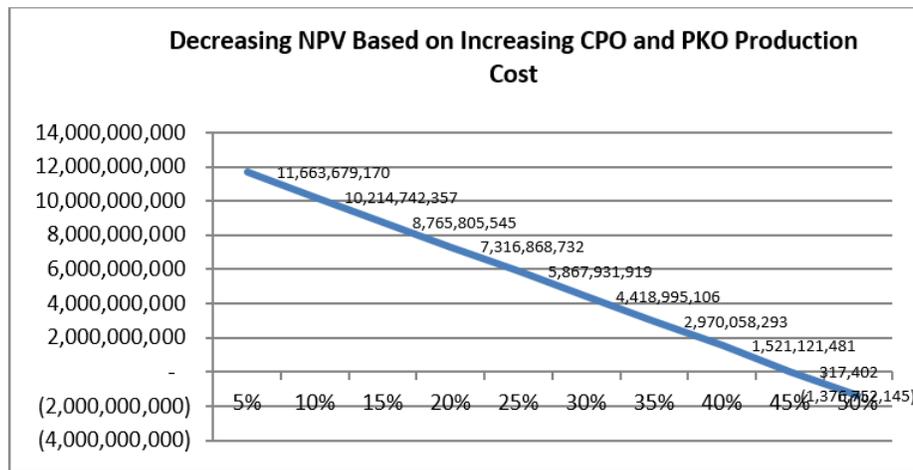


Fig. 5: Decreasing NPV based on increasing CPO and PKO production costs.

NPV value of palm oil plantation projects is the selling price of FFB.

Sensitivity Analysis Based on Changes in Selling Prices of CPO and PKO

Any decrease in the selling price of CPO/PKO of 5% will result in a decrease in NPV of 252.45%. From Graph 4, it can be seen that a decrease in the selling price of FFB of 1.95% will cause the project's NPV to be zero.

Sensitivity Analysis Based on Changes in CPO/PKO Production Costs

Any increase in CPO/PKO production costs of 5% will result in a decrease in the NPV value of 11.05%. From Graph 5, it can be seen that the project's NPV value will be zero if there is an increase in CPO/PKO production costs of 45.25%. It can be concluded that the factor that has the greatest effect on the NPV value of the palm oil processing plant construction project is the selling price of CPO and PKO.

B. Common, Organization and Market Aspects

The palm oil industry cannot be separated from environmental issues. Indonesia itself established the Indonesian Sustainable Palm Oil (ISPO) plan in 2011, with the aim of increasing the global competitiveness of Indonesian palm oil, and regulating it by tighter environment friendly rules.

The management of palm oil plantations and processing mills is an activity consisting of various disciplines that require experts from various fields. PT. XYZ has determined that the operational leadership of the project will be held by an Operational Director, who will oversee the General Manager. The General Manager will form a team consisting of managers and assistants as needed.

In 2016 world vegetable oil production was around 180 million tons, of which 90 percent comprised the four main vegetable oils. 42 million tons of oil came from sunflower and rapeseed oil, and 54 million tons from soybean oil. The remainder consisted of palm oil. In the future, it is estimated that the world's need for palm oil from Indonesia will be

around 115 million tons (<http://www.sawit.or.id>) [11]. In 2017 it was estimated that Indonesia's palm oil production was around 40 million tons. Thus the world palm oil market opportunity is still wide open.

## VI. CONCLUSION

- 1) The criteria for the feasibility of the project of opening palm oil plantation and the construction of palm oil processing plant by PT. XYZ are based on the payback period/discounted payback period, net present value, profitability index and internal rate of return.
- 2) The conclusion from the results of the study is that the project for opening palm oil plantation is feasible in the three scenarios, namely the base scenario, optimistic scenario, and pessimistic scenario. As for the construction project of palm oil processing plant, it is feasible to do this the base scenario and optimistic scenario, but it is not feasible in the pessimistic scenario.
- 3) Based on the results of the sensitivity analysis it can be seen that the factor which has the greatest effect on the net present value of the project of opening palm oil plantation is the selling value of FFB. The factor that has the greatest effect on the net present value of the palm oil processing plant construction projects are the selling values of CPO and PKO.

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