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Economic Analysis on Processing Organic Pineapple Peel Waste as Eco-Enzyme Liquid Fertilizer

Bilqis Aprilia Salima[1*]
[1]Program Studi Kimia, Pendidikan Matematika dan Ilmu Pengetahuan Alam, Universitas Pendidikan Indonesia, Bandung, Indonesia 40154

Correspondence		
Email: bilqis.aprilia@upi.edu		No. Telp:
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Abstract.
The objective of this research is to analyze, evaluate, and compare the feasibility analysis results of liquid fertilizer production from pineapple peel waste based on an economic perspective. Mass balance and several economic parameters such as Gross Profit Margin (GPM), Cumulative Net Present Value (CNPV), Internal Rate of Return (IRR), Payback Period (PBP), Break-Even Point (BEP), and Profitability Index (PI) are calculated to assess the project's feasibility from an economic standpoint. The results indicate that the project has the potential for profitability in large-scale production, as it requires a short time to recover the investment costs, approximately 3 years based on the PBP analysis. Furthermore, in terms of external tax factors, despite a tax rate of 100%, the project still generates profits. However, the profits generated are not as much as a 10% tax rate. Nevertheless, the project remains profitable.
Keywords: Economic evaluation, liquid fertilizer, pineapple peel waste.

1. Introduction

Pineapple is one of the flagship fruit commodities with a production volume of 1.73 million tons in 2015. Internationally, Indonesia plays a crucial role as a pineapple producer, contributing approximately 23% to the world's total production. Pineapple production comes from orchards in five provinces, with significant contributions from Lampung (32.77%), North Sumatra (12.78%), West Java (10.39%), East Java (8.92%), and Jambi (8.23%) (Center for Agricultural Data and Information Systems, 2016) (Nuraeni, 2019).

Mature pineapples are typically consumed fresh or processed into jam, jelly, and fruit juice. Mature pineapples have a limited shelf life, approximately 4-5 days after harvesting before they start to decay. The edible part of the pineapple contains 85% water, 0.4% protein, 14% sugar, 0.1% fat, 0.5% fiber, and is rich in vitamins A and B (Ashari, 2006). The waste from pineapple peels generated from one pineapple ranges from 21.73% to 24.48%. With an average pineapple weight of 600-800 grams per fruit, 200 kg of pineapples can produce 40-50 kg of pineapple peel waste.

The substantial potential lies in the abundant quantity of fruit waste, which can be used as a raw material source for liquid organic fertilizer production. This waste is often overlooked by communities

as it is considered unsuitable for animal feed and is frequently left untreated. As a result, unpleasant odors emerge, negatively impacting environmental cleanliness and posing health risks. As a mitigation effort for the impact of fruit waste, fruit peel waste can be considered a potential alternative raw material source for creating liquid organic fertilizer. Moreover, this technology has numerous advantages, where the fruit waste slurry produced can be used as liquid organic fertilizer, while the residue can serve as a growth medium (compost). The organic fertilizer produced involves essential elements crucial for plant growth. Specific compounds like proteins, cellulose, lignin, and others cannot be substituted by chemical fertilizers (Bayuseno, 2009).

Liquid organic fertilizer contains a maximum of 5% chemical content, providing nutrients according to the plant's needs in a liquid form. In situations of excess fertilizer in the soil, plants can automatically regulate the absorption of the required fertilizer composition. Fertilizing with liquid organic fertilizer has a more even distribution, avoiding the accumulation of fertilizer concentration in one location as this fertilizer is 100% soluble. Another advantage is its ability to quickly address nutrient deficiencies without causing nutrient leaching issues (Musnamar, 2006). In addition to benefits for plants, liquid organic fertilizer also has positive impacts on the environment, reducing waste and improving environmental health. This is because liquid organic fertilizer is a solution resulting from the decomposition of organic materials from plant residues, animal manure, and human activity waste, with a nutrient content of more than one (Hadisuwito, 2008).

Soil cultivated continuously experiences a decline in fertility due to a decrease in nutrient content. Therefore, fertilization becomes a necessity to enhance soil nutrient levels. Organic fertilizers, although having a slower effect, are environmentally friendly. This type can improve soil properties and serve as a buffer to provide nutrient elements for plants, thus restoring soil fertility. Organic fertilizers can be classified into solid and liquid organic fertilizers, with the latter being one of the widely available types in the market. Liquid organic fertilizer is often applied through leaves or known as foliar liquid fertilizer, containing essential macro and micronutrients (Yuliarti, 2009).

Based on the previous explanation, large-scale peanut oil production requires data on all parameters, such as Gross Profit Margin (GPM), Cumulative Net Present Value (CNPV), Internal Rate Return (IRR), Payback Period (PBP), Break Event Point (BEP), and Profitability Index (PI) to identify the best and optimal economic conditions. These parameters are calculated so that economic evaluation analysis can be carried out.

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2. Methods

2.1. Production of Liquid Fertilizer from Pineapple Peel

The production of liquid organic fertilizer begins by adding 4 kg of finely ground pineapple peel waste to a plastic bucket. Next, mix in 250 g of finely ground brown sugar, add 1000 ml of EM4, and pour 20 liters of water into the bucket. Stir the mixture thoroughly until it is well blended, then seal the bucket tightly with plastic and let it sit for 4 weeks until the ingredients undergo proper fermentation. After 1 week, the solution will be marked by the presence of water droplets on the fermentation container's lid, a distinct odor, and a layer of white fungus on the surface of the solution and the container walls. The liquid organic fertilizer is then filtered until clear and stored in sealed bottles.

2.2. Economic Evaluation

In this economic evaluation, price data analyzed were obtained from several online stores on Shopee and Tokopedia. Data processing in this economic evaluation analysis was mathematically processed using Microsoft Excel. To realize this idea, calculations were performed using several equations, such as:

- Gross profit margin is a primary evaluation that can assess productivity levels up to a certain limit. This examination aims to reduce transaction costs related to raw material costs (Nandiyanto, 2018).
- Internal Rate of Return (IRR) can be considered as a representation indicating the normal annual return drawn for all costs and salaries in equal amounts. If the Internal Rate of Return is higher than the prevailing original interest rate (the bank loan interest rate at that time), the production line is considered profitable. Conversely, if the Internal Rate of Return is lower than the original interest rate, the plant is considered to be experiencing a deficit (Nandiyanto, 2018). The calculation of Internal Rate of Return (IRR) is performed using equation (2) as follows:

  IRR = $\sum_{t-1}^{t} \frac{Ct}{(1+r)^t} - Co$

  Where :

  Ct = net cash inflows during period t

  Co = total investment cost

  R = discount rate

  t = time (year)
- Break Even Point (BEP) is the point at which income equals the invested capital, resulting in neither profit nor loss. BEP can be calculated by dividing the value of fixed costs by the difference between the total selling price and total variable costs. BEP calculations can take the form of projections or estimates of the minimum number of units that must be sold during a specific period (Astuty et al., 2020).

- Payback Period (PBP) is a calculation that can be used to project the time required to recover the initial capital (investment capital). In short, the Payback Period is calculated when the Cumulative Net Present Value (CNPV) reaches zero (Nandiyanto, 2018).
- Cumulative Net Present Value (CNPV) is the total Net Present Value (NPV) from the start of factory construction to the end of factory operations. CNPV is calculated as the cumulative sum of cash flows each year. Additionally, CNPV is also used to calculate land and end depreciation, as well as the final depreciation value (Brenan & Golonka, 2002). CNPV is calculated using the equation below:

  $\text{CNPV} = \sum NPV = \sum \frac{(Bt-Ct)}{(1+i)^t}$

  Where:

  Bt = Profit

  Ct = cost

  i = one-period social discount rate in period t

  t = time (year)
- Total Investment Cost (TIC) is the initial capital or cost that needs to be prepared in the early stages of production. TIC is generally calculated based on the total factory cost (Total Purchasing Cost (TPC)). Simply put, TIC includes the factory construction cost and initial expenses, including equipment costs and services related to the equipment in the factory (Frioui & Oumeddour, 2008).
- Net Present Value (NPV) is the value obtained from a project representing expenditures and revenues. NPV calculations must take into account social opportunity costs as the discount rate. Additionally, NPV can be used to project expected cash flows in the future (Brenan & Golonka, 2002).

In determining economic analysis, there are several assumptions that may occur during the project, including:

a. Economic evaluation analysis is conducted using IDR currency.
b. The exchange rate is calculated as 1 USD equivalent to Rp 15,489.
c. Equipment prices are determined based on commercially available prices online, with a total equipment purchase cost of IDR 160,950.
d. Electricity costs are assumed to be IDR 1,444.70 per KWh
e. The production of 60 liters of liquid fertilizer from pineapple peel takes 1 week.
f. The project operates for 4 days per month or 48 days in one year.
g. The annual price decline rate is 15%.

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h. Income tax is 10% per year

i. The project is implemented for 10 years

3. Results and Discussion

Economic perspective analysis in the production of liquid fertilizer from pineapple peel waste is conducted using several assumptions, namely a) the conversion rate from USD to Rupiah is 1 USD = Rp 15,491; b) all raw material and equipment prices are obtained from online stores Shopee and Tokopedia. The price of raw material, sugarcane, is 0.57 USD/500 g; c) the electricity utility cost is 2.23 USD/kWh; d) the number of workers in this project is 1 person with a total wage of 5.47 USD/day; and e) the project operates for 20 years.

Table 1. TMC Calculation for liquid fertilizer from pineapple peel waste Production per Year

Component	Factor	Cost for liquid fertilizer
Raw material	-	267.48
Utilities	-	2.23
Loan Interest	7% of loan	-
Operating Labor	-	262.86
Labor related Cost	-	162.97
Capital related cost	-	1.13
Sales related cost	-	454.58

Table 2. Detail of The Price of Raw Material Used per Year for Liquid Fertilizer from Pineapple Peel Waste

Raw Material	Unit	Cost (USD)
Pineaple peel	720 kg	0
Cane sugar	36 kg	55.047
EMP4	144 L	212.445

Tabel 3. Detail of The Price of Utilities per Year for Liquid Fertilizer from Pineapple Peel Waste Production

Items	kWh	Cost per Year (USD)
Electricity	0.093	2.23
Packaging	2534,4	1,856.28

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a. Engineering Perspective

Several assumptions are employed in this study based on the representation of liquid fertilizer production from pineapple peel waste. In this study, the production output after project scale-up results in approximately 60 liters of fertilizer per week. From a technical standpoint, the total annual raw material cost is 267.51 USD, while the sales revenue from the fertilizer obtained in one year is 6,494.16 USD. The profit gained during one year amounts to 10,398.78 USD. The cost incurred to purchase the equipment is 10.37 USD. The project has been running for 20 years, and the Payback Period (PBP) is achieved in the 3rd year as the project has been progressing well.

b. Ideal Condition

Figure 1 depicts the graph illustrating the relationship between CNPV/TIC and time. The X-axis represents the years, while the Y-axis represents CNPV/TIC. The graph illustrates a decline in income in the first and second years, attributed to the initial capital expenditure for the purchase of equipment needed in the liquid fertilizer production process and the cost of land acquisition. In the fourth year, there is an increase in income known as the payback period. This income boost occurs because the factory has been able to produce and sell liquid fertilizer, covering the initial capital used to purchase equipment and the cost of land acquisition. The profit continues to increase until the 20th year. Thus, liquid fertilizer production is a highly profitable project as it only takes 3 years for the return on investment.

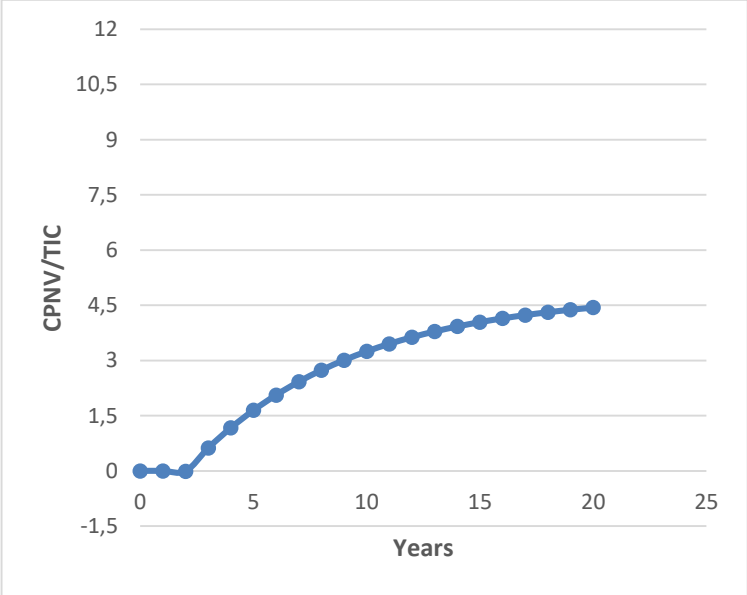

Figure 1. CNPV/TIC versus Lifetime (Year) Curve of Ideal Condition for Liquid Fertilizer from Pineapple Peel Waste Production

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c. Influence of External Conditions

Several factors from external conditions can influence success to a certain extent. This single figure represents the cost imposed by the government to support various open utilization. Taxation is one external factor that affects the success of a project. Taxes are an external factor originating from the economic conditions of the country imposed on a company (Prabowo, 2019). The impact of taxes on a company can be identified through speculative tax value analysis ranging from 10% to 100%. Figure 2 shows the CNPV/TIC graph with various tax variations. In the first 3 years, the CNPV/TIC values for various tax variations are the same because the project development has not yet become a burden for the company. Taxes come into effect in the 4th year and onwards, where the higher the tax imposed on the project, the lower the final CNPV value. From Figure 2, even with a tax value of 100%, the project still generates a profit. However, the profit generated is not as much as a 10% tax.

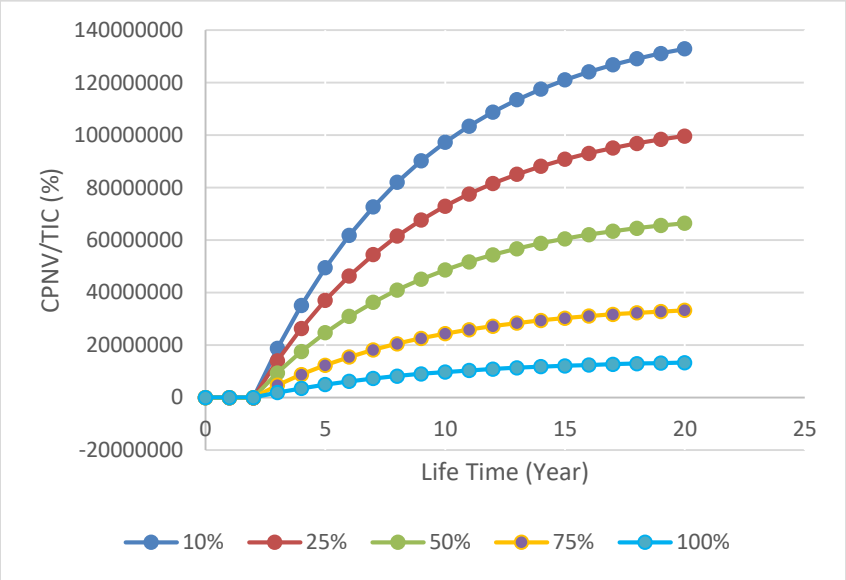

Figure 2. Tax Variation Analysis Curve to the CNVP Value Liquid Fertilizer from Pineapple Peel Waste

4. Conclusion

Based on the analysis above, the production project of liquid fertilizer from pineapple peel waste is considered prospective and economical because this method is very simple and cost-effective. This analysis is derived from economic evaluations with several parameters indicating that the production of liquid fertilizer from pineapple peel waste is highly promising. The investigation of the Payback Period shows that the endeavor becomes productive after a period of more than three years. The analysis of

CNPV/TIC and PBP values is influenced by various factors such as price variations, sales tax, and selling prices. The results of our research on the economic evaluation of liquid fertilizer production from pineapple peel waste are expected to provide insights for future industrial-scale production, and it can be concluded that this project is feasible for implementation.

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