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Study of Investment in the Organic Fertilizer Industry to Improve Community Economists

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Abstract

Based on the results of observations of organic waste in the village of Jogotirto Berbah, Sleman, it is known that the amount of household organic waste and cow dung from 2015 to 2020 continues to increase by ± 12% per year. In Jogotirto, the average person produces 0.36 kg of organic waste per day and 15 kg of dry cow dung per day. In 2020 the amount of household organic waste is 8,477 kg per day, while for cow dung is 16,787.75 kg per day. Analysis of the study of the establishment of the organic fertilizer industry is carried out by processing household organic waste and solid cow dung by fermentation. This fermentation process is carried out anaerobically for 21 days. The organic fertilizer processing process is carried out by mixing cow dung and household waste with varying ratios. From the results of research on making organic fertilizer, it is known that a mixture of cow dung and household waste with a mixture ratio of 2: 1 contains nitrogen compounds as much as 1.04%, organic C 17.6%, phosphorus 1.7% and potassium as much as 7.02%. Based on the analysis of investment feasibility using the Net Present Value method, the fertilizer industry can generate a profit of 200.18% for 5 years. Analysts using the ROR method can provide a profit of 31.7% per year and the analysis using the pay back method is known that the period of capital will return after 3.85 years. Based on the sensitivity test of the fertilizer industry, it is still said to be safe for changes in influencing parameters, namely the sensitivity rate of 20%. This study of the establishment of the organic fertilizer industry aims to provide advice to the government in the context of improving the community's economy.

Keywords: Fermentation, Industry, Investment, Profit, Organic Fertilizer,

INTRODUCTION

An investment study in the establishment of organic fertilizer needs to be carried out, during the current pandemic. This is because a lot of organic waste such as livestock manure and organic waste is very abundant and can be processed into compost or organic fertilizer. Based on data compiled by the Ministry of Agriculture and the Central Statistics Agency (BPS), the total population of beef cattle, dairy cattle, and buffalo in Indonesia in 2020 reached 20.12 million heads. In the village of Jogotirto Berbah, Sleman, as a research sample in 2020, the number of cows was 1267. In fact, apart from cow dung and household waste, there is still a lot of organic waste that has the potential to be composted, such as dry leaves, animal feed waste, and so on. According to Sutarto as the head of the Piyungan TPA (garbage disposal site), the amount of waste disposed of from Yogyakarta City, Bantul Regency and Sleman Regency to Piyungan TPA every day is ± 600 tons (Republika 13/01/20).

The investment study conducted in this research is the fertilizer industry for the next 5 years based on forecasting results using the QS 3.0 software. The data used is from 2016. Observations on the amount of waste were carried out by taking samples from the village of Jogotirto Berbah, Sleman. Analysis of the costs incurred uses prices in July 2021 and nutrient analysis is carried out in the laboratory.

The results of the feasibility analysis study on the establishment of organic fertilizers are expected to provide a reference on the establishment of the fertilizer industry in each region, so that the community can improve family food security. The research carried out is by processing organic waste as much as 9.75 tons per day

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LITERATURE REVIEW

Organic fertilizers are fertilizers that come from organic waste that is broken down by microorganisms. Organic fertilizers in the long term can increase soil fertility. Organic fertilizer materials generally vary so that the results of organic fertilizer content also vary (Didi, 2006).

In essence, investment is the placement of a number of funds at this time with the hope of obtaining profits in the future. According to Pujawan (2012), the investment objectives include:

a. The creation of sustainability (continuity) in the investment;
b. The creation of maximum profit or expected profit (actual profit)
c. Creating prosperity for shareholders
d. Contribute to the development of the nation.

Data testing is carried out to ensure that the data obtained can be said to be feasible. Data testing is carried out in two stages, namely as follows;

Data Uniformity Test

Data uniformity testing needs to be done with the aim of knowing the uniformity data. The following is the data uniformity test formula (Purnomo, 2004):

$BKA = \bar{i} + k\sigma aa$

$BKB = \bar{i} - k\sigma$

$$\text{dengan } \sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{N-k}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Data Sufficiency Test

Adequacy testing is carried out to ensure that the data obtained meet the level of confidence and degree of accuracy expected (Yakop, 2003).

The following is the data adequacy test formula (Purnomo, 2004):

$$N' = \left[\frac{\frac{k}{s}\sqrt{N\sum x^2 - (\sum x)^2}}{\sum x}\right]^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

N: number of observations
N': amount of theoretical data
k: confidence level
s: degree of accuracy
x: total cycle time is N

Because investment returns are usually obtained gradually in the future, then in investment analysis it is necessary to forecast the parameters related to business feasibility. There are several methods given to forecasting techniques, including the following (Makridakis, 99):

a. Moving Average Method with Linear Trend
   This method will be effective if the linear trend and random error factor is not large. The function of this merote equation is as follows:
   F = where I = t – m + 1, …., t ..... (3)
b. Single Exponential Smoothing with Linear Trend
   This method is basically the same as the single exponential smoothing method. However, this method considers the presence of a linear trend element in the data series. This method refines the trend and slope directly by using different constants, namely α and β. The function of this equation is as follows:
   $T_t = \beta (F_t - F_{t-1}) + (1 - \beta) T_{t-1}$ ..... (4)

Number of digits year (SOYD) method

SOYD is one of the methods designed to charge more depreciation at the beginning of the year. The equation used to calculate SOYD is as follows:

$$Dt = \frac{\text{SRemaining lassets life}}{SOYD} \text{Initial cost} - \text{Residual value} \quad \ldots\ldots\ldots\ldots \quad (5)$$

Where:

Dt = depreciation expense in year t
SOYD = Number of year digits from 1 to N

The feasibility of an investment proposal can be analyzed using several methods, including:

1. Net Present Value (Now Value Method)

Net Present Value (NPV) is an investment criterion that is widely used in measuring whether a project is feasible or not. The Net Present Value method is a method that calculates the difference between the present value of investments (capital outlays) and the present value of net cash receipts (present value of proceeds) both from operational cashflows and from cashflow terminals in the future during the life of the investment 2013. The formula used in the NPV analysis is:

$$\text{NPV} = -\text{Ao} \sum_{i=1}^{n} \frac{At}{(1+i)N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where:
Ao = Investment expenditure in year 0
At = Net cash inflow in year t
i = The rate of profit required by the owner of the capital N
= Number of years (economic life) of the project

2. Internal Rate of Return (Rate of Return Method)

Internal Rate of Return is used to determine the percentage of profit per period by calculating using the present value of income and expenditure = 0 (zero). Thus, if the result of the IRR calculation is greater than the Social Opportunity Cost of Capital (SOCC), the project/business is said to be feasible.

$$\text{IRR} = \sum_{t=0}^{n} \frac{At}{(1+i)N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where:
i = Interest rate sought so that the value of the cash flow is equal to the value of the investment
At = Cash flow that occurs in year t
N = Total age (economic size) of the project

3. Payback period analysis

Payback period analysis is used to determine the number of years the return period of capital while the formula used is:

$$0 = -P + \sum_{t=1}^{N'} At(P/F.i\%.t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where A*t* is the cash flow that occurs in periods t and N'
The feasibility of the investment also needs to be done with a sensitivity analysis. Sensitivity analysis is used to determine how sensitive a decision is to changes in parameters that affect it. This analysis will provide an illustration of the extent to which a decision will be strong enough to deal with changes in influencing parameters (Haryanto 1983).

RESEARCH METHODOLOGY

The research was conducted in the village of Jogotirto, Berbah District, Sleman Regency, Yogyakarta Special Region. Based on data from Jogotirto village, the population and number of cattle from 2016 to 2020 has increased ± 12% per year. In 2016 the population was 10,840 people and the number of cows was 892 heads. Meanwhile, in 2020 the population will increase to 11,519 people and the number of cows will increase to 1,267. Jogotirto Village has 10 hamlets, 32 RW and 79 RT. Jogotirto village is an area that has great potential in the agricultural sector, namely with control of 283.20 ha of paddy/wet land and 117.70 ha of dry/dry land.

The data used in this study are:

a. Observation data on household organic waste expenditure per person/day
b. Data on the number of cattle and cow dung
c. Nutrient content of research results Organic fertilizer
d. Production cost data
    - Worker wages
    - Raw material
    - Electricity and telephone
    - BBM
    - Land rent
e. Fixed cost data
    - Building costs
    - Work equipment equipment costs
    - Tricycle Motor
f. Product selling price

The steps taken in this research are:

- Observing directly household organic waste that can be fermented to make compost or organic fertilizer.
- Observing the output of household waste for 50 people as a sample and observing cow dung for 50 adult cows.
- Conduct data adequacy and data uniformity tests
- Analyze the water content of cow dung as raw material for fermentation in research. The analysis was carried out for wet cow dung that had been left for 30 days by heating it in an oven at a temperature of 1100 C for 2 hours
- Enumerate household organic waste using a chopper machine
- Fermentation of cow dung and household organic waste in a ratio of 2:1, 1:1 and 1:2, with the addition of other materials such as dolomite and lime with a concentration of 5% by weight of organic waste and cow dung. Fermentation was carried out for 21 days with 3 times of reversal, namely day 4, day 10 and day 15. The amount of raw material in the study was 1 ton,
- Analyzing the results of organic fertilizer products including organic N, C, P, K, PH, and water content in the laboratory.
- Forecasting the amount of household organic waste and cow dung for the next 5 years using the QS.3.0 software. This forecast is used to determine the availability of raw materials and the costs incurred during the next 5 year period.
- Collecting data on the costs needed in the manufacture of organic fertilizer which includes fixed costs and production costs. All fees are based on 2021 prices
- Conducting an investment feasibility analysis, this analysis is used to determine whether or not this business is feasible based on cash flow. The method used is Net Present Value, Rate of Return (ROR) method, payback period and sensitivity analysis, Net Present Value method is used to determine net profit for 5 years, rate of return (ROR) method is used to determine the feasibility of an investment by calculating the percentage of profit per year, payback analysis is used to find out when the capital returns. Sensitivity analysis is used to determine the level of sensitivity to possible changes in parameters over a period of 5 years to come.
- Conclusions and suggestions

Finding and Discussion

1. Data on population and household organic waste in Jogotirto.

The data is calculated based on observations of 50 samples, this observation is carried out by weighing the output of organic waste. In this study, assisted by 2 garbage collectors who disposed to the Piyungan TPA every day, the waste calculation was based on the number of people in the family. From the results of these observations obtained data as in table 1 below:

Table 1. Observation data on household organic waste expenditure per person/day in Jogotirto village

N	X	$\bar{x}$	X^2	$X-\bar{x}$	$X-X^2$	N	X	$\bar{x}$	X^2	$X-\bar{x}$	$X-X^2$
1	0.5	0.4	0.25	0.09	0.248	26	0.3	0.4	0.09	0.06	0. 26
2	0.5	0.4	0.25	0.09	0.248	27	0.3	0.4	0.09	0.06	0.21
3	0.5	0.4	0.25	0.09	0.248	28	0.3	0.4	0.09	0.06	0.21
4	0.5	0.4	0.25	0.09	0.248	29	0.4	0.4	0.16	0.04	0.24
5	0.4	0.4	0.16	0.06	0.244	30	0.4	0.4	0.16	0.04	0.24
6	0.4	0.4	0.16	0.06	0.244	31	0.4	0.4	0.16	0.04	0.24
7	0.4	0.4	0.16	0.06	0.244	32	0.4	0.4	0.16	0.04	0.24
8	0.4	0.4	0.16	0.06	0.244	33	0.3	0.4	0.09	0.04	0.218
9	0.4	0.4	0.16	0.01	0.228	34	0.3	0.4	0.09	0.04	0.218
10	0.4	0.4	0.16	0.01	0.228	35	0.3	0.4	0.09	0.04	0.218
11	0.4	0.4	0.16	0.01	0.228	36	0.3	0.4	0.09	0.04	0.218
12	0.4	0.4	0.16	0.01	0.228	37	0.5	0.4	0.25	0.09	0.248
13	0.5	0.4	0.25	0.14	0.25	38	0.4	0.36	0.16	0.04	0.24
14	0.5	0.4	0.25	0.14	0.25	39	0.4	0.36	0.16	0.04	0.24
15	0.5	0.4	0.25	0.14	0.25	40	0.4	0.36	0.16	0.04	0.24
16	0.5	0.4	0.25	0.09	0.248	41	0.4	0.36	0.16	0.04	0.24
17	0.5	0.4	0.25	0.09	0.248	42	0.5	0.36	0.25	0.14	0.25
18	0.5	0.4	0.25	0.09	0.248	43	0.5	0.36	0.25	0.14	0.25
19	0.5	0.4	0.25	0.09	0.248	44	0.5	0.36	0.25	0.14	0.25
20	0.2	0.4	0.04	0.12	0.182	45	0.5	0.36	0.25	0.14	0.25
21	0.2	0.4	0.04	0.12	0.182	46	0.4	0.36	0.16	0.04	0.24
22	0.2	0.4	0.04	0.12	0.182	47	0.4	0.36	0.16	0.04	0.24
23	0.2	0.4	0.04	0.12	0.182	48	0.4	0.36	0.16	0.04	0.24
24	0.3	0.4	0.09	0.06	0.21	49	0.4	0.36	0.16	0.04	0.24
25	0.3	0.4	0.09	0.06	0.25	50	0.25	0.36	0.06	0.11	0.187
$\sum X^2$	8.232										
$(\sum X)^2$	390.06										
$\bar{x}$	0,36										

Data Sufficiency Test

$$\frac{2}{\sqrt{50(\ 19.75) - (390.06)^2}}$$

$$N' = [\ \frac{0.05}{19.75}\ ]$$

N' = 7,8

Because N' (7,8) < N (50) then the data obtained is sufficient, so no additional observations are needed

2. Data on the amount of household organic waste and cow dung

The amount of waste is calculated by multiplying the number of residents with the results of household waste expenditure, namely the population multiplied by 0.36 kg/day/person. While the cow dung data is calculated based on the result of multiplying the number of cows with solid manure. Cow dung weight was observed after being left for 30 days from wet dung. From the results of observations of the number of adult cows as many as 50 heads, the average cow dung per head is 15.2 kg / per day. Forecasting is done to determine the amount of organic waste available for the next 5 years. The methods used in this forecasting are Double Exponential Smoothing with Linear Trend, Exponential Smoothing with Linear Trend, and Moving Average with Linear Trend. Forecasting is done using QS 3.0 software and the prediction results are based on the smallest error (Mean Square Deviation/MSD)

Table 2. Data on the amount of household organic waste and the amount of cow dung

Year	Amount of household organic waste (kg /day)	The amount of household organic waste forecasted (kg/day)	Amount of cow dung (kg /day)	the amount of cow dung forecasting results (kg/day)
2016	3902.4		11.819	
2017	3945.6		12.084	
2018	3976.56		12.746,5	
2019	4060.08		16.098,75	
2020	4146.84		16.787,75	
2021		4487.76		16.859
2022		4537.44		17.167
2023		4573.044		17.870
2024		4669.092		18.474
2025		4768.866		19.145

2. Data analysis of organic fertilizer products

Processing of organic fertilizers is carried out using 3 mixed variations with a ratio of cow dung and organic waste in a ratio of 2:1, 1:1, and 1:2 with each ratio added lime and dolomite as much as 5 %.

Tabel 3. Data on the content of organic fertilizers from research

No	Content	2:1	1:1	1:2
		consentration	consentration	consentration
1	Water content	30,3 %	33.5%	36%
2	PH	6,8	6.2	5,8
3	Nitrogen	1,04 %	0.9	0.76
4	Pospor	1,8 %	1.6	1.6
5	C Organik	19,2 %	19.3	19.4
6	Calium	7.02 %	6.4	6.3

3. Product selling price data

From the results of research on the manufacture of organic fertilizers using cow dung and household organic waste in a ratio of 2: 1, the product yields in the form of organic fertilizers as much as 65% of the weight of the raw materials. By processing 15 tons of raw materials per day, 15 tons of organic fertilizers X 0.65 = 9.75 tons are obtained. This research does not take into account marketing costs, such as promotion, product delivery, packaging and others so that the determination of the selling price is assumed to be 45% of the market price, namely: 0.45 x Rp 1000 = Rp 450/ Kg.

4. Production costs and fixed costs

This analysis of production costs and fixed costs for the period 2021-2025 uses a bank interest rate of (i) 12% / year

a. Production cost

The calculation of production costs per year period is calculated using the formula F = P (1+i) n or F= P (F/P.i. n).

Table 4. Cost of production costs in 2021-2025

Year	Labor costs (Salary 9 people and 1 manager)	Bioactivator Material	Raw material costs	Solar and electricity costs and telephone calls	Biaya sewa tanah	Amount of expenditure based on the value of money in the **n** year
2021	190,620,000	42,000,000	864,000,000	17,650.000	2250000	1648552500

2022	213,494,400	47,040,000	967,680,000	11,848.000	2520000	1846378800
2023	266,868,000	58,800,000	1,209,600,000	12,310.000	2812500	2307467250
2024	299,273,400	65,940,000	1,356,480,000	12,590.500	3150000	2587653675
2025	335,491,200	73,920,000	1,520,640,000	12,904.000	3532500	2900811150

b. Fixed cost depreciation.

The calculation of depreciation is carried out using the method using the number of digits of the year (SOYD). The following is an example of a calculation assuming the residual value of the building is still 40% of the current price.

Table 5. Fixed cost expenditure based on depreciation during 2021-2025

year	Building	Work device	tricycle	.Chopper Machine	Expenditure amount	F=P(F/P, i%.N)	Value for money year n
2,022	20,000,000	5,800,000	10,000,000	5,000,000	40,800,000	1.12	45,696,000
2,023	16,000,000	4,640,000	8,000,000	4,000,000	32,640,000	1.25	40,800,000
2,024	12,000,000	3,480,000	6,000,000	3,000,000	24,480,000	1.40	34,272,000
2,025	8,000,000	2,320,000	4,000,000	2,000,000	16,320,000	1.57	25,622,400
2026	4,000,000	1,160,000	2,000,000	1,000,000	8,160,000	1.97	16,075,200

5. Profitability analysis:

a. Net Present Value (NPV) Analysis

Analysis of income before tax based on the calculation of expenses and income using the Net Present Value (NPV) method using a bank interest rate of 12% per year. Income calculation is based on 300 working days/year assuming daily production is 9.75 tons and price is 450 rupiah per kg

Table 6. Income with expenses is assumed to increase by 6% per year and sales to increase by 8% per year'

Year	Expenditure		Sale	Sale
	Production cost	Fixed cost	F= P (1+i)n	
2021	1648552500	45,696,000	1,872,000,000	727,269,000
2022	1846378800	40,800,000	2,515,968,000	1,244,248,800
2023	2307467250	34,272,000	3,369,600,000	1,797,016,500
2024	2587653675	25,622,400	4,528,742,400	2,778,017,550
2025	2900811150	16,075,200	6,094,393,344	4,144,444,044

5-year income based on NPV are:

$NPV = 727,269,000\ (1,12)^{-1} + 1,244,248,800\ (1.25)^{-2} + 1,797,016,500(1,4)^{-3} + 2,778,017,550\ (1,57)^{-4} + 4,144,444,044\ (1,97)^{-5}$

$= 3,697,467,991$

Profit in 5 years is = Income – expenses

= 3,697,467,991- 1.159.151.458

= 2,538,316,533

b. Rate of Return (ROR) analysis

ROR analysis is used to determine the percentage of profit per year. The following is the calculation of the ROR for the feasibility analysis of the investment carried out:

ROR = Present worth of receipts – Present worth of expenses = 0

$ROR = 7,284,011,942\ (1+i)^{-n} - 1,159.151,458 = 0$

By way of Trial and Error

i = 35 % = 7,284,011,942 $(1+35\%)^{-5}$ – 1,159.151,458 = -136,069,881
i = 30 % = 7,284,011,942 $(1+30\%)^{-5}$ – 1.159.151,458 = 764,042,890
By interpolation we get

$$i = 30\% + 5\% \left(\frac{764.042.890}{(764.042.890+136.069.881)}\right) x\ 100\% = 31.37\%$$

ROR = 31, 37 %/ tahun

C. Payback period analysis
Payback analysis period using i=12% is

$$0 = -P + \sum_{n-1}^{n'} At\left(\frac{P}{F}, i\%.n\right) + \text{nilai sisa}$$

$0 = -5.433.629.326 + 727,269,000\ (1+12\%)^{-1} + 1,244,248,800\ (1+12\%)^{-2} + 1,797,016,500\ (1+12\%)^{-3} + 2,778,017,550\ (1+12\%)^{-4}$
$= -5.433.629.326 + 727,269,000\ (0.83) + 1,244,248,800\ (0.79) + 1,797,016,500\ (0.71) + 2,778,017,550\ (0.63)$
$= 391,565,372$
So it can be concluded that the investment will return after 3.85 years.

c. Sensitivity analysis
This sensitivity analysis is used to provide an illustration if the parameters such as increases in worker wages, decreases in selling prices, increases in fuel and electricity and increases in raw material costs change. The following is an example of sensitivity analysis if some parameters of production costs and sales prices change

1). Selling price of compost products decreased by 20%

Table 7. Decreasing the selling price of compost by 20%

Year	Sales price	Total expenses	Profit before tax.
2021	1,797,600,000	1,663,673,350	133,926,650
2022	2,112,774,400	2,075,896,680	36,877,280
2023	2,695,680,000	2,575,913,175	119,766,825
2024	3,622,993,920	2,874,603,683	748,390,237
2025	4,875,514,675	3,208,574,985	1,666,939,690

2). Production cost increase and fixed cost increase 20% at the same time

Table 8. Expenditures on production costs and fixed costs increased by 20% at the same time

Year	Sales price	Sales price	Profit before tax.
2021	1,872,000,000	2,033,098,200	161,098,200
2022	2,515,968,000	2,264,614,560	251,353,440
2023	3,369,600,000	2,810,087,100	559,512,900
2024	4,528,742,400	3,135,931,290	1,392,811,110
2025	6,094,393,344	3,500,263,620	2,594,129,724

From the sensitivity analysis to changes in parameters as shown in table 7 and table 8, the company is still profitable even though there is a 20% change in parameters.

CONCLUSIONS AND FUTHER RESEARCH
Based on the research data analysis, it can be concluded that:

a. Compost processing, which amounts to 15 tons of raw materials per day, is still not able to process organic waste and cow dung in the Jogotirto Berbah village, Sleman, Yogyakarta, whose numbers continue to increase.
b. Financially, the fertilizer industry with a production capacity of 9.75 tons per day for 5 years is able to provide a profit of 200.18% of the investment costs incurred.
c. Organic fertilizer industry is feasible because it can provide a profit of 31.7% per year
d. In this study, the determination of the selling price is only based on production costs so that the selling price is only assumed to be 45% of the market price. Further researchers are expected to be able to analyze marketing costs so that in determining the selling price it can be maximized close to the market price.
e. The government should be able to establish an organic fertilizer industry as one of the programs to improve the community's economy and to overcome the increasing waste generation

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