Eco. Env. & Cons. 28 (May Suppl. Issue) : 2022; pp. (S88-S99)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i03s.011

Drip Irrigation (*Financial analysis*) System for Strawberry Plants (Fragaria sp): Case Study in Pandanrejo Village, Bumiaji Sub-district, Batu City

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(Received 23 September, 2021; Accepted 15 November, 2021)

ABSTRACT

Drip irrigation is a method of providing water with a low flow rate. The drip irrigation system can save water usage, because it can minimize water losses that may occur. The use of drip irrigation systems needs to be considered from a financial analysis point of view. Financial analysis is one of the aspects used in assessing the investment plan of a development. There are several investment criteria that can be used in project evaluation, including Net Present Value (NPV), Net Benefit Cost Ratio (Net B/C), IRR, and BEP. Based on the description above, it will raise important issues that will become the details of the problem, namely to provide an assessment of the economic efficiency of operations and maintenance of the drip irrigation system. The results of the drip irrigation project research show that it is feasible to run based on investment criteria. The results of the NPV calculation are Rp. 74,293,523.47. The result of IRR calculation is 36.53%. The result of the calculation of Net B/C is 1.75. The calculation result of BEP is 547.7 kg/year, while the rupiah BEP is Rp. 24,902.15/kg. The results of the feasibility and sensitivity test gives a conclusion that the application of drip irrigation is feasible for the owner farmers, especially the scavenger farmers in Pandanrejo Village.

Key words : *Drip irrigation, Financial analysis, NPV, Net B/C, IRR, BEP, Sensitivity analysis.*

Introduction

Strawberry varieties are widely developed in several regions in Indonesia. Strawberry cultivation in Indonesia uses various kinds, for example in land, using polybags, hydroponically. Cultivation has many advantages and disadvantages. For example, hydroponically, this method can optimize environmental conditions (Noviyanti and Susanto, 2005). Hydroponic cultivation has many advantages including it does not require large land, the need for water, nutrients and light is easy to adjust according

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to plant needs, pest and disease control is easier and more sterile because it does not use soil (Schwarz, 1995).

Based on the research stages, in the third year the researchers conducted a financial analysis of the effect of the application of technology on plant productivity. Financial analysis is used to evaluate which treatments can be considered appropriate and most appropriate to be developed. In the financial evaluation of each treatment compared with the economic age of the irrigation machine tool, the treatment of farmers and using the drip irrigation system. It is possible that there are cost differences because the total cost per unit time is different and the farmers' income is due to the different selling prices of each Strawberry production. In financial analysis, several values are calculated, including Net Benefit Cost Ratio (Net B/C), Net Present Value (NPV) and Internal Rate of Return (IRR), and Pay Back Period. The following formula is used in the study (Suharto *et al.* (2018).

Engineering and technological innovation of drip irrigation system is a very important development for farmers. The existence of technology development is intended to support the development of Science and Technology applied to the field of Agriculture. Increasing the quality and quantity to achieve export products in agriculture, especially in horticultural products, can be achieved through this innovation. Through this innovation, it is hoped that it will increase regional income, and bring many multiplier effects, such as quality improvement, market price stability, and the welfare of farmers. Socialization and assistance to farmers is needed in the application of this technological innovation from the beginning to the end of the research.

Research Methods

The research partner's garden is located at Jalan Raya Pandanrejo, Pandanrejo Village, Bumiaji District, Batu City. Geographically, the research location is precisely at coordinates 7o52'12.0" South Latitude and 112o32'39.3" East Longitude.

Data collection in the form of primary data and secondary data. Primary data were obtained from direct observations in the field and information from interviews with related parties (farmers and local residents). The following details the data needed for research, among others:

1. Production results before and after drip irrigation
2. Initial capital
3. Operating costs
4. Irrigation age
5. Production selling price
6. Profit earned

In addition to these data, other supporting data are needed, namely:

Research site conditions

The research location can be known to describe the physical condition of the research area.

Installation of drip irrigation system

Knowing the need for drip irrigation installations, related data are needed.

Detailed data on drip irrigation needs

Detailed data on the list of needs and material prices for drip irrigation systems.

The data that has been obtained is then calculated from the capital required for the construction of drip irrigation, annual production yields, cash inflows before and after the project and annual income.

The data obtained are compiled, then calculated starting from the capital required for the construction of irrigation networks, annual agricultural production, cash inflow before, during and after the project as well as the annual income of farmers. After the process, the post-project economic method is used, namely by comparing the profit of agricultural production before the project and the profit of agricultural production after the project takes place. The results obtained are then retested using certain methods to get a better picture.

Calculation of the financial aspect can be started by knowing the amount of costs as follows:

Fixed cost

Calculate the total depreciation cost of the components of investment costs and the total cost of capital interest.

Variable Costs (Not Fixed)

Calculates variable costs per year as required operating costs per year.

Total Cost

The total cost is obtained from the number of fixed costs per year and the number of Variable costs per year.

After obtaining the total cost per year, the cost of goods and the break-even point can be known.

Analysis of the feasibility of a farming activity can use several investment criteria, including:

Cost of Production (HPP)

HPP calculation using the formula:

$$HPP = \frac{Jumlah\ Biaya}{Jumlah\ barang\ yang\ dihasilkan}$$

Break Event Points (BEP)

BEP analysis is an analytical technique to study the relationship between fixed costs, variable costs, profits and the volume of activities that occur in a business. The formula used for the calculation of BEP is:

$$BEP(Unit) = \frac{Biaya\ Tetap}{Harga\ Jual\ per\ unit - Biaya\ Variabel\ per\ unit}$$

Net Present Value (NPV)

NPV shows the profit that will be obtained over the life of the investment, which is the total value of cash flow receipts at the present time minus the costs incurred during a certain time. It is systematically formulated as follows:

$$\boldsymbol{NPV = \sum_{i=1}^{n} \frac{NBi}{(1+i)^n}}$$

Where :

NBi = Net Benefit (benefit cost) = Benefit - cost

i = discount factor (%)

n = Time (year)

The assessment of investment feasibility based on the NPV value is as follows:

NPV > 0, then the project is profitable and feasible.

NPV = 0, means that the project does not gain but also does not lose (the benefits obtained are only sufficient to cover the costs incurred so that project implementation is based on the subjective judgment of decision makers.

NPV < 0, means the project is losing money and is not feasible to implement.

4. Net Benefit Cost Ratio (Net R/C Ratio)

Net B/C is the ratio between the amount of positive NPV (as a numerator) and the negative NPV (as a denominator), this number indicates the magnitude of the additional benefit at each additional cost of one unit. Systematically formulated as follows:

$$RC = \frac{TR}{TC} \quad \text{with:}$$

TR = P x Q

TC = TFC – TVC

Where :

TR = Total Revenue (sum of all revenue earned)

TC = Total Cost (sum of all costs incurred)

P = Price (Price)

Q = Quantity (Quantity)

TFC = Total Fix Cost (Amount of all fixed costs)

TVC = Total Variable Cost (Amount of all variable costs)

If the Net R/C value > 1, then the project is efficient and will be profitable, if the Net R/C value < 1, then the project is inefficient and detrimental. If Net R/C = 1, then the project is neither profitable nor detrimental.

Internal Rate of Return (IRR)

IRR shows the percentage of profit to be earned or the net investment of a project, or the discount rate that can make the current net income from investment (NPV) equal to zero. It can be systematically formulated as follows:

$$IRR = i_1 + \frac{NPV_1}{NPV_1 + NPV_2} \times (i_2 - i_1)$$

Dimana

i_1 = Discount rate resulting in NPV0]_1 (low discount rate)

i_2 = Discount rate resulting in NPV]_2 (high discount rate)

NPV0]_1 = Present value of additional net benefit flows at i_1

NPV0]_2 = Present value of additional net benefit flows at i_2

If the IRR value is greater than the applicable discount rate, then the project is feasible to implement. On the other hand, if the IRR value is less than the applicable discount rate, then the project is not feasible to implement.

Payback Period (PP)

The rate of return on investment or payback period, is defined as the period of return on investment issued, through the profits obtained from a project. The faster the rate of return on investment, the strawberry farming is considered to be better to

carry out, the payback period shows how much the rate of return on an investment is, the shorter the payback period, the better the business is run. The formula used is:

$$PP = t \ \frac{b-c}{d-c} \times 12 \text{ bulan}$$

Where:

t = the last year in which the cumulative net cash has not reached the initial investment

b = initial investment (initial capital)

c = cumulative net cash inflow at time t

d = cumulative net cash inflow at time t+1

Sensitivity analysis is a tool that directly analyzes the effects of risks borne as a result of the uncertainty of business activities. Sensitivity analysis aims to examine the extent to which the elements in the financial aspect change to what is selected. These elements can be in the form of raw material prices, production costs, decreased market share and decreased product prices per unit or on loan interest. The feasibility of the business is carried out for 10 years according to the age of the plant from 0 to 10 years because after the age of the plant is more than 10 years the amount of production decreases. Determination of change and how much change can be made in a study must be based on strong and rational assumptions. The assumptions used include:

Land

The area of land used is one hectare with the amount of production per land has been converted in per hectare. Land rent Rp. 1.000.000,- per year.

Use of Seeds

Some of the seeds used by farmers came from the purchase of Rp. 2.500,- per seed.

Production Quantity

The number of strawberries harvested is assumed to be sold entirely to collectors. The level of strawberry production is obtained from the results of a direct farmer survey to the catching farmers and owners. With drip irrigation, the total production is assumed to increase by 44%.

Output Price

The output price used is IDR 40,000 per kilogram which is the average price of purchases by collectors per month. The output price is assumed to increase by 10% every 2 years.

Pesticides and Fertilizers

The use of fertilizers and pesticides based on the age of the plant according to the results of a survey to farmers in Pandanrejo Village. Prices of pesticides and fertilizers are obtained from direct surveys to providers of agricultural production facilities. Assuming a price increase of up to 25 percent, it is expected to still be profitable.

Labor

The workforce used consists of workers within the family and workers outside the family. Calculation of labor outpouring is based on how many hours it takes workers to complete one job, 1 HOK is 5 hours per day for both male and female workers. While the hourly wage for labor is Rp. 15,000 per hour.

Use of Drip Irrigation Technology

The timing of the use of drip irrigation is adjusted to the water requirement per plant. With a land area of 1 hectare, the additional costs for the drip irrigation device are one unit of water pumping machine with a capacity of 300 liters per minute, five tons of water with a capacity of 2,000 liters, 4 mm diameter PVC pipe, 2,648 meters long polytube hose and 2,500 bubbler emitters. units, the cost of electricity for 1.5 hours per day and IDR 720,000 per year.

Accumulated Depreciation Cost of Equipment and Machinery

Depreciation costs consist of the cost of agricultural equipment and machinery used in the application of drip irrigation. Economic life is assumed to be 10 years, and at year 10 there is no salvage value.

Results and Discussion

In the calculation of the cost analysis of the drip irrigation project requires an investment of Rp. 79,117,500 for 1 unit of green house with an area of 144 m^2.

The investment costs are outlined in Table 1. Investment costs are estimated for 5 years for this project. This is based on the economic life of the drip irrigation network. Analysis of the costs taken into account in this project are fixed costs, variable costs, total costs, basic costs and break-even point.

Investment Costs and Fixed Costs

Determination of financial analysis must know the

amount of investment costs and fixed costs. Details to determine the need for investment costs and fixed costs can be seen in Table 1.

Depreciation costs depend on the value of the equipment at the time of purchase, the economic life of the equipment, the salvage value after the economic period expires (in this case it is considered zero). Based on the above equation, the depreciation cost is described as follows:

1. Greenhouse = (79.117.500 -7.911.750)/5 = Rp. 14.241.150,-/year
2. Drip irrigation network = (19,700,000-1,970,000)/ 5 = IDR 3,546,000,-/year
3. Equipment = (750,000-75,000)/5 = IDR 135,000,- /year

Total depreciation cost = IDR 17,922,150,-/year

Perhitungan bunga modal ini menggunakan tingkat bunga 15% / tahun. Perhitungan dijabarkan sebagai berikut :

I = Rp 99.567.500 x 10% / tahun
= Rp 9.956.750

Total bunga modal = Rp 9.956.750,-

Total biaya tetap = Total biaya penyusutan + Total biaya bunga modal
= Rp (17.922.150 + 9.956.750) / tahun
= Rp27.878.900,- / tahun

Variable Costs (Operating Costs)

Determination of financial analysis must know the amount of variable costs. Details to determine the need for variable costs can be seen in Table 2.

California strawberry plants experience 3 growing seasons in one year so that the total variable costs per year are obtained as follows:

Total variable cost = variable cost per season x growing season
= IDR 5,349,500 x 3 seasons
=Rp.16,048,500,-

Total Cost and Cost

The total cost is obtained from the sum total of fixed costs and variable costs.

Total Cost (Production Cost) = BT +BV
= IDR (27,878,900 + 6,048,500)/year
= Rp43,927,400,-

Before doing financial calculations, it is necessary to know the amount of harvest per planting season. Yields per growing season are described as follows.

Yield (per growing season) = crop productivity per growing season x seeds x percentage of yield =

Table 1. Details of the Need for Investment Costs and Fixed Costs

No.	Description	Of Needs (unit)	Unit Price (Rp/unit)	Total Price (Rp)
1.	Green House	1	79.117.500	79.117.500
2.	Drip Irrigation Network	1	19.700.000	19.700.000
3.	Equipment (Hoes, shovels, buckets. etc.	1	750.000	750.000
	Total Cost per unit (144 m^2)			99.567.500
	Total Investment cost per m^2			691.440

Source: Research Results, 2021

Table 2. Details of the need for investment costs and fixed costs

No.	Description	Of Needs (unit)	Unit Price (Rp/unit)	Total Price (Rp)
1.	Planting media	144 m^2	3.500/m^2	504.000
2.	Sedds	900 plants	750 plants	675.000
3.	Pesticides			
	(a) Fungicide	400 gr	110.000/kg	44.00
	(b) Insecticide	0.75 lt	110.000/lt	82.500
4.	Nutrition (KNO_3)	8 kg	5500/kg	44.000
5.	Labor	2 people/month	500.000/people month	4.000.000
	Total variable cost per season (4 months)			5.349.500
	Total variable cost per year (3 growing seasons)			16.048.500

Source: Research Results, 2021

1 kg/plant x 735 plants x 80%
= 588 kg/season
Yield (total production) per year = yield per growing season x growing season
= 588 x 3 seasons
= 1764 kg/year

After obtaining the amount of fixed costs, variable costs, production costs, total costs, depreciation of equipment, and yields per year, then the calculation of NPV (Net Present Value), IRR (Internal Rate of Return), Net B/C, and BEP (Break Even Point) to find out whether the project is worth running or not.

Calculation of NPV

The determination of the amount of NPV is carried out using calculations based on cash flows. The calculation is based on cash flow, namely the accumulated value of PVB-C in the last year or the sum of all PVB-C values in each year.

The details from the table above are described as follows:

- Investment fee is only filled in year 0 as initial cost.
- Variable Costs as operational costs that come into effect in the first year to the fifth year.

Production costs are the sum of fixed costs per year with variable costs per year starting from the first to the fifth year.

- Revenue is income derived from selling price x total production per year.
- B-C as profit earned from revenue – total cost.

NPV (Net Present Value) Calculation Analysis

In the NPV calculation, it is known that the investment cost is Rp. 99,567,500.00 as the initial cost. Variable costs are Rp. 16,048,50,00,- whose amount is always consistent from the first year to the fifth year. Variable costs state the amount of costs used for the operation of this drip irrigation project. The production cost is Rp. 43,927,400,00,- which is obtained from the sum of fixed costs per year with variable costs per year and the value is always consistent from the first year to the fifth year. Based on the results of the calculation of NPV with a 10% discount rate and a project life of 5 years, it is Rp. 74,293,523.47,-. The results of the financial analysis show that the Net Present Value is greater than 0, so it can be said that this project is feasible to continue. The NPV value also shows a positive value so that this drip irrigation project is a profitable project. This NPV value indicates that this project generates additional benefits of IDR 74,293,523.47,-. NPV is zero according to NPV calculations based on cash flows when the Payback Period reaches the third year.

The concept of Net Present Value is based on the concept of discounting all cash flows to their present value. NPV is obtained by discounting all cash in-

Table 3. NPV cash flow calculation

Year	Cost				Reception	B-C	DF 10%	PVb	PVc	PVbc (NPV)	Accumulation PV B-C	
	Investment	Variabel	Production	Total								
0	99,567,500.00	0	0	99,567,500.00	0	(99,567,500.00)	1.000	0	99,567,500.00	(99,567,500.00)	(99,567,500.00)	
1	0	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.909	96,218,181.82	54,523,545.45	41,694,636.36	(57,872,863.64)	
2	0	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.826	87,471,074.38	49,566,859.50	37,904,214.88	(19,968,648.76)	
3	0	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.751	79,519,158.53	45,060,781.37	34,458,377.16	14,489,728.40	Payback Period
4	0	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.683	72,290,144.12	40,964,346.70	31,325,797.42	45,815,525.82	
5	0	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.621	65,718,312.83	37,240,315.18	28,477,997.65	74,293,523.47	
TOTAL										74,293,523.47		

Source: Research Results, 2021.

flows and cash outflows over the life of the project to their present value. After that, calculate it using the current price. The calculation of NPV considers two factors, namely the time value of money and the difference in the amount of cash inflows and outflows. NPV can show the amount with a certain discount current and give how much money at this time. NPV assessment criteria in this financial analysis will be obtained several advantages have included the time value of money factor and has considered all aspects of project cash flow.

Calculation of IRR (Internal Rate of Return)

Determination of the amount of IRR is done by using a calculation based on trial and error. This method is done by simulating the data that has been obtained, because it cannot be solved directly.

The details from the table above are described as follows:

- Investment fee is only filled in year 0 as initial cost.
- Variable Costs as operational costs that come into effect in the first year to the fifth year.
- Production costs are the sum of fixed costs per year with variable costs per year starting from the first to the fifth year.
- Revenue is income derived from selling price x total production per year.
- B-C as profit earned from revenue – total cost.
- The quantities i' and i'' are assumptions

IRR (Internal Rate of Return) Calculation Analysis

In the IRR calculation, it is known that the investment cost is Rp. 99,567,500.00 as the initial cost. Variable costs are Rp. 16,048,50,00,- whose amount is always consistent from the first year to the fifth year. Variable costs state the amount of costs used for the operation of this drip irrigation project. The production cost is Rp. 43,927,400,00,- which is obtained from the sum of fixed costs per year with variable costs per year and the value is always consistent from the first year to the fifth year. Based on the re-

Table 4. IRR Cash Flow Calculation

Year	Cost			Total	Receiptio	B-C	36%	P\bc (NPV)	37%	P\bc (NPV)
							DF		DF	
	Production	Variable	Investment							
0	99,567,500.00	-	-	99,567,500.00	-	(99,567,500.00)	1.000	(99,567,500.00)	1.000	(99,567,500.00)
1	-	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.735	33,723,602.94	0.730	33,477,445.26
2	-	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.541	24,796,766.87	0.533	24,436,091.43
3	-	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.398	18,232,916.82	0.389	17,836,563.09
4	-	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.292	13,406,556.48	0.284	13,019,389.11
5	-	16,048,500.00	43,927,400.00	59,975,900.00	105,840,000.00	45,864,100.00	0.215	9,857,762.12	0.207	9,503,203.73
			TOTAL					450,105.23		(1,294,807.39)
										IRR
										36.532856723527704%

Source: Research Results, 2021.

sults of the IRR calculation using the trial and error method, the assumption is that the discount rate is between 36% to 37%. After that, interpolation was carried out to obtain an IRR of 36.53%. The results of the financial analysis show that the IRR is greater than the discount rate used in the calculation or is assumed to be 10%. The IRR value indicates that this project is feasible to continue.

Net B/C. Calculation Analysis

Based on the results of the calculation of Net B/C with a 10% discount rate and a project life of 5 years, a ratio of 1.75 was obtained. The Net B/C value is obtained from a comparison between a positive NPV and a negative NPV. The number of positive NPV as the numerator and the number of negative NPV as the denominator. The net B/C shows an illustration of how many times the benefits (benefits) obtained from the costs incurred. The results of the financial analysis show that the Net B/C is greater than 1, it can be said that this project is feasible to continue. The Net B/C value of 1.75 means that this drip irrigation project will provide a net benefit of 1.75 times the total cost incurred. Based on the Net B/C value, the ratio between loss and profit is 1:1.75. The Net B/C value of 1.75 is calculated by comparing the positive NPV (profit) with the negative NPV (loss). The number of positive NPV obtained is Rp. 173,861,023.47 while the number of negative NPV is Rp. 99,567,500.00 so that the Net B/C value is 1.75. This means that the income earned is 1.75 times greater than the costs incurred.

Calculation of BEP (Break Even Point)

Determining the value of BEP requires the amount of production per year, operational costs, fixed costs, total costs, and selling price per kg. It is known that the annual production is 1764 kg/year, operational costs are Rp. 16,048,50,00, fixed costs are Rp. 27,878,900.00, total costs are Rp. 43,927,400.00 which is obtained from the sum of operational costs with fixed costs, and prices. selling per kg of Rp. 60,000.00.

Based on the results of the calculation of the BEP unit with a 10% discount rate and a project life of 5 years, it was obtained at 547.7 kg/year, while the rupiah BEP was obtained at Rp. 24,902.15/kg.

Based on the results of the Break Even Point (BEP) calculation above, it shows that if you want to make a profit, you must produce or sell above 547.7 kg/year. If you produce or sell products below this amount, you will certainly suffer losses. Likewise, when the product is sold at a price below Rp. 24,902.15/kg, it is certain that it will suffer a loss. Price Rp 24,902.15/kg is the minimum sales limit so as not to experience a loss.

Sensitivity to Rising Investment Costs

The test is carried out through a simulation of NPV and IRR calculations with an investment cost of Rp. 99,567.5000.00, - increasing gradually every 10%. The results show that the IRR and NPV values decrease as investment costs increase. This project is still feasible before the increase in investment costs reaches 80%. If the cost increase reaches 80% or more, it is said that the project is not feasible to implement. The sensitivity of the increase in investment costs is described in Table 5.

Table 5. Sensitivity Analysis to Investment Increase

Increase in Investment Cost	IRR	NPV
0%	36.53%	74,293,523.47
10%	31.34%	64,336,773.47
20%	27.38%	54,380,023.47
30%	23.36%	44,423,273.47
40%	19.60%	34,466,523.47
50%	16.45%	24,509,773.47
60%	14.12%	14,553,023.47
70%	11.06%	4,596,273.47
80%	9.56%	(5,360,476.53)
90%	7.81%	(15,317,226.53)
100%	6.05%	(25,273,976.53)

Source: Research Results, 2021.

Based on the table above, when the investment cost increases by 80% from the initial cost, it will experience a loss. IRR shows under the assumption that the interest used in this project is below 10% and the NPV shows a negative value. In addition to the table above, the sensitivity to the increase in investment costs is also illustrated by graphs that can be seen in Figure 1 and 2.

Based on the graph above it can be concluded that the project will suffer a loss if the investment cost increases by 80% where the NPV shows less than 0 and shows a negative value.

Sensitivity to Increase in Operating Costs

The test is carried out through simulation of NPV and IRR calculations with operational costs of Rp. 16,048,500.00, - increasing gradually every 10%. The results show that the IRR and NPV values decrease with the increase in operating costs. This project is still feasible until the operational costs increase by 100%. When the cost increase reaches 100%, the IRR

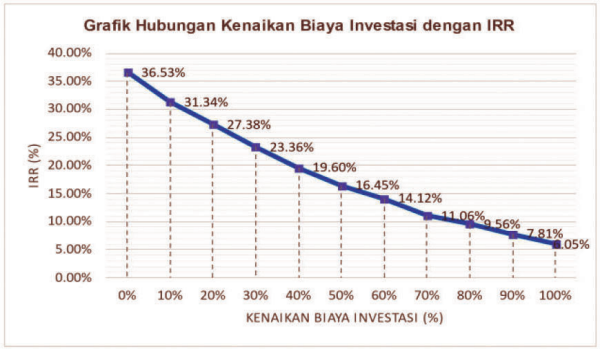

Fig. 1. Graph of Relationship between Increase in Investment Costs and IRR. Source: Research Results, 2021

Fig. 2. Graph of Relationship between Increase in Investment Costs and NPV. Source: Research Results, 2021.

Fig. 3. Graph of the Relationship between Increase in Operating Costs and IRR. Source: Research Results, 2021.

Fig. 4. Graph of Relationship between Increase in Operating Costs and NPV. Source: Research Results, 2021.

still shows interest above the assumed rate and the NPV still shows a positive value.

Ssensitivity to the increase in operational costs is also illustrated by a graph that can be seen in Figure 3 and Figure 4.

Based on the graph above it can be concluded that the project is still said to be feasible when operational costs increase up to 100% where the IRR still shows greater than the assumed interest rate of 10%.

Based on the graph above it can be concluded that the project will still benefit when operating costs increase to 100% where the IRR value still shows more than the assumed interest and the NPV value still shows a positive value.

Sensitivity to Decline in Selling Price

The test is carried out by simulating the calculation of NPV and IRR with a selling price of Rp. 60,000.00,-/kg gradually decreasing every 5%. The results show that the IRR and NPV values decrease as the selling price decreases. This project is still feasible before the selling price drop reaches 20%. If the selling price decreases by 20% or more, it is said that this project is not feasible to implement.

Sensitivity to the decline in selling prices is also illustrated by graphs that can be seen in Figure 5 and Figure 6.

Based on the graph above it can be concluded that the project will suffer a loss if the selling price decreases by 20% where the IRR indicates less than the assumed interest rate of 10 %.

Based on the graph above it can be concluded that the project will suffer a loss if the selling price decreases by 20% where the NPV shows a negative value.

Sensitivity to Decreased Productivity

The test was carried out through a simulation of NPV and IRR calculations with the annual production of 1764 kg/year decreasing gradually every 5%. The results show that the IRR and NPV values decrease along with the decrease in productivity. The project is still feasible before the reduction in production reaches 15%. If the decrease in the amount

Fig. 5. Graph of the Relationship between Sales Price Decline and IRR. Source: Research Results, 2021.

Fig. 6. Graph of the Relationship between Sales Price Decline and NPV. Source: Research Results, 2021

Fig. 7. Graph of the Relationship between Decrease in Production Amount and IRR. Source: Research Results, 2021.

of production is 15% or more, it is said that this project is not feasible to carry out. Sensitivity to a decrease in the number of products is also illustrated by a graph that can be seen in Figure 7 and Figure 8.

Based on the graph above it can be concluded that the project will suffer a loss if the amount of

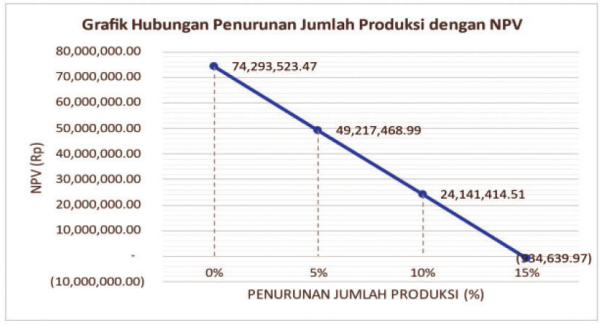

Fig. 8. Graph of the Relationship between Decrease in Total Production and NPV. Source: Research Results, 2021.

production decreases by 15% where the NPV shows a negative value.

Conclusion

1. The results of the NPV calculation are Rp. 74,293,523.47 and show the results are more than 0 or positive so that the project can be said to be feasible.
2. The results of the IRR calculation are 36.53% and show a yield greater than the assumed interest rate so that the project is said to be feasible and profitable.
3. The result of the Net B/C calculation is 1.75 and shows a result greater than 1, so it can be said that this project is feasible to continue. The Net B/C value of 1.75 means that this drip irrigation project will provide a net benefit of 1.75 times the total cost incurred.
4. The BEP calculation result is 547.7 kg/year, while the rupiah BEP is Rp. 24,902.15/kg. The BEP above shows that if you want to make a profit, you must produce or sell above 547.7 kg/year. If you produce or sell products below this amount, you will certainly suffer losses. Likewise, when the product is sold at a price below Rp. 24,902.15/kg, it is certain that it will suffer a loss.
5. Sensitivity analysis is only carried out on the NPV and IRR investment criteria. Tests are assumed when the project experiences an increase in investment costs, an increase in operational costs, a decrease in selling prices, and a decrease in the amount of production. In testing the increase in investment costs, the project will experience a loss if the investment costs increase

by 80% where the NPV shows less than 0 and the IRR shows the yield is less than the assumed interest. In testing the increase in operational costs, the project is still said to be feasible when the operational costs increase to 100% where the NPV still shows a value of more than 0 and the IRR still shows a higher rate than the assumed interest rate of 10%. In the selling price decline test, the project will suffer a loss if the selling price decreases by 20% where the NPV indicates less than 0 and the IRR indicates less than the assumed interest rate of 10%. In the productivity decline test, the project will suffer a loss if the selling price decreases by 15% where the NPV indicates less than 0 and the IRR indicates less than the assumed interest rate of 10%.

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