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Financial Feasibility of Greenhouse Hydroponic Vegetable Business

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Abstract

Despite the potential revenue, many farmers still hesitate to start a hydroponic vegetable business due to its high initial capital. Therefore, this study aimed to analyze the financial feasibility of greenhouse hydroponic vegetable businesses. The research was conducted in Greater Malang by determining the location intentionally (purposefully) and determining the research sample using accidental sampling, i.e., taking samples that happened to be encountered, with a total of 8 eligible respondents, using descriptive quantitative data analysis with NPV investment criteria, Net B/C Ratio, and IRR. With an NPV of IDR 81,180,303, a Net B/C Ratio of 1.32, and an IRR of 55%, the hydroponic green lettuce business is deemed feasible. Whereas the hydroponic greenhouse vegetable business with a polyculture planting pattern has eight commodities (green lettuce, romaine lettuce, red lettuce, kale, bok choy, kale, caisim, and gai lan) declared feasible to run with the results of NPV analysis of IDR 78,294,406, Net B/C Ratio of 1.38, and IRR of 55%. This research is essential so that millennials can use the results of this study as a guide or reference when starting a hydroponic greenhouse vegetable business.

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INTRODUCTION

The horticultural sub-sector, specifically vegetable commodities, is one of the most expensive agricultural commodities on the market (Agung *et al.,* 2019). East Java is one of the regions in Indonesia where demand for vegetables tends to increase (Rahmawati & Fariyanti, 2018). It is supported by an increase in vegetable production in the Greater Malang Area, wherein the Malang Regency accounts for 2.64% of the whole national vegetable production (Damayanti *et al.,* 2014). Besides, Malang City also contributes to vegetable production in East Java, where the percentage of vegetable production in Malang City was recorded at 0.13% in 2017, which had a slight increase to 0.14% in 2018 (Peni *et al.,* 2022). Meanwhile, vegetable production in Batu City was reported to have reached a total of 1,221,18 tons in 2020 (Hongu *et al.,* 2022).

The phenomenon of agricultural land conversion has been a growing trend that continues to increase yearly (Atasa *et al.,* 2022). The availability of high-quality agricultural land is one of the greatest challenges facing urban agriculture (Okuputra *et al.,* 2022). The problem of agricultural land conversion has a negative impact on food security, making it a major challenge for younger generations entering the agricultural industry (Sambo *et al.,* 2019).

Hydroponics is a planting system that relies on water and sunlight (Amaluddin *et al.,* 2023). Meanwhile, according to a study in Japan, hydroponics is a planting method using water as a medium for delivering nutrients to plants that are maximized by utilizing greenhouses (Endo *et al.,* 2016). In addition, to increase crop yields, efficient use of inputs (water, fertilizers, and pesticides) can be achieved in hydroponic vegetable farming, giving significant profits (Khan *et al.,* 2018).

Hydroponic systems produce more than conventional growing systems, allowing businesses that implement this system to strengthen the future economy (Souza *et al.,* 2019). Besides, the target market for hydroponic vegetables is typically the upper middle class, which allows for significantly higher prices (Nursahib *et al.,* 2021). According to a study conducted in the United States that evaluated the hydroponic system as a project, using this system in the agricultural business carries a relatively low risk if evaluated continuously (Faraz Moghimi & Asiabanpour, 2021).

One of the most important things done in developing hydroponic technology is the development of low-cost hydroponic systems that minimize initial investment and lower operational expenses (Sharma *et al.,* 2018). Fluctuating production has an impact on the generated income as well as the pricey operational costs (Resdiana *et al.,* 2022). Feasibility studies are crucial since they equip farmers with insights into the potential profit of their business operations and strategies for maximizing profitability. This understanding is crucial for determining the viability and profitability of the business (Kholis *et al.,* 2022).

The novelty of this research is to modify the investment costs and benefits of the hydroponic vegetable greenhouse business and conduct a feasibility analysis of the cost modification. Numerous studies have addressed the feasibility of hydroponic vegetable business from individual and company-owned business premises; therefore, the urgency of this study was to determine the feasibility of hydroponic vegetable business with the desired modification or design in order to minimize future losses. Thus, the objective of this study is to examine the financial feasibility of a hydroponic greenhouse vegetable business with a monoculture planting pattern of green lettuce and the financial feasibility of a hydroponic greenhouse vegetable business with a polyculture planting pattern using NPV, Net B/C Ratio, and IRR investment criteria.

RESEARCH METHODS

This study was conducted in Greater Malang, comprising Malang Regency, Malang City, and Batu City. Since Greater Malang is a well-known center for vegetable production, this location was chosen purposively. In addition, many people in Greater Malang are starting to implement food independence by growing vegetables in their yards using a hydroponic system.

This study's participants are hydroponic greenhouse vegetable farmers in Greater Malang. The determination of respondents was conducted using accidental sampling, which is the determination of respondents by taking respondents who happen to be in a place. Finally, a sample of eight respondents who met the analysis requirements, namely using iron greenhouses and NFT and DFT hydroponic systems, was obtained. Estimation of business age uses the highest investment, namely iron greenhouses that are 15 years old. The eight analyzed respondents were separated into two groups based on the planting pattern, i.e., green lettuce monoculture and polyculture with variations of more than two vegetable commodities aged between 6 and 8 weeks on a land area of 220 m^2.

Data collection methods were conducted through surveys, interviews, questionnaires, and documentation to collect primary data. Meanwhile, secondary data sources were derived from a literature study. The method of data analysis employed is descriptive quantitative data analysis employing a business feasibility analysis criteria approach in the form of Net Present Value (NPV), Net Benefit Cost Ratio (B/C R), and Internal Rate of Return (IRR) values. Here are the formulas:

1. *Net Present Value* (NPV)

NPV (Net Present Value) is an investment criterion obtained from the calculation of the difference between the value of benefits (benefits) and production costs (costs) calculated based on current values (Anwar *et al.,* 2018). The formula for NPV is as follows:

$$NPV = \sum_{t=0}^{n} \left(\frac{Bt - Ct}{(1+i)^t} \right)$$

Remarks:

B_t : Benefit in year t

C_t : Cost in year t

t : Year
i : *Discount rate*

Inference indicators:
a. If NPV < 0, the business is not feasible to run or incurs a loss.
b. If NPV = 0, the business is difficult to run, or the business is not profitable or incurs a loss.
c. If NPV > 0, then the business is feasible or profitable.

2. *Net Benefit Cost Ratio* (Net B/C)

The Net Benefit Cost Ratio (Net B/C) is the comparison between the present value of benefits and the present value of costs or financing. The formula employed is as follows:

$$Net\ B/C\ Ratio = \frac{\text{PV Net B } (+)}{\text{PV Net B } (-)}$$

Remarks:
PV B (+) = Total Present Value Benefit during the period that is positive
PV B (-) = Total Present Value Benefit during the period that is negative

Decision-making criteria:
a. If Net B/C < 1, the business is not feasible.
b. If Net B/C = 1, the business is at a break-even point (BEP).
c. If Net B/C > 1, the business is feasible.

3. *Internal Rate of Return* (IRR)

Internal Rate of Return (IRR) is one of the investment criteria used to estimate the percentage of profit, where the value is obtained from the discount rate value that results in NPV equal to zero. The formula is as follows:

$$\text{IRR} = \frac{(\text{Df } 1 + \text{NPV } 1)}{(\text{NPV } 1 - \text{NPV } 2)} \text{ x } (\text{Df } 2 - \text{Df } 1)$$

Remarks:
NPV1 = Positive Present Value
NPV2 = Negative Present Value
Df 1 = Discount rate that produces NPV1
Df 2 = Discount rate that produces NPV2

The following are the IRR decision-making criteria
a. If the IRR percentage < the prevailing interest rate, the business is not feasible.
b. If the IRR percentage > the prevailing interest rate, the business is feasible.

RESULTS AND DISCUSSION

Financial Feasibility of Greenhouse Hydroponic Green Lettuce Monoculture Vegetable Business

In analyzing the feasibility of a hydroponic greenhouse vegetable business, the investment cost data used is the average investment cost cultivated by respondent farmers. It is because the researcher wanted to modify the investment plan, starting

with the costs and benefits expected from the greenhouse hydroponic vegetable business. The investment costs of each respondent who utilized a monoculture agricultural system are detailed in Table 1.

Table 1. Greenhouse Investment Costs with Green Lettuce Monoculture Planting Patterns

Resp No.	Business Location	Greenhouse size (m²)	Number of Planting Holes	Greenhouse Investment Cost (IDR)
1	Malang City	220 m²	1600	120,000,000
2	Malang Regency	220 m²	1600	85,000,000
Average Investment Costs				**102,500,000**

Primary Data: processed (2023)

Based on the data in Table 1, there is a difference in the total investment costs of the two farmers who cultivate hydroponic greenhouse vegetables with a monoculture planting pattern of green lettuce. The investment cost of respondent 1, located in Malang City, is the highest compared to other farmers. The differences in each respondent's total investment cost are due to the construction cost of the greenhouse structure, given that the cost of greenhouse equipment and materials varies for each respondent.

Based on the abovementioned data, the greenhouse investment cost used in this study is IDR 102,500,000, representing the respondents' average investment cost. In accordance with the analysis criteria used in this study, a greenhouse made of iron will be made with an area of 220 m². Table 2 below presents the detailed investment data.

Table 2: Initial Investment in Hydroponic Green Lettuce Business.

No	Remark	Estimated Economic Life (Year)	Total	Unit Price (IDR)	Total Cost (IDR)
1	*Greenhouse*	15	1 unit	102,500,000	102,500,000
2	Instalasi Hidroponik	10	6 pieces	6,000,000	36,000,000
3	Pompa Air	2	6 pieces	100,000	600,000
4	Gelas Ukur	2	3 pieces	20,000	60,000
5	Pisau	1	5 pieces	20,000	100,000
6	Bak Kotak	2	10 pieces	20,000	200,000
Total cost of initial investment					**139,460,000**

Primary Data: processed (2023)

Table 2 states that the greenhouse is the most valuable investment and has the longest estimated economic life, as it is made of iron and is, therefore, sturdier than the bamboo greenhouse. Therefore, the estimated service life is 15 years, although some greenhouse components must be replaced every few years. The replacement costs are listed in Table 3 below.

Table 3. Annual Replacement Cost of Hydroponic Green Lettuce Vegetable Business

Year	Remarks							Total Cost (IDR)
	Hydroponic Installation	Water pump	Measuring cup	Knife	Box tub	UV plastic	Insect Net	
1	-	-	-	100,000	-	-	-	100,000
2	-	600,000	60,000	100,000	200,000	-	-	960,000
3	-	-	-	100,000	-	-	-	100,000
4	-	600,000	60,000	100,000	200,000	-	-	960,000
5	-	-	-	100,000	-	6,600,000	-	6,700,000
6	-	600,000	60,000	100,000	200,000	-	-	960,000
7	-	-	-	100,000	-	-	-	100,000
8	-	600,000	60,000	100,000	200,000	-	-	960,000
9	36,000,000	-	-	100,000	-	-	-	100,000
10	-	600,000	60,000	100,000	200,000	6,600,000	1,500,000	45,060,000
11	-	-	-	100,000	-	-	-	100,000
12	-	600,000	60,000	100,000	200,000	-	-	960,000
13	-	-	-	100,000	-	-	-	100,000
14	-	600,000	60,000	100,000	200,000	-	-	960,000
15	-	-	-	100,000	-	6,600,000	-	6,700,000

Primary data: processed (2023)

When viewed from Table 3, it is known that year 10 has the highest total replacement cost because, in that year, there was a replacement of the hydroponic installation, which necessitated the highest cost that year.

Apart from equipment investment, operational costs are also taken into account in the production process. Operational costs are dynamic costs that fluctuate after the production period. The expenses include procuring planting media, seeds, A&B mix nutrients, packaging, fuel, and electricity. The operational costs of the hydroponic lettuce monoculture greenhouse are presented in Table 4.

Tabel 4. Biaya Operasional Usaha Sayur Selada Hijau Hidroponik.

Year	Total Cost (IDR)
0	13,500,000
1	20,250,000
2	20,250,000
3	20,250,000
4	20,250,000
5	20,250,000
6	20,250,000
7	20,250,000
8	20,250,000
9	20,250,000
10	20,250,000
11	20,250,000
12	20,250,000
13	20,250,000
14	20,250,000
15	20,250,000

Primary data: processed (2023)

According to Table 4, the operational costs of the green lettuce vegetable business are fixed every year. There is a difference between the amount of operational costs in year 0 and year 1. One of the reasons for this disparity is that in year 0, the production period can only be conducted four times with a two-month production period. In contrast, the following year has a six-time production period. The first year serves for greenhouse construction, hydroponic installation, and farming preparation.

The greenhouse hydroponic green lettuce vegetable business is anticipated to cultivate 1,600 planting holes per week. The weekly harvest is assumed to be 80 kg, and the selling price per kilogram of green lettuce is IDR 20,000. The annual revenue of the hydroponic green lettuce business is displayed in Table 5 below.

Table 5. Revenue of Hydroponic Green Lettuce Vegetable Business.

Year	Yield per harvest (Kg)	Harvest frequency in one year	Price (IDR)	Revenue (IDR)
0	80	32	20,000	51,200,000
1	80	48	20,000	76,800,000
2	80	48	20,000	76,800,000
3	80	48	20,000	76,800,000
4	80	48	20,000	76,800,000
5	80	48	20,000	76,800,000
6	80	48	20,000	76,800,000
7	80	48	20,000	76,800,000
8	80	48	20,000	76,800,000
9	80	48	20,000	76,800,000
10	80	48	20,000	76,800,000
11	80	48	20,000	76,800,000
12	80	48	20,000	76,800,000
13	80	48	20,000	76,800,000
14	80	48	20,000	76,800,000
15	80	48	20,000	76,800,000

Primary data: processed (2023)

According to Table 5, the first year of operation has begun to produce, but the yield obtained is not optimal. It is because the planting period is only done four times, so the harvest frequency in the first year is only done 32 times compared to the following year, which has a harvest frequency of 48 times.

The feasibility of a hydroponic green lettuce vegetable business is analyzed using financial analysis with the investment criteria used, namely NPV, Net B/C Ratio, and IRR. The interest rate used is the Bank Rakyat Indonesia (BRI) deposit rate of 3%. The results of the financial feasibility analysis of the hydroponic green lettuce vegetable business are provided in Table 6 below.

Table 6. Financial Feasibility Analysis of Greenhouse Hydroponic Green Lettuce Vegetable Business

Approach	Numbers	Conclusion
NPV	IDR 81,180,303	Feasible
Net B/C Ratio	1.32	Feasible
IRR	55%	Feasible

Primary data: processed (2023)

Table 6 shows the NPV value of IDR 81,180,303, where the hydroponic lettuce vegetable business is deemed feasible because NPV > 0. The Net B/C Ratio is deemed feasible when the B/C value > 0; it can be seen that the green lettuce vegetable business is deemed feasible with a value of 1.32. As for the green IRR value, it is deemed feasible when the IRR percentage value is greater than the value of the applicable deposit interest rate. Thus, the hydroponic green lettuce vegetable business is deemed feasible with a value of 55%.

Several previous studies have shown that the monoculture planting pattern of hydroponic green lettuce is profitable due to its high economic value (Raharja *et al.,* 2023). According to Kusmaria *et al.* (2021) in their study about the feasibility of hydroponic green lettuce polyculture, the NPV value is IDR 648,421,649.95, the IRR is 34%, and the Net B/C value is 1.27, making the business feasible. Meanwhile, according to the research of Khoiris and Thoriq (2022), the NPV was IDR 31,361,433, the Net B/C was 1.85, and the IRR was 16%. In the study by De Carvalho *et al.,* (2015) the greenhouse investment is relatively large, resulting in a negative NPV of $ -76,893.29 in the first year, indicating that operational costs must be reduced to attain stable profits.

Several previous studies indicated that the hydroponic green lettuce monoculture vegetable business was feasible. However, a study conducted in Brazil found that at the initial age of the business, the NPV value was relatively negative, indicating that the business was not feasible. However, the findings of this study's financial analysis can serve as a guide for developing a hydroponic greenhouse business with one commodity, namely green lettuce.

Financial Feasibility of Greenhouse Hydroponic Polyculture Vegetable Business

This study also examined the financial feasibility of a hydroponic vegetable business with a polyculture planting pattern besides the monoculture one. The exact investment cost is utilized using the average investment cost of farmer respondents in Greater Malang and assuming a greenhouse dimension of 220 square meters. Each respondent's investment costs using the polyculture planting pattern system are detailed in Table 7.

Table 7. Greenhouse Investment Costs with Polyculture Cropping Patterns

Resp No.	Business Location	Greenhouse size (m²)	Number of Planting Holes	Greenhouse Investment Cost (IDR)
3	Batu City	90 m²	800	65,000,000
4	Batu City	220 m²	1,600	155,000,000

5	Malang Regency	300 m²	1,000	60,000,000
6	Malang Regency	70 m²	850	58,000,000
7	Malang Regency	220 m²	1,600	80,000,000
8	Malang Regency	220 m²	1,600	75,000,000
Average Investment Costs				**82,166,667**
Average Investment/Average Size = Investment Cost per m²				**440,175**
Projected to 220 m²				**96,839,286**

Primary data: processed (2023)

Based on the data in Table 7, it is apparent that the greenhouse area of each respondent varies. Therefore, an approach is taken to determine the greenhouse investment cost per square meter by dividing the average value of the overall investment cost of respondents by the average area of respondents, i.e., IDR 82,166,667 divided by 187 m², and then calculating the investment result per m². The projected greenhouse investment value is IDR 96,839,286 based on the greenhouse farming area of 220 square meters.

Besides the greenhouse investment, there are also other initial investment costs, which are presented in Table 8 below.

Table 8: Initial Investment in Greenhouse Hydroponic Vegetable Business with Polyculture Planting Pattern

No	Remarks	Estimated Economic Life (Years)	Total	Unit Price (IDR)	Total Cost (IDR)
1	*Greenhouse*	15	1 unit	96,839,286	96,839,286
2	Hydrophonic Installation	10	6 pieces	2,500,000	15,000,000
3	Water Pump	2	6 pieces	100,000	600,000
4	Measuring Cup	2	3 pieces	20,000	60,000
5	Knife	1	5 pieces	15,000	75,000
6	Box tub	2	10 pieces	20,000	200,000
Total cost of initial investment					**139,460,000**

Primary data: processed (2023)

Table 8 shows that the greenhouse investment cost is the most expensive and has the longest estimated economic life. Hence, the estimated business life used in this study is 15 years, but there are some components of the greenhouse that need to be replaced every few years. Table 9 displays the replacement cost.

Table 9. Annual Replacement Cost of Greenhouse Hydroponic Vegetable Business with Polyculture Planting Pattern

Year	Remarks							Total Cost (IDR)
	Hydrophonic Installation	Water Pump	Measuring Cup	Knife	Box tub	UV Plastic	Insect Net	
1	-	-	-	75,000	-	-	-	75,000
2	-	600,000	60,000	75,000	200,000	-	-	935,000
3	-	-	-	75,000	-	-	-	75,000
4	-	600,000	60,000	75,000	200,000	-	-	935,000
5	-	-	-	75,000	-	6,600,000	-	6,700,000
6	-	600,000	60,000	75,000	200,000	-	-	935,000
7	-	-	-	75,000	-	-	-	75,000
8	-	600,000	60,000	75,000	200,000	-	-	935,000
9	15,000,000	-	-	75,000	-	-	-	75,000
10	-	600,000	60,000	75,000	200,000	6,600,000	1,500,000	24,035,000
11	-	-	-	75,000	-	-	-	75,000
12	-	600,000	60,000	75,000	200,000	-	-	935,000
13	-	-	,-	75,000	-	-	-	75,000
14	-	600,000	60.000	75,000	200,000	-	-	935,000
15	-	-	-	75,000	-	6,600,000	-	6,675,000

Primary data: processed (2023)

When viewing Table 9, it is obvious that year 10 has the highest total replacement cost because, in that year, the hydroponic installation was replaced, which required the highest cost. In addition, there was a replacement for UV plastic that year.

Green lettuce, romaine lettuce, red lettuce, water spinach, bok choy, kale, caisim, and gai lan are the eight most common hydroponic vegetable crops cultivated by farmers in Greater Malang who employ polyculture planting patterns. This research, therefore, implies that a hydroponic vegetable business has these eight commodities. The operational costs of a hydroponic greenhouse vegetable business with a polyculture planting pattern are presented in Table 10 below.

Table 10: Operational Costs of Greenhouse Hydroponic Vegetable Business with Polyculture Planting Pattern

Year	Total Cost (IDR)
0	10,630,000
1	15,945,000
2	15,945,000
3	15,945,000
4	15,945,000
5	15,945,000
6	15,945,000
7	15,945,000
8	15,945,000
9	15,945,000
10	15,945,000
11	15,945,000
12	15,945,000
13	15,945,000
14	15,945,000
15	15,945,000

Primary data: processed (2023)

It is known that the amount of operational costs in year 0 differs from the following year. Because in year zero, or the first year, the production period can only be repeated four times due to the ongoing farming preparations. Besides, the farmers are also looking for the appropriate target market.

This hydroponic greenhouse vegetable business is assumed to have 1600 planting holes and weekly harvesting. The quantity of the weekly harvest is assumed to be 65 kilograms. The annual revenue of the hydroponic green lettuce business is depicted in Table 11 below.

Table 11: Revenue of Greenhouse Hydroponic Vegetables with Polyculture Planting Pattern

Commodity	Yield per harvest (Kg)	Price (IDR)
Green lettuce	10	19,000
Romaine lettuce	5	30,000
Red lettuce	10	25,000
Water spinach	10	12,500
Kale	5	30,000
Bak choy	10	16,000
Caisim	10	15,000
Gai lan	5	20,000
Total revenue in the first year (IDR)		**40,800,000**
Total revenue of the following year (IDR)		**61,200,000**

Primary data: processed (2023)

Table 11 displays the first year's revenue, which is different from the following year's because the planting period is only carried out four times. Hence, the harvest frequency in the first year is only 32 times, whereas the harvest frequency in the following year is 48 times.

This study employs financial analysis to determine the feasibility of a hydroponic vegetable business based on the investment criteria of NPV, Net B/C Ratio, and IRR. The interest rate in this study is 3%, where the type is Bank Rakyat Indonesia (BRI) deposits. The following are the results of the hydroponic vegetable business's financial feasibility analysis with polyculture planting patterns.

Table 12: Financial Feasibility Analysis of Greenhouse Hydroponic Vegetable Business with Polyculture Planting Pattern

Approach	Numbers	Conclusion
NPV	IDR 78,294,406	Feasible
Net B/C Ratio	1.38	Feasible
IRR	55%	Feasible

Primary data: processed (2023)

Table 12 shows that the NPV value is IDR 78,294,406, in which the hydroponic vegetable business with polyculture planting patterns is declared feasible because the NPV is greater than 0. The Net B/C Ratio is declared feasible when the B/C value is > 1 and the Net B/C Ratio value of the business is 1.38. Therefore, it can be stated that the hydroponic vegetable business is feasible. Meanwhile, the IRR value is 55%;

a business is deemed feasible when the IRR percentage value is greater than the prevailing deposit interest rate. Thus, the hydroponic green lettuce vegetable business is deemed feasible.

A polyculture planting pattern with a variety of vegetable crops has the advantage that when the price of one commodity declines, other commodities can be an opportunity to increase revenue. In addition, previous feasibility analyses, such as the one conducted by Souza *et al.,* (2019) on a hydroponic vegetable business in Brazil, revealed the NPV value to be $177,845.74, the IRR to be 30.45%, and the Net B/C Ratio to be 2.13, thereby declaring the business feasible. Meanwhile, Akiang *et al.,* (2020) reported that the NPV was $9,706,160, the Net B/C Ratio was 1.3, and the IRR was 25%, declaring the business feasible. According to Kusmiati *et al.,* (2022) the NPV for a five-year period is positive, totaling IDR 77,886,534.77, with a Net B / C Ratio greater than 1; the IRR is greater than the interest rate (7%), totaling 36.41%.

This study has similarities in the research results with previous studies, which concluded that the hydroponic vegetable business with polyculture planting patterns is feasible. In addition, the same investment criteria are also utilized, namely NPV, Net B/C Ratio, and IRR. The study yielded the financial data necessary to run a hydroponic greenhouse vegetable business.

CONCLUSIONS

This study concludes that the hydroponic vegetable greenhouse with a monoculture planting pattern of green lettuce is feasible to run, with NPV results of IDR 81,180,303, a Net B/C Ratio of 1.32, and an IRR greater than the prevailing interest rate of 55%.

The hydroponic greenhouse vegetable business with polyculture planting patterns growing eight commodities (green lettuce, romaine lettuce, red lettuce, kale, bok choy, kale, caisim, and gai lan) is deemed feasible to run with the results of NPV analysis of IDR 78,294,406, a Net B/C Ratio of 1.38, and an IRR of 55%.

As a comparison of operating a hydroponic vegetable business, the conclusion of the results of the two objectives of this study demonstrates the advantages, which are to analyze in greater depth to determine and assume the financial calculation of the two planting patterns. However, further studies must be conducted to examine the business's feasibility after it is run.

SUGGESTIONS AND RECOMMENDATIONS

The recommendations in this study are directed at farmers who will develop a greenhouse-based hydroponic vegetable business, as the study shows that the hydroponic vegetable business is feasible and profitable. Thus, the findings of this study can serve as a guide to be implemented but then modified to account for local business conditions. Furthermore, further research should be carried out notably related to the feasibility of the hydroponic vegetable business when the business has been realized.

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The successful completion of this research endeavor is anticipated to yield the desired outcomes of this program, specifically in the form of an article published in a reputable journal. The estimated duration for the implementation of this research is projected to be six months.

AUTHOR CONTRIBUTIONS

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