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Analysis of Shallot Farming Business in Pringsewu Regency

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ABSTRACT

Shallot farming in Pringsewu Regency, Indonesia, is a profitable business with an average income of IDR 298 million per hectare. However, the productivity is still low, at 15 tons/ha compared to the potential of 20 tons/ha. This research analyzes the cost structure, production, income, and income of shallot farming in Pringsewu Regency. The research results show that the total cost is IDR 115 million per hectare, while the average income is IDR 182 million per hectare. The feasibility analysis shows that shallot farming is profitable with an R/C ratio of 2.6 and a B/C ratio of 1. To improve the performance of shallot cultivation in Pringsewu and Pagelaran Districts, important suggestions involve providing proactive mentoring and advice from the Food Crops Agriculture Service, facilitated by PPL officers. Furthermore, farmers should explore the adoption of advanced shallot farming techniques to increase income. Additionally, it is recommended to extend the duration of shallot cultivation, supported by favorable returns on investment, as indicated by Internal Rate of Return (IRR) values of 97% and 93% for two planting periods in Pagelaran District, exceeding the bank interest rate of 12%. In summary, increasing productivity can further increase the profitability of shallot farming in Pringsewu Regency.

Keywords: Income; Livestock; Pringsewu; Productivity; Shallot Farming

INTRODUCTION

Research Background

Shallots play a crucial role in Indonesia as both a culinary spice and traditional medicinal ingredient, contributing significantly to income, employment, and regional economic development. The country's emphasis on stability in chili and shallot production is evident in the 2015-2019 Mid-Term Development Plan, fostering positive values in horticultural commodities. Indonesia's position as a leading shallot exporter enhances its global development prospects. From 2002 to 2018, there has been a consistent increase in shallot consumption, reaching 27.64 kg/capita/year in 2018. Continuous enhancement of shallot production contributes to increased exports, with an effort to focus on supporting productivity and reducing dependency on imports. Despite being seasonal, shallots necessitate imports to maintain availability and price stability. The inelastic demand for shallots, resilient to price fluctuations, creates opportunities for agribusiness to increase household farmer income. The development of shallot farming in Indonesia, with a reported growth of 1.54% per year in harvest size from 2018-2019, signifies its importance in the agricultural landscape.

Table 1. Harvest area and shallot production in Lampung Province 2016-2019

Year	Harvest Area	Production	Productivity (Tons/ha)
2016	290	2.574	8.87
2017	361	2.821	7.81
2018	471	3.609	7.66
2019	465	3.628	7.80

Source: Badan Pusat Statistik, 2019

Table 1 depicts a positive trend in shallot production in Lampung from 2016 to 2019, with an average annual increase of 12.68%. However, the growth in 2019 was smaller, at 0.52%, and the harvested area experienced a decline of 1.27% due to pest attacks and extreme weather conditions. Challenges such as high input costs, pests, diseases, inadequate storage facilities, and limited access to superior seeds can impact productivity, leading to fluctuating growth rates. Despite these challenges, sustainable shallot farming in Lampung, identified as a horticultural development area, particularly in Pringsewu Regency, remains promising.

Table 2. Development of harvested area, production and productivity of shallots in the Regency Pringsewu 2016-2019

Year	Harvest Area (Hectare)	Production (Tons)	Productivity (Tons/ ha)
2016	14	24.0	1.71
2017	30	65.7	2.19
2018	22	99.7	4.53
2019	10	80.0	8.00

Source: BPS, 2020

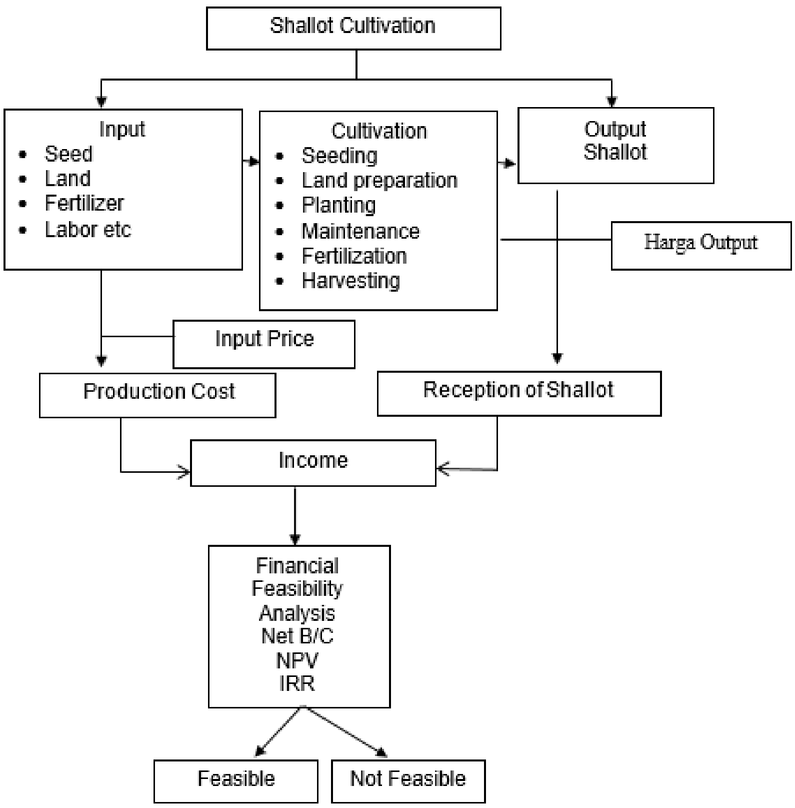
Shallot production in Pringsewu Regency exhibited a positive trend from 2016 to 2018, marked by a notable acceleration in 2017. However, a significant decline of 19.70% occurred in 2019, attributed to climate challenges and pest attacks. Seasonal fluctuations and the impact of the Covid-19 pandemic on commodity inflation were evident, influencing shallot prices and subsequently farmers' income. Challenges include low national productivity, averaging 9.24 tons/ha, with Pringsewu Regency's productivity below the national level due to slow development and small-scale cultivation. Farmers face variations in shallot quality, affecting prices and income, leading to diversified income sources. Despite obstacles, the ongoing development highlights promising prospects for shallot farming in Pringsewu Regency, emphasizing the need for comprehensive analysis to understand the dynamics of this agricultural enterprise.

Research Objective
This research aims to analyze the cost, production, receipts, and income structure of shallot farming in Pringsewu Regency. Additionally, it seeks to evaluate the financial feasibility of developing shallot farming in the same region.

Research Significance
This research holds significance as a valuable reference for policy-making agencies, particularly in shaping policies related to shallot cultivation. It contributes to the enhancement of knowledge among shallot farmers in Pringsewu Regency, serving as a guide for the development of shallot cultivation practices.

Research Framework
The significance of successful shallot farming in Pringsewu Regency, Lampung Province, is highlighted amid challenges like a notable decline in production attributed to climate and pest-related issues. With Indonesia's shallot productivity averaging 9.24 tons/ha, falling below the potential of over 20 tons/ha, Pringsewu faces lower productivity than the national level. Factors contributing to this gap include small-scale cultivation, slow development, and diverse production factors among farmers affecting shallot quality and income. Despite challenges, the ongoing shallot farming development in Pringsewu Regency shows promising prospects, encouraging further pursuit and emphasizing the need for in-depth analysis to understand dynamics and assess the suitability of shallot farming as a primary household business for financial benefits, aiding farmers in the decision-making.

Figure 1. Diagram of farming analysis and financial feasibility of shallots in Pringsewu Regency



LITERATURE REVIEW

Shallot Cultivation

Shallots (Allium ascalonicum L) are a versatile horticultural commodity with various uses, from cooking spice to medicinal applications. Beyond flavoring dishes, shallots are known for health benefits, contributing to cholesterol and blood sugar management. The seasonal nature of shallot farming makes it a substantial source of income and employment, playing a vital role in regional economic development in Indonesia. Key shallot-producing provinces include Central Java, East Java, West Java, West Nusa Tenggara, South Sulawesi, and North Sulawesi. The cultivation process follows a seasonal pattern, primarily during the dry season, with specific temperature and soil requirements. Seasonal variations impact production, contributing to price fluctuations and occasional shortages. Shallots are primarily propagated using tubers as seeds, with seed quality influencing yields. Despite challenges, shallot farming remains strategically important, fulfilling market demand and contributing significantly to the country's economy. Efforts to meet domestic demand involve enhancing production in major areas and exploring potential cultivation in metropolitan cities like Jakarta. Proper soil processing, fertilization, and pest control are essential aspects of successful shallot cultivation, presenting economic opportunities for farmers in Indonesia.

Location Selection

Location selection is crucial to ensure optimal shallot production by choosing land that meets the specific requirements for cultivation. This process aims to prevent failures during production and secure a suitable environment for growing shallots. Several things to do before the implementation include as follows. First, shallots are suitable for cultivation in the lowlands and highlands (0 -1000 m above sea level) but will grow optimally at an altitude of 0-450 m above sea level. Second, shallot farming can be done in paddy fields or dry land. However, it is best done on dry land. Third, the soil pH needed for shallot to grow optimally is 5.6 to 6.5. If the soil pH is less than 5.5 then dolomite application of approximately 1.5 tonnes/ha is required. Fourth, shallot requires maximum light intensity, 70% required, and are not protected by plants around them. Fifth, the optimal air temperature required is 25 - 320C. Sixth, shallot requires soil with a crumbly, medium to clay structure, good aeration and containing sufficient organic material. Seventh, the suitable type of soil is alluvial soil or a combination with Glei humus or latosol soil.

Determining Planting Time

Planting time determination is crucial for successful shallot cultivation, aiming for optimal growth and harvest. Ideal planting times are during the dry season when water availability is sufficient, typically in April/May and July/August. Dry season planting is preferred on former rice fields, while moorlands are chosen during the rainy season. Accurate planting time estimation requires at least 5 years of rainfall data at the location and information on agreed planting patterns. Additionally, consideration of shallot variety based on the planting time is essential.

Seed Setup

Shallots come in various types like Bima Brebes, Bima Curut, Maja, Kramat 1, Kramat 2, Kuning, Pikatan, Pancasona, Trisula, Katumi, Maja, and Mentes, among others. Commonly planted varieties in Jakarta include Bima, Pikatan, Trisulla, Mentes, and Kramat, with the versatile Bima being a popular choice. Shallots can be propagated through tubers or seeds, with tuber multiplication being more popular due to its ease, faster growth, and quicker harvest. For each hectare, 800 to 1500 kg of shallot tubers are needed. Quality seed varieties are essential for uniformity and healthy growth. The process involves selecting qualified seeds, choosing medium-sized or large tubers, cleaning, and cutting the tip. Although True Shallot Seed (TSS) is an alternative, tubers remain the primary method. TSS offers benefits like reduced seed requirements and freedom from diseases, but seed costs contribute around 40% to the total production costs.

Land Bribery
Land clearing is essential to create a disturbance-free environment for plant growth. This involves removing rocks, weeds, and plant residues, ensuring the soil is ready for processing. Dry land cleaning utilizes methods like hoeing, plowing, and rock removal. After clearing, the soil is processed until it's loose, and beds are made longitudinally, providing an ideal planting environment. Bed creation involves a width of 1-1.2 m and a bund height of 25 cm, with length adjusted based on land conditions. The process continues with organic fertilizer application, and land cultivation can be done manually or with tractors.

Making Artificial Planting Holes with Plant Spacing
Planting holes are created with precise spacing by using marked ropes and appropriate tools like *blak* and scoop. After adequate watering, rows are formed, and holes are made using a scoop, reaching a depth of ¾ of the seed tuber. The recommended plant spacing is 15-20 cm between rows for medium-sized seeds and 20-25 cm for large seeds. Within rows, maintain a spacing of 10 cm for medium seeds and 15 cm for large seeds.

Planting
Planting involves immersing shallot tubers into prepared planting holes. Each hole is 1 cm deep, and the recommended spacing between tubers is either 20 x 20 cm or 20 x 15 cm. In each planting hole, one shallot tuber is planted by immersing ¾ of the tuber into the hole. Before planting, the tip of the shallot tuber is cut to break dormancy, promote synchronized growth, check for signs of rot or mold, and prevent undesirable growth. For large-scale planting, after cutting the tip, applying the fungicide Mancozep is recommended to prevent disease. Planting is ideally done during the dry season, with attention to ensuring sufficient irrigation.

Fertilization
Fertilization for shallots involves three stages: basic fertilizer, supplementary fertilizer 1, and supplementary fertilizer 2. Basic fertilizer, comprising organic fertilizer (15-20 t/ha cow manure, 5-6 tons/ha chicken manure) and TSP (120-200 kg/ha), is applied 1 to 2 days before planting. The mixture is evenly spread and incorporated into the soil. The first follow-up fertilization occurs at 10-15 days after planting, providing Urea (100-150 kg/ha), KCl (50-100 kg/ha), and ZA (200-250 kg/ha). The second follow-up, performed at 20-25 days after planting, involves the same fertilizers. Both supplementary fertilizations are evenly spread and mixed into the soil, with the second application occurring 3 days after drying.

Irrigation
Irrigation is crucial for shallot growth, impacting harvest success. The frequency and timing of irrigation depend on climate, soil moisture, growth rate, and root characteristics. For the initial 3 weeks after planting, consistent morning and evening watering is essential. Adequate watering, especially during tuber formation, is critical to prevent reduced tuber production. Watering continues twice daily until one week before harvest, adjusting the method based on soil type. Sandy soil receives flooding for 15 minutes, while clay soil is watered through sprinkling.

Plant Maintenance
Stitching, replacing damaged or non-growing seeds, is typically done 7-10 days after planting. Weeding involves unplugging and clearing weeds to maintain a clean and optimal growth environment. Weeding is crucial around the 25th day after planting to eliminate remaining grass. Refilling is performed to repair ground structure, cover exposed shallot roots, and promote upright and sturdy plant growth. Hilling, achieved by raising and piling soil around plants, improves bed elevation.

Harvest
The harvest time for shallots varies based on the variety. For the Bima variety, harvesting for consumption is typically done at 60 days, while for seed tubers, it occurs between 70 to 90 days after planting. Signs of readiness for harvest include limp base leaves, 70-80% yellowing and shedding leaves, visible tubers, and dark red/purplish color. Harvesting is best during sunny weather by carefully uprooting and bundling 10-15 plants, tied at 1/3 of the leaf tip. Attention must be given to prevent tuber injuries and soil contamination, and watering 1-2 days before harvest helps avoid tuber damage.

Drying
The purpose of the drying process is to reduce the water content of shallot tubers to inhibit microorganism development and enzymatic activity. Similar to withering, the drying process lasts 7-14 days, involving hanging the shallots and turning them over every 2 days, depending on weather conditions. Arranging rows with leaves on top, the tubers are reversed every 2-3 days. Drying concludes when tubers achieve a weight loss of 25-40% and a water content of 80-84%.

Processing the Harvest for Seeds
Processing harvested shallot tubers for seeds involves drying them under direct sunlight for 7-14 days until the water content decreases to 80-84%, and the tuber weight reduces by 25-40%. After drying, store the shallots by tying them and hanging on shelves in a room with a temperature of 30-33°C and a relative humidity of 65-70%. After 2-3 months of storage, the shallot tubers can be utilized as source seeds until they are ready for distribution.

Farming Concept
Farming is the study of efficiently allocating resources to maximize profits at a specific time. Effective resource allocation ensures optimal use of farming resources. Farming management styles are divided into two categories: subsistence farming, aimed at meeting family needs with or without monetary circulation, and commercial farming, a business-driven approach focused on maximizing profits. Family farming often involves basic processing, while commercial farming is managed efficiently and professionally. Commercialization in farming is reflected in decision-making orientations, such as problem orientation, needs orientation, and rational or irrational approaches (Soekartawi, 2019; Hernanto, 1991).

Farming Income Theory
Farming income encompasses gross and net income, as outlined by Gustiyana (2019) and Soekartawi (2019). Gross income represents the total revenue generated from farming products over a specific period, considering various uses. On the other hand, net income is the profit derived by subtracting farming expenses, including production costs and labor, from the gross income. The factors influencing farming income, as highlighted by Hernanto (1991), include business area, production level, choice and combination, planting company intensity, and labor efficiency. These factors collectively impact the income derived from farming activities.

The data analysis method is described below. According to Sudarman (2019), total costs use the following equation:
TC = TFC + TVC ………………………………………………………………. (1)

Note: TC = Total Cost (Total Cost);
TFC = Total Fixed Costs (Total Fixed Costs);
TVC = Total Cost Variable (Total Variable Costs).

To count big reception determined with use formula as following:
TR = Pq . Q .... (2)

Notes: TR = Total Revenue;
Pq = Product Price (Rp kg-1);
Q = Amount Production (kg).

Andriyanto (2017) defines farmers' income as the total revenue from production minus the costs incurred in both the production and marketing of the produce. Another definition by Soekartawi (2019) states that income is the product of the production received by farmers multiplied by the selling price. Mathematically, farming income can be written as follows:
I = TR – TC ……………………………………………….... (3)

Note: I = Income (Rp)
TR = Number of recipients of shallot farming (Rp)
TC = Total cost shallot farming (Rp)

Financial Feasibility Analysis
The financial component involves creating a budget forecast to predict future annual gross revenues and expenses (Lainawa et al., 2022). This projection helps assess the financial feasibility of the endeavor by estimating income and costs over time. Pasaribu (2019) suggests that project value can be measured as a benchmark for assessing financial feasibility. The assessment of financial feasibility is highly beneficial in making decisions regarding the development of livestock businesses, particularly for commercial objectives (Kalangi et al., 2022). It serves as a foundation for investors to make more impartial investment choices aimed at ensuring the sustainability of shallot farming (Handayani et al., 2021).

The method proposed involves financial feasibility analysis using various investment criteria, which serve as tools to determine whether the project should proceed or not. Regarding the criteria is as following:

Net Benefit Cost Ratio (Net B/C)
Comparison between the number of positive NPVs with the negative NPV. It shows that the magnitude of the benefit is how much it costs and investment to obtain the benefit. Net B/C ratio calculation according to Kadariah (2019):

$$NetB/C = \frac{\sum_{t=0}^{n} Bt - Ct / (1+i)^t}{\sum_{t=0}^{n} Ct - Bt / (1+i)^t}$$

Note:
Bt = Benefit in year i
Ct = Cost in year i

n = Project age (8 years)
t = Year 1, 2, 3 etc
i = Discount rate (10.75%)

The feasibility of the Net Cost Benefit Ratio (Net B/C) Indicator is:
1. If the Net Cost Benefit Ratio (Net B/C) is more than 1, then the project is worth held
2. If the Net Cost Benefit Ratio (Net B/C) is less than 1, then the project is not worth held.

Gross Benefit Cost Ratio (B/C Gross)

Cost benefit analysis is the ratio between the positive and negative net benefit. The application of B/C ratio analysis is needed to chech the extent of the comparison between the value of benefits and costs.

B/C Ratio Equation that is
Gross B/C = ∑ Bt /(1+ i)t
∑Ct/(1+ i)t

Notes:
Bt = Benefit in year i
Ct = Cost in year i
i = Interest rate (10.75%)
t = Year 1, 2, 3 etc.

The feasibility of the Gross Benefit Cost Ratio (B/C Gross) Indicator is:
1. If the Gross Benefit Cost Ratio (B/C Gross) is more than 1, then the project is feasible.
2. If the Gross Benefit Cost Ratio (B/C Gross) is less than 1, then project is not feasible.

Net Present Value (NPV)

$$NPV = \sum_{T=1} \frac{Bi - Ci}{(1 + i)^{i}}$$

Net Present Value (NPV) or net cash value, is a method to calculating difference between benefit or reception with cost or expenditure. The Calculation is measured with current value of money with criteria evaluation as following:
1) NPV > 0, then the investment is worth (feasible)
2) NPV < 0, then investment said is not worth (no feasible)
3) NPV = 0, then investment is in the Break Event Points position
(Ibrahim, 2019)

Internal Rate of Return (IRR)

$$IRR = \frac{NPV}{NPV1 - NPV2} \, x \, i_1 + (i_2 + \, i_1$$

Internal Rate of Return (IRR) is an interest level that shows the net present value (NPV) is the same with the whole amount of investment project or in other words level interest yields is the same NPV with zero. (Ibrahim, 2019)

The assessment criteria as following:
1) IRR > i, then investment stated feasible (feasible)
2) IRR < i, then investment stated not feasible (not feasible)
3) IRR = i, then investment is in the Break Event Point position

Review of Previous Research
Much research has been conducted on shallot farming, serving as valuable references for the current study. These studies focus on shallots as the commodity of interest. The distinction lies in the specific measurement employed in the upcoming research, where the contribution of shallot income to farmers' household income will be utilized to gauge the future prospects of shallot farming. Further details on previous research can be found in Table 3.

No	Title	Objective	Analysis Method	Results
1	Analisis Usaha Tani Bawang Merah Dalam Aspek Teknis, Finansial Dan Sosial Ekonomi Di Kecamatan Kota Gajah, Lampung Tengah (Fajarika et al., 2019)	Finding the benefits and feasibility in technical, financial and socio-economic aspects of shallot farming	Method of analyzing investment criteria for NPV, IRR, income and cost ratios.	Shows that the research area has the climate, soil type, availability and skills of farmers that meet shallot farming. The financial analysis shows that the business is feasible because the income and cost ratio is 1.8, with Rp. 16,343,200,177.00 NPV value and IRR 15.19% in the second period above the discount rate. In the socio-economic aspect, it shows that shallots are able to increase farmers' income by 4 times compared to rice farming and it creates cooperative relationships with various parties, both government, private and farmers outside the Kota Gajah sub-district.
2	Analisa Kelayakan Usaha Budidaya Bawang Merah Ramah Lingkungan Di Kabupaten Tegal (Mardiyanto *et al.,* 2017)	Find out and explain production costs Recognize and explain agricultural business acceptance Find out and explain the feasibility of environmentally friendly shallot farming	Income and B/C Ratio Analysis	The production costs of the recommended technology are 15.88% higher than the farmer's method; Farming acceptance of recommended technology is 67.51% higher than the farmer's method; Recommended farming is feasible to be implemented in environmentally friendly shallot cultivation, by showing the R/C and B/C ratios of the recommended technology are greater than the farmer's method, 2.99 > 2.40 and 1.99 > 1.40 respectively.

RESEARCH METHOD

The research employs the survey method, focusing on a subset of the larger population involved in shallot farming. The unit of analysis comprises farmers engaged in shallot cultivation. Preparatory steps before the research involves establishing basic concepts and operational definitions, determining the research location, identifying respondents and the research timeframe, selecting data collection types and methods, and outlining the data analysis methods. Further details are elaborated below.

Location, Respondents, and Research Time

This research focused on shallot farming in Pringsewu Regency, specifically in Pagelaran and Pringsewu Districts, selected purposively due to their significance in shallot cultivation. The study aims to comprehensively analyze and evaluate the financial feasibility of shallot farming in Pringsewu District during January to February 2022. The respondents, comprising shallot farmers, were chosen through purposive sampling, a judgmental method aligned with research objectives. Given the manageable population size, a census approach was employed to include the entire population in the study, ensuring results closely reflect the actual situation (Singarimbun & Effendi, 1995), as detailed in Table 4.

Table 4. Total Shallot Farmers in the Pringsewu Regency

No.	Subdistrict	Farmer Group Name	Number of Members (person)
1.	Pringsewu	Makmur I	8
2.		MugiRahayu IV	12
3.		SukoTani	12
4.		Trubus	12
5.		Subur IX	12
6.	Pagelaran	Serbaguna	12
7.		Sukaratu III	12
Total			80

Types and Methods of Data Collection

Data used in the study are primary data and secondary data. Primary data was obtained from shallot farmers via interviews with a questionnaire (draft questions) that has been prepared to use in shallot farming strategic development analysis.

Data Analysis Method

Income Analysis

To determine the income level of shallot farming in Pringsewu Regency, this research employs income analysis. Quantitative analysis is used to determine the level of income obtained by shallot farmers using the equation:

The data analysis method is described below. According to Sudarman (2001), the total costs use the following equation:

$$TC = TFC + TVC \quad (1)$$

Notes: TC = Total Cost;
TFC = Total Fixed Costs;
TVC = Total Variable Costs.

To calculate the amount of revenue, it is determined using the following formula:

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TR = Pq. Q ………………………………………………………. (2)

Notes: TR = Total Revenue;
Pq = Product Price (Rp kg-1);
Q = Production Quantity (kg).

Mathematically, shallot farming income can be written as follows:

I = TR – TC ………………………………………………………… (3)

Notes: I= Income (Rp)
TR = Number of recipients from shallot farming (Rp)
TC = Total costs of shallot farming (Rp)

To find out whether shallot farming in Pringsewu Regency is profitable or detrimental, a R/C ratio analysis was employed. Revenue Cost Ratio analysis is a comparison (ratio) between receipients (revenue) with cost. The R/C ratio value is obtained using the formula as follows:

Notes:
R/C = Ratio between revenue and costs
PT = total receipts
BT = total cost

Decision making criteria :
A. If R/C < 1, then shallot farming is not yet profitable
B. If R/C > 1, then shallot farming is profitable.
C. If R/C = 1, then the shallot farming is at the break-even point.

Income Contribution
Quantitative analysis is employed to achieve the second objective, assessing the contribution of shallot farming income to the overall household income of farmers. The initial step involves analyzing the income of shallot farmers' households, which is calculated by summing up income from on-farm, off-farm, and non-farm sources. The formula used to determine farmers' household income is based on Rodjak (2002).
Prt = P usaha tani + P off farm + P non farm ……………………..(4)

Notes:
Prt = Farmer household income per year
P farming = Income from farming
P off farm = Income from outside the farming which remains related to the agricultural sector
P non-farm = Out of agricultural income

The calculation of the contribution of shallot farming income (KPBM) to farmer household income is as follows:

$$KPBM = \frac{\text{Shallot Income}}{\text{Household Income}} \times 100\% \quad \ldots\ldots (5)$$

Financial Analysis
For the second objective, a quantitative descriptive analysis method is employed for financial analysis. This assessment is based on various investment criteria, including

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the Gross Benefit-Cost Ratio (Gross B/C ratio) and Net Benefit-Cost Ratio (Net B/C Ratio) analyses. These criteria are as follows.

Net Benefit Cost Ratio (Net B/C)

Comparison between the number of positive NPVs and the number of negative NPVs. This shows that the benefit is counted many times the cost and investment to obtain a benefit. Mathematically, Net B/C can be formulated as follows.

$$NetB/C = \frac{\sum_{t=0}^{n} Bt - Ct/(1+i)^t}{\sum_{t=0}^{n} Ct - Bt/(1+i)^t} \quad \text{................................(6)}$$

Notes:

Bt = Benefits t year
Ct = Cost of year t
I = Discount factor (10.75%)
t = Age time project (8 years)

The feasibility of the Net Cost Benefit Ratio (Net B/C) Indicator is:
1. If the Net Cost Benefit Ratio (Net B/C) is more than 1 then project is feasible,
2. If the Net Cost Benefit Ratio (Net B/C) is less than 1 then the project is not feasible.

Net Present Value (NPV)

$$NPV = \sum_{T=1} \frac{Bi - Ci}{(1 + i)^{i}} \quad \text{8)}$$

Net Present Value (NPV) or net cash value, is a method that calculates the difference between benefits or receipts and costs or expenses. The calculation is measured by the current value of money with the following assessment criteria
1) NPV > 0, then the investment is feasible
2) NPV < 0, then the investment is not feasible
3) NPV = 0, then the investment is at the Break Event Point position
(Siagian et al., 2000).

Internal Rate of Return (IRR)

$$IRR = I_1 + \left(\frac{NPV1}{NPV1 - NPV\,2} \right) (i_2 - i_1) \text{ ....(9)}$$

Internal Rate of Return (IRR) is an interest rate that shows the net present value (NPV) is equal to the total project investment or in other words the interest rate that produces an NPV equal to zero.

The assessment criteria as following:
1) IRR > i, then investment is feasible
2) IRR < i, then investment is not feasible
3) IRR = i, then investment is in the Break Event Point position
(Siagian et al., 2000)

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RESULTS

General Condition of the Pringsewu District

Geographical Circumstance

Pringsewu Regency is comprised of nine sub-districts: Pardasuka, Ambarawa, Pagelaran, Pagelaran Utara, Pringsewu, Gading Rejo, Sukoharjo, Banyumas, and Adiluwih. Approximately 41.79% of the region is flat (0-8% slope), mainly found in Pringsewu, Ambarawa, Gadingrejo, and Sukoharjo Districts. Wavy slopes (8-15%) dominate in Adiluwih District, covering around 19.09% of the area. Steeper slopes (>25%) are distributed in Pagelaran and Pardasuka Districts, accounting for about 21.49%. The majority of the land is situated at 100–200 meters above sea level, with Pagelaran District having the highest proportion. The highest altitude class (>400 meters) represents the smallest portion, around 5.99%, concentrated in Pardasuka and Pagelaran Districts.

Topography and Climate Conditions

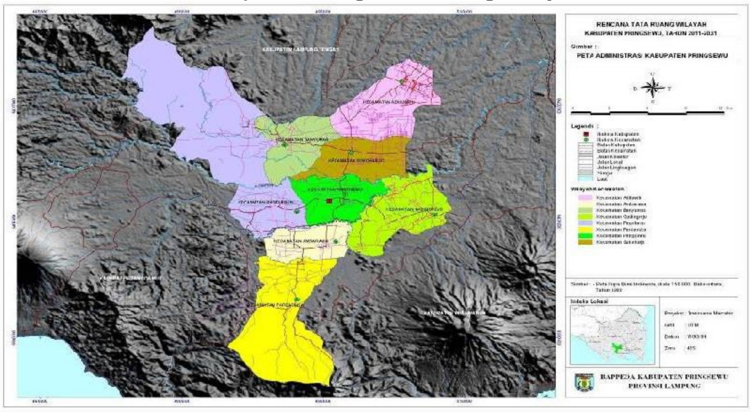
Pringsewu Regency spans 62.510 hectares, characterized by a tropical climate with an average monthly rainfall of 161.8 mm and 13.1 rainy days. Its climate makes it suitable for agricultural development. The topography includes lowlands and highlands, with approximately 40% being flat areas ranging from 800 m to 1.115 m above sea level. The region is comprised of 58% land for housing and yards, and 42% dedicated to offices, plantations, agriculture, and other facilities. The sub-districts and their respective areas are detailed in Table 5.

Table 5. Names and Areas of Districts in the Regency Pringsewu

No.	Subdistrict	Amount Village/Subdistrict	An area (Ha)	(%) In Total
1	Sukoharjo	16	7.295	11.67
2	Ambarawa	8	3.099	4.96
3	Pagelaran	24	9.474	15.16
4	Adiluwih	13	7.482	11.97
5	Pringsewu	15	5.329	8.53
6	Banyumas	11	3.985	6.37
7	Pardasuka	13	9.474	15.16
8	Gadingrejo	23	8.571	13.71
9	Pagelaran Utara	10	7.801	12.47
Total		133	62.510	100.00

Source: Recapitulation of Pringsewu Regency Family Data Collection Results, 2021

Figure 1. Administrative Area Map of Pringsewu Regency



Source: POKJA AMPL Bapeda Pringsewu Regency Lampung Province, 2021

Demographics

Pringsewu Regency is characterized by ethnic diversity, with a prominent Javanese community and indigenous Lampung groups such as Pepadun (Pubian) and Saibatin (Peminggir). The primary economic activities in Pringsewu are agriculture and trade. As of 2021, Pringsewu District has the highest population density at 1.427 people/km2, while Pardasuka District has the lowest at 340 people/km2. Further details on population density across sub-districts are provided in Table 6.

Table 6. Area, total population, number of families and population density in the Pringsewu District

No.	Subdistrict	An Area (Km²)	Total Population (people)	Total KK	Population Density 2021 (People/Km²)
1	Sukoharjo	73	51,519	13,053	142
2	Ambarawa	31	35,795	91.60	87
3	Pagelaran	95	52,706	13,488	180
4	Adiluwih	75	33,731	8,801	222
5	Pringsewu	53	82,677	21,357	64
6	Banyumas	40	22,195	5,758	180
7	Pardasuka	95	39,426	9,510	241
8	Gadingrejo	86	73,838	18,721	116
9	Pagelaran Utara	78	17,482	4,046	466

Source: Recapitulation of Pringsewu Regency Family Data Collection Results, 2021

Respondent Characteristics

The characteristics of farmer respondents in shallot farming, including age, education level, farming experience, land area, and number of family dependents, are summarized below.

Age Level

Table 7 displays the distribution of respondent farmers across different age groups. These groups are categorized into two main segments: the non-productive age group, consisting of individuals aged 0-14 years and those over 65 years, and the productive age group, encompassing individuals aged 15-64 years. This breakdown allows for an understanding of the demographics of farmers involved in the study.

Table 7. Age Level of Respondents in Pringsewu and Pagelaran Districts Pringsewu Regency

No.	Age Classification (years)	Total (respondents)	Percentage (%)
1.	30 – 39	45	56.25
2.	40 – 45	20	25.00
3.	46 – 51	10	12.50
4.	> 52	5	7.50
Total		80	100.00

Source: Research data, 2023

Respondent's Education Level

Education plays a role in corn farming development because apart from the abilities and skills of the farmers themselves, basic education, especially reading, writing and calculating, greatly influences the decisions taken by respondents in running farming and marketing and can minimize the risk of incidents that leads to losses for farmers. The percentage of respondents based on education level is provided in Table 8.

Table 8. Education level of respondents in Pringsewu and Pagelaran Districts Pringsewu Regency

No.	Level of Education	Total (respondents)	Percentage (%)
1.	No school	10	12.50
2.	elementary school	25	31.25
3.	Junior High School	30	37.50
4.	Senior High School	15	22.50
5.	S1	-	-
Total		80	100.00

Source: Research data, 2023

Farming Experience

Farmers' experience in farming is crucial for developing the necessary skills and expertise to manage their agricultural endeavors effectively. As shown in the table below, the respondents' exhibit varying degrees of experience, with some having longer periods of engagement in farming, indicating a potential enhancement in their skills and efficiency over time.

Table 9. Farming Experience of Respondents in Pringsewu and Pagelaran Districts, Pringsewu Regency

No.	Farming Experience (years)	Total (respondents)	Percentage (%)
1.	2 – 11	45	56.25
2.	12 – 21	25	31.25
3.	22 – 31	10	12.50
Total		80	100.00

Source: Research data, 2023

Land Area

Land is a crucial factor in farming, significantly impacting both corn production and farmers' income. Table 10 provides data on the number of respondents categorized by the area of shallot farming land, revealing insights into the distribution of land among the participants.

Table 10. Respondents' land area in Pringsewu and Pagelaran Districts, Pringsewu Regency

No.	Land Area (ha)	Total (respondents)	Percentage (%)
1.	0.50 – 1.00	50	62.50
3.	1.05 – 1.50	26	32.50
4.	1.55 – 2.00	4	5.00
Total		80	100.00

Source: Research data, 2023

Number of Family Dependents

Table 11 presents data on respondents categorized by the number of family dependents. Dependents refer to individuals living in the same household as the family head. The distribution shows variations, with the majority falling into the 3 - 4 family dependents category.

Table 11. Number of Family Dependents of Respondents in Pringsewu District and Pringsewu Regency Performance

No.	Dependents Family	Total (respondent)	Percentage (%)
1.	0 – 2	25	31.25
2.	3 – 4	45	56.25
3.	5 – 6	10	12.50

Total	80	100.00

Source: Research data, 2023

Analysis of Shallot Farming
To determine the income level of shallot farming in Pringsewu Regency, this research uses income analysis. Quantitative analysis is used to determine the level of income obtained by shallot farmers which is measured through:

Shallot Farming Costs
The costs of shallot farming consist of fixed costs and variable costs, the equation to find the total costs uses the following formula:
TC = TFC + TVC

Notes:
TC = Total Costs;
TFC = Total Fixed Costs;
TVC = Total Cost Variable.

Based on the equation, here are the shallot farming costs that can explained in Table 12.

Table 12. Costs shallot farming in the District Pringsewu Regency Pringsewu

No.	Cost Type	Average needs (Rp/Kg/Lt/HSP)	Average Rp	Average/ha
1	Fixed cost			
	Land lease	669,642.86	669,642.86	2,092,633,937
	Land tax	100,142.86	100,142.86	312,946,437
	Tool depreciation	1,052,881.00	1,052,881.00	-
	Labor	245.8	6,697,857.10	20,930,803,437
	Total fixed costs		8,520,523.82	23,336,383.81
2	Variable costs			
	Seed	331.3	12,158,036	37,993,862.5
	Dolomite/captan	53.6	14,464	45,200
	Manure	318.7	1,042,411	3,257,534,375
	NPK	275.5	1,642,580	5,133,062.50
	Pesticide	0.2	74,817	233.803.125
	Fungicide	4.7	285,357	891.740.625
	Herbicide	3,2	202,321	632.253.125
	Total variable costs		15,419,986	48,187,456
	Total farming costs		23,940,510	71,523,840

Source: Research data, 2023

Table 13. Shallot farming costs in the Pagelaran District Pringsewu Regency

No.	Cost Type	Average needs (Rp/Kg/Lt/HSP)	Average Rp	Average/ha
1	Fixed cost			
	a. Land lease	125,000	125,000	625,000
	b. Land tax	107,375	107,375	536,875
	c. Tool depreciation	602,799	602,799	-
	d. Labor	39	3,248,690	16,243,452
	Total fixed costs		4,640,278	18,687,395
2	Variable costs			
	a. Seed	135	5,485,417	27,427,085

	b. Dolomite/captan	153	158,292	791,460
	c. Manure	38	393,333	1,966,665
	d. NPK	126	1,341,042	6,705,210
	e. Pesticide	1	247,583	1,237,915
	f. Fungicide	1	347,083	1,735,415
	g. Herbicide	1	138,958	694,790
	Total variable costs		8,111,708	40,558,540
	Total farming costs		12,751,986	59,245,935

Source: Research data, 2023

Revenue from Shallot Farming

Table 14 displays the revenue generated from shallot farming in Pringsewu District and Pagelaran District, Pringsewu Regency. The revenue is calculated by multiplying the production quantity with the respective price levels at the research locations.

Table 14. Revenue from Shallot Farming in Pringsewu District and Pagelaran District, Pringsewu Regency

No.	Subdistrict	Average land area (Ha)	Average Production (Kg)	Conversion/ha	Average kg/ha	Average Price (Rp)	Reception (Rp)/ha
1	Pringsewu	0.32	2,898	1/0.32x2.898	9,056	24,661	223,330,016
2	Pagelaran	0.20	870	1/0.20x 870	4,349	21,048	91,537,752

Source: Research data, 2023

Shallot Farming Income

Table 15 illustrates shallot farming income, calculated as the disparity between total revenue and overall farming costs (including fixed and variable costs), for both Pringsewu District and Pagelaran District.

Table 15. Shallot farming income in Pringsewu District and Pagelaran District, Pringsewu Regency (per hectare)

No.	Description	Subdistrict	
		Pringsewu	Pagelaran
1	Revenue	223,330,016	91,537,752
2	Fixed cost	23,336,383.81	18,687,395
3	Variable costs	48,187,456	40,558,540
4	Income	148.347.175	35,188,174
5	R/C ratio	3.0	1.4
6	B/C ratio	2.0	0.6

Source: Research data, 2023

Financial Analysis

The financial analysis of shallot farming in Pringsewu District and Pagelaran District, Pringsewu Regency is presented in Table 16.

Table 16. NPV, IRR and *Net* B/C of shallot farming in Pringsewu District and Pagelaran District, Pringsewu Regency

No.	Description	Subdistrict	
		Pringsewu	Pagelaran
1	NPV	633,405,244.22	34,584,942.22
2	IR	0.97	0.93

3	B/C clean	2.8	14.7

Source: Research data, 2023

Based on the results of NPV, IRR and Net B/C calculation, it can be discussed as following:

Net Present Value (NPV)

The Net Present Value (NPV) of shallot farming in Pringsewu District amounts to IDR 633,405,244.22, and in Pagelaran District, it reaches IDR 34,584,942.22, indicating that NPV is greater than 1. This signifies the sustainability of shallot farming for the future. NPV serves as a critical method for assessing the feasibility and profitability of business ideas before the investment process begins. Businesspeople and companies engage in discussions to identify profitable ventures. NPV, a tool used in capital budgeting and investment planning, calculates the difference between the current value of cash inflows and outflows over a specific period. It provides insights into anticipated income and costs associated with projects, guiding expert managers in making informed decisions about future outcomes.

Benefits of Calculating NPV

To navigate the business landscape effectively, understanding how to calculate Net Present Value (NPV) is crucial for business individuals seeking benefits. NPV calculations offer insights into a company's potential and capabilities, aiding in strategic investment management over several years. This is particularly valuable for anticipating changes in currency values and assessing a business's performance in the face of inflation. It serves as a vital tool for predicting the future profitability or losses of an investment project, influencing decisions on whether to proceed based on emerging conditions. Furthermore, NPV acts as a key consideration for larger-scale investments, guiding decisions and contributing to the overall success and continuity of a business.

Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is a crucial metric indicating the annual profit percentage and gauging a project's ability to yield returns on the invested capital. In the analysis of shallot farming in Pringsewu District and Pagelaran District, the calculated IRR values stand at 97% and 93%. These results signify that the returns on the capital invested in shallot cultivation over the 5 periods are substantial and surpass the bank interest rate of 12%. The success is attributed to effective management practices and adherence to recommendations, leading to successful harvests and accelerated capital returns within the specified 5-year timeframe.

Benefit Cost Ratio (Net B/C)

The Net Benefit-Cost Ratio (Net B/C) serves as a metric to assess the profitability and feasibility of a project. In the case of shallot farming, the Net B/C analysis in Pringsewu District yields a ratio of 2.8 at a 12% discount factor. This implies that for every current expenditure of Rp. 1, a benefit of IDR 2.8 is obtained, indicating the sustainability of shallot farming in Pringsewu District. Similarly, the Net B/C analysis for shallot farming in Pagelaran District reveals a ratio of 14.7 at a 12% discount factor, signifying that each expenditure of Rp. 1 generates a substantial benefit of Rp. 14. Consequently, shallot farming in the Pagelaran District is deemed sustainable for the future.

DISCUSSION

This research investigates the development of shallot farming in Pringsewu Regency as it produces in a significant number which boosts local economy. Table 5 reveals that Pagelaran district has the highest number of villages, totaling 24, followed by Gading Rejo and Sukoharjo. In terms of land area, Pagelaran and Pardasuka districts lead, followed by Gading Rejo and Adiluwih sub-districts. Consequently, Pagelaran sub-district stands out as the most dominant in Pringsewu Regency, both in terms of village quantity and land area. As of 2021, Pringsewu Regency has a population of 409.369 people, and the largest population distribution is in Pringsewu District, accounting for 20.84%, with a growth rate of -0.42%. Conversely, Banyumas District has the smallest population distribution at 5.21%, accompanied by a growth rate of 2.6%.

Table 7 presents diverse age groups among respondents, with the majority falling in the 30-39 age range (56.25%). Even though the respondents vary in age, they are predominantly in the productive age range. This productivity is essential for contributing more labor to their farming activities, potentially increasing production and overall income. As individuals age, especially in physically demanding work, productivity may decline, and retirement becomes a consideration (Maryam, 2016; Sukirno, 2014). Further, table 8 displays the educational background of the respondents, indicating that the majority have completed junior high school (37.50%), while 12.50% are uneducated. This suggests that, despite variations in educational levels, respondents possess the basic skills needed for farming activities, such as reading, writing, and calculating. Higher education levels tend to contribute to more effective production activities (Mankiw, 2006). However, there are contrasting views, with some arguing that education does not necessarily guarantee business development (Siagian & Sugiarto, 2006). Nonetheless, the respondents' varied education levels demonstrate a diverse skill set within the farming community. Each Farmer has different farming experiences. Table 9 shows there are 10 respondents who have farming experience between 22-31 or 12.50%, and those who have farming experience between 2-11 have 45 respondents or 56.25%. It shows that the respondent's experience in shallot farming is considered experienced enough in managing shallot farming.

According to Nurhayati and Sahara in Ranti (2009), one’s farming experience greatly influences the management of the farming business they manage. The longer a person has farming experience, the greater the success in farming can be predicted. Table 10 illustrates that the majority of respondents (62.50%) possess land in the range of 0.50-1.00 hectares, while a minimal percentage (5.00%) has land between 1.55-2.00 hectares. On average, respondents tend to have a land area within the 0.50-1.00 hectare range. As per Maryam (2016), the size of the land directly impacts the production output. Larger land areas are associated with higher production, while smaller land areas correlate with lower production levels.

Table 11 indicates variations in family size among respondents, with the highest number falling within the 3 - 4 family dependents category (56.25%), while the smallest group comprises those with 5 - 6 family dependents (12.50%). The study acknowledges that family responsibilities do not necessarily correlate with increased production but emphasizes that family members can serve as valuable labor resources, contributing to farming activities and productivity (Yasin & Ahmad, 2008; Hernanto & Fadholi, 1991).

Table 12 reveals that the major expenses for shallot farming in the Pringsewu District, Pringsewu Regency, are primarily allocated to purchasing shallot seeds, amounting to Rp. 37,993,862.5 per hectare, followed by labor costs totaling Rp. 20,930,803,437 per hectare. Additionally, fixed costs, encompassing land lease, land tax, and tools depreciation, sum up to Rp. 23,336,383.81 per hectare, while variable costs for seed, dolomite/captan, manure, NPK, pesticides, herbicides, and fungicides, reach Rp. 48,187,456 per hectare. Consequently, the overall cost of shallot farming in the Pringsewu District is calculated at Rp. 71,523,840 per hectare. The detailed costs for shallot farming in the Pagelaran District, Pringsewu Regency, are presented in Table 13. Table 13 illustrates the costs associated with shallot farming, highlighting the major expenses. The largest cost is attributed to purchasing shallot seeds, totaling Rp. 27,427,085 per hectare, followed by labor costs amounting to Rp. 17,525,520 per hectare. Additionally, fixed costs, including land lease, land tax, and tool depreciation, amount to Rp. 18,687,395 per hectare. Variable costs, covering seed, dolomite/captan, manure, NPK, pesticides, herbicides, and fungicides, sum up to IDR 40,558,540 per hectare. In conclusion, the total cost of shallot farming in the Pagelaran District, Pringsewu Regency, is Rp. 59,245,935 per hectare.

Table 14 indicates that shallot farming revenue in Pringsewu District reaches IDR 223,330,016,-/ha, whereas in Pagelaran District, it is IDR 91,537,752,-/ha. The disparity in revenue between the two districts results from variations in land management practices and shallot cultivation area. Notably, Pringsewu District farmers typically use manure, contributing to an average shallot production of 9,056 kg/ha. In contrast, Pagelaran District farmers do not utilize manure, resulting in a lower average shallot production of 4,349 kg/ha. Consequently, the production difference between the two districts amounts to 4,707 kg/ha (9,056 kg/ha – 4,349 kg/ha).

Farming income from shallot cultivation in Pringsewu District amounts to IDR 148,347,175-/ha, while in Pagelaran District, it is IDR 35,188,174-/ha. The feasibility of shallot farming is demonstrated through the R/C ratio analysis, where in Pringsewu sub-district, R/C = 3.0 and B/C = 2.0, both exceeding 1, indicating the sustainability of shallot farming. In Pagelaran sub-district, R/C = 1.4, signaling the potential for future continuation. However, the B/C ratio is below 1, suggesting that the technology used doesn't significantly increase income. In this case, every current expenditure of Rp. 1, - yields benefits of 1.4 and 0.6 times the costs incurred in Pringsewu and Pagelaran sub-districts, respectively.

CONCLUSION

The research concludes that in Pringsewu District, shallot farming exhibits favorable economic indicators with a total cost of IDR 71,523,840/ha and a revenue of IDR 223,330,016/ha, resulting in an income of IDR 148,347,175/ha. The R/C ratio and B/C ratio values of 3.0 and 2.0, respectively, suggest sustainability. In Pagelaran District, the total cost is IDR 59,245,935/ha, revenue is IDR 91,537,572/ha, and income is IDR 35,188,174/ha. While the R/C ratio is 1.4 and B/C ratio is 0.6, indicating sustainability. Financial analysis reveals positive Net Present Values (NPV) of IDR 633,405,244.22 in Pringsewu District and IDR 34,584,942.22 in Pagelaran District, reinforcing the sustainability of shallot farming in both areas for the future.

The analysis of shallot farming in Pringsewu District and Pagelaran District reveals promising returns with IRR values of 97% and 93%, respectively, over the 5 cultivation periods. This indicates a favorable "Returns to Capital Invested" compared to the 12% bank interest rate. Successful harvests, facilitated by effective management following recommendations, contribute to accelerated profits and quicker return on capital within the specified 5-year timeframe. In Pringsewu District, the Net B/C value at a 12% discount factor is 2.8, implying that each current expenditure of Rp. 1 yields benefits of IDR 2.8, suggesting sustainability. Similarly, Pagelaran sub-district shows a Net B/C value of 14.7, supporting the sustainability of shallot farming in the future.

To enhance the success of shallot farming in Pringsewu and Pagelaran Districts, key recommendations include active guidance and counseling by the Food Crops Agriculture Service, facilitated through PPL officers. This initiative aims to encourage farmers to embrace innovative practices in shallot cultivation. Additionally, farmers should consider adopting more income-generating shallot cultivation technologies, especially in Pagelaran District, where the current technology's B/C ratio of 0.6 (< 1) indicates suboptimal utilization. Moreover, extending the shallot farming period is advised, as evidenced by favorable return on investment with IRR values of 97% and 93% for two planting periods in Pagelaran District, surpassing the bank interest rate of 12%. Continuing this cultivation period can contribute to sustained profitability and economic viability.

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The authors declared no potential conflicts of interest.

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