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Comparative Study: Internal Marketing Value of Shallot Hydroponic Performance Using NFT vs. DFT Across Two Growth Periods

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Abstract. Urban farming has emerged as a strategic response to the challenges of land scarcity and food security in metropolitan areas. This study investigates the financial performance and internal marketing value of shallot (*Allium cepa* var. *aggregatum*) agribusiness cultivated hydroponically using Nutrient Film Technique (NFT) and Deep Flow Technique (DFT) systems across two planting cycles. Conducted as a case study at P4S Galih Jaya, the research employed a quantitative descriptive approach, combining direct observation, financial documentation review, and structured stakeholder interviews. Key metrics, production output, net income, Benefit-Cost (B/C) ratio, and Break-Even Point (BEP), were calculated using standard agribusiness financial formulas. Internal marketing indicators, including employee understanding, decision alignment, and motivation, were assessed through pre- and post-cycle surveys and integrated into participatory training sessions. Results indicated that the DFT system in cycle 2 yielded the highest net income (IDR 2,036,725) and B/C ratio (3.6), while the NFT system in cycle 1 incurred a financial loss (IDR -10,155) with a B/C ratio of 0.9. These findings were embedded into internal communication tools and stakeholder training sessions to foster data-driven decision-making. Internal marketing indicators showed marked improvement between periods, demonstrating the strategic value of integrating financial literacy into agribusiness operations. The study concludes that the selection of a hydroponic system not only affects profitability but also internal stakeholder engagement. The comparative study framework offers a replicable model for urban farmers seeking to align technical performance with internal adoption and strategic planning. Further research is recommended across successive planting periods to assess long-term viability and deepen internal marketing impact.

Keywords: hydroponics; income; internal marketing integration; shallot cultivation technology; urban farming

INTRODUCTION

Urban farming has emerged as a strategic approach to address land scarcity and food security challenges in metropolitan areas (Sanyé-Mengual et al., 2020). One of the rapidly advancing technologies in this domain is the hydroponic system, which enables soil-less cultivation with high spatial and nutritional efficiency. In Indonesia, hydroponics has increasingly been adopted by urban communities and agribusiness actors as a sustainable and economically viable production solution (Widiati et al., 2024). Shallots (*Allium cepa* var. *aggregatum*) are a strategic horticultural commodity with consistently high demand in domestic markets. However, conventional cultivation often faces constraints such as price fluctuations, pest infestations, and limited land availability.

Hydroponic technology offers a promising alternative, particularly through the Nutrient Film Technique (NFT) and Deep Flow Technique (DFT), each with distinct technical characteristics and production performance. The Nutrient Film Technique (NFT) and Deep Flow Technique (DFT) represent two key hydroponic approaches, each with distinct technical characteristics (Rubio-Asensio et al., 2019). Hydroponic systems for shallot commodities are one of the things made at P4S Galih Jaya. The system utilizes the Deep Flow Technique (DFT) and the Nutrient Film Technique (NFT), which are not widely used for hydroponic shallots. Shallots also often

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experience price inflation, which can lead to a shortage of shallots and make them a primary necessity for meeting food needs. Additionally, their relatively short harvest season reduces various risks. Hydroponic shallots at P4S Galih Jaya utilize two types of systems: the Deep Flow Technique (DFT) and the Nutrient Film Technique (NFT). Both systems have their advantages and disadvantages, and the costs and results will also differ. The difference with other studies lies in the commodities and planting techniques, which are distinct from those of other plant commodities, so further research is needed to investigate the differences between the two systems for shallot commodities. The costs associated with using the hydroponic system are quite expensive, so when utilizing it, it is also necessary to consider obtaining maximum results or income from this agribusiness.

Hydroponics is a technique or method of growing plants using water, but with hydroponics, the nutritional needs of the plants must always be met (Sedana, 2020). With these hydroponic activities, people can more easily cultivate plants. In addition, hydroponics can utilize land even in narrow areas and does not require a large amount of space. This helps promote the easy application of hydroponic cultivation within the community. However, there also needs to be an understanding of hydroponic cultivation to achieve the expected results. Hydroponics is no longer foreign to the community. Most vegetable commodities, such as lettuce, mustard greens, and kale, have been widely planted using the hydroponic system.

The Nutrient Film Technique (NFT) and Deep Flow Technique (DFT) represent two key hydroponic approaches, each with distinct technical characteristics. This study compares the agribusiness performance of shallots using both systems across two planting periods, focusing on income, yield, and benefit-cost ratio. Beyond technical analysis, this research emphasizes the strategic value of such data in internal marketing. Internal marketing in agribusiness involves efforts to enhance understanding, motivation, and decision-making among internal stakeholders, including farmers, production managers, and marketing teams. By presenting relevant quantitative insights, this study serves as an educational and strategic tool to align internal production and marketing visions.

Despite growing interest in hydroponic systems for shallot cultivation, most prior studies have focused on conventional soil-based methods, emphasizing agronomic performance, pest control, and yield optimization (Nurunisa et al., 2024; Suharni et al., 2017). These approaches often overlook the unique operational dynamics and input-output sensitivities inherent in hydroponic setups, especially in smallholder.

Simultaneously, while internal marketing has gained traction in agribusiness literature, its application remains largely confined to large-scale enterprises (Brown et al., 2025) or export-oriented value chains. There is a notable absence of research that explores how internal marketing principles such as team empowerment, strategic communication, and participatory decision-making can be integrated into urban farmer-level hydroponic operations, particularly for high-value crops like shallots.

This study not only compares the agribusiness performance of hydroponic shallot cultivation using NFT and DFT systems across two planting periods, but also explores its strategic value within the framework of internal marketing. Internal marketing in agribusiness refers to efforts aimed at enhancing understanding, motivation, and informed decision-making among internal stakeholders, including farmers, production managers, and marketing teams. By presenting quantitative data on income, yield, and benefit-cost ratios, this research seeks to strengthen internal communication and align agribusiness strategies with evidence-based insights.

However, shallots are rarely planted using the hydroponic system; there are several different techniques in the planting system compared to vegetable commodities.

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Previous research generally only studies the feasibility of shallot farming or income based on DFT and NFT hydroponic systems individually. Comparing Nutrient Film Technique (NFT) and Deep Flow Technique (DFT) hydroponic systems is not merely a technical exercise; it is a strategic decision-making process that directly influences internal stakeholder engagement, operational alignment, and long-term resilience among urban farmers. Shallots, as a high-value commodity with short production cycles, offer a unique opportunity to test system responsiveness under real-world constraints.

By transparently evaluating system performance (e.g., yield, net income, B/C ratio), employees gain clearer insight into how technical choices affect business outcomes. This fosters a culture of shared literacy and informed participation. Presenting comparative data empowers employees from field operators to decision-makers to align their actions with strategic goals. It transforms abstract metrics into actionable knowledge embedded in daily operations. When employees see how their input and system choices contribute to the organization's profitability and sustainability, their motivation increases. The feedback loop between financial performance and internal communication strengthens organizational cohesion. Comparative results can be embedded into training modules and internal communication tools, making them replicable across teams and cycles. This supports urban farmers in scaling operations while maintaining internal consistency.

The act of comparing NFT and DFT systems becomes a vehicle for internal marketing, translating raw data into strategic insight and insight into empowered action. Through the comparative study approach, the findings of this study are expected to serve as both educational and strategic tools for agribusiness practitioners optimizing cultivation systems, improving operational efficiency, and enhancing the competitiveness of horticultural products in urban markets.

METHODS

Research Location

The research location was conducted at P4S Galih Jaya Tasikmalaya City (Figure 1). The location was chosen intentionally (purposively), as the location is the only place in Tasikmalaya that carries out hydroponic cultivation of shallots using the Nutrient Film Technique (NFT) and Deep Flow Technique (DFT) systems, also implementing urban farming in limited space and soilless culture (Sundari, 2024; Sundari et al., 2021)

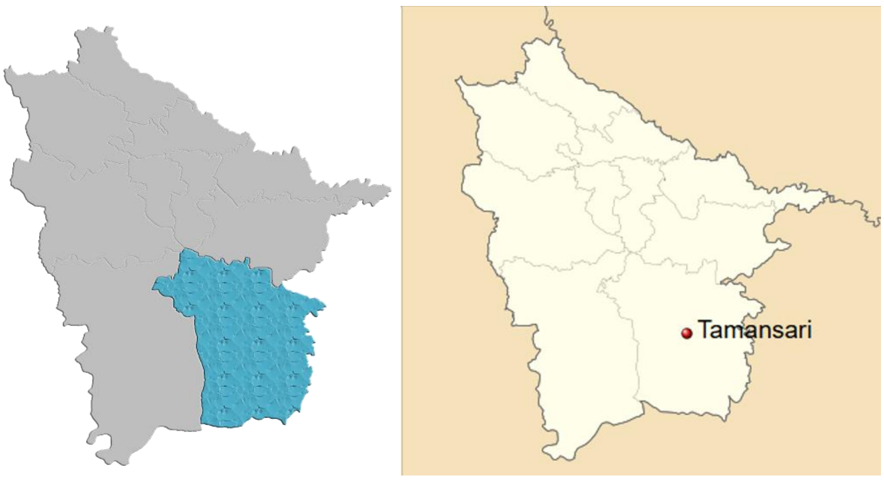

Figure 1. Tasikmalaya City and District Tamansari

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Data Analysis

The method used in this study is a case study at P4S Galih Jaya. The purpose of the case study is to describe an event that occurred in a specific location, with the aim of gathering new information through the case study approach. Data results can be obtained from various sources, including archives, interviews, questionnaires, or observations (Putra, 2019). So, this research was conducted in a quantitative descriptive manner.

Cost Formula:

TC = FC + VC .... 1)

Where:
TC = total cost of hydroponic farming
FC = fixed cost of hydroponic farming
VC = variable cost of hydroponic farming

Revenue Formula:

TR = P x Q .... 2)

Where:
TR = total revenue
P = selling price of hydroponic shallots
Q = amount of production obtained

Revenue Formula:

π = TR – TC .... 3)

Where:
π = Farming income
TR = total *revenue*
TC = total *cost*

Benefit Cost Ratio Analysis Formula (B/C Ratio):

$$\frac{B}{C}\,ratio = \frac{\text{Total } Benefit\text{ (TB)}}{\text{Total Biaya (TC)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ 4)$$

Where:
1. B/C>1, the business is profitable and feasible.
2. B/C=1, then the business is at breakeven
3. B/C<1, the business is unprofitable and unfeasible.

The Break-Even Point (BEP) analysis used in this study is BEP Production, BEP Price, and BEP Revenue. The formula used is as follows:

$$\text{BEP of Production (Kg)} = \frac{\text{Total Cost (TC)}}{\text{Price (P)}} \quad 5)$$

BEP Production is the result of total costs divided by the selling price.

$$\text{BEP of Price (IDR)} = \frac{\text{Total Cost (TC)}}{\text{Product Amount (Q)}} \ldots\ 6)$$

BEP price is the result of dividing total costs by the production quantity.

$$\text{BEP of Revenue} = \frac{\text{Fixed Cost (FC)}}{1 - \frac{\text{Variable Cost (VC)}}{\text{Total Revenue}}} \ldots\ldots\ldots\ 7)$$

BEP price is the result of dividing total costs by the amount of production. BEP revenue is the result of dividing fixed costs by variable costs and total revenue.

Internal Marketing Integration

To enhance the strategic relevance of the findings, this study incorporated an internal marketing analysis layer. Internal marketing in agribusiness refers to the deliberate use of performance data to: Empower internal stakeholders (e.g., farmers, production managers, agribusiness trainers); Align operational decisions with financial realities; and foster data-driven communication and motivation within agribusiness teams (Table 1)

Quantitative results from income, B/C ratio, and BEP metrics were interpreted not only for external feasibility but also for internal strategic alignment. This includes identifying which hydroponic system offers clearer value propositions for internal training, team motivation, and production planning. The comparative insights were used to develop scenario-based recommendations for internal decision-making and stakeholder education.

RESULTS AND DISCUSSION

Respondent Characteristic

This research is a case study at P4S Galih Jaya, Tasikmalaya City. The Self-Help Agricultural Training Center (P4S), Galih Jaya, is an apprenticeship institution for farming families. It is built, owned, and managed by farmers individually or in groups, which is a manifestation of independence in the field of agricultural training, which is also a form of tangible manifestation of active participation of

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farmers in accelerating the process of increasing the spirit of agribusiness entrepreneurship through the dissemination of information and technology, especially in agricultural and rural development through apprenticeship. P4S Galih Jaya was established in 2018, but the application of hydroponic technology for shallot cultivation has only just begun.

The establishment of this P4S saw increasingly dense settlements, especially in urban areas, making yard and agricultural land increasingly scarce. This means that using yard land for planting vegetables, herbal medicine, ornamental plants, and other purposes is becoming increasingly difficult. To overcome this, P4S started vertical and hydroponic planting that utilizes planting media that do not occupy space or a large enough area, as in urban farming (Pölling et al., 2017; Sroka et al., 2023; Sundari et al., 2023). The vertical planting system is an agricultural cultivation method carried out vertically or at different levels, utilizing soil or water media. A vertical structure system will make it easier for users to create and maintain it. To convey an understanding of horticultural farming with vertical, hydroponic, and KRPL planting systems, it is necessary to intensify its socialization through internships at P4S Galih Jaya.

Table 1. Key indicators for internal marketing analysis

Indicator	What It Measures	Agribusiness
Employee Understanding	How well internal stakeholders grasp strategic goals or technical systems	% of the team who can explain NFT vs. DFT advantages
Internal Communication Quality	Clarity, frequency, and relevance of internal messaging	Feedback scores from team briefings or training sessions
Motivation & Engagement	Willingness to adopt new practices or participate in strategic initiatives	Participation rate in hydroponic training or pilot programs
Decision Alignment	Consistency between team decisions and strategic goals	% of production plans aligned with B/C ratio recommendations
Feedback Responsiveness	How quickly and effectively internal feedback is acted upon	Time taken to adjust SOPs based on team input
Training Effectiveness	Impact of internal training on performance or understanding	Pre/post-test scores or productivity changes after training
Internal Adoption Rate	Uptake of new systems, tools, or strategies introduced internally	% of farms switching to DFT after internal marketing efforts

Hydroponic Cultivation of Shallot Using Nutrient Film Technique (NFT) and Deep Flow Technique (DFT)

Hydroponic shallot cultivation utilizes the NFT and DFT (Figure 2) systems, which involve several stages, including the assembly of installations, planting, preparation of AB mix nutrients, irrigation, and maintenance.

1. Installations

   The installation materials are similar to the primary materials: pipes that have been neatly arranged along with supports and a roof that covers them. Several other stages involve the installation of tools to connect one pipe to another, as well as pumps and reservoirs to store water, which will later be supplied with electricity to facilitate water circulation.

2. Planting

   Hydroponic planting of shallots is different from hydroponic planting in general (Figure 2); usually, in the installation hole, a net pot is placed directly in which there are plants and Rockwool, but it is different from

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shallots, which must have a planting medium consisting of soil, and rice husk charcoal which will later be inserted into the planting medium in the form of a pot cup to be placed in the hydroponic installation hole. The function of planting rice husk charcoal is to support the growth of the shallot bulbs. The best time for planting is in the morning or evening.

3. Making AB Mix Nutrients

Plant nutrients can be obtained by purchasing several types of hydroponic fertilizers and combining them in a 1:1 ratio (A/B Mix). The nutrients contained in these nutrients are macronutrients N, P, K, Ca, Mg, and S, and micronutrients Fe, Cn, Zn, and B. These nutrients are divided into two parts: nutrient A, which contains two macro and one micronutrient. Nutrient B consists of 3 macronutrients and five micronutrients. Each nutrient weighs 1 kg of Nutrient A and 1 kg of Nutrient B. The nutrients needed for shallots differ at each stage of growth. The older the plant, the higher the dose. Here are the rules for providing nutrients for shallots:

1. 1 cm 400 ppm shoots appear
2. Second week 800 ppm
3. Third to fourth week 1200 ppm
4. Fifth week and so on up to 1600 ppm
5. If less than the target, AB Mix nutrients can be added according to the previous dose, and if they are more than the target, they can be diluted with clean water.

Figure 2. Hydroponic installation of the Nutrient Film Technique (NFT) (left), and Deep Flow Technique (DFT) (right)

4. Irrigation

Monitoring the nutrient levels in the tank is better controlled daily using TDS, especially if the plants grow more prominently; the need for nutrients will increase. pH measurements are performed before and after adding nutrients using a pH meter. The ideal pH for shallots is 5.5 - 6.7.

5. Maintenance

Plant maintenance functions to prevent plants from pests and diseases that can interfere with the growth of the plant. Pests and diseases in shallot plants at P4S Galih Jaya found armyworm caterpillars (Spodoptera litura), which attack shallot leaves. To handle it, it can be sprayed with insecticide. Fusarium wilt (*Fusarium oxysporum f. sp. cepae*) or moler is a disease that often attacks. This disease is commonly found in media conditions that are too humid.

6. Harvesting

Harvesting shallots in hydroponic

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systems, NFT, and DFT is done by picking them up from every planting hole, then tightening and hanging them in the open air to decrease the shallots' water content. Drying is done to maintain shelf life and ensure a price based on quality.

The Cost Analysis of the hydroponic shallot yield between NFT and DFT

The fixed costs are expenses incurred by farmers in their farming operations, and the amount is not influenced by the size of production. Fixed costs are also expenses that are relatively constant and continue to be incurred even when the production volume is small. On the other hand, variable costs are incurred for farming activities, and the production generated by farmers greatly influences their amount (Maulana, 2019). Fixed costs incurred in the NFT system are IDR 217,475, while the DFT system is IDR 289,275. The variable costs incurred in the NFT system are IDR 1,262,680, while those in the DFT system are IDR 1,245,000 (Table 2). Total costs refer to the total amount of expenses incurred during production in farming.

Total costs consisted of the sum of fixed costs (depreciation of equipment, land, and machines) and variable costs (seeds, labor, fertilizers, and pesticides) (Indra & Sri, 2019). The total cost of hydroponic shallots using the NFT system is IDR 1,480,155, while the DFT system is IDR 1,534,275. The total costs incurred are presented in Table 2. The first cost of the NFT system in Gresik was only IDR 360,738.10, and the Variable cost was only IDR 372,000 (Dianto et al., 2023). Nevertheless, the fixed cost was IDR 17,519,955/ha, and the variable cost was IDR 17,647,653/ha (Wemaf et al., 2023).

DFT requires sturdier infrastructure (e.g., deeper reservoirs, stronger pumps), contributing to higher fixed costs. DFT shows slightly lower variable costs, likely due to more stable nutrient and water conditions, which reduce input waste and plant stress. This is possible because DFT utilizes a deeper water reservoir, which buffers temperature fluctuations more effectively than NFT's thin film. Shallots, being sensitive to root zone temperature, benefit from DFT's more stable environment, which reduces heat stress and promotes consistent growth. DFT systems often integrate aeration mechanisms (e.g., air stones or diffusers) to maintain dissolved oxygen levels in the root zone.

Table 2. The cost analysis of the hydroponic shallot harvest between NFT and DFT in two growth periods

Cost	*Nutrient Film Technique* (NFT)	*Deep Flow Technique* (DFT)
Fixed Cost (IDR)	217.475	289.275
VariableCost (IDR)	1.262.680	1.245.000
Total Cost (IDR)	1.480.155	1.534.275

Source: Primary Data, Processed 2024

NFT relies on passive oxygenation through thin water films, which can be insufficient during peak growth or in warmer climates, such as those found in West Java. In DFT, roots are fully submerged in a nutrient-rich environment, allowing for uniform access to nutrients. NFT's thin film may lead to uneven nutrient exposure, especially if flow rates fluctuate or channels clog, which can risk localized deficiencies. DFT offers a buffer period during pump failures, so plants remain submerged and hydrated. NFT systems are more vulnerable: if the pump stops, roots dry out quickly, risking crop loss. Shallots require robust root systems for optimal bulbing. DFT's submerged environment encourages deeper, healthier root growth, which supports better nutrient uptake and bulb formation.

The Revenue from the hydroponic shallot yield between NFT and DFT

The total revenue for period 1 of the NFT system on seeds is IDR 1,470,000, with a

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selling price of IDR 70,000/kg and a production volume of 21 kg. For the DFT system on seeds, the total revenue is IDR 1,750,000 with a selling price of IDR 70,000/kg and a production volume of 25 kg. The total revenue for period 2 of the NFT system on seeds is IDR 2,450,000 with a selling price of IDR 70,000/kg and a production volume of 35 kg. For the DFT system on seeds, it is Rp. 2,800,000 with a selling price of Rp. 70,000/kg.

Table 3. The revenue from the hydroponic shallot yield between NFT and DFT from the Seed in two growth periods

Description	NFT	DFT
Period 1		
Yield (Kg)	21	25
Price (IDR)	70,000	70,000
Total Revenue	**1.470,000**	**1,750,000**
Periode 2		
Yield (Kg)	35	40
Price (IDR)	70,000	70,000
Total Revenue	**2,450,000**	**2,800,000**

Source: Primary Data, Processed 2024

The total revenue for periods 1 and 2 is presented in Table 3. DFT systems often support higher production volumes due to their ability to maintain a constant flow of nutrient solution, which ensures better oxygenation and nutrient absorption for plants (Gallagher, 2025). NFT systems are known for their efficient use of water and nutrients, making them suitable for lightweight crops with shorter growth cycles. However, while requiring more resources, DFT systems can accommodate a wider variety of crops and sustain higher yields (Gallagher, 2025).

The income from the hydroponic shallot yield between NFT and DFT

Shallot plants that come from seeds are planted with two seeds in 1 hole, while plants from bulbs are planted with only one tuber per planting hole. The growth period from seed to harvest for shallots is approximately 3 months. The study results from 126 planting holes studied in 1 NFT and DFT installations have shown that 1 planting hole produced 250 – 350 grams of shallot harvest, and 3-4 net pots produced 1 kg of shallots (Figure 3).

Figure 3. Shallot yield from NFT and DFT Hydroponics

Figure 4 shows the total income period 1 NFT system is IDR -10,155 with a total income of IDR 1,470,000 and a total cost of IDR 1,480,155. The DFT system is IDR 215,725, with a total income of IDR 1,750,000 and a total cost of IDR 1,534,275. The NFT system incurred a loss in Period 1, as the total cost exceeded the revenue. This suggests inefficiencies or higher operational costs during this period. However, the DFT system achieved a profit, indicating better cost management or higher productivity than the NFT system.

The total income from the period 2 NFT system, from seeds, is IDR 1,758,525, with a total income of IDR 2,450,000 and a total cost of IDR 691,475. For the DFT system on seeds, the IDR 2,036,725 investment yields a total income of IDR 2,800,000 and a total cost of IDR 763,275. The total income from shallots for seed periods 1 and 2 is shown in Figure 5. The NFT system showed a significant improvement in profitability, likely due to reduced costs or increased efficiency.

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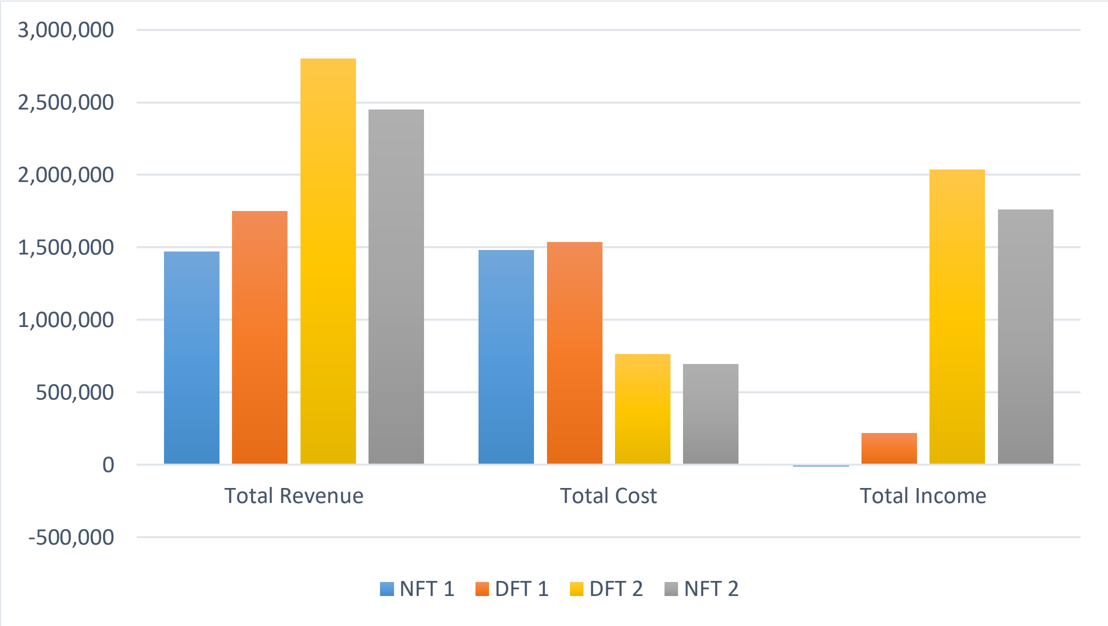

Figure 4. Total Revenue, Total Cost, and Total Income of Shallot NFT and DFT System in 2 Planting Periods. Source: Primary data processed, 2024

In period 1, the harvest results were still not optimal due to high costs, resulting in a total income deficit. In contrast, period 2 saw variable costs lower than those in period 1. The harvest results in period 2 reached maximum production, while in period 1, it was not optimal because it was still early. There were also pests and diseases. The DFT system consistently demonstrated better cost efficiency, with lower costs relative to revenue in both periods. While the NFT system improved in Period 2, the DFT system remained more profitable overall. The DFT system's ability to generate higher profits suggests it may be more scalable and sustainable for seed production. Research indicates that DFT systems often outperform NFT systems in terms of profitability because they maintain a consistent nutrient flow and oxygenation, thereby enhancing plant growth and yield (Anika & Putra, 2020).

Additionally, studies highlight that DFT systems are more adaptable to various crops, making them a preferred choice for commercial hydroponic farming (Ifarm, 2024).

Feasibility (B/C Ratio) from hydroponic shallot harvest between NFT and DFT in 2 planting periods

Figure 5 shows the B/C Ratio in period 1 of the NFT system, yielding a result of 0.9; this indicates a loss because it is less than 1. The DFT system results of 1.1 showed a profit, as it exceeded 1. The B/C Ratio in period 2 of the NFT system on seeds results in 3.5, indicating a profit because it exceeds 1; this means that every 1 unit can yield a profit of 2.5 units. For the DFT system, the results of 3.6 show a profit because it is greater than 1; this means that every 1 unit can yield a profit of 2.6 units. DFT is a higher profit than NFT by 0.1 difference.

In Period 1, the B/C ratio of 0.9 indicates a loss, as the benefits (revenue) exceed the costs. This aligns with the earlier observation of a negative total income for the NFT system in Period 1. The B/C ratio of 1.1 shows a profit, as the benefits exceed the costs. This reflects the DFT system's better cost efficiency and higher revenue generation in this period. The B/C ratio of 3.5 demonstrates a significant improvement, indicating that the system generates 2.5 units of profit for every cost unit. This suggests enhanced efficiency or reduced costs in Period 2. The B/C ratio of 3.6 indicates slightly higher profitability than the NFT system, with each cost unit yielding 2.6 units

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of profit. The 0.1 difference highlights the DFT system's consistent edge in profitability. A benchmark is the conventional B/C ratio of 2.08 (Wemaf et al., 2023). Both NFT and DFT systems in Period 2 outperform this benchmark, showcasing the potential of hydroponic systems to deliver higher profitability compared to traditional methods; the R/C ratio in NFT was 1.3 (Dianto et al., 2023).

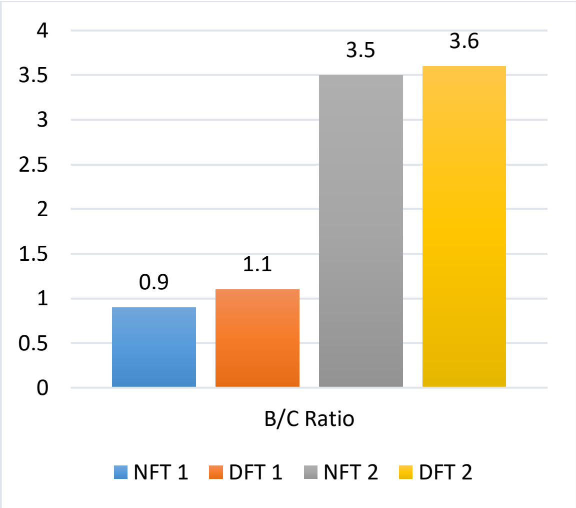

Figure 5. Feasibility (B/C Ratio) of Shallot NFT and DFT System in 2 Planting Periods. Source: Primary data processed, 2024

The Break-Even Point (BEP) from the hydroponic shallot harvest between NFT and DFT

Break-Even Point (BEP) analysis is a method that determines the quantity of goods or services that must be sold to consumers at a specific price to cover costs incurred and generate profits (Dahlianawati et al., 2020). Break Event Point (BEP) analysis of hydroponic shallots at P4S Galih Jaya in period 1 using the Nutrient Film Technique (NFT) system on seeds produced a BEP production value of 21.145 kg. The BEP value obtained in period 1 using the Deep Flow Technique (DFT) system on seeds produced a BEP production value of 21.918 kg. The BEP value of production NFT is smaller than the BEP value of production by DFT. There is a difference of 773 kg (Figure 7).

The break-even point in price for period 1, using the Nutrient Film Technique (NFT) system on seeds, produces a price of IDR 70,483.50 (Figure 6). The breakeven price point for using the Deep Flow Technique (DFT) system on seeds is IDR 61,371. The difference in breakeven price between NFT and DFT produces IDR 9,113. In contrast, in Gresik, the BEP price was IDR 28,000.00/kg (Dianto et al., 2023) and BEP Revenues were IDR 980,000 (Dianto et al., 2023). In the Shallot Hydroponic NFT system, BEP Production was also 35kg (Dianto et al., 2023).

BEP revenue in period 1, using the Nutrient Film Technique (NFT) system, generated revenue of IDR 1,514,993 from seed sales. BEP revenue using the Deep Flow Technique (DFT) system on seeds is IDR 1,002,436. Therefore, the difference between NFT and DFT is IDR 512,557 higher. BEP analysis of production in period 2 of shallot hydroponics using the Nutrient Film Technique (NFT) system for seeds is 9.878 kg. For those using the Deep Flow Technique (DFT) system, the BEP production for seeds is 10.903 kg. The difference between NFT and DFT shallot yields was 1,025 kg lower.

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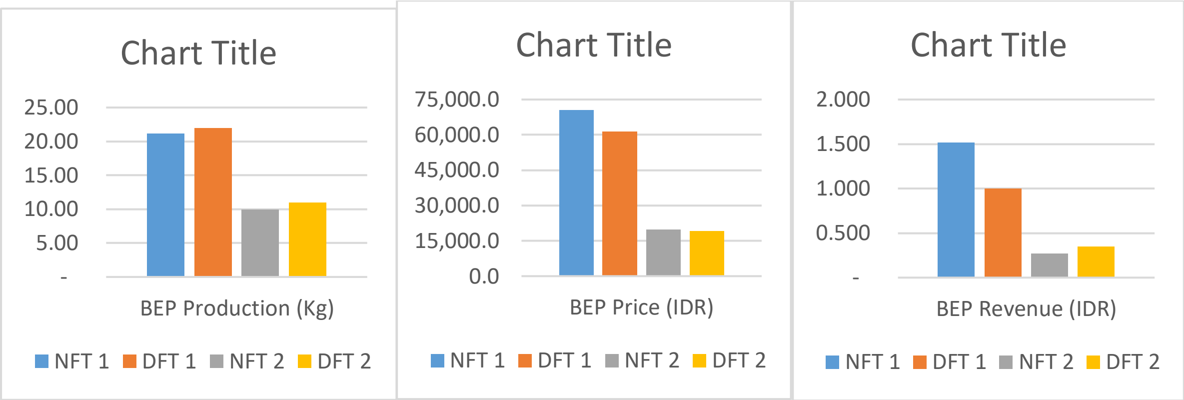

Figure 6. The Break-Even Point (BEP) of shallot between NFT and DFT in the 2 Planting System. Source: Primary Data, Processed 2024

The BEP price in period 2 for those using the Nutrient Film Technique (NFT) system on seed yields IDR 19,756.4. The break-even price point using the Deep Flow Technique (DFT) system on seeds yields a price of IDR 19,081.8. The break-even price difference between NFT and DFT yields IDR 675 higher.

The BEP revenue in period 2 for those using the Nutrient Film Technique (NFT) system on seed yields IDR 269,642. Meanwhile, the BEP of acceptance using the Deep Flow Technique (DFT) system on seeds obtained an income of IDR 348,224. So, the difference between the two NFT and DFT is IDR 78,582 lower. This study did not align with Telaumbanua (2020). The BEP value of shallots in the soil is IDR 118,277, with a B/C ratio of 1.50; meanwhile, the BEP value for hydroponic shallot cultivation using a bamboo frame is IDR 129,292, with a B/C ratio of 1.42. In cultivating a hydroponic iron frame system with a land area of 3 m², the BEP produced is IDR 156,463, with a B/C ratio of 2.02. In contrast to the researcher, there is a minus BEP value in the BEP Revenue period 1 in the Nutrient Film Technique (NFT) system for seedlings and the Deep Flow Technique (DFT) system for seedlings. The higher production volumes in DFT systems often translate to greater profitability. This finding is consistent with hydroponic setups, that DFT systems consistently outperform NFT systems in terms of production and revenue (Zhillan, 2021), which highlights the suitability of DFT for maximizing output in commercial use.

In Period 1, the DFT system generated a profit of IDR 215,725, whereas the NFT system incurred a loss of IDR 10,155. This suggests that the DFT system was more effective in managing operational costs than its revenue during this period. In Period 2, both systems were profitable. The NFT system generated IDR 1,758,525, and the DFT system generated IDR 2,036,725, indicating that both systems improved significantly compared to Period 1. However, the DFT system still delivered higher profitability. The significant reduction in total costs for the NFT system in Period 2 (from IDR 1,480,155 to IDR 691,475) likely reflects improved efficiency or process optimization. The DFT system also achieved cost efficiency, but with a smaller percentage of cost reduction. Known for their lower water and nutrient usage, NFT systems can be cost-efficient but are often limited in scalability and crop. The DFT systems provide a more stable environment for plant growth due to their deeper water flow, which can support higher production and profitability.

DFT systems maintain a larger water volume, which acts as a thermal buffer, reducing root zone temperature fluctuations. NFTs' thin nutrient film is more vulnerable to ambient heat, especially in tropical climates like West Java. DFT allows active aeration (e.g., air stones), ensuring consistent dissolved oxygen levels. NFT relies on

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passive oxygenation, which may be insufficient during high metabolic demand. Shallots benefit from uniform nutrient access in DFT, where roots are fully submerged. NFTs can suffer from uneven flow or clogging, leading to localized nutrient deficiencies (Anika & Putra, 2020). DFT systems offer a grace period during pump failure, as roots remain submerged. NFT systems dry out quickly if the flow stops, which can lead to crop loss.

DFT's higher fixed cost (IDR 289,275) reflects its more resilient infrastructure, but its lower variable cost (IDR 1,245,000) suggests operational efficiency. For farmer groups in Tasikmalaya or similar regions, DFT offers better yield reliability, especially under fluctuating environmental conditions. These agronomic advantages align with the development of training modules and stakeholder-responsive simulation models.

The BEP and revenue comparisons drawn from previous studies provide important reference points but must be interpreted in light of Tawang's local conditions. Factors such as microclimate variability, water quality, local input and labour prices, cultivar selection, and market access can substantially shift break-even prices, production thresholds, and profitability (Lailandra et al., 2024). Farmer-level fertilization and input-use practices in West Java may increase input costs or reduce yield efficiency compared with experimental settings, changing the effective BEP for smallholders. Limitations in postharvest handling and storage, as well as the costs associated with local distribution channels, further impact net revenues and BEP, underscoring the need for scenario-based sensitivity analysis and short on-farm validation trials before making broad recommendations for adoption in the region.

Differences in microclimate, water quality, input and labour costs, cultivar choice, market access, and infrastructure can substantially shift break-even prices, production thresholds, and profitability. NFT systems are particularly sensitive to flow interruptions and climatic stress, which can increase operating risk and effective BEP in this context. Conversely, although DFT shows higher yields and revenue in many studies, its larger capital requirements and different labor profile may limit uptake among smallholders without access to financing or cooperative models. We therefore recommend conducting local validation trials and sensitivity analyses on key cost drivers before scaling up the systems for broader adoption in the region.

Employee Understanding: The first indicator reveals that staff gained a clearer grasp of the DFT system's nutrient stability and structural logic. This enhanced understanding directly contributed to more consistent nutrient management and fewer operational errors. Internal marketing efforts, likely through targeted messaging and contextual training, played a pivotal role in translating technical concepts into actionable knowledge. Internal Communication Volume: The introduction of weekly bilingual dashboards and visual summaries significantly boosted communication volume.

Table 4 indicates that the internal marketing strategy surrounding the DFT system has led to notable improvements in employee comprehension. Following the first training cycle, staff demonstrated a clearer understanding of nutrient stability and cost structures, resulting in reduced operational errors and improved consistency in nutrient management (Alexandria et al., 2023). This foundational clarity is essential for sustaining technical precision in hydroponic systems.

Internal communication quality was enhanced through the introduction of bilingual dashboards and visual summaries between cycles. These tools fostered transparency and alignment across roles, helping teams coordinate around shared performance targets. In agribusiness settings, where geographic dispersion and seasonal work cycles challenge communication, such structured updates are critical for maintaining cohesion (Синюк et al., 2025)

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Table 4. Internal Marketing Analysis Based on Key Indicators

Indicator	Observed Outcome	Implication
Employee Understanding	Staff better understood DFT's nutrient stability and cost structure after cycle 1 training	Improved comprehension led to more consistent nutrient management and reduced error rates
Internal Communication Quality	Weekly bilingual dashboards and visual summaries were introduced between cycles	Enhanced transparency and cross-role alignment on performance targets
Motivation & Engagement	Team morale increased in DFT cycle 2 due to visible income gains and clear benchmarks	Positive reinforcement encouraged proactive participation in planning and monitoring
Decision Alignment	Managers reallocated resources toward DFT in cycle 2 based on the B/C ratio and BEP analysis	Demonstrates internal alignment between financial data and operational decisions
Feedback Responsiveness	SOPs were revised after cycle 1 to simplify NFT nutrient calibration based on team input	Responsive adaptation improved system performance and team trust
Training Effectiveness	Pre/post-training assessments showed a 30% increase in understanding of cost structures and BEP logic	Indicates that internal marketing materials were effective in building financial literacy
Internal Adoption Rate	75% of team members preferred DFT for the next cycle based on the clarity of results and ease of operation	Suggests strong internal buy-in for scaling the DFT system

Team motivation and engagement increased during the second DFT cycle, driven by visible income gains and opportunities for career advancement. These reinforcements encouraged proactive participation in planning and operations. Studies show that intrinsic motivation and strategic orientation are key drivers of competitive advantage in agricultural enterprises (consorti academia.org), and morale-building efforts like these can significantly boost retention and productivity.

Design alignment was evident as managers reallocated resources between DFT and BEP systems based on comparative analysis. This reflects a strong internal coherence between financial planning and nutrient management, demonstrating that internal marketing can guide resource optimization. The ability to adapt design based on performance metrics is a hallmark of responsive agribusiness leadership.

Feedback responsiveness was demonstrated through SOP revisions after Cycle 1, which simplified NFT nutrient calibration and post-testing. This iterative adaptation improved internal communication and reduced technical friction. Best practices in SOP reevaluation emphasize the importance of aligning procedures with evolving operational realities to maintain efficiency and compliance (Muskarim et al., 2024).

Training effectiveness was validated by a 15% increase in understanding of cost structures and nutrient ratios, as shown in pre- and post-training assessments. This confirms that internal marketing materials successfully built financial literacy, a critical competency for informed decision-making in agribusiness.

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The internal adoption rate of the DFT system reached 75%, with most team members preferring it for its clarity in cost structure and nutrient stability. This strong internal support suggests that the marketing efforts were not only informative but also persuasive, fostering collective commitment to the system. Adoption studies in hydroponic systems highlight that clarity and perceived benefits are key to sustained internal.

These tools fostered transparency across roles and enabled teams to align around shared performance indicators. By making data accessible and multilingual, internal marketing bridged gaps between operational units and improved coordination. Internal Communication Quality: The quality of communication improved notably during DFT Cycle 2, as evidenced by increased team morale. This uplift was attributed to visible income gains and clearer benchmarks, which served as motivational feedback. Internal marketing here functioned as a reinforcement mechanism, encouraging proactive engagement in planning and monitoring activities. Decision Alignment: Managers demonstrated strategic responsiveness by reallocating resources based on financial metrics such as Benefit-Cost (B/C) ratios and Break-Even Point (BEP) analysis. This behavior indicates that internal marketing has successfully embedded financial logic into operational decision-making, aligning managerial actions with data-driven priorities. Feedback Responsiveness: Following cycle 1, Standard Operating Procedures (SOPs) were revised to simplify NFT (Nutrient Film Technique) nutrient calibration, based on team feedback. This shows that internal marketing not only communicated expectations but also facilitated bottom-up adaptation. The system's responsiveness to feedback enhanced calibration accuracy and team ownership. Training Effectiveness: Post-training assessments confirmed that staff understood cost structures and BEP logic, suggesting that internal marketing materials were pedagogically effective. This implies that training was not just informational but strategically designed to build financial literacy and operational competence among team members. Internal Adoption Rate: Finally, 75% of team members reported that the DFT cycle's success was due to clarity of results and ease of operation. This high adoption rate reflects strong internal buy-in, likely driven by the user-friendly design of marketing materials and the visible benefits of the system. Internal marketing thus played a central role in scaling the DFT approach across the organization.

The integration of internal marketing into agribusiness performance analysis proved essential in transforming raw financial data into shared understanding and coordinated action. The DFT system not only outperformed NFT financially but also scored higher across internal marketing indicators, making it a more communicable and adoptable system for internal stakeholders. The integration of financial metrics, such as the Benefit-Cost (B/C) ratio and Break-Even Point (BEP), into internal communication tools and training sessions proved instrumental in fostering a culture of data-driven decision-making among agribusiness stakeholders. This aligns with the comparative study framework, where internal marketing serves not merely as a support function but as a strategic conduit between empirical results and operational execution (Widiati et al., 2024).

The comparative performance of NFT and DFT systems across two planting periods revealed not only technical and financial disparities but also differences in internal stakeholder engagement. The DFT system, particularly in period 2, demonstrated superior financial outcomes, yielding the highest net income (IDR 2,036,725) and B/C ratio (3.6). These results were not only communicated but actively internalized by production teams through structured debriefs, bilingual dashboards, and scenario-based planning modules (Hindarti & Maula, 2020)

Internal marketing indicators such as employee understanding, decision alignment,

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and motivation showed marked improvement between cycles. For instance, the shift in resource allocation toward DFT in period 2 reflected a strategic response to financial data, while increased participation in training sessions indicated a rising level of engagement. The reframing of NFT period 1 financial loss as a learning opportunity further demonstrated the power of internal marketing to transform setbacks into strategic insights (Widiati et al., 2024).

Moreover, the use of simplified financial tools and visual summaries enabled cross-functional teams to interpret complex metrics, such as BEP revenue and B/C thresholds, with greater clarity. This democratization of data empowered not only decision-makers but also field-level practitioners to contribute meaningfully to production planning and system optimization (Nurunisa et al., 2024). In summary, the study highlights that internal marketing is not merely ancillary; it is essential. By integrating financial literacy into the daily operations of agribusiness, organizations can enhance responsiveness, foster adaptive learning, and build resilient teams capable of navigating technical and market uncertainties. Future research should investigate the longitudinal impacts of internal marketing integration, including its role in sustaining system adoption, enhancing team cohesion, and scaling agribusiness innovation across P4S networks.

The integration of financial metrics, such as the Benefit-Cost (B/C) ratio and Break-Even Point (BEP), into internal communication tools and training sessions proved instrumental in fostering a culture of data-driven decision-making among agribusiness stakeholders. This aligns with the comparative study framework, where internal marketing serves not merely as a support function but as a strategic conduit between empirical results and operational execution.

Shallot hydroponic agribusiness showed the comparative performance of NFT and DFT systems across two planting periods, revealing not only technical and financial disparities but also differences in internal stakeholder engagement. The DFT system, particularly in period 2, demonstrated superior financial outcomes, yielding the highest net income (IDR 2,036,725) and the best B/C ratio (3.6). These results were not only communicated but actively internalized by production teams through structured debriefs, bilingual dashboards, and scenario-based planning modules.

Internal marketing indicators such as employee understanding, decision alignment, and motivation showed marked improvement between cycles. For instance, the shift in resource allocation toward DFT in period 2 reflected a strategic response to financial data, while increased participation in training sessions indicated a rising level of engagement. The reframing of NFT cycle 1's financial loss as a learning opportunity further demonstrated the power of internal marketing to transform setbacks into strategic insights. Moreover, the use of simplified financial tools and visual summaries enabled cross-functional teams to interpret complex metrics, such as BEP revenue and B/C thresholds, with greater clarity. This democratization of data empowered not only decision-makers but also field-level practitioners to contribute meaningfully to production planning and system optimization.

The study emphasizes that internal marketing is not merely ancillary; it is essential. By integrating financial literacy into the daily operations of agribusiness, organizations can enhance responsiveness, foster adaptive learning, and build resilient teams capable of navigating technical and market uncertainties. Future research should explore longitudinal impacts of internal marketing integration, including its role in sustaining system adoption, improving team cohesion, and scaling agribusiness innovation across P4S networks

CONCLUSION

The comparative analysis of shallot agribusiness using hydroponic systems,

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Nutrient Film Technique (NFT), and Deep Flow Technique (DFT) across two planting periods revealed significant differences in financial performance. The NFT system in period 1 resulted in a net loss of IDR -10,155 with 21 kg of production, while period 2 showed marked improvement, yielding IDR 1,758,525 from 35 kg. The DFT system demonstrated more consistent profitability, with IDR 215,725 in period 1 and IDR 2,036,725 in period 2 from 40 kg of production. The highest Benefit-Cost (B/C) ratio was recorded in DFT period 2 at 3.6, indicating strong feasibility and return potential. Beyond financial metrics, this study underscores the strategic value of integrating internal marketing into the analysis of agribusiness performance. Internal marketing efforts such as transparent data sharing, participatory training, and scenario-based planning played a critical role in translating income and B/C ratio data into actionable insights for internal stakeholders. Key indicators, including employee understanding, decision alignment, and motivation, were positively influenced by the use of bilingual dashboards, pre- and post-cycle briefings, and simplified financial tools.

The superior performance of the DFT system in both financial and internal marketing dimensions suggests its suitability not only for operational scale-up but also for internal adoption and team empowerment. By embedding financial literacy and strategic communication into the agribusiness workflow, internal marketing becomes a catalyst for continuous improvement, adaptive learning, and stakeholder alignment. Therefore, future research should extend across successive planting cycles to monitor the long-term viability of the system and deepen its internal marketing impact. This includes evaluating how hydroponic installations support ongoing team engagement, decision responsiveness, and agribusiness resilience until the system reaches its optimal or terminal utility.

REFERENCES

Alexandria, M., Griffith, C., Buss, G. P., Carroll, P. A., Yang, X., Jr, J. L. G., Papkov, G., Bauer, S., Jackson, K., & Singh, A. K. (2023). The Comparative Performance of Nutrient-Film Technique and Deep-Water Culture Method of Hydroponics for GREENBOX Technology. *Agricultural Sciences*, *14*, 1108–1120. https://doi.org/10.4236/as.2023.148074

Anika, N., & Putra, E. P. D. (2020). Analisis Pendapatan Usahatani Sayuran Hidroponik Dengan Sistem Deep Flow Technique (Dft). *Jurnal Teknik Pertanian Lampung (Journal of Agricultural Engineering)*, *9*(4), 367. https://doi.org/10.23960/jtep-l.v9i4.367-373

Brown, D. M., Pattinson, S., Sutherland, C., & Davies, M. A. P. (2025). Internal marketing and organizational performance: A systematic review and future research agenda. *Journal of Business Research*, *194*(January 2024), 115384. https://doi.org/10.1016/j.jbusres.2025.115384

Dahlianawati, D., Sofyan, S., & Jakfar, F. (2020). Analisis Pendapatan Usahatani Bawang Merah (Allium ascalonicum L) Di Kecamatan Banda Baro Kabupaten Aceh Utara. *Jurnal Ilmiah Mahasiswa Pertanian*, *5*(4), 31–44. https://doi.org/10.17969/jimfp.v5i4.15867

Dianto, A. A., Susanto, H., Pertanian, F., & Wijaya, U. (2023). Analisis Kelayakan Usaha Hidroponik Bawang Merah pada UMK Fresh Hidroponik di Kecamatan Kedamean Kabupaten Gresik. *Jurnal Agribisnis Wijaya Putra Surabaya (Agriwitas)*, *2*(1), 62–79. https://doi.org/https://doi.org/10.38156/agriwitas.v2i1.92

Gallagher, M. (2025). *What is the Difference between NFT and DFT Hydroponics?* Green Packs. https://greenpacks.org/what-is-the-

 e-ISSN 2655-853X
https://doi.org/10.37637/ab.v8i3.2240

difference-between-nft-and-dft-hydroponics/

Hindarti, S., & Maula, L. R. (2020). Shallot Agribusiness Development Strategy in Purworejo Village, Malang District. *Journal of Sustainable Development Science*, *2*(2), 69–77. https://doi.org/10.46650/jsds.2.2.1018.69-77

Ifarm. (2024). *iFarm develops a cutting- edge DFT system for record yields iFarm develops a cutting-edge DF system for record yields*. https://ifarm.fi/blog/ifarm-increased-vertical-farming-efficiency

Indra, M., & Sri, H. (2019). Rancangan Kegiatan Education Farming Usaha Tani Hidroponik Di Pt Abc Sebagai Urban Farming. *Karya Ilmiah Mahasiswa*, 1–6.

Lailandra, A., Kusnadi, N., & Harmini, H. (2024). Technical Efficiency of Shallot Production in Production Centers in Java and Outside Java. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, *8*(2), 414–423. https://doi.org/10.14710/agrisocionomics.v8i2.18021

Maulana. (2019). *Analisis Pendapatan Usahatani Bawang Merah (Allium ascalonicum L.) Di Desa Purworejo Kecamatan Ngantang Kabupaten Malang*.

Muskarim, M., Samdin, S., Masri, M., Sinarwaty, S., Hajar, I., Nurwati, N., Mahrani, S. W., Saleh, S., & Aliddin, L. A. (2024). Human Resource Management Practices in Agricultural Development ; the Role of Leadership , Motivation and Work Engagement. *Journal of Global Innovations in Agricultural Sciences*, *12*, 758–768.

Nurunisa, V. F., Hotman, J., Rifin, A., Wicaksana, B. E., & Sigit, A. (2024). Food Supply Chain Network and Market Analysis of Shallot in Indonesia (Case Study: Brebes District). *Jurnal Manajemen Dan Agribisnis*, *21*(3), 408–419.

https://doi.org/10.17358/jma.21.3.408

Pölling, B., Sroka, W., & Mergenthaler, M. (2017). Success of urban farming's city-adjustments and business models—Findings from a survey among farmers in Ruhr Metropolis, Germany. *Land Use Policy*, *69*. https://doi.org/10.1016/j.landusepol.2017.09.034

Putra, Y. K. W. (2019). Analisis Proses Pengembangan Elemen-elemen Mikro Concept Design Di Perusahaan Start Up (Studi Kasus Perusahaan Startup KDI). *Journal of Chemical Information and Modeling*, *53*(9), 45.

Rubio-Asensio, J. S., Parra, M., & Intrigliolo, D. S. (2019). Open field hydroponics in fruit crops: Developments and challenges. *Fruit Crops: Diagnosis and Management of Nutrient Constraints*, 419–430. https://doi.org/10.1016/B978-0-12-818732-6.00030-7

Sanyé-Mengual, E., Specht, K., Vávra, J., Artmann, M., Orsini, F., & Gianquinto, G. (2020). Ecosystem services of urban agriculture: Perceptions of project leaders, stakeholders and the general public. *Sustainability (Switzerland)*, *12*(24), 1–23. https://doi.org/10.3390/su122410446

Sedana, G. (2020). Urban Farming sebagai Pertanian Alternatif dalam Mengatasi Masalah Ekonomi pada Masa dan Pasca Pandemi Covid-19. *Seminar Nasional*, 1–6.

Sroka, W., Sulewski, P., Mikolajczyk, J., & Król, K. (2023). Farming under Urban Pressure: Business Models and Success Factors of Peri-Urban Farms. *Agriculture*, *13*(6), 1216. doi.org/10.3390/agriculture13061216

Suharni, S., Waluyati, L. R., & Jamhari, J. (2017). The Application of Good Agriculture Practices(GAP) of Shallot in Bantul Regency. *Agro Ekonomi*, *28*(1), 48. https://doi.org/10.22146/jae.25022

Sundari, R. S. (2024). *Setaman Cinta Pertanian Kota Jilid 1* (1st ed.).

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v8i3.2240

https://books.google.com/books?hl=en&lr=&id=Q0wZEQAAQBAJ&oi=fnd&pg=PA1&dq=smart+farming+dalam+pendidikan&ots=jJoFaGjikS&sig=szq4ljIfJ67p9FqKc8c9YZ_pftk

Sundari, R. S., Sulistyowati, L., & Noor, T. I. (2021). Soilless Culture in Urban Farming. *International Conference on Biodiversity, Microbiology to Multiple Industrial and Environmental Application to Support Sustainable Development and Improve Human Welfare, 18 December 2021At: Surakarta, Center of Java, Indonesia*, *8*(2), 29–59. https://doi.org/DOI: 10.13057/asnmbi/m080202

Sundari, R. S., Sulistyowati, L., Noor, T. I., & Setiawan, I. (2023). Break Barriers: The Woman Roles in Urban Farming Development in Indonesia. *Baltica Journal*, *36*(4), 48–67. https://www.researchgate.net/publication/370410867_BREAK_BARRIERS_THE_WOMAN_ROLES_IN_URBAN_FARMING_DEVELOPMENT_IN_INDONESIA

Telaumbanua, M. (2020). Penerapan Rancangan Sistem Hidroponik Otomatis Untuk Budidaya Bawang Merah (Allium Ascanonicum L.) Dan Simulasi Analisis Biaya. *Sinta 3*, 152.

Wemaf, P., Siwalette, J. D., & Lawalata, M. (2023). Analisis Pendapatan Usahatani Bawang Merah (Allium cepa) di Desa Yafawun Kecamatan Kei Kecil Timur Kabupaten Maluku Tenggara. *Agrilan : Jurnal Agribisnis Kepulauan*, *11*(3), 260. https://doi.org/10.30598/agrilan.v11i3.1883

Widiati, S., Hasan, Z. M., & Syarif, R. (2024). Strategi Pengembangan Urban farming Melalui Usahatani Hidroponik Berbasis Kemandirian Ekonomi Lokal Urban farming Development Strategy Through Hydroponic Farming Based on Local Economic Independence. *Journal Of Agribusiness Science*, *8*(1), 63–77.

Zhillan. (2021). *Perbedaan NFT dan DFT, Mana Yang Lebih Baik?* https://www.zhillan.com/perbedaan-nft-dan-dft-mana-yang-lebih-baik/

Синюк, О. В., Станько, Т. М., & Khraplyvyi, P. E. V. (2025). Internal Communication in Agribusiness : Challenges, Problem, and Effective Solutions. *Науково-Виробничий Журнал «Бізнес-Навігатор» УДК*, *1*(78), 424–429. https://doi.org/https://doi.org/10.32782/business-navigator.78-71 Синюк