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Income Analysis of Taro Farming in Bogor Regency, Indonesia

Analisi Pendapatan Usahatani Talas di Kabupaten Bogor, Indonesia

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ABSTRAK

Usahatani talas merupakan sumber pendapatan tertinggi di antara tanaman umbi-umbian di Kabupaten Bogor, Indonesia. Namun, terjadi penurunan produksi talas di Kecamatan Tamansari, yang merupakan salah satu sentra produksi talas, sehingga penelitian ini dilakukan untuk mengevaluasi kelayakan ekonominya. Penelitian ini bertujuan untuk menganalisis pendapatan, rasio R/C, pengembalian terhadap total modal, pengembalian terhadap tenaga kerja keluarga. Hasil penelitian menunjukkan bahwa usahatani talas di Tamansari menguntungkan dengan pendapatan bersih sebesar Rp 56.417.964 per ha serta rasio R/C 2,5. Selain itu usahatani talas memberikan *return to capital* dan *return to family labor* masing-masing sebesar 157.13% dan Rp. 456.641 per HOK. Hasil penelitian juga menunjukan bahwa kelompok tani masih belum berperan dalam meningkatkan pendapatan petani. Namun demikian, temuan ini menegaskan bahwa usahatani talas memiliki potensi yang kuat sebagai sumber pendapatan utama bagi petani, sekaligus mendukung keberlanjutan ekonomi masyarakat setempat.

Kata kunci: Efisiensi, Indonesia, Pendapatan, Petani, Talas.

ABSTRACT

Taro farming is the highest income source among root crops in Bogor Regency, Indonesia. However, there has been a decline in taro production in Tamansari Subdistrict, one of the main production centers, prompting this study to evaluate its economic feasibility. The study aims to analyze income, the R/C ratio, returns on total capital, and returns on family labor. The results indicate that taro farming is profitable, with a net income of IDR 56,417,964 per hectare and an R/C ratio of 2.5. Additionally, taro farming provides a return on capital of 157.13% and a return on family labor of IDR 456,641 per workday (HOK). The findings also reveal that farmer groups have not yet played a significant role in increasing farmers' incomes. Nevertheless, these results confirm that taro farming holds strong potential as a primary income source for farmers while supporting the economic sustainability of the local community.

Keywords: *Efficiency, Farmer, Income, Indonesia, Taro.*

INTRODUCTION

Agricultural development, as a vital subsystem of national development, plays a central role in the economy, largely due to its direct impact on meeting the fundamental needs of human society. Therefore, substantial efforts and commitment from Indonesia's agricultural community are necessary to promote commercial agriculture within the framework of agribusiness, while also enhancing food security. To support these efforts, the agricultural sector is generally divided into five main subsectors, including food crops, horticulture, forestry, plantations, and animal husbandry.

Within the food subsector, in addition to rice, secondary crops are widely cultivated by farmers (Habibah and Astika 2020). Among these secondary crops, tuber crops such as taro are prevalent (Rizka et al. 2022). To foster the development of this subsector, the role of farmer groups becomes essential as a supporting institution for farmers, spanning various areas from input supply to product marketing (Widajati et al. 2023).

Farmer groups act as supporting institutions that assist farmers through multiple stages, including input supply, access to capital, provision of agricultural tools, support for farming activities, and the marketing and distribution of agricultural products (Azzahra et al. 2020; Fufa et al. 2021). The inclusion of farmers in well-managed groups represents a key solution for advancing the development of their agricultural enterprises (Zikri and Herawati 2020). However, the success of these groups is not always guaranteed, as several technical and social factors may impact their dynamics and performance.

The failure of farmer groups is often attributed to a decline in group dynamics, which negatively affects group performance (Sukmawati and Santosa 2020). This decline may be influenced by technical factors, such as crop failure caused by pest infestations or insufficient water supply (Velayati 2013). Additionally, social factors play a significant role, including members' lack of trust in the group's management of capital and the group's limited capacity to establish relationships with other institutions (Syauqi and Purnaningsih 2020). A notable example is found in Tamansari Subdistrict, where the performance of taro farmers who are members of farmer groups is compared to those who are not, offering an opportunity to assess the effectiveness of farmer groups.

Bogor Regency is one of the leading contributors to taro production, particularly within Tamansari Subdistrict (Pratama and Purnaningsih 2020). Although the most recent official data on taro crops is not available, historical trends show a decline in both planting area and production from 2013 to 2015, indicating challenges regarding the sustainability of taro farming. Specifically, the planting area decreased by approximately 4 hectares during this period, with production dropping from 1,652 tons in 2013 to 1,642 tons in 2015 (BPS Kabupaten Bogor 2016). This trend highlights the need to evaluate the income dynamics and operational efficiency of farmer groups.

This study conducts an analysis of income levels and the R/C ratio in taro farming to assess the potential profits earned by farmers, both those involved in farmer groups and those who are not. Additionally, it is crucial to examine how farmers allocate their capital, particularly in light of pressures to shift to other commodities perceived as more profitable.

In addition to income levels, this study also investigates the returns on capital and agricultural labor. Labor return, in particular, plays a crucial role in retaining labor within taro farming, especially when compared to alternative options in both agricultural and non-agricultural sectors. Therefore, this analysis aims to provide a comprehensive overview of the sustainability of taro farming in Tamansari Subdistrict.

Based on the issues outlined, the objectives of this study are as follows:

1. To analyze the income levels in taro farming and determine whether there is a difference between group members and non-members.
2. To analyze the R/C ratio, return to family labor, and return on total capital.

RESEARCH METHODS

Research location and data

The research was conducted in the Bogor Regency, with a specific focus on the Tamansari Subdistrict, selected for its status as a prominent center for taro cultivation within the region. The study employed primary data, integrating both qualitative and quantitative methods. Primary data were gathered through direct interviews with farmers, who were selected as research participants. In addition to the primary data, secondary data were incorporated to provide supplementary context, sourced from various relevant literature and studies pertaining to the research topic.

The primary data collection process involved face-to-face, structured interviews, supported by a pre-designed questionnaire. For secondary data, a range of official documents were consulted, including previous research reports, academic journal articles, publications from the Central Bureau of Statistics (BPS), reports from the Agriculture and Forestry Department of Bogor Regency, as well as information from the Indonesian Institute for Rice Research. Additional secondary sources were accessed through online databases and other pertinent supporting documents.

Samples Selection

The process of selecting the sample aimed to identify the farmers who would participate as respondents in the taro farming study. Due to the lack of a sampling frame for taro farmers in the region, the snowball sampling technique was chosen. The first respondents were identified with the assistance of the Field Coordinator from the Agriculture Division in the Tamansari Subdistrict. Following that, the snowball sampling technique was used to identify additional respondents.

During the sample collection process, two active farmer groups were identified, namely Amanah Karya and Cipta Karya. Additionally, an inactive farmer group association, known as Gabungan Kelompok Tani (Gapoktan), was also identified. A total of 30 farmers were successfully included as respondents, which consisted of 18 members

of farmer groups and 12 non-members. These respondents were distributed across four villages, including Sirnagalih, Paireurih, Sukaresmi, and Sukaluyu. The decision to use snowball sampling was due to the limited initial information about the population of taro farmers and the absence of official data regarding farmer groups and their members in the Tamansari Subdistrict.

Analysis and Data Processing

The collected primary and secondary data were processed and analyzed using both descriptive and quantitative methods. The descriptive method was employed to outline the characteristics of the farmers, while the quantitative method was utilized to assess key variables such as income levels, farming efficiency, return on total capital, and return on family labor.

Farming analysis

The purpose of the farming analysis is to determine the farming revenue, farming costs, and the income derived from farming activities. The data collected includes the quantity of input used, input prices, output quantity, and output prices. The income analysis of the farming includes:

Farm Income Analysis

The farm income is the net revenue obtained by farmers, both in cash and on a non-cash basis. Income based on cash expenses refers to the actual costs incurred by the farmer, while income based on total expenses includes all family-owned inputs that are also accounted for as costs (Soekartawi, 2006). Farm income is the difference between revenue and expenses, which can be mathematically expressed as follows:

$$\pi_{total}=TR-TC$$

Dimana :

Π = Taro farm income (Rp)
TR = Total revenue of taro farming (Rp)
TC = The total cost of taro farming (Rp) consists of cash costs and imputed costs (Rp)

Revenue-Cost (R/C) Ratio Analysis

The R/C ratio analysis in farming is used to assess the economic feasibility of a farming operation by comparing its revenue to the costs incurred. According to Soekartawi (2006), the R/C ratio represents the relationship between total farm income and total expenditure. The formula for calculating the R/C ratio is as follows:

$$\text{R/C ratio based on cash costs} = \frac{\text{Total farm revenue}}{\text{Total cash cost of farming}} = \frac{TR}{TC}$$

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$$\text{R/C ratio based on total cost} = \frac{\text{Total farm revenue}}{\text{Total farm cost}} = \frac{\text{TR}}{\text{TC}}$$

This analysis helps determine how much revenue is generated for every rupiah spent in the farming process. If the R/C ratio is greater than 1 (R/C > 1), the farming activity is considered viable and profitable. Conversely, if the R/C ratio is less than 1 (R/C < 1), the farming activity is deemed unfeasible, indicating that costs exceed revenue.

Return to total capital

The return to total capital is a measure of the return on investment used to assess the profitability of farming capital. Its value can be calculated both as an absolute return amount and as a percentage of the total capital, as follows (Swinton & Lowenberg-DeBoer 2013):

Return to Total Capital (Rp) = Net Farm Income (Rp) – Value of Family Labor (Rp)

$$\textit{Return to Total Capital (\%)}: \frac{Return\ to\ total\ capital}{Total\ capital} \text{ x } 100\%$$

If the return to total capital is higher than the prevailing credit interest rate, then the farmer's decision to invest capital in the agricultural sector is more favorable than investing it in a bank.

Return to family labor

Return to family labor is used to measure the income generated from utilizing family labor in farming operations (Swinton & Lowenberg-DeBoer 2013). This value can be compared to the wages of hired farm labor, which are calculated per person-day (HOK), using the following formula:

Return to Family Labor (Rp) = Net Farm Earnings (Rp) – (Capital Interest Rate (%) × Farmer's Capital (Rp))

$$\text{Return per Person-Day of Family Labor}: \frac{Return\ to\ family\ labor}{\text{Person}-\text{day (HOK)}}$$

RESULTS AND DISCUSSION

Characteristics of Respondents and Taro Farming

Respondents characteristics

The demographic profile of the respondents indicates that the majority (60%) belong to the older age category (45-59 years), while the remaining 40% fall within the

adult age range (30-44 years). This age distribution is consistent across both members and non-members of farmer groups.

In terms of farming experience, most respondents have been engaged in taro cultivation for an extended period, primarily as a result of generational inheritance from their parents. However, some acquired their farming knowledge through guidance from fellow farmers. The distribution of farming experience is as follows: 50% of respondents have been cultivating taro for 5-10 years, 36.67% for 11-20 years, and 13.33% for over 21 years. Generally, both farmer group members and non-members have between 11 and 20 years of farming experience.

With regard to educational attainment, the majority of respondents (70%) have completed only elementary school, while the remaining 30% have attained a junior high school education. This trend is observed among both farmer group members, 78% of whom have only an elementary-level education, and non-members, where 58% have the same level of schooling. The limited formal education among respondents is associated with challenges in record-keeping related to farm inputs and outputs, as well as a limited understanding of market mechanisms. It is hypothesized that this educational constraint restricts their ability to access more favorable market opportunities, as all respondents reported selling their harvests exclusively to middlemen or collectors.

Household dependency levels among respondents also vary, with 66.67% supporting between 1 and 3 family members, while the remaining 33.33% are responsible for 4 to 6 dependents. Notably, a greater proportion of farmers with larger household responsibilities are found among farmer group members, reflecting a higher economic burden.

The respondents' cultivated land area is relatively small, with an average size of 2,600 m². According to the classification set by the 2023 Agricultural Census, farmers managing less than 0.5 hectares of land are categorized as small-scale farmers (BPS 2023). Among all respondents, 72% of farmer group members operate on small landholdings, while all non-members also cultivate limited farmland.

Characteristic of taro farming

The respondents involved in taro cultivation implement an intercropping system, integrating three cycles of choy sum and three cycles of spinach within a single taro planting season. This intercropping practice takes place from the initial planting phase until the third month. Taro is typically harvested between 7 and 8 months after planting.

The farming process begins with land preparation following a one-month fallow period after the previous planting cycle. Land preparation includes weed removal, bed formation, and basal fertilization using manure. Once the beds and fertilizer are prepared, taro seedlings are planted the next day. Before planting, the seedlings are soaked in water and treated with *Puradan*, either by direct application or by sprinkling it into the holes.

The crops are grown in raised beds, maintaining a planting distance of 0.5 meters in length and 1 meter in width, with a planting depth of 15-20 cm.

Crop maintenance occurs twice a month during the first three months, coinciding with the growth of intercrops. From the fourth to the seventh month, maintenance is conducted once a month. This process includes weeding, earthing-up, sucker removal, leaf pruning, and replacing dead plants.

Farmers use both organic and chemical fertilizers. Manure serves as basal fertilizer, mixed with soil during bed preparation, while chemical fertilizers such as Urea and NPK are applied as needed. Approximately ten sacks of manure are used per 1,000 square meters of land, applied only once per growing season.

Harvesting is conducted when taro reaches 7-8 months of age. None of the respondents perform harvesting independently, as they adopt a contract-based harvesting system. In this arrangement, farmers enter a pre-harvest sales agreement with middlemen, ensuring that they do not incur additional harvesting costs.

Taro Farming Revenue

The revenue calculation for taro farming is based on the average land area per hectare within a single planting season. The revenue components consist of taro sales, which are categorized into three size classes, including taro weighing 1-2 kg per plant, 3-4 kg per plant, and less than 1 kg per plant, with respective prices of Rp 10,000, Rp 18,000, and Rp 5,000 per unit.

The average revenue is Rp 89,451,851 for respondents who are members of farmer groups, Rp 91,527,084 for respondents who are not members, and Rp 90,579,044 on average for all respondents. A detailed breakdown of revenue is presented in Table 1.

Table 1. Breakdown of taro farming revenue per hectare in the study area

Description	Revenue		
	Farmer Group	Non-Farmer Group	Overall
Cash Revenue			
a. Taro 1-2 kg (per stem)	49,370,370	49,930,556	47,492,444
b. Taro 3-4 kg (per stem)	30,850,000	33,300,000	33,199,600
c. Taro < 1 kg (per stem)	9,231,481	8,173,611	9,757,000
Non-Cash revenue			
a. Taro	136,111	122,917	130,000
Total	89,451,851	91,527,084	90,579.044

Taro farming Cost

The cash costs per hectare for taro farming encompass expenditures on seeds, fertilizers, Furadan, hired labor, and land rental. Among these, hired labor constitutes the largest share of cash expenses for both farmer group members and non-members, accounting for 31.29% and 32.08%, respectively. Furthermore, seed costs represent the most significant component of the overall expenditure structure for both groups. A detailed breakdown of farming costs is presented in Table 2.

Table 2. Breakdown of Average Taro Farming Costs per Hectare in the Study Area

Description	Farmer Group		Non-Farmer Group		Overall	
	Amount (Rp)	Percentage (%)	Amount (Rp)	Percentage (%)	Amount (Rp)	Percentage (%)
Cash Cost						
A. Seed	5,100,000	23.61	5,128,571	24.19	5,109,524	23.89
B. Fertilizers						
a. Urea	1,702,775	7.88	1,701,245	8.02	1,858,633	8.69
b. Npk	1,946,028	9.01	1,944,280	9.17	1,626,459	7.60
c. Manure	932,472	4.32	972,140	4.59	992,896	4.63
C. Furadan	441,370	4.20	398,456	1.88	420,904	1.97
D. Hired labor	6,760,018	31.29	6,801,738	32.08	7,28,009	32.86
E. Land rent	4,256,938	19.70	4,253 112	20.06	435,809	20.36
Total	21,139,603	100	21,199,541	100	21,338,687	100
Calculated cost						
a. Seed	5,140,000	41.71	5,137,500	42.81	5,138,889	41.62
b. Family labor	2,926,667	23.75	2,610,000	21.75	2,740,000	22.19
c. Opportunity cost of land	4,256,938	34.54	4,253,112	35.44	4,354,809	35.37
d. Depreciation	111,329	0.02	111,229	0.02	113,888	0.01
Total	12,323,605	100	12,000,612		12,347,587	100

Utilization of Planting Material

The planting material utilized by farmers primarily originates from taro offshoots cultivated in the preceding growing season. However, some farmers procure seedlings from other cultivators to supplement their supply. The predominant variety used is *Pandan Wangi* taro. On average, approximately 10,200 seedlings are planted per hectare, with a unit cost of Rp 500 per seedling.

Fertilizer Application

Taro farmers employ both chemical and organic fertilizers to enhance crop growth and soil fertility. The primary chemical fertilizers used are urea and NPK, priced at Rp 2,000 and Rp 3,500 per kilogram, respectively. While some farmers rely exclusively on urea, the average application rates per hectare are 547 kg for urea and 419 kg for NPK.

Additionally, organic manure is applied as a basal fertilizer at an average rate of 68 sacks per hectare, each costing Rp 12,000.

Labor Utilization

Taro cultivation involves two categories of labor, namely family labor and hired labor. Labor is allocated for critical agricultural activities such as land preparation, bed formation, seedling transplantation, weeding, and fertilization. The average labor input per hectare is 114 HOK, consisting of 23 HOK from family labor and 118 HOK from hired labor. Each HOK represents a five-hour workday, with a wage rate of Rp 50,000 per HOK. Notably, farmers affiliated with farmer groups tend to rely more on family labor compared to non-members.

Utilization of Agricultural Tools

The agricultural tools employed in taro cultivation are predominantly traditional and relatively simple. The highest expenditure is associated with hoes, each costing Rp 150,000. The total investment in agricultural equipment amounts to Rp 735,000, with a recorded depreciation cost of Rp 228,833.

Land Utilization

Taro cultivation is carried out on both privately owned and leased land. Farmers who lease land incur a rental cost of Rp 1,500,000 per 1,000 square meters per year or Rp 5,906,717 per planting season. The cultivated land area varies among farmers, with the smallest plot measuring 1,000 square meters and the largest extending up to 5,000 square meters. Furthermore, some farmers implement intercropping systems, integrating taro cultivation with choy sum and spinach to maximize land productivity.

Income and R/C Ratio in Taro Farming

The analysis indicates that farmers who are not members of farmer groups generate higher net income based on total costs compared to those who are affiliated with such groups, with respective earnings of Rp 56,124,755 and Rp 58,326,931. The overall average income across all respondents is Rp 56,417,964. Furthermore, the revenue-to-cost (R/C) ratio is lower among group-member farmers than among non-members.

Non-member farmers achieve higher net income based on cash costs, primarily due to their ability to produce taro of superior quality, with a greater proportion of grade A and B yields compared to group members. These findings suggest that participation in farmer groups has not yet contributed significantly to increasing farmers' income. The study further reveals that farmer groups have not played a substantial role in enhancing productivity through technological interventions, improving product quality, or facilitating better market access for their members.

Moreover, the findings indicate that farmer groups have not been effective in improving market access, as all respondents, regardless of membership status, continue to sell their entire harvest to intermediaries. Enhancing farmers' engagement in the taro

value chain is crucial to ensuring that they obtain a larger share of value-added benefits (Onsay et al. 2022).

Table 3. Income and R/C ratio in taro farming per hectare

Description	Farmer groups	Non-Farmer Groups	Overall
A. Cash revenue	89,451,852	91,404,167	90,449,044
B. Imputed revenue	136,111	122,917	130,000
C. Total revenue (A+B)	89,587,963	91,527,038	90,579,044
D. Cash expenses	21,139,603	21,199,541	21,813,494
E. Imputed expenses	12,323,505	12,000,612	12,347.587
F. Total expenses (D+E)	33,463,208	33,200,153	34,161,081
G. Income over cash cost (C-D)	68,448,360	70,327,542	68,765,550
H. Income over total cost (C-F)	56,124,755	58,326,931	56,417,964
I. R/C over cash cost (C/D)	4.24	4.32	4.15
J. R/C over total cost (C/F)	2.68	2.76	2.65

Return to Total Capital and Return to Family Labor

The average Return to Total Capital per hectare for farmers in farmer groups, non-farmer groups, and all respondents is 158.97 percent, 167.82 percent, and 157.13 percent, respectively. These findings suggest that farmers have made optimal financial decisions in allocating their capital to taro farming, as the return on total capital significantly exceeds the 12-month deposit interest rate of Bank BRI, which is 5 percent.

The Return to Family Labor represents the income generated from utilizing family labor and serves as a benchmark for comparison with the wages of hired agricultural labor, calculated per person-day (HOK). The average Return to Family Labor per hectare in taro farming is Rp 427,075 for farmers in farmer groups, Rp 536,179 for non-farmer groups, and Rp 456,641 for all respondents combined.

Table 4. Average Return to Total Capital and Return to Family Labor

Component	Farmer groups (Rp)	Non-farmer groups (Rp)	Overall (Rp)
A. Total revenue	89,587,963	91,527,083	90,579,004
B. Total expenses	33,463,208	33,200,153	34,161,081
C. Net income	56,124,755	58,326,931	56,417,964
D. Family Labor Value	2,926,667	2,610,000	2,740,000
E. *Return to total capital* (C-D)	53,198,089	55,716,931	53,677,964
F. *Return to total capital* (%) (B/E)	158.97%	167,82%	157.13%

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Tabel 5. Rata-rata *return to total capital* dan *return to family labor*

Component	Farmer groups (Rp)	Non-farmer groups (Rp)	Overall (Rp)
A. Net income	56,124,755	58,326,931	56,417,964
B. Capital interest	35,136,368	34,860,160	35,869,135
C. *Return to family labor* (A-B)	20,988,388	23,466,771	20,548,829
D. Total Family Labor (HOK)	49	44	45
E. *Return to family labor* per HOK (C/D)	427,075	536,179	456,641

Contribution of Taro Farming Income to Total Household Income

The contribution of taro farming income to household income is calculated to determine the extent to which taro farming contributes to the total household income of farmers. This analysis is conducted by dividing the average monthly income from taro farming by the total average monthly household income of farmers. The total household income consists of earnings from taro farming, choy sum, spinach, other agricultural activities, and non-agricultural sources.

Table 6. Contribution of Taro Farming Income to Total Household Income

Income source	Total income (Rp)	Percentage (%)
Taro	1,708,390	23.30
Choy sum	1,443,305	19.68
Spinach	1,421,003	19.38
Other agricultural business	1,171,429	15.98
Non-agricultural income	1,587,167	21.65
Total	7,330,993	100.00

The respondent farmers practice intercropping taro with choy sum and spinach, where one taro planting cycle accommodates three growing cycles of choy sum and spinach. The planting of choy sum and spinach occurs simultaneously with the planting of taro, with each growing cycle lasting 20-25 days from the initial planting. The intercropping system lasts for a period of three months from the start of the taro planting. The farmers prefer this approach due to the lengthy harvesting period of taro, which spans 7-8 months, allowing them to make optimal use of the land and generate income before the taro harvest. The total household income is Rp 7,330,993, derived from taro, choy sum, spinach, other agricultural activities, and income from non-agricultural sources. Taro farming makes the largest contribution to household income, accounting for 23.30 percent or Rp 1,708,390. Based on the income calculations, it can be concluded that the decision to engage in taro farming is sound. It is also recommended that taro farming be considered the primary source of income for these farmers, as it provides the highest contribution to their overall income.

CONCLUSIONS

The primary objective of this study was to analyze income, the Return-to-Cost (R/C) ratio, return on total capital, and return on family labor within the household income of farmers. The results of the analysis of taro farming income in Tamansari District indicate that taro farming in the study area is profitable. However, it was observed that farmers not affiliated with farmer groups achieved higher profits than those who were members of such groups. The role of farmer groups has yet to yield a positive impact on increasing farmers' income. This is attributed to the fact that the farmer groups primarily function as formal institutions, without fulfilling their potential as support entities that could facilitate the introduction of technology or enhance farmers' access to improved marketing channels.

The R/C ratio analysis for taro farming reveals that the farming activities in Tamansari District are economically efficient, as evidenced by R/C ratios exceeding 1 for both total and cash costs. Furthermore, when evaluating the returns on family labor and total capital, taro farming in the district can be considered financially viable, generating returns that surpass the local wage rate and the interest earned from bank deposits.

Based on the findings, several recommendations are proposed. It is suggested that farmer groups in Tamansari District adopt a more proactive role in assisting farmers with capital access, input supply, agricultural production, and the marketing of taro to maximize profits. Additionally, future research should focus on conducting a value chain analysis and comparing the income levels of various actors in the taro value chain, such as wholesalers and retailers, to enable farmers to better understand the profit margins available to them.

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