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Analysis of Price Volatility and Downstream Strategy for Shallot Price Stability in Java Island

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ABSTRACT

Shallots are one of the horticultural products of seasonal crops whose prices have high volatility. Shallots are one of the commodities contributing to inflation in Java. This study aims to analyze the volatility and disparity of shallot prices in Indonesia in 2019-2024, focusing on provincial areas in Java. The analysis tools used price disparity, the food price variation coefficient, and importance-performance analysis. The study results show significant price fluctuations across different regions in Java. Shallot prices in Banten Province are elevated because of insufficient local supply. The price of shallots in East Java Province, which serves as the primary production center, tends to be lower than in other Java provinces. This study identifies the need for downstream processes as a strategic step to stabilize shallot prices. According to this study, improving infrastructure, research and development (R&D), and price stability measures is imperative to lower shallot price volatility, guarantee higher farmer earnings, and guarantee that consumers experience more stable pricing. Agriculture downstream is a crucial strategy to overcome shallot price volatility and improve overall supply chain efficiency.

Keywords: Downstream; Importance Performance Analysis; Price Disparity; Price Stabilization; Price Volatility; Shallot

INTRODUCTION

Shallots are one of the strategic commodities contributing to inflation in Java. Economic actors such as households, food, and processing industries need shallots (Achmad et al., 2024). Economic actors are interested in the stability of shallot prices (Pardian et al., 2016). The price of shallots has high fluctuations because high demand is not balanced with the amount of supply (Shankar et al., 2023). Many factors cause the instability of shallot prices, including limited use of cultivation technology and dependence on unpredictable weather conditions (Susilowati et al., 2023). In 2023, Java Island was recorded as the national shallot production center, contributing 59.28% of total national production (Central Agency of Statistics Indonesia [BPS Indonesia], 2024). Despite dominating production, the volatility of shallot prices on Java Island remains a significant challenge, especially during the lean season and peak harvest.

Dwindling shallot stocks cause price spikes during the lean season, suppress consumer purchasing power, and trigger inflation. Conversely, when the harvest is abundant, shallot prices drop drastically, causing farmers to suffer losses (Putri et al., 2023). This volatility emphasizes the importance of strategic interventions for price stabilization. Downstream is a potential solution focusing on processing shallots into value-added products. This process can extend the shelf life of shallots and reduce price fluctuations (Ruspayandi et al., 2022).

The downstream strategy in stabilizing shallot prices includes steps to increase the added value of shallot products through efficient processing, storage, marketing, and distribution. Through downstream, shallot products can have a longer shelf life and encourage product diversification. Through sound processing and storage, shallot stocks can be managed more stably to reduce price pressures when supply is abundant or low.

The objectives of this study are to analyze price volatility and downstreaming strategies for shallots in Java. This research is important because there are still limited studies on price volatility and economic impact, lack of emphasis on downstream strategies as a solution, and absence of integrated models for shallot price stabilization. Previous studies (Pardian et al., 2016; Shankar et al., 2023) have discussed shallot price fluctuations but have not comprehensively analyzed the impact on different economic actors and the broader inflationary effects. Existing research (Ruspayandi et al., 2022) highlights downstream processing benefits but lacks empirical analysis on how it directly contributes to price stabilization. While previous research has discussed aspects of processing, storage, and distribution, there is a lack of an integrated strategy that connects these elements into a holistic price stabilization approach. This research is essential for understanding the dynamics of shallot prices in Java and examining the effective downstream implementation. The study results are expected to provide concrete recommendations for the government, industry players, and farmers to overcome market uncertainty through the shallot downstream strategy.

LITERATURE REVIEW

Volatility of Shallot Prices

Shallots (*Allium ascalonicum L.*) are a vegetable commodity that plays a vital role in society because of their high economic value and nutritional content, which is beneficial for health (Rodrigues et al., 2017). Shallot cultivation is generally carried out on dry land, which requires a sound irrigation system to maintain the quality and quantity of the harvest (Fauziah et al., 2016). India is the country that contributes almost a quarter of the world's total shallot input, followed by China, Egypt, Iran, and Türkiye (Global Top Stats, 2024). In Indonesia, shallots are among the most essential horticultural

commodities for domestic needs and export. Java Island is the center of shallot production in Indonesia, contributing more than the national output. Volatility in shallot prices is often a problem, significantly when supply decreases or increases drastically.

Volatility refers to the level of price fluctuations over a certain period. It is a leading indicator of risk in the market, where rapid and unexpected price changes complicate economic planning and decisions (United Nations Conference on Trade and Development, 2015). Volatility refers to the extent to which prices fluctuate around an average or central value. It represents the tendency for prices to deviate significantly from their typical value. Typically, volatility is characterized by large deviations from the overall trend, indicating substantial variation in price levels over time (Bhinadi, 2023). The higher the volatility, the greater the risk market participants face because unstable prices complicate financial planning and investment decisions. Volatility is usually used in a financial or economic context to measure the movement of prices or the value of an asset (De Silva et al., 2017). For shallots, price fluctuations indicate an imbalance in supply and demand within the domestic market (Liang, 1998).

Several factors affect the price volatility of shallots. First, extreme weather changes, such as extended droughts or excessive rain, can disrupt the planting and harvesting process, thus affecting supply and prices (Mirzabaev et al., 2023). Second, seasonal patterns also affect shallot production, where prices rise during the lean season and fall during the main harvest (Australian Centre for International Agricultural Research [ACIAR], 2013). Third, the limited availability of adequate storage facilities makes it difficult for farmers to maintain the quality and quantity of onions, causing oversupply during the harvest season and shortages during the lean season (Tibaingana et al., 2022). Fourth, inefficient distribution, including transportation problems and logistics costs, also contributes to price instability in various regions (Amin et al., 2024).

Shallot price fluctuations pose a significant challenge, as the resulting uncertainty compels farmers and consumers to adjust their budgets continuously to accommodate shifting prices. For farmers, high price volatility often leads to income uncertainty, making farmers reluctant to invest in technology or innovation that can increase productivity (Authority of the House of Lords, 2016). Meanwhile, for consumers, high price volatility causes an increase in unexpected expenses. It affects purchasing power, especially for low-income people (Committee on World Food Security, 2011). High fluctuations in the price of shallots also make it difficult for the government to maintain price stability in the market because price adjustments that occur too often can disrupt the food security program (The World Bank, 2012).

Shallot Downstream Processing

Downstream is transforming and adding value to raw products through various stages of processing and processing. The primary purpose of downstream is to increase added value, extend the shelf life of a product, and expand the market share of a product (Asmy et al., 2024). Downstream strategies are implemented in various sectors to reduce dependence on raw materials and increase product competitiveness in local and international markets (Aisyah et al., 2021). Downstream provides direct economic benefits and helps developing countries create jobs, increase export attractiveness and revenues, and strengthen economic resilience (International Monetary Fund [IMF], 2023).

In the agricultural sector, downstream is carried out in various ways, such as processing harvests into processed products, developing storage technology that extends the life of products, and increasing distribution efficiency (Fikri et al., 2023). Agricultural downstream aims to overcome the problem of supply and price volatility often triggered

by various factors, improve the economic value of farm products, and strengthen farmers' bargaining position in the market. In shallots, downstream includes processing raw products into processed products, such as fried onions, onion powder, and onion paste, extending the shelf life and increasing the selling value. Shallot products are consumed as fresh ingredients and processed forms that the market can access throughout the year.

Several countries, including India and Thailand, have successfully implemented shallot downstream processing to reduce price volatility. In India, the government has supported the development of shallot and other commodities processing by providing farmers access to processing technology and adequate storage facilities (Vision IAS, 2024). This support helps ensure that the shallots are processed efficiently, reducing waste and improving shelf life, stabilizing prices. Similarly, in China, the focus on post-harvest technology integration for shallots has allowed for longer storage, which helps prevent spoilage and reduces market fluctuations (Fauziana et al., 2023). Modern refrigerated storage and logistics systems play a critical role in maintaining the quality of shallots as they travel from farms to consumers, ensuring that prices remain stable in local and export markets (Winkworth-Smith et al., 2015). These successful models demonstrate how adopting advanced technology in the post-harvest phase can mitigate seasonal price fluctuations and enhance market stability.

RESEARCH METHOD

The research in this article uses secondary data, including shallot prices, from six provinces in Java Island, Indonesia, from January 2019 to October 2024. The data originated from the Regional and Indonesian Food Price Monitoring Survey carried out by Bank Indonesia and was sourced from the National Strategic Food Price Information Center's website. A mathematical tool measures price disparity by comparing the average food prices at the provincial and national levels. It is formulated as follows:

$$D = Hp - Hn$$

Where:
D = Price disparity
Hp = Provincial-level average prices
Hn = National-level average prices

If the price disparity is positive, it indicates that the average price at the provincial level is higher than the national price. Conversely, if the price disparity is negative, the price in the province is lower than the national price level. Meanwhile, price volatility is measured using the food price variation coefficient, which is formulated as follows:

$$CV = \left(\frac{SD}{M}\right) \times 100\%$$

Where:
CV = Variation coefficient
SD = Dispersion measure
M = Average price

A low coefficient of variation value indicates that price stability has occurred. At the same time, a high coefficient of variation value indicates price instability. In Indonesia, the price of essential commodities is stable if it has a coefficient of variation value ranging from 5% - 9% (Jumiana et al., 2018).

Importance Performance Analysis was also conducted to complement the analysis results, evaluate the performance of attributes considered necessary in the downstream process, and identify priority improvements that need to be made. The IPA analysis utilizes primary data through surveys of Java farmers, processors, and shallot traders. The IPA method integrates measurements of the perceived importance and performance of the evaluated attributes. The results of the IPA analysis are then visualized in a Cartesian diagram consisting of four quadrants (Martilla & James, 1997; Ong & Pambudi, 2014).

In Quadrant I (Top Priority), according to respondents, this quadrant contains important attributes but performs poorly. Characteristics in this quadrant require primary attention to improve their performance. Quadrant II (Maintain Achievement) shows the attributes respondents consider essential for high performance. Its main focus is on maintaining and sustaining optimal performance. Quadrant III (Low Priority) consists of attributes respondents view as having low importance and poor performance. Traits in this category may receive less attention or face temporary postponement. Quadrant IV (Excessive)**:** Includes attributes considered less critical by respondents but that perform well. Resources allocated to this attribute can be diverted to other aspects that require more attention.

In efforts to downstream shallots, attributes that can be analyzed through IPA include raw material availability, processing technology, infrastructure, market access, government support, and others (Sjafrina et al., 2023). The procedures or steps taken in IPA analysis (Anggraeni et al., 2015), include:

Assigning Weights to the Importance Level and Performance Level
The IPA analysis employs a 4-point Likert Scale, with each point assigned a score or weight, as shown in Tables 1 and 2 below.

Table 1. Importance Level Weighting

Criteria	Scale	Description
SP	4	This indicator is very important for downstream performance in Java.
P	3	This indicator is quite important for downstream performance in Java.
TP	2	This indicator is not important for downstream performance in Java
STP	1	This indicator is very unimportant to the downstream performance in Java.

Table 2. Performance Level Weighting

Criteria	Scale	Description
SB	4	This indicator shows excellent performance in influencing Java downstream.
B	3	This indicator shows good performance in influencing Java downstream.
TB	2	This indicator shows poor performance in influencing downstream in Java.
STB	1	This indicator shows abysmal performance in influencing Java downstream.

Calculate the Suitability Value Between Importance and Performance Levels
The conformity level determines the priority order that should receive primary attention. It is denoted as follows:

$$Tki = \frac{xi}{yi} \times 100\%$$

Where:
Tki = Level of conformity
xi = Performance assessment scores
yi = Importance assessment score

Calculate the Mean Value of Each Attribute
The average for each attribute perceived by the respondents. Noted as follows:

$$\overline{XI} = \frac{\sum XI}{n} ; \overline{YI} = \frac{\sum YI}{n}$$

Where:
$\overline{XI}$ = The Average score of the product performance level
$\overline{YI}$ = The Average score of the product importance level
n = The total count of respondents.

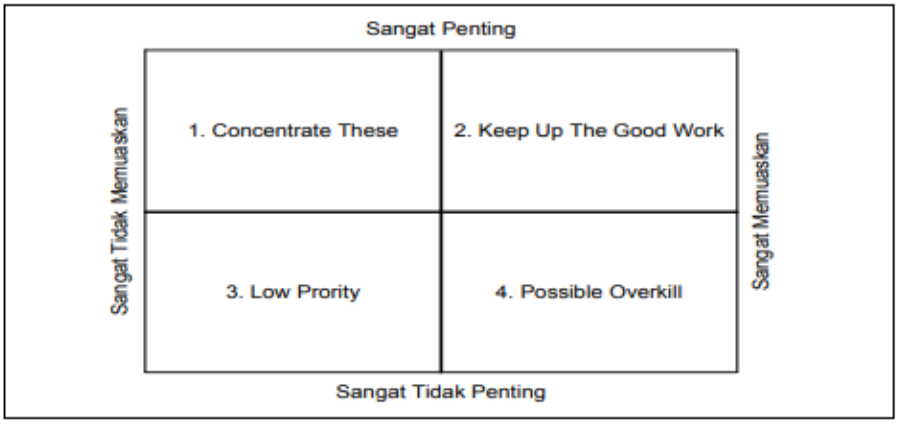
Cartesian Diagram
The boundaries of the Cartesian diagram are established to identify the positions of importance and performance levels. It is denoted as follows:

$$\overline{\overline{X}} = \frac{\sum \overline{XI}}{k}; \overline{\overline{Y}} = \frac{\sum \overline{YI}}{k}$$

Where:
$\overline{\overline{X}}$ = The mean performance score for all products or attributes
$\overline{\overline{Y}}$= The mean importance level of all attributes, influencing consumer satisfaction
k = The number of attributes that can influence consumer satisfaction

Once the limits can be calculated, the description of each attribute can be depicted in a Cartesian diagram as illustrated in Figure 1.

Figure 1. IPA Quadrant (Cartesian Diagram)



RESULTS

Disparity and Volatility
Table 3. Average Price of Shallots at Farmer Level (IDR/Kg)

Average Price (IDR/Kg)							
	2019	2020	2021	2022	2023	2024	Mean
Indonesia	20.567	25.271	21.875	28.504	24.329	27.165	24.618
Banten	20.250	25.708	26.354	31.833	27.542	27.228	26.486
West Java	15.633	21.158	17.021	23.179	19.650	21.985	19.771
DKI Jakarta	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Central Java	15.346	20.371	16.483	21.079	18.492	21.710	18.913
DI Yogyakarta	15.988	22.750	19.200	26.196	22.283	24.485	21.817
East Java	14.958	20.488	14.408	20.329	18.171	19.735	18.015

Source: Processed Data by Researchers (2024)

Table 3 presents the average price of shallots per kilogram at the farmer level across the provinces of Java Island from 2019 to 2024. Banten Province recorded the highest average price throughout the observation period, while East Java Province had the lowest.

Table 4. Average Price of Shallots at Wholesaler Level

Average Price (IDR/Kg)							
	2019	2020	2021	2022	2023	2024	Mean
Indonesia	24.513	31.183	24.254	30.875	27.833	30.780	28.240
Banten	21.875	30.833	23.083	31.875	31.708	34.350	28.954
West Java	22.825	30.925	23.442	30.246	28.029	29.350	27.469
DKI Jakarta	22.208	29.792	20.250	27.083	24.292	34.305	26.322
Central Java	18.979	26.263	20.133	26.133	24.158	25.245	23.485
DI Yogyakarta	20.063	25.646	22.125	26.500	26.125	29.950	25.068
East Java	18.296	24.358	19.042	24.450	22.479	23.875	22.083

Source: Processed Data by Researchers (2024)

Table 4 shows the average shallot price at the wholesaler level across provinces on Java Island for 2019-2024. Throughout the observation period, Banten Province recorded the highest average price at the wholesaler level, while East Java Province had the lowest.

Table 5. Disparity in Shallot Prices at Farmer Level

Price Disparity							
	2019	2020	2021	2022	2023	2024	Mean
Avg Price at the Indonesian Level	20.567	25.271	21.875	28.504	24.329	27.165	
Banten	-0.317	0.438	4.479	3.329	3.213	0.063	1.867
West Java	-4.933	-4.113	-4.854	-5.325	-4.679	-5.180	-4.847
Central Java	-5.221	-4.900	-5.392	-7.425	-5.838	-5.455	-5.705
DI Yogyakarta	-4.579	-2.521	-2.675	-2.308	-2.046	-2.680	-2.802
East Java	-5.608	-4.783	-7.467	-8.175	-6.158	-7.430	-6.604

Source: Processed Data by Researchers (2024)

Table 5 shows the price differences of shallots at the farmer level across the provinces of Java Island compared to the national average for 2019-2024. Except for Banten Province, the average shallot price in the provinces of Java Island is lower than the national average.

Table 6. Disparity in Shallot Prices at The Wholesaler Level

Price Disparity							
	2019	2020	2021	2022	2023	2024	Mean
Avg Price at the Indonesian Level	24.513	31.183	24.254	30.875	27.833	30.780	
Banten	-2.638	-0.350	-1.171	1.000	3.875	3.570	0.714
West Java	-1.688	-0.258	-0.813	-0.629	0.196	-1.430	-0.770
DKI Jakarta	-2.304	-1.392	-4.004	-3.792	-3.542	3.525	-1.918
Central Java	-5.533	-4.921	-4.121	-4.742	-3.675	-5.535	-4.754
DI Yogyakarta	-4.450	-5.537	-2.129	-4.375	-1.708	-0.830	-3.172
East Java	-6.217	-6.825	-5.213	-6.425	-5.354	-6.905	-6.156

Source: Processed Data by Researchers (2024)

Table 6 shows the difference in shallot prices at the wholesaler level across the provinces on Java Island and the national prices from 2019 to 2024. From the data presented, it can be seen that most provinces on the island of Java experience lower price differences compared to national prices, with East Java recording the largest price disparity consistently from 2019 to 2024.

Table 7. Coefficient of Variation of Shallot Prices at Farmer Level

Coefficient of Variation							
	2019	2020	2021	2022	2023	2024	Mean
Standard Deviation	10.833	12.746	11.150	14.779	12.754	14.210	
Banten	53.49%	49.57%	42.30%	46.42%	46.30%	52.18%	53.49%
West Java	69.29%	60.24%	65.50%	63.76%	64.90%	64.63%	69.29%
Central Java	70.59%	62.56%	67.64%	70.11%	68.97%	65.45%	70.59%
DI Yogyakarta	67.76%	56.02%	58.07%	56.41%	57.23%	58.03%	67.76%
East Java	72.42%	62.21%	77.38%	72.69%	70.19%	72.00%	72.42%

Source: Processed Data by Researchers (2024)

Table 7 presents the coefficient of variation of shallot prices at the farmer level across Java's provinces. The magnitude of the coefficient of variation indicates the magnitude of price volatility. East Java Province has the highest shallot price volatility and the lowest in Banten Province.

Table 8. Coefficient of Variation of Shallot Prices on the Wholesaler Side

Coefficient of Variation							
	2019	2020	2021	2022	2023	2024	Mean

Standard Deviation	6.142	7.046	5.450	6.750	6.483	6.265	
Banten	28.08%	22.85%	23.61%	21.18%	20.45%	18.24%	28.08%
West Java	26.91%	22.78%	23.25%	22.32%	23.13%	21.35%	26.91%
DKI Jakarta	27.65%	23.65%	26.91%	24.92%	26.69%	18.26%	27.65%
Central Java	32.36%	26.83%	27.07%	25.83%	26.84%	24.82%	32.36%
DI Yogyakarta	30.61%	27.47%	24.63%	25.47%	24.82%	20.92%	30.61%
East Java	33.57%	28.93%	28.62%	27.61%	28.84%	26.24%	33.57%

Source: Processed Data by Researchers (2024)

Table 8 shows the coefficient of variation for shallot prices at the wholesale level across provinces on Java Island. This coefficient reflects the extent of price fluctuations. East Java Province exhibits the highest price volatility for shallots, while Banten Province shows the lowest.

Importance-Performance Analysis

Table 9. Indicators in Quadrant I (Main Priority for Improving Performance in Downstream of Shallot Commodities)

Code	Attribute	Performance Level	Importance Level
C5	Availability of related and supporting industries and services in terms of R&D	2.12	3.83
B2	Development of foreign demand (exports)	2.14	3.84
E1	Price stabilization (food inflation)	2.17	3.84
A15	Raw material innovation	2.23	3.82
A14	Quality of raw materials	2.27	3.69
A51	Access to financing	2.28	3.74
A11	Availability of domestic raw materials	2.31	3.79
D2	Domestic market structure	2.31	3.85
C1	Availability of related and supporting industries and services in terms of transportation and logistics	2.40	3.82
A34	Availability and quality of quality supporting facilities and infrastructure	2.43	3.77
C2	Availability of related and supporting industries and services in financial terms	2.68	3.78
A64	Energy sustainability	2.70	3.76
D3	Foreign market structure	2.77	3.85
A13	Raw material prices	2.78	3.71
A63	Environmentally friendly energy	2.93	3.74

Source: Processed Data by Researchers (2024)

Table 9 presents the score calculation for the first quadrant assessment of the performance and importance levels of shallot downstream on Java Island, highlighting significant gaps between performance and importance levels. Attributes such as domestic market structure (D2) and foreign market structure (D3) exhibit high importance scores (3.85), but their performance levels remain relatively low (2.31 and 2.77, respectively). This significant gap indicates a critical need for targeted improvements in these areas to enhance the efficiency and effectiveness of shallot downstream activities on Java Island.

Table 10. Indicators in Quadrant II (Priority to Maintain Performance in Shallot Downstream)

Code	Attribute	Performance Level	Importance Level
D1	Competitive strategy	3.01	3.88
F5	Domestic regulations related to exports	3.13	3.84
A23	Level of technology effectiveness	3.14	3.72
C4	Availability of industry and related and supporting services in terms of industry associations	3.14	3.75
E5	Food safety	3.16	3.82
F4	Domestic regulations regarding Certification	3.19	3.86
A21	Activity-based technology use	3.20	3.59
F1	Domestic regulations related to Licensing	3.25	3.80
F3	Domestic regulations related to monetary policy	3.26	3.61
B1	Development of domestic demand	3.27	3.85
B4	Competition in demand with other producers	3.28	3.82
A44	Education and training for workers	3.29	3.76
G1	Macro and regional economic stability conditions	3.32	3.82
A12	Availability of imported raw materials	3.32	3.71
A62	Energy prices	3.32	3.82
A43	Labor wages	3.33	3.61
D4	Competition with other domestic producers	3.34	3.81
G2	Conditions of social stability	3.35	3.87
F8	Export destination country regulations	3.39	3.76
E2	Availability of food products	3.45	3.87
F7	Domestic regulations related to technical policies in the agricultural and agro-industrial sectors	3.46	3.85
F2	Domestic regulations related to fiscal incentives	3.47	3.80
E3	Nutrition of food products	3.48	3.78
A42	Workforce competency	3.53	3.72
A61	Energy availability	3.56	3.83
A36	Packaging system	3.59	3.77
A32	Availability and quality of storage facilities and infrastructure	3.60	3.75
A52	Interest rate	3.65	3.76
A53	Guarantee/collateral to financial institutions	3.65	3.73
A22	Production efficiency level	3.68	3.83
A31	Availability and quality of production tools and machines	3.71	3.83
A33	Availability and quality of transportation and logistics facilities and infrastructure	3.81	3.74
A41	Labor availability	3.87	3.78

Source: Processed Data by Researchers (2024)

Table 10 presents the calculation of the score for the results of the quadrant II assessment of the performance and importance levels of shallot downstream in the provinces on Java Island, indicating that the attributes in this quadrant, such as labor availability (A41) with the highest performance level of 3.87 and conditions of social stability (G2) with an importance level of 3.87, are performing well, suggesting these

areas should be maintained to ensure the sustainability and competitiveness of the shallot downstream sector.

Table 11. Indicators in Quadrant III (Low Priority in Shallot Downstream)

Code	Attribute	Performance Level	Importance Level
A54	Business insurance	2.84	3.23
C3	Availability of industry and related & supporting services in terms of education	2.94	3.58
A23	Level of technology effectiveness	3.14	3.72

Source: Processed Data by Researchers (2024)

Table 11 displays the calculation of the assessment score for quadrant III, which indicates the performance level and the significance of shallot downstream in the provinces on Java Island, highlighting that attributes such as business insurance (A54) with the lowest performance level of 2.84, indicate a low-performance priority but have the potential to be improved gradually along with the development of downstream activities.

Table 12. Indicators in Quadrant IV (Over-performance in Shallot Downstream)

Code	Attribute	Performance Level	Importance Level
D5	Competition with other foreign manufacturers	3.04	3.53
B3	Consumer preferences	3.07	3.40
E4	Prevalence of inadequate food consumption	3.10	3.52
F6	Domestic regulations related to imports	3.22	3.52
A45	Career development opportunities	3.23	3.56
A35	Waste management facilities and infrastructure	3.25	3.41

Source: Processed Data by Researchers (2024)

Table 12 calculates the score for the assessment results of quadrant IV, showing the performance and importance levels of shallot downstream in the provinces on the island of Java, shows that attributes such as political stability conditions (G3) with a performance level of 3.45 and an importance level of 3.51, and career development opportunities (A45) with a performance level of 3.23 and an importance level of 3.56, show an overperformance trend, indicating that these areas exceed their relative importance and may not require additional focus during downstream activities.

Figure 2. Cartesian Diagram of Shallot Commodity

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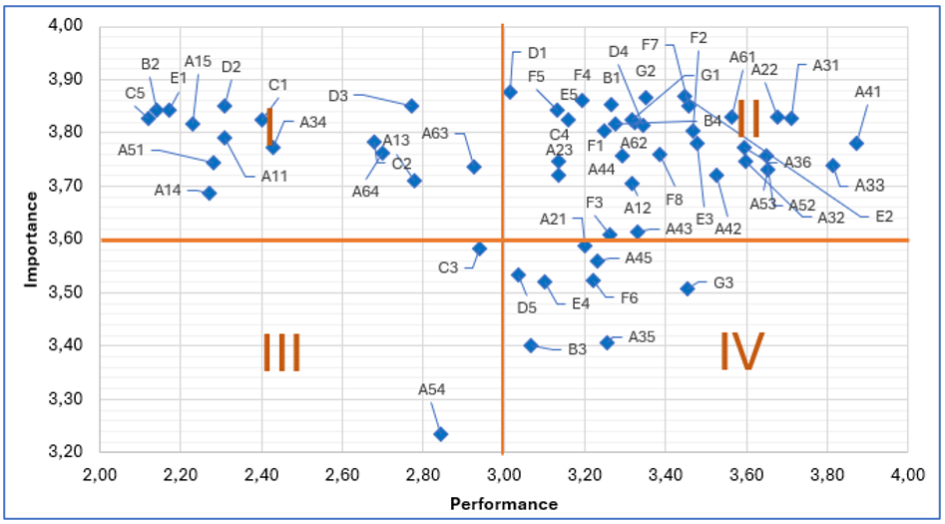


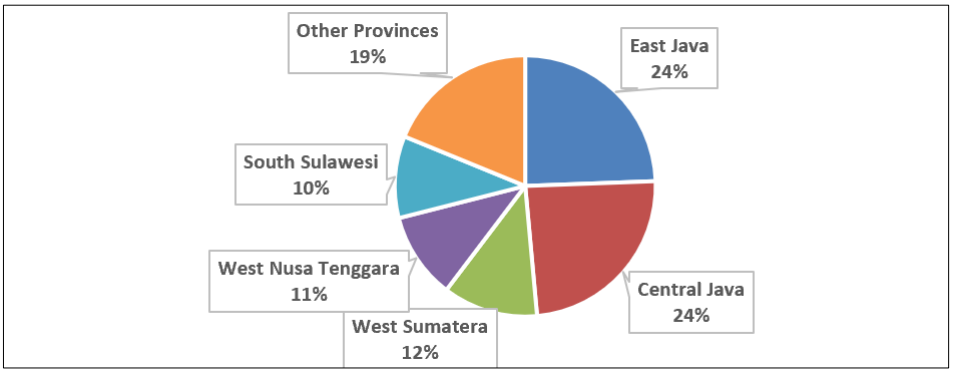
Source: Processed Data by Researchers (2024)

The Cartesian diagram of the IPA analysis is presented in Figure 2. Based on the IPA results, quadrant I indicators must be maintained because they are crucial for the success of shallot downstream, quadrant II requires increased performance, quadrant III has low priority, and quadrant IV shows excessive performance compared to its level of importance so it needs to evaluate resource allocation.

DISCUSSION

Shallot farming is an essential sector in Indonesian agriculture, contributing significantly to national vegetable production. 2023 shallot production reached 1,985,233 tons or around 13.59% of the total national vegetable production (BPS Indonesia, 2024). This figure reflects the high role of shallots in supporting domestic food needs, considering that this commodity is the main ingredient in various traditional Indonesian dishes. This success is supported by the vast area of planting land and attention to cultivation management by farmers in different regions.

Figure 3. The Contribution of Shallot Production Centers in Indonesia in 2023

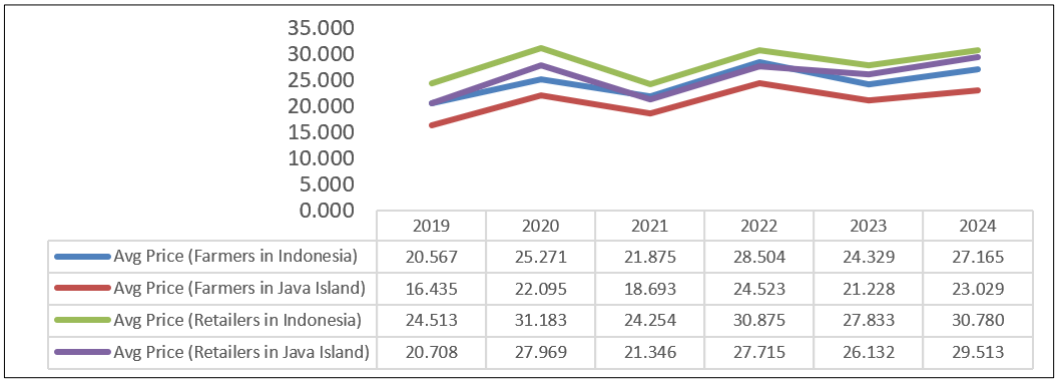


Source: BPS Indonesia (2024), Processed Data by Researchers (2024)

Figure 3 shows that Java Island is a wholesale production center that contributes 59.28% of total national production, making it a leading center for this commodity (BPS Indonesia, 2024). East Java has the most significant role, and it is supported by production centers such as Nganjuk, Probolinggo, and Malang. These areas have good cultivation practices and supporting technologies such as modern irrigation and broader access to superior seeds. In addition, the existence of adequate storage infrastructure also supports the optimization of harvest results.

One key factor for the success of shallot production in Java is better irrigation technology and access to agricultural inputs such as superior seeds and fertilizers. However, the technological gap between large and small farmers is still an obstacle to increasing production efficiency evenly. This gap impacts the fluctuation of shallot prices in Java, even though Java is the largest contributor of shallots in Indonesia.

Figure 4. The Dynamics of Shallot Prices in Indonesia and Java Island 2019-2024



	2019	2020	2021	2022	2023	2024
Avg Price (Farmers in Indonesia)	20.567	25.271	21.875	28.504	24.329	27.165
Avg Price (Farmers in Java Island)	16.435	22.095	18.693	24.523	21.228	23.029
Avg Price (Retailers in Indonesia)	24.513	31.183	24.254	30.875	27.833	30.780
Avg Price (Retailers in Java Island)	20.708	27.969	21.346	27.715	26.132	29.513

Source: Processed Data by Researchers (2024)

Figure 4 shows fluctuations in shallot prices on the island of Java in the 2019–2024 period reflecting major challenges to the economic stability of the agricultural sector. Shallot prices show an increasing trend but are accompanied by volatility that impacts farmer welfare. In 2024, the average price of shallots at the farmer level in Java was recorded at IDR 23,029, lower than the national average of IDR 27,165. This difference of -17.95% shows that farmers in Java receive much lower prices than farmers in other areas, even though Java is the main production center (BPS Indonesia, 2024).

This disparity becomes more apparent when comparing prices at the wholesaler level. The average price of shallots at wholesalers in Java is IDR 29,513, slightly lower than the national average of IDR 30,780, with a difference of -4.29%. This disparity indicates a higher profit margin at the wholesaler level than at the farmer level. Large traders in Java have strong bargaining power due to their control over the distribution and storage of shallots, which recognizes economic injustice for farmers.

Dependence on seasonal patterns also increases price volatility. In the lean season, limited shallot stocks cause significant price increases in the market, while during abundant harvests, prices drop drastically to below production costs. This pattern affects consumer purchasing power as well as farmer incomes. This situation poses a significant challenge to maintaining price stability in Java, which has the largest consumer market but also faces an uneven distribution of profits along the supply chain.

The average price of shallots at the farmer level in Java Island shows significant variation between provinces, reflecting local supply and demand dynamics. In Banten Province, shallot prices are above the national average because this region is known as a deficit area for shallot production. Banten's dependence on supplies from outside the province makes shallot prices there tend to be higher than in other regions (BPS Indonesia, 2024). Geographical and logistical factors also contribute to high distribution costs, which affect farmer prices. In contrast, East Java, one of Indonesia's leading centers of shallot production, has an average shallot price lower than the national average. This province is a major producer with abundant harvests from centers such as Nganjuk and Probolinggo. The availability of stable supply in East Java puts downward pressure on prices at the farmer level. In addition, high production capacity and access to modern cultivation technology also support efficiency in harvest management.

Wholesale prices reflect a similar pattern to those at the farmer level. In Banten, wholesale shallot prices are higher due to the high demand for commodities outside the province. In contrast, East Java again shows the lowest wholesale prices on Java Island, reflecting its strategic role in meeting domestic market needs. This trend confirms that the availability of local supply and distribution efficiency in each province greatly influences price dynamics at the farmer and wholesale levels.

Analysis of Tables 5 and 6 shows a striking difference in the disparity of shallot prices between Java and the national level, highlighting the structural realities in the shallot market. The data show shallot prices at the provincial level in Java, except for Banten, are lower than the national average. Banten is the only province in Java with a positive average disparity, IDR 1,867 on the producer side and IDR 714 on the wholesaler side. The high positive disparity in Banten is due to its status as a shallot deficit area, so it relies on supplies from outside the province with higher logistics costs, which are passed on to consumer prices. In contrast, East Java displays the largest negative price disparity. At the producer level, the average gap in East Java is -IDR 6,604, while at the wholesaler level, it reaches -IDR 6,156. The low prices in East Java reflect its status as Indonesia's main shallot production center.

The positive price disparity of shallots in Banten provides relative benefits for market players, such as wholesalers and retailers, who can enjoy higher profit margins. However, for consumers, this higher price increases the burden of food costs, which is especially felt by low-income people who depend on shallot consumption for their daily needs. This situation contributes to increasing inflation and instability of purchasing power, especially during certain seasons when demand increases. In contrast, the negative disparity in East Java provides economic benefits for consumers who get lower prices in the market. However, this low price poses challenges for regional producers and wholesalers. At this time, producers are often forced to sell shallots at prices lower than their production costs, which can reduce profit margins and affect the sustainability of their businesses (BPS Indonesia, 2024; Putri et al., 2023).

The correlation coefficient analysis in Tables 7 and 8 shows that shallot prices at Java's farmer and wholesaler levels are relatively unstable. A more than 9% correlation coefficient value indicates significant price fluctuations, reflecting unpredictable market dynamics. Supply-demand imbalances, weather disruptions, and limited distribution infrastructure often cause these price fluctuations. For example, although average prices are lower in East Java, sharp price shocks can cause hardship for farmers who face losses when prices drop drastically during a bumper harvest (Shankar et al., 2023; Susilowati et al., 2023).

In addition, this price volatility also impacts the distribution of profits along the supply chain. Wholesalers in areas with harmful disparities, such as East Java, may be forced to sell shallots at low prices and bear the risk of losses when market prices fall. Conversely, in areas with positive disparities, such as Banten, wholesalers make greater profits but are impacted by consumers who have to pay higher prices. Therefore, policies to stabilize prices, improve supply chains, and increase distribution efficiency are crucial to reducing price declines. The volatility of shallot prices in Java Island shows a significant disparity between surplus and deficit areas. In Banten, shallot prices tend to be higher than the national average due to a local shortage of supply that causes prices to increase.

Conversely, in East Java, the main production center, prices are lower than the national average due to abundant oversupply. This price disparity creates instability in farmers'

incomes, where farmers in East Java face economic pressure due to low prices. In contrast, farmers in Banten make greater profits, but consumers there have to pay higher prices. This price disparity analysis also shows that the volatility of shallot prices in Java Island is relatively high, as reflected in the correlation coefficient value greater than 9%, indicating uncertainty in prices that can harm all market players.

This condition shows the need for strategic steps to stabilize the price and distribution of shallots, one of which is downstream. With downstream, the added value of products can be increased through processing, more efficient storage, and more even distribution. The downstream process can reduce dependence on seasonal supplies and increase price resilience in the market. Through efficient processing, abundant shallots can be stored longer and marketed when supplies are low so that prices remain stable.

Based on the IPA analysis, it can be explained that the downstream efforts of shallots have experienced various obstacles. These obstacles cause the performance level of each strategic attribute/aspect to be low even though the level of importance is high. The attribute with the highest and most gap values is the first attribute of the downstream factor condition. In this attribute, three main aspects have the highest gap values, including the supply of raw materials, mastery of downstream technology, and capital. Regarding raw materials, the most prioritized areas for immediate improvement are the availability of domestic raw materials, raw material prices, the quality of raw materials, and raw material innovation. For the availability of domestic raw materials to be met, it is necessary to strengthen the distribution and logistics network from shallot-producing areas to various production and processing centers. Easier access to raw materials can be achieved by improving transportation infrastructure and implementing policies that support supply chain efficiency (Tejaningrum & Putra, 2022). In addition, controlling raw material prices is very important to maintain the stability of the downstream industry. The government must implement an effective market monitoring mechanism, including setting basic prices and providing subsidies to farmers, to prevent price fluctuations that can disrupt smooth production. In terms of raw material quality, increasing farmer capacity through training programs and technical assistance is a step that needs to be taken. The application of modern agricultural technology, such as superior varieties, balanced fertilization, and integrated pest control, must be widely introduced so that the quality of the shallots produced is by downstream industry standards (Ernawatiningsih et al., 2023). Innovation in raw materials is also an important aspect that should not be ignored. Developing shallot varieties with advantages such as resistance to disease or longer shelf life can add significant value to downstream products. Applying post-harvest processing technology to maintain the quality of raw materials during the distribution process is also very important.

The attributes with the largest gap between performance and importance are the related industries and downstream supporters. To address this gap effectively, three key aspects require immediate attention: financial access, industry associations, and research and development (R&D). From a financial standpoint, it is imperative to ensure easier and more targeted access to affordable financing options for participants in the shallot industry. This includes tailoring funding solutions to meet their specific needs. Expanding special financing schemes, such as the *Kredit Usaha Rakyat* (KUR) program with low-interest rates or offering innovation grants, could significantly enhance financial inclusivity (Sahay et al., 2015). Furthermore, both the government and financial institutions must collaborate to provide long-term financing options aimed at enabling investments in advanced and efficient shallot processing technologies. In addition to technology investments, funding should also support the development of robust downstream infrastructure, which plays a critical role in sustaining the value chain. Such

infrastructure improvements would foster a more stable and efficient ecosystem, enhancing the competitiveness of the shallot industry in domestic and global markets.

Industry associations hold a pivotal position in bringing together various stakeholders within the shallot value chain, including farmers, processors, distributors, and exporters. By fostering collaboration among these actors, they play a key role in enhancing the synergy needed to develop and expand downstream products. Effective cooperation, coordination, and communication facilitated by these associations can drive innovation and streamline efforts across the industry. One of the primary functions of industry associations is policy advocacy. They can influence the formulation of regulations that support the growth of the shallot downstream industry. This includes promoting policies that ease the export process for derivative shallot products and establishing higher quality standards to ensure competitiveness in both domestic and international markets. By pushing for such supportive measures, associations not only empower industry players but also create a more favorable business environment. Additionally, industry associations are instrumental in strengthening market networks for downstream products (Marques, 2017). They can connect members with domestic buyers and international trading partners, opening new avenues for market access and growth. Through these efforts, they ensure that the benefits of downstream development are shared across the value chain, boosting profitability and sustainability for all stakeholders involved.

R&D serves as the cornerstone for driving innovation within the shallot downstream sector, laying the groundwork for sustainable growth and value creation. Strategic investment in R&D should prioritize the development of advanced, efficient, and eco-friendly processing technologies (Bataineh et al., 2024). This includes technologies that not only improve productivity but also reduce environmental impact, aligning with global sustainability goals. Additionally, research efforts should focus on cultivating new shallot varieties that offer higher added value, such as those with enhanced nutritional profiles, longer shelf lives, or suitability for specialized applications.

An important dimension of R&D is finding innovative ways to utilize shallot waste, which currently represents an untapped resource. By transforming this waste into valuable derivative products, such as ingredients for the cosmetics or functional food industries, the sector can create new revenue streams while reducing environmental waste. Examples might include extracting bioactive compounds for skincare or processing shallot residues into health-promoting food supplements. To achieve meaningful progress, collaboration between universities, research institutions, and industry players is critical. Such partnerships ensure that R&D initiatives are not only well-funded but also aligned with industry needs and market demands. By fostering an ecosystem of shared knowledge and resources, these collaborations enhance the likelihood that innovations will be adopted widely and efficiently.

CONCLUSION

This study aims to analyze the volatility and disparity of shallot prices in Indonesia from 2019 to 2024, focusing on provincial areas in Java. The findings reveal that the imbalance in shallot production between surplus regions like East Java and deficit regions like Banten has led to significant price instability, negatively impacting both farmers and consumers. In East Java, oversupply has driven prices down, reducing farmers' incomes, while in Banten, undersupply has caused prices to surge, exacerbating income inequality and market distortions. To address these challenges, optimizing shallot downstream processes is essential, including efficient processing, the development of derivative products, and improvements in storage and distribution infrastructure. Additionally, investing in research and development of post-harvest

technology and implementing government policies for price stabilization are critical to maintaining supply and price balance. Strengthening the quality of raw materials and ensuring more equitable distribution will enhance the competitiveness of the shallot sector, reduce price volatility, and promote the fair welfare of farmers and consumers across Indonesia.

The government, industry stakeholders, and farmers must work collaboratively to tackle Indonesia's shallot industry challenges. The government should implement price stabilization policies, such as setting floor prices, to protect farmers from market volatility and ensure fair incomes. Additionally, investing in agricultural infrastructure, particularly post-harvest storage and cold chains, would reduce losses and stabilize prices. Market information systems should also be developed to provide real-time data, improving market transparency and decision-making. For industry players, strengthening supply chain efficiency by building stronger relationships with farmers and optimizing logistics can reduce price fluctuations. Moreover, technological processing, packaging, and distribution innovations can streamline operations and mitigate risks. At the same time, long-term partnerships with farmers through contract farming or cooperatives can ensure stable supply and fair pricing. Farmers, on their part, can diversify crops and explore value-added products like shallot powder to increase income, while accessing financial support such as crop insurance and loans can help manage market risks. Finally, sustainable farming practices can improve productivity and ensure long-term profitability, contributing to a more resilient and sustainable shallot industry.

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DECLARATION OF CONFLICTING INTERESTS
The researcher affirms that this article is their original work and has neither been nor is currently being considered for publication elsewhere.

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