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Analysis of Distribution and Added Value of Shallots (*Allium Ascalonicum L)* Using the Commodity System Assessment Method (CSAM) From Songan B Village to Denpasar

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Abstract

Shallots (*Allium ascalonicum* L.) are high-value horticultural commodities that are susceptible to postharvest losses and quality changes during distribution. Songan B Village, Kintamani District, Bangli Regency, is one of the shallot-producing areas supplying markets in Denpasar, Bali. This study aimed to analyze shallot distribution channels, postharvest handling practices, postharvest losses, quality changes, and added value along the distribution chain using the Commodity System Assessment Method (CSAM). Data were collected through interviews, observations, questionnaires, and literature studies using snowball sampling to identify distribution actors. The results identified three distribution channels: farmers–retailers, farmers–collectors–retailers, and farmers–collectors–suppliers. Postharvest handling activities included sorting and grading, cleaning, weighing, storage, waiting, packaging, transportation, and display. Postharvest losses were 1.98% at the farmer level, 3.50% at the collector level, 1.27% at the retailer level, and 1.17% at the supplier level, all of which were categorized as insignificant (<5%). Farmers obtained the highest nominal profit of IDR 26,267/kg, while among trading actors, suppliers generated the highest profit of IDR 4,850/kg, with a marketing margin of IDR 5,000/kg and a profit-to-cost ratio of 32.33. Quality analysis showed final moisture contents of 44.77% at the farmer level, 45.80% at the collector level, 45.40% at the supplier level, and 43.30% at the retailer level, while texture values ranged from 9.60 N to 13.88 N. The findings indicate that the shallot distribution system from Songan B Village to Denpasar has relatively low postharvest losses; however, improved postharvest handling, particularly at the collector level, is required to maintain product quality and improve distribution efficiency.

Keywords: Shallot, Commodity System Assessment Method, Distribution, Postharvest Loss, Added Value

Introduction

Shallot (*Allium ascalonicum* L.) is an important horticultural commodity in Indonesia due to its widespread use as a food ingredient and its high economic value for farmers and marketing actors. The horticultural subsector has considerable potential to support economic growth, increase farmers' income, expand trade, and create employment opportunities (Directorate General of Horticulture, 2019) [4]. Shallot production also has promising business prospects because of its high demand for household consumption, the food industry, and other uses (Pebriani *et al*., 2024) [12]. In Bali, shallot production reached 35,374 tons in 2023, with Bangli Regency contributing approximately 94% of the province's total production (BPS Statistics Indonesia, 2023) [2]. Kintamani District is one of the main shallot-producing areas in Bangli Regency Bali Provincial Agriculture and Food Security Service, (2023) [1], making the distribution system from production centers to consumption areas, particularly Denpasar, important for maintaining product availability and quality.

As a perishable horticultural commodity, shallot is susceptible to quantitative and qualitative losses throughout the postharvest chain. Postharvest losses may occur during harvesting, handling, storage, processing, packaging, transportation, and marketing (Mrema and Rolle, 2002) [8]. Inadequate handling, packaging, storage, and transportation, as well as microbial activity and mechanical damage, can contribute to product losses and quality deterioration (Kasso and Bekele, 2018) [5]. Therefore, postharvest management is an important component of shallot distribution because each handling activity can influence the quantity and quality of products reaching the final market.

Songan B Village, Kintamani District, Bangli Regency, is one of the shallot-producing areas supplying markets in Denpasar. Distribution from the production area to the market involves several actors and a series of postharvest activities. The involvement of different actors and handling stages may affect product flow, postharvest losses, and distribution efficiency. Consequently, evaluating the distribution system requires not only identifying the marketing channels but also examining the handling activities performed at each stage and determining where losses occur. A systematic assessment is therefore necessary to identify critical points and develop appropriate improvements throughout the distribution chain.

Product quality and economic value are also closely related to postharvest handling. During distribution, shallots may undergo physical and physicochemical changes, including changes in moisture content and texture, as well as weight loss, decay, and microbial deterioration. Such changes can affect product quality and marketability (Suravi *et al*., 2024; Kasso and Bekele, 2018; Damayanti *et al*., 2026) [15, 5, 3]. At the same time, distribution involves transportation, storage, packaging, and other marketing costs that influence margins and profits received by each actor. Economic indicators such as costs, profits, marketing margins, and the share received by farmers can therefore be used to assess marketing performance and distribution efficiency (Kharisma *et al*., 2020; Pebriani *et al*., 2024 [12]).

Previous studies have generally examined individual components of the shallot distribution system. Pebriani *et al*., (2024) [12] analyzed marketing channels, margins, costs, profits, *farmer's share*, and marketing efficiency, while Kharisma *et al*. (2020) examined marketing chains and product movement, storage, and distribution. Other studies have focused on postharvest quality and losses associated with storage, packaging, transportation, mechanical damage, and physicochemical changes (Kasso and Bekele, 2018; Suravi *et al*., 2024; Damayanti *et al*., 2026) [5, 15, 3]. However, an integrated assessment linking distribution channels, actors and handling activities, postharvest losses, quality changes, and economic consequences is required to provide a more comprehensive understanding of the shallot commodity system. The Commodity System Assessment Method (CSAM) provides a systematic approach for evaluating the stages of a commodity system and identifying problems that can serve as the basis for improvement recommendations (La Gra, 2016) [7].

The novelty of this study lies in the integrated assessment of the shallot distribution system from Songan B Village, Bangli Regency, to Denpasar by quantitatively evaluating postharvest losses at different distribution stages and applying CSAM to examine the relationships among distribution structure, postharvest handling, product quality, and economic value. This approach is expected to provide a more comprehensive basis for improving distribution efficiency, reducing postharvest losses, maintaining product quality, and supporting the economic performance of actors along the distribution chain. Therefore, this study aimed to analyze the distribution channels, postharvest handling system, actors and handling activities, postharvest losses and critical loss points, quality changes, and added value of shallots distributed from Songan B Village to Denpasar using the Commodity System Assessment Method (CSAM).

Research Method

Material

The study was conducted in Songan B Village, Kintamani District, Bangli Regency, Bali, Indonesia, from April to June 2026. Songan B Village is located at approximately 1,393 m above sea level and is one of the shallot-producing areas supplying markets in Denpasar. The research material consisted of fresh shallots obtained from farmers in Songan B Village. Research instruments included structured questionnaires administered to farmers, collectors, suppliers, and retailers, as well as a digital scale, ruler, and measuring tape for field observations and measurements.

Research Implementation

The study involved farmers, collectors, suppliers, and retailers participating in the shallot distribution chain from Songan B Village to Denpasar. Respondents were selected using snowball sampling by tracing the flow of shallots and identifying subsequent distribution actors (Neuman, 2003) [10]. A total of 60 respondents were surveyed, consisting of 40 farmers, four collectors, four suppliers, and 12 retailers.

Primary data were collected through structured questionnaires, interviews, and direct field observations to obtain information on distribution channels, postharvest handling activities, postharvest losses, product quality, and economic aspects at each distribution level. Secondary data were obtained from scientific literature, statistical publications, and reports from relevant institutions.

The Commodity System Assessment Method (CSAM) was used to trace product flows, identify distribution actors and handling activities, quantify postharvest losses, and identify critical points along the distribution chain. The research procedure included identification of the research location and respondents, field surveys, questionnaire administration, data collection, identification of distribution channels and postharvest handling systems, CSAM analysis, and formulation of recommendations for improving the shallot distribution system. The research procedure is presented in Fig 1.

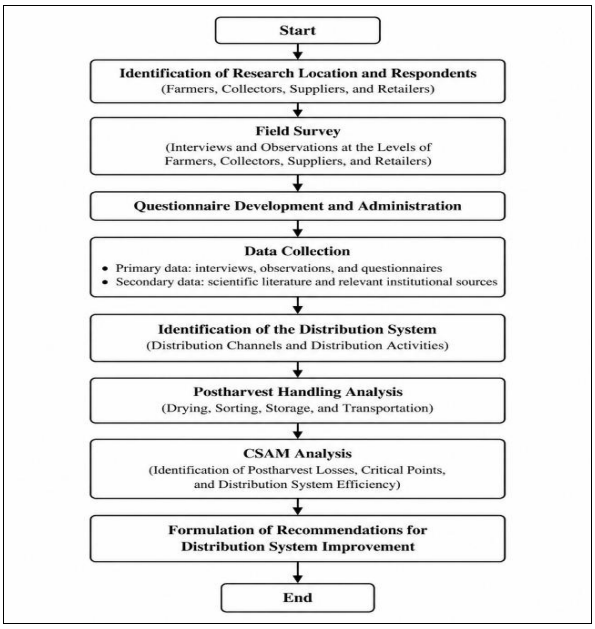

Fig 1: Research Procedure for Assessing the Shallot Distribution System Using the Commodity System Assessment Method (CSAM)

Observation Variable

The observed variables included distribution channels, postharvest handling systems, distribution actors and their activities, postharvest losses, economic value, and shallot quality. Postharvest handling activities were classified according to CSAM as operation (O), transportation (T), storage (S), inspection (I), and delay (D), while handling time, transportation distance, temperature, and other relevant conditions were recorded at each distribution stage.

Postharvest losses were determined from changes in shallot weight before and after handling at the farmer, collector, supplier, and retailer levels and were classified according to La Gra (2016) [7] as insignificant (<5%), significant (5–30%), and highly significant (>30%). Economic variables included purchase price, selling price, distribution costs, added value, marketing margin, profit, and profit-to-cost ratio. Shallot quality was evaluated based on moisture content and texture at each distribution level. Three samples were evaluated at each level, with texture measured three times per sample and moisture content expressed as a percentage.

Data Analysis

Data were analyzed descriptively and quantitatively using the Commodity System Assessment Method (CSAM). Distribution channels and handling activities were mapped to describe product flows and identify critical handling points. Postharvest losses were calculated from changes in product weight and expressed as percentages according to the CSAM impact categories of La Gra (2016) [7].

Economic analysis included distribution costs, added value, marketing margin, profit, and profit-to-cost ratio. Added value was determined from the difference between output value and input costs, while marketing margin was calculated as the difference between selling and purchasing prices. Shallot quality was analyzed descriptively by comparing moisture content and texture among distribution levels. The economic, quality, and postharvest-loss results were subsequently interpreted together with the CSAM assessment to evaluate their relationship with handling practices along the distribution chain.

Results and Discussion

Shallot Distribution Channels from Farmers in Songan B Village to Denpasar

The results identified three shallot distribution channels involving four main actors: farmers, collectors, retailers, and suppliers. The distribution channels were: (1) farmers–retailers, (2) farmers–collectors–retailers, and (3) farmers–collectors–suppliers. These channels differed in the number of actors involved, market destinations, and postharvest handling activities. Similar findings were reported by Olabu *et al*., (2022) [11], who identified three shallot marketing channels involving farmers and different marketing intermediaries.

Channel 1. Farmers → Retailers

In Channel 1, farmers sold shallots directly to retailers located around Songan B Village. Retailers contacted farmers when the shallots were ready for harvest, and the products were delivered directly after harvesting and initial postharvest handling. This was the shortest distribution channel because no collectors or suppliers were involved. A similar farmer–retailer channel was reported by Olabu *et al*., (2022) [11], particularly when farmers and retailers were located relatively close to each other.

Channel 2. Farmers → Collectors → Retailers

In Channel 2, farmers sold shallots to collectors on a weight basis. The collectors subsequently performed sorting, cleaning, grading, weighing, packaging, temporary storage, and transportation before distributing the products to retailers. Collectors also provided wider market access because shallots were distributed to Denpasar and other areas, including Tabanan, Buleleng, and Klungkung. This distribution pattern is consistent with the farmer–collector–retailer channel reported by (Olabu *et al*., 2022) [11].

Channel 3. Farmers → Collectors → Suppliers

In Channel 3, farmers sold shallots to collectors, who subsequently prepared the products according to buyer requirements before distributing them to suppliers. Shallots were sorted and graded based on size and quality specifications required by private-sector customers. Thus, collectors and suppliers served not only as distribution intermediaries but also as actors responsible for preparing shallots according to specific market requirements. Compared with Channel 1, this channel involved additional handling activities, including sorting, grading, temporary storage, packaging, and transportation.

Postharvest Handling System for Shallots from Farmers in Songan B Village to Retailers

Postharvest handling practices differed among distribution actors according to their respective roles in the distribution chain. At the farmer level, activities included harvesting, sorting, drying, cleaning, grading, packaging, weighing, and transportation. Collectors performed sorting and cleaning, grading, weighing, packaging, temporary storage, and transportation. Retailers mainly conducted sorting and display, while suppliers performed packaging, temporary storage, and transportation. The postharvest handling systems for the three distribution channels are presented in Tables 1–3.

Table 1: Flow Diagram of the Postharvest Handling System for Shallot Distribution Channel 1

Postharvest System Stages	Symbol					Additional Info		
	O	T	I	D	S	Temperature	Time	Observations
Farmer Level								
a. Harvesting						20 C	07.00 am - 09.30 am	Harvesting process carried out using sickles and bamboo ties
b. Sorting/grading						20 C	07.00 am - 09.00 am	Selecting good and defective shallots as well as sorting them by size
c. Packaging						20 C	08.00 am - 09.00 am	Packaging using bamboo baskets
d. Transportation						20 C	09.30 am - 10.00 am	Commodity transported using open pickup truck to farmer's shallot warehouse
e. Storage						20 C	10.00 am - 16.00 pm	Commodity stored in shallot storage shed for 2 weeks
f. Waiting						20 C	04.00 pm - 07.00 am	Commodity placed in shallot storage shed
g. Packaging						20 C	07.00 am - 07.30 am	Packaging using plastic mesh bags
h. Transportation						20 C	07.30 am - 09.00 am	Commodity transported using open pickup truck
Retailer Level								
a. Wheighing						22 C	09.00 am - 09.30 am	Weighing carried out according to order using digital scales
b. Sorting/grading						22 C	09.30 am - 10.30 am	Selecting good and defective shallots as well as sorting them by size
c. Display						22 C	10.30 am - 16.00 pm	Commodity displayed on provided shelves
d. Storage						23 C	06.00 pm - 07.00 am	Unsold commodities stored inside plastic mesh bags

Table 2: Flow Diagram of the Postharvest Handling System for Shallot Distribution Channel 2

Postharvest System Stages	Symbol					Additional Info		
	O	T	I	D	S	Temperature	Time	Observations
Tingkat Petani								
a. Harvesting						20 C	07.00 am - 09.30 am	Harvesting process carried out using sickles and bamboo ties
b. Sorting/grading						20 C	07.00 am - 09.00 am	Selecting good and defective shallots as well as sorting them by size
c. Packaging						20 C	08.00 am - 09.00 am	Packaging using bamboo baskets
d. Transportation						20 C	09.30 am - 10.00 am	Commodity transported using open pickup truck to farmer's shallot warehouse
e. Storage						20 C	10.00 am - 04.00 pm	Commodity stored in shallot storage shed for 2 weeks
Collector Level								
a. Sorting and cleaning						20 C	09.00 am - 12.00 pm	Actor sorts and cleans by peeling the outer skin layer of shallots
b. Packaging						22 C	09.00 am - 12.00 pm	Commodity packaged using plastic mesh bags
c. Weighing						22 C	12.00 pm - 12.30 pm	Weighing carried out using digital scales
d. Waiting						23 C	12.30 pm - 04.00 pm	Commodity placed inside plastic mesh bags
d. Transportation						23 C	04.00 pm - 06.00 pm	Actor transports commodity using open pickup truck
e. Storage						20 C	06.00 pm - 02.00 pm	Commodity stored in warehouse using plastic mesh bags
Retailer Level								
a. Transportation						20 C	05.00 am - 06.00 am	Actor transports commodity using open pickup truck
b. Weighing						20 C	06.00 am - 06.30 am	Weighing carried out using digital scales
c. Sorting and cleaning						20 C	06.30 am - 07.00 am	Sorting carried out to select commodity based on size
d. Display						20 C	07.00 am - 03.00 pm	Commodity displayed on provided shelves

Table 3: Flow Diagram of the Postharvest Handling System for Shallot Distribution Channel 3

Postharvest System Stages	Symbol					Additional Info		
	O	T	I	D	S	Temperature	Time	Observations
Farmer Level								
a. Harvesting						20 C	07.00 am - 09.30 am	Harvesting process carried out using sickles and bamboo ties
b. Sorting/grading						20 C	07.00 am - 09.00 am	Selecting good and defective shallots as well as sorting them by size
c. Packaging						20 C	08.00 am - 09.00 am	Packaging using bamboo baskets
d. Transportation						20 C	09.30 am - 10.00 am	Commodity transported using open pickup truck to farmer's shallot warehouse
e. Storage						20 C	10.00 am - 04.00 pm	Commodity stored in shallot storage shed for 2 weeks
Collector Level								
a. Sorting and cleaning						20 C	09.00 am - 12.00 pm	Actor sorts and cleans by peeling the outer skin layer of shallots
b. Packaging						22 C	09.00 am - 12.00 pm	Commodity packaged using plastic mesh bags
c. Weighing						22 C	12.00 pm - 12.30 pm	Weighing carried out using digital scales
d. Waiting						23 C	12.30 pm - 04.00 pm	Commodity placed inside plastic mesh bags
d. Transportation						23 C	04.00 pm - 06.00 pm	Actor transports commodity using open pickup truck
e. Storage						20 C	06.00 pm - 02.00 pm	Commodity stored in warehouse using plastic mesh bags
Supllier Level								
a. Storage						20 C	07.00 pm - 10.00 pm	Commodity packaged using plastic mesh bags on wooden pallets
b. Transportation						20 C	10.00 pm - 02.00 am	Shallots distributed to the market

Postharvest Handling at the Farmer Level

Shallots were harvested at approximately 60–65 days after planting when the foliage began to soften and lodge. Harvesting was performed using sickles, and the harvested plants were bundled using bamboo ties. These maturity indicators are consistent with Prabawati *et al*., (2026) [13], who reported that tropical shallots generally reach maturity at approximately 60 days after planting, with lodging foliage as an indicator of harvest maturity. After harvesting, shallots were sorted to remove damaged bulbs and dried for approximately 14 days. The products were then cleaned, graded according to size, packed in plastic mesh bags, weighed, and transported to retailers or collectors. Drying and curing are important for reducing moisture in the foliage and bulb neck and developing a protective dry outer layer (Prabawati *et al*., 2026) [13]. Similar postharvest practices involving drying, sorting, grading, and storage were also reported by (Triyono, 2008) [16].

Postharvest Handling at the Collector Level

Collectors performed sorting, cleaning, grading, weighing, packaging, temporary storage, and transportation. Dry outer skins and impurities were removed using a blower, while grading was conducted according to product size and buyer requirements. The shallots were packed in plastic mesh bags and temporarily stored before distribution to retailers or suppliers. Appropriate storage conditions are important because temperature, relative humidity, ventilation, and storage duration may affect shallot weight loss and quality (Prabawati *et al*., 2026) [13]. Risyahadi *et al*., (2019) [14] also reported that storage methods influence postharvest losses and the economic value of shallots. The products were subsequently transported using open-bed pickup trucks.

Postharvest Handling at the Retailer Level

At the retailer level, shallots were sorted to remove bulbs showing abrasions, decay, or other physical damage before being displayed for sale. Sorting was repeated during the display period when deteriorated products were identified. Thus, retailers functioned as the final quality-control point before the shallots reached consumers. Appropriate sorting is important for separating damaged or decayed products from marketable products and maintaining product quality during marketing (Mulyawanti and Suryana, 2024) [9].

Postharvest Handling at the Supplier Level

Suppliers received shallots according to buyer specifications and conducted packaging, temporary storage, and transportation to consumers. Shallots were packed in plastic or mesh bags, temporarily stored on wooden pallets, and subsequently transported using open-bed pickup trucks. The use of pallets prevented direct contact between packages and the warehouse floor, while appropriate ventilation and product arrangement were important for maintaining product condition during temporary storage. Storage conditions, particularly temperature and relative humidity, may influence respiration, transpiration, weight loss, and microbial deterioration of shallots (Prabawati *et al*., 2026) [13].

Identification of Distribution Actors and Handling Activities

Four main actors were identified in the shallot distribution system: farmers, collectors, retailers, and suppliers. Their activities included harvesting, sorting and grading, packaging, weighing, waiting or temporary storage, transportation, and display. Following the CSAM approach, these activities were identified based on who performed the activity, what was performed, how, when, why, and where the activity was conducted. Detailed handling activities at each distribution level are presented in Table 4.

Table 4: Identification of Post-Harvest Handling Actors and Activities Carried Out

Handling Stage	Who	What	How	When	Why	Where
A. Farmer Level						
Harvesting	Farmer	Uprooting and cutting shallots aged 60–65 days	Using sickles, bamboo ties, and baskets	After 60–65 days	To harvest mature shallots and prevent bulb splitting or regrowth phase (regrowth)	In the field
Sorting/Grading	Farmer	Removing dry outer skin and sorting shallots by size	Peeling dry skin, selecting large/small sizes, and separating damaged shallots	After shallots are harvested	To achieve good quality and secure high prices	In the field
Packaging	Farmer	Packaging sorted shallots	Placing shallots into bamboo baskets	After shallots are sorted	To protect shallots from damage risks and facilitate transportation	In the shallot storage shed
Transportation	Farmer	Carrying shallots from the field to the storage shed	Using closed pickup trucks	After all handling steps at the farmer level are completed	To distribute shallots to the next actors in the supply chain	From the shallot shed to the next destination
B. Collector Level						
Sorting/Grading	Collector	Removing dry outer skin and sorting shallots by size	Cleaning dry skin	Upon arrival of commodities at the facility	To achieve good quality and secure high prices	In the farmer's storage shed
Weighing	Collector	Weighing sorted shallots	Using digital scales	After shallots are sorted	To determine the weight of sorted shallots	In the farmer's storage shed
Waiting/Storage	Collector	Storing shallots in plastic mesh bags	Placing shallots into plastic mesh bags	After weighing	To wait for buyers / next distribution stage	At the collector's facility
Transportation	Collector	Transporting shallots to the supplier's facility	Transporting using open pickup trucks	In the morning	To distribute shallots to suppliers	From the collector's facility
C. Retailer Level						
Transportation	Retailer	Transporting shallots	Using open pickup	In the afternoon	To market shallots to	At the market

		from collector to market	trucks		end consumers	
Sorting	Retailer	Separating damaged shallots	Separating damaged shallots	Upon arrival at the market	To achieve good quality and secure high prices	At the market
Display	Retailer	Displaying shallots at the market	Arranging shallots at the point of sale	After sorting	To attract consumers	At the market
D. Supplier Level						
Sorting	Supplier	Separating damaged shallots and sorting by size	Separating damaged shallots and sorting by size	During transport from collector to facility	To obtain high-quality shallots	At the supplier's warehouse
Transportation	Supplier	Transporting shallots from supplier's facility	Transported using open pickup trucks	In the afternoon	To distribute shallots to market traders	At the supplier's facility/house

The results showed that each actor performed different but interconnected functions along the distribution chain. Farmers were mainly responsible for harvesting and initial product preparation, collectors performed sorting, grading, weighing, temporary storage, and transportation, retailers conducted final sorting and display, while suppliers performed storage and transportation before further distribution. Differences in these activities reflect the specific functions of each actor within the shallot distribution system.

Effects of Postharvest Handling During Distribution on Shallot Postharvest Losses

Postharvest losses occurred at all distribution levels, with different percentages among actors. The highest loss was observed at the collector level (3.50%), followed by the farmer (1.98%), retailer (1.27%), and supplier levels (1.17%). Based on the CSAM classification, all losses were categorized as insignificant (<5%). Nevertheless, the collector level represented the highest loss point in the distribution chain and therefore requires greater attention in postharvest handling.

Differences in postharvest losses were associated with the handling activities performed at each distribution level. Collectors conducted several successive activities, including sorting and cleaning, grading, weighing, waiting, temporary storage, packaging, and transportation. However, because losses were not measured separately for each handling activity, the 3.50% loss at the collector level cannot be attributed to a single operation. Postharvest losses may be influenced by harvesting practices, storage conditions, postharvest technology, and supply-chain efficiency (Mulyawanti and Suryana, 2024) [9].

The losses observed in the present study were lower than those reported for Chinese cabbage using the same CSAM approach. In the Chinese cabbage distribution system, postharvest losses reached 10.25% at the farmer level, 11.42% at the collector level, 3.16% at the wholesaler level, 4.55% at the supplier level, and approximately 11% at the retailer level. The differences indicate that postharvest losses may vary according to commodity characteristics and handling systems. Shallots that have undergone drying differ physiologically from leafy vegetables with high moisture content and greater susceptibility to wilting.

Harvest Quantity, Postharvest Loss, and Net Marketable Yield at the Farmer Level

Total shallot harvest from ten observed farmers was 12,100 kg, with a weight loss of 240 kg and a net marketable yield of 11,860 kg. The average harvest was 1,210 kg per farmer, with an average loss of 24 kg. The resulting postharvest loss was 1.98%, while 98.02% of the harvested shallots remained marketable. According to the CSAM classification, this loss was categorized as insignificant (<5%). The harvest quantity, weight loss, and net marketable yield observed at the farmer level are presented in Table 5.

Table 5: Harvest Yield, Weight Loss, and Net Harvest Yield at the Farmer Level

Farmer	Harvest yield (kg)	Weight loss (kg)	Net Yield (kg)
1	1000	50	950
2	800	50	750
3	1000	10	990
4	1000	20	980
5	3000	30	2970
6	500	10	490
7	2000	20	1980
8	1500	10	1490
9	1000	10	990
10	300	30	270
Total	12100	240	11860
Average	1210	24	1186
Percentage %		1.98%	98.02%

Source: Primary Data (2026)

The observed weight loss occurred mainly during sorting and the approximately 14-day drying period. During sorting, unsuitable products were removed, while drying resulted in moisture reduction. Therefore, the recorded weight loss should not be interpreted entirely as physical product damage. Shallots remain physiologically active after harvest, and weight loss may occur through water loss and metabolic activity influenced by maturity, curing, temperature, relative humidity, and storage conditions (Suravi *et al*., 2024) [15]. Mulyawanti and Suryana (2024) [9] also emphasized the importance of drying in preparing shallots for storage and marketing. Thus, the relatively low farmer-level loss reflected both removal of unsuitable products and physiological moisture loss during postharvest handling.

Purchase Quantity, Postharvest Loss, and Net Marketable Yield at the Collector Level

At the collector level, the total quantity of shallots purchased by the two observed collectors was 24,000 kg, with a weight loss of 840 kg and a net marketable quantity of 23,160 kg. The resulting postharvest loss was 3.50%, leaving 96.50% of the initial quantity marketable. Although this was the highest loss among the distribution actors, it remained below 5% and was therefore classified as insignificant according to CSAM. The purchase quantity, weight loss, and net marketable quantity at the collector level are presented in Table 6.

Table 6: Purchase Results, Weight Loss, and Net Results at the Collector Level

Collector	Harvest Yield (kg)	Weight Loss (kg)	Net Yield (kg)
1	14000	490	13510
2	10000	350	9650
Total	24000	840	23160
Average	12000	420	11580
Percentage %		3.50%	96.50%

Source: Primary Data (2026)

The relatively higher loss at the collector level occurred alongside several successive handling activities, including repeated sorting and cleaning, grading, weighing, packaging, waiting or temporary storage, and transportation. Sorting and cleaning removed dry outer skins and products that did not meet market requirements, while temporary storage may have allowed further physiological moisture loss. Suravi *et al*., (2024) [15] reported that onion weight loss during storage is influenced by water loss, physiological activity, temperature, relative humidity, air circulation, and storage duration. Therefore, the 3.50% loss should be interpreted as the cumulative loss observed during collector-level handling rather than being attributed to a single operation.

Purchase Quantity, Postharvest Loss, and Net Marketable Yield at the Retailer Level

The two observed retailers received a total of 1,500 kg of shallots, with a weight loss of 19 kg and a net marketable quantity of 1,481 kg. The resulting postharvest loss was 1.27%, while 98.73% of the initial quantity remained marketable. This loss was categorized as insignificant according to the CSAM classification. The purchase quantity, weight loss, and net marketable quantity at the retailer level are presented in Table 7.

Table 7: Purchase Results, Weight Loss, and Net Results at Retailers

Retailer	Harvest Yield (kg)	Weight Loss (kg)	Net Yield (kg)
1	1000	14	986
2	500	5	495
Total	1500	19	1481
Average	750	9.5	740.5
Percentage %		1.27%	98.73%

Source: Primary Data (2026)

Retailer-level losses occurred during transportation, sorting, cleaning, and product display. Sorting removed bulbs showing abrasions, decay, or other defects and therefore reduced marketable weight while simultaneously serving as a final quality-control activity. Mulyawanti and Suryana (2024) [9] identified sorting and appropriate handling as important components of Good Handling Practices for maintaining horticultural product quality. In addition, shallots remain physiologically active during display and may continue to experience moisture loss and deterioration (Suravi *et al*., 2024) [15]. Thus, appropriate sorting and management of display conditions remain important even at the final marketing stage.

Purchase Quantity, Postharvest Loss, and Net Marketable Yield at the Supplier Level

At the supplier level, the total quantity of shallots received by the two observed suppliers was 3,000 kg, with a weight loss of 35 kg and a net marketable quantity of 2,965 kg. The resulting postharvest loss was 1.17%, corresponding to a net marketable proportion of 98.83%. This was the lowest loss among the distribution actors and was classified as insignificant according to CSAM. The purchase quantity, weight loss, and net marketable quantity at the supplier level are presented in Table 8.

Table 8: Purchase Results, Weight Loss, and Net Results at the Supplier

Supplier	Harvest Yield (kg)	Weight Loss (kg)	Net Yield (kg)
1	2000	15	1985
2	1000	20	980
Total	3000	35	2965
Average	1500	17.5	1482.5
Percentage %		1.17	98,83

Source: Primary Data (2026)

The relatively low loss at the supplier level occurred during temporary storage and subsequent distribution. Although storage was relatively short, shallots remained physiologically active and could continue to lose moisture. Storage conditions such as temperature, relative humidity, ventilation, and duration may influence postharvest weight loss and quality (Suravi *et al*., 2024) [15]. However, because the contribution of each handling activity was not measured separately, the 1.17% loss should be interpreted as the overall loss observed at the supplier level rather than as the effect of a specific handling factor.

Overall Effects of Postharvest Handling on Shallot Losses

Postharvest losses differed among distribution actors, with the highest loss observed at the collector level (3.50%), followed by the farmer (1.98%), retailer (1.27%), and supplier levels (1.17%). All values were below 5% and were therefore classified as insignificant according to the CSAM criteria. Nevertheless, the collector level represented the highest loss point and involved several successive handling activities, including sorting and cleaning, grading, waiting, temporary storage, and transportation. Because losses were not measured separately for each activity, the collector-level loss cannot be attributed quantitatively to any single handling operation.

The losses observed in this study were lower than those reported in a CSAM assessment of Chinese cabbage, where losses reached 10.25% at the farmer level, 11.42% at the collector level, 3.16% at the wholesaler level, 4.55% at the supplier level, and approximately 11% at the retailer level. These differences indicate that loss percentages should be interpreted in relation to commodity characteristics and

handling systems because dried shallots differ from leafy vegetables with high moisture content and greater susceptibility to wilting.

Although all losses were categorized as insignificant, improvements in postharvest handling remain important for maintaining marketable quantity and product quality. Particular attention should be given to the collector level through improved sorting and cleaning, reduced unnecessary waiting periods, adequate ventilation during temporary storage, appropriate packaging and stacking, and careful transportation and loading and unloading.

The overall impact classification of postharvest handling and losses at each distribution level is summarized in Table 9.

Table 9: Classification of Postharvest Losses at Each Distribution Level

Handling Stage	Insignificant	Significant	Highly Significant
A. Farmer Level			
1. Harvesting	V (1,98%)		
2. Sorting/grading	V		
3. Packaging	V		
4. Transportation	V		
B. Collector Level			
1. Sorting and cleaning	V (3,50%)		
2. Weighing	V		
3. Waiting	V		
4. Transportation	V		
C. Retailer Level			
1. Transportation	V		
2. Sorting and cleaning	V		
3. Display	V (1,27%)		
D. Supplier Level			
1. Sorting/grading	V (1,17%)		
2. Transportation	V		

Note:
Not Significant: < 5%
Significant: 5 – 30%
Highly Significant: > 30% (La Gra, 1999)

Table 10: Economic Analysis of Each Shallot Distribution Actor

Perpetrator	Purchase Price	Selling Price	Margin	Total Cost	Profit	Profit Ratio
Farmer		Rp 40,000	Rp	Rp 13,733	Rp 26,267	1.91
Collector	Rp 40,000	Rp 43,000	Rp 3,000	Rp 250	Rp 2,750	11.00
Retailer	Rp 43,000	Rp 45,000	Rp 2,000	Rp 150	Rp 1,850	12.33
Supplier	Rp 43,000	Rp 48,000	Rp 5,000	Rp 150	Rp 4,850	32.33

Source: Primary Research Data (2026)

Economic Analysis of the Shallot Distribution Chain

Economic analysis was conducted to evaluate the value generated by farmers, collectors, retailers, and suppliers along the shallot distribution chain. The analysis included purchase and selling prices, marketing margins, production or distribution costs, profits, and profit-to-cost ratios. The economic structure of each distribution actor is presented in Table 10.

Farmers sold shallots at IDR 40,000/kg, with a production cost of IDR 13,733/kg, resulting in a nominal profit of IDR 26,267/kg. Among the trading actors, suppliers obtained the highest marketing margin and nominal profit, at IDR 5,000/kg and IDR 4,850/kg, respectively, followed by collectors with a margin of IDR 3,000/kg and profit of IDR 2,750/kg, and retailers with a margin of IDR 2,000/kg and profit of IDR 1,850/kg. The increase in selling prices along the distribution chain reflects differences in the marketing and handling functions performed by each actor. Pebriani *et al*. (2024) [12] similarly reported that differences in shallot marketing margins and profits were associated with the marketing functions and costs incurred by distribution actors.

The profit-to-cost ratios were 1.91 for farmers, 11.00 for collectors, 12.33 for retailers, and 32.33 for suppliers. The relatively high supplier ratio resulted from a recorded distribution cost of IDR 150/kg compared with a marketing margin of IDR 5,000/kg. However, these ratios should be interpreted cautiously because the cost components differed among actors. The farmer ratio was calculated using the overall production cost, whereas the ratios for collectors, retailers, and suppliers were based on recorded distribution costs excluding the purchase price of the shallots. Therefore, the ratios provide information on profit relative to the specific costs recorded for each actor but should not be interpreted as directly comparable measures of overall efficiency.

Overall, the economic analysis showed two distinct patterns. Farmers generated the highest nominal profit per kilogram IDR 26,267/kg, whereas among the trading actors, suppliers generated the highest nominal profit IDR 4,850/kg and profit-to-cost ratio 32.33. These differences indicate that economic value was distributed differently according to the functions and cost structures of each actor along the shallot distribution chain.

Quality Analysis

Shallot quality was evaluated based on moisture content and texture at the farmer, collector, supplier, and retailer levels. Moisture content decreased at all distribution levels, with relative decreases of 7.19% at the farmer level, 3.92% at the

collector level, 3.81% at the supplier level, and 2.77% at the retailer level. The largest relative decrease occurred at the farmer level, where moisture content decreased from 48.23% to 44.77%. This decrease occurred during a stage that included approximately 14 days of drying, together with sorting, cleaning, grading, packaging, and preparation for transportation. Therefore, the relatively greater moisture reduction at the farmer level may be associated with the drying process, although it cannot be attributed exclusively to a single handling activity.

The mean texture parameter values were 9.60 at the farmer level, 12.84 at the collector level, 12.49 at the supplier level, and 13.88 at the retailer level. The texture parameter generally tended to increase toward the downstream end of the distribution chain, although the pattern was not linear. Postharvest factors such as curing, storage conditions, temperature, relative humidity, and packaging may influence the physical characteristics of shallots (Suravi *et al*., 2024) [15]. However, because different samples were evaluated at each distribution level and individual handling factors were not experimentally isolated, these differences should be interpreted as descriptive patterns rather than causal changes.

A summary of moisture content, texture, and postharvest loss at each distribution level is presented in Table 11.

Table 11: Moisture Content, Texture, and Postharvest Loss of Shallots at Each Distribution Level

Distribution Level	Initial Moisture Content (%)	Final Moisture Content (%)	Relative Moisture Decrease (%)	Mean Texture Parameter	Postharvest Loss (%)
Farmer	48.23	44.77	7.19	9.6	1.98
Collector	47.67	45.8	3.92	12.84	3.5
Supplier	47.2	45.4	3.81	12.49	1.17
Retailer	44.53	43.3	2.77	13.88	1.27

Source: Primary Research Data (2026)

The relative decrease in moisture content was highest at the farmer level (7.19%), followed by collectors (3.92%), suppliers (3.81%), and retailers (2.77%). At the farmer level, moisture content decreased from 48.23% to 44.77% during a stage that included approximately 14 days of drying. The relatively greater decrease at this level may therefore be associated with the drying process, which is an important part of shallot postharvest preparation. Mulyawanti and Suryana (2024) [9] reported that drying is an important handling operation for preparing shallots for storage and marketing. However, the observed moisture reduction cannot be attributed exclusively to drying because other environmental and handling conditions may also have contributed.

The mean texture parameter values were 9.60 N at the farmer level, 12.84 N at the collector level, 12.49 N at the supplier level, and 13.88 N at the retailer level. Thus, texture parameter values generally tended to increase toward the downstream end of the distribution chain, although the pattern was not linear. Suravi *et al*., (2024) [15] reported that onion quality during postharvest handling may be influenced by initial bulb condition, curing, storage environment, temperature, humidity, and packaging. Therefore, differences in texture parameter values may reflect different handling histories among distribution actors, although they cannot be attributed to a single handling activity.

The changes in moisture content did not show the same pattern as postharvest losses. Farmers recorded the largest relative decrease in moisture content (7.19%) but a postharvest loss of only 1.98%, whereas collectors showed a smaller moisture decrease (3.92%) but the highest postharvest loss (3.50%). This indicates that moisture change alone cannot explain the magnitude of postharvest loss. Other handling activities, including sorting, cleaning, removal of dry outer skins, temporary storage, waiting, and physical handling, may also contribute to reductions in marketable product weight. Therefore, moisture content, texture, and postharvest loss should be interpreted as complementary indicators of product condition rather than as interchangeable measurements.

Within the CSAM framework, quality measurements provide complementary information for evaluating product condition alongside handling activities and quantitative losses. Based on the conditions observed in the distribution system, maintaining shallot quality requires appropriate drying, adequately ventilated packaging, proper stacking, reduced unnecessary waiting periods, adequate air circulation during temporary storage, and careful handling during transportation and loading and unloading. These practices are consistent with the Good Handling Practices described by (Mulyawanti and Suryana, 2024) [9].

Conclusion

The distribution structure of shallots from Songan B Village, Kintamani District, Bangli Regency, to Denpasar consisted of three distribution channels: farmers–retailers, farmers–collectors–retailers, and farmers–collectors–suppliers. Postharvest handling activities varied among distribution actors and included sorting and grading, cleaning, weighing, packaging, temporary storage or waiting, transportation, and product display. Postharvest losses were relatively low throughout the distribution chain, accounting for 1.98% at the farmer level, 3.50% at the collector level, 1.27% at the retailer level, and 1.17% at the supplier level, all of which were classified as insignificant (<5%) according to the CSAM criteria. The collector level recorded the highest percentage of postharvest loss among the distribution actors. Economic analysis showed differences in profitability among distribution actors. Farmers generated the highest nominal profit of IDR 26,267/kg, with a production cost of IDR 13,733/kg and a selling price of IDR 40,000/kg. Among the trading actors, suppliers generated the highest profit of IDR 4,850/kg, followed by collectors at IDR 2,750/kg and retailers at IDR 1,850/kg. Suppliers also recorded the highest marketing margin of IDR 5,000/kg and a profit-to-distribution-cost ratio of 32.33, compared with 12.33 for retailers and 11.00 for collectors. Quality analysis indicated changes in the physical characteristics of shallots throughout the distribution chain. The final moisture contents were 44.77%, 45.80%, 45.40%, and 43.30% at the farmer, collector, supplier, and retailer levels, respectively, while the corresponding mean texture values were 9.60 N, 12.84 N, 12.49 N, and 13.88 N. These results indicate that the physical quality characteristics of shallots, particularly moisture content and texture, changed during postharvest handling and distribution. Overall, the shallot distribution system from Songan B Village to Denpasar was characterized by relatively low postharvest losses, although variations in economic returns and physical quality were observed among distribution actors. Therefore, postharvest

management should focus on improving sorting and cleaning practices, minimizing unnecessary waiting periods, maintaining adequate ventilation during temporary storage, using appropriate packaging and stacking methods, and ensuring careful handling during transportation, loading, and unloading to minimize product losses and maintain shallot quality throughout the distribution chain.

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