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PERFORMANCE ANALYSIS OF THE SHALLOT SUPPLY CHAIN IN SAMOSIR REGENCY, NORTH SUMATRA PROVINCE

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Abstract

This research aims to analyze the performance of the shallot supply chain in Samosir Regency. Place and Time of Research This research was conducted in Samosir Regency, North Sumatra Province. Data Collection and Analysis Analysis of the Condition of the Shallot Supply Chain The condition of the shallot supply chain is discussed descriptively following the FSCN (Food Supply Chain Network) discussion framework developed by Van der Vorst. The research results show that shallot supply chain activities in Samosir Regency are based on a food supply chain networking model where fluctuating prices and weather are the main inhibiting factors in supply chain activities starting from product availability to delivery. Measuring the performance of the shallot supply chain using the Supply Chain Operations Reference (SCOR) method has not shown optimal results on all indicators such as delivery performance, standard compliance and conformity with standards. Judging from the profit shares of producers, collectors and retailers, they differ from each other, this reflects the unequal profits of each trading system so that the trading system in this area is not yet efficient. In general, the shallot trading system in this village is not yet efficient. It is a good idea for farmers themselves to sort and sort small, medium and large shallots. So that the selling price can also increase and be more profitable.

Keywords**: *Supply Chain, Performance Analysis, Shallots, Samosir Regency***

1. INTRODUCTION

Supply chain analysis of shallots involves an in-depth understanding of the entire production, distribution and marketing process of shallots from start to reach the consumer. Meanwhile, logistics is a strategic process in managing the procurement, movement and storage of materials, both finished and semi-finished materials, through an organization and marketing channels (Zutsara, 2022). To obtain an effective and efficient logistics system, the supply chain management concept is used. This is the relationship between supply chain and logistics. Supply chain management can bring chain members to optimal levels of efficiency and effectiveness so that high profits are obtained (Kamble et al., 2020). This is because an effective and efficient supply chain can integrate existing resources, reduce logistics costs, increase logistics cost efficiency and high quality (Mellat-Parast & E. Spillan, 2014; Marchi & Zanoni, 2017). On the other hand, if the supply chain is inefficient it will lead to losses such as high logistics costs, information management costs, resources not being utilized properly, and reduced production capacity (Wijaya Ibr & Zailani, 2010; Raychaudhuri & Ghosh, 2016; Trisia et al., 2021). Proper supply chain management provides a great strategic opportunity to create competitive advantage (Siregar et al., 2024). Managing the shallot supply chain is quite complex. Like other agricultural commodities, the management of the shallot supply chain has certain characteristics because it is influenced by the production system, bulky, perishable and continuous decline in quality. In fact, demand for shallots occurs every day while consumer needs must always be met so that efforts to improve the performance of the shallot supply chain are very necessary so that customer needs and business actors' profits can be achieved (Gumilar et al., 2023).

In the context of shallot commodities, shallots are one of the important agricultural commodities in Indonesia (Rahmawati et al., 2018; Saptana et al., 2021). Shallots are a staple food ingredient that is often used in Indonesian cooking (Yofananda et al., 2020; Indrasari et al., 2021;

Cempaka et al., 2023). Indonesia has climatic conditions that are suitable for growing shallots, and several regions in Indonesia are known as the largest producers of shallots (Rahayu et al., 2018; Saidah et al., 2020). Several shallot-producing regions in Indonesia include Central Java, East Java and West Java (Triyono & Sulistyaningsih, 2021; Hidayah et al., 2023). However, shallot production is also carried out in other areas such as Sumatra, Sulawesi and Bali. Shallot production in Indonesia is usually carried out traditionally by small farmers or commercially by large companies (Sayaka et al., 2021; Hayati et al., 2021). Shallots are usually grown on a small scale in agricultural land or home gardens (Askari-Khorasgani & Pessarakli, 2020; Baiq Nurul Hidayah et al., 2023; Pangestuti et al., 2023). However, there are also large businesses that use modern technology to increase production and efficiency in shallot cultivation. The shallot market in Indonesia is quite large, because shallots are one of the main food ingredients in everyday Indonesian cooking. This high demand makes shallots one of the important agricultural commodities in the Indonesian economy. However, like other agricultural commodities, shallot prices can be influenced by factors such as weather, planting season and supply availability.

The perishable nature of shallots, but which are needed continuously in almost all regions, makes a supply chain management system very necessary. According to Samaranayake (2005), chain management is an integrated effort to increase efficiency through the related supplier chain, starting from the initial supplier (raw material supplier) to the final customer (end customer). From this phenomenon, supply chain analysis is very necessary to determine the efficiency of marketing channels and supply chains for horticultural agricultural products such as shallots. Samosir Island is located in the middle of Lake Toba, North Sumatra, Indonesia (Yulfi et al., 2017; Chesner et al., 2020). Samosir is known as one of the beautiful tourist areas in Indonesia, but also has significant agricultural potential, including for shallot farming. On Samosir Island, shallot cultivation is usually carried out by small farmers who use limited agricultural land. Shallot farming there is often done traditionally, using methods that have been passed down from generation to generation.

Samosir Island has a wet tropical climate which is suitable for the growth of shallot plants (Napitupulu et al., 2021; Boer et al., 2020). The rainy season and dry season also influence the planting and harvesting patterns of shallots on this island. The availability of agricultural land is an important factor in shallot cultivation on Samosir Island. Farmers generally use available land around their villages to grow shallots. Even though Samosir is not very big geographically, access to local markets in surrounding areas such as Parapat and Balige is very important for farmers to sell their crops. The level of technology and farmers' knowledge of modern agricultural practices also influence shallot production (Askari-Khorasgani & Pessarakli, 2020; Tinaprilla et al., 2022). Adoption of modern technology such as proper fertilization, use of superior seeds, and control of pests and diseases can increase crop yields. Shallot farming on Samosir Island, like farming in many other areas, can have challenges such as extreme weather, pest attacks and plant diseases, as well as access to markets and technology. Despite this, shallots remain one of the main agricultural commodities in this area, making an important contribution to the local economy and providing a livelihood for farmers on Samosir Island.

2. IMPLEMENTATION METHOD

The rationale for shallot business, even though it is a superior commodity, often faces various obstacles in meeting demand that occurs all the time. Consumer demand must be met so that business actors' profit targets can be achieved. Therefore, efforts to improve the performance of the shallot supply chain are very necessary. Samosir Regency, as the best producer of shallots in North Sumatra Province, is a very strategic location to research in order to seek efforts to improve the performance of the shallot supply chain. In order to formulate efforts to improve the performance of the shallot supply chain, it is necessary to first study the condition of the shallot supply chain. The assessment of the condition of the shallot supply chain in Samosir Regency refers to the FSCN (Food Supply Chain Network) discussion framework developed by van der Vorst et al. (2009). It is hoped that the use of this discussion framework will clarify the condition of

the supply chain, the results of which will be used as input in measuring supply chain performance. Performance measurement is carried out using the rating scale method. Performance assessment indicators (metrics) are adapted from the SCOR (Supply Chain Operations Reference) model (Sellitto et al., 2015). To formulate efforts to improve performance, a gap analysis is first carried out between the current supply chain performance and the expected supply chain performance and an analysis of shallot supply chain problems (Sjafrina et al., 2020). Next, recommendations/efforts to improve the performance of the shallot supply chain are formulated.

Place and Time of Research This research was conducted in Samosir Regency, North Sumatra Province. Collection and analysis of data on the condition of the shallot supply chain. The condition of the shallot supply chain is discussed descriptively following the FSCN (Food Supply Chain Network) discussion framework developed by (J.G.A.J. van der Vorst et al., 2005). The discussion framework includes aspects of supply chain structure, supply chain management, supply chain resources, and supply chain business processes. Data and information were obtained using questionnaires and in-depth interviews. The selection of respondents in this analysis was carried out using a snowball sampling technique, namely by tracing the red onion supply chain channels at the research location based on information obtained from relevant stakeholders (farmers, traders, household consumers, transport and transport service providers, farmer groups, combined farmer groups, associations, as well as related departments at the Samosir Regency level. The number of respondents who were successfully interviewed was 20 people.

3. RESULTS AND DISCUSSION

Supply Chain Management

Most farmers choose potential partners based on the highest price offer and partly based on the partner's close location and social norm factors that still apply (Thorpe, 2018). The collecting trader does not specify the specific quality desired but will give a price according to the quality of the shallots that the farmer brings as an example. Contractual agreements formed in the shallot supply chain between members of the chain are formed informally only verbally and there is no written contractual evidence in the form of an agreement on the price of the payment system and the quantity of the product to be sold. Support from the government is related to the chain management system through the construction of an STA (Agribusiness Sub Terminal) located in the Samosir Regency area which is expected to help the community market their products independently and get maximum profits.

Chain Structure

The supply chain structure is related to the market structure in the shallot supply chain, including farmers, collecting traders, local and non-local wholesalers, and local and non-local retailers (L. D. Rahmawati & Usman, 2024). Shallot farmers are members of the first supply chain who also act as shallot producers. North Sumatra is a large onion producing area, one of which is Samosir Regency. In 2020, shallot production in Samosir Regency was 1,980 tons, where Pangururan District had the highest onion planting area, namely 115 ha with a production of 7,952 tons. Seeing Samosir's strategic geographic location with the support of transportation infrastructure that allows the marketing of produce via land and water transportation, as well as the original Samosir variety of red onions which at one time were successful in increasing regional income, this potential can be studied and redeveloped. The marketing opportunities that are still open, including local, inter-provincial and inter-island marketing, make it possible to increase onion productivity again. Sales management is an aspect of marketing that focuses on how production reaches consumers (distribution). A trading system can be said to be efficient if it is able to deliver production results to consumers at the lowest possible cost and is able to provide a fair distribution of profits from the overall price paid by consumers to all parties who take part in production and trading activities. Trading systems are activities that cover the movement of goods from producers to consumers, including the processes involved, which in the trading system can be

said to be efficient if they obtain fair profits for all parties involved. Meanwhile, traders are differentiated as follows :

1. Collector Trader
   Collecting traders are intermediary traders who are in villages and around where farmers live.
2. Local Wholesalers
   Local wholesalers are traders from surrounding areas who buy products in large quantities through collectors or farmers directly.
3. Non-Local Wholesalers
   A non-local wholesaler is a trader who buys red onions in Samosir Regency but comes from outside the area.
4. Market Traders/Retailers
   Retailers are the final supply chain actors in shallot supply chain activities in Samosir Regency.

Table 1. Harvest area, production and productivity of shallot plants according to sub-districts in Samosir Regency

District Area	Harvested Area (ha)	Production (tons)	Productivity (Quintals/ha)
	2015	2015	2015
Sianjur Mulamula	20.00	149.70	74.85
Harian	18.00	126.00	70.00
Sitiotio	25.00	162.50	65.00
Onan Runggu	33.00	181.50	55.00
Nainggolan	14.00	70.00	50.00
Palipi	36.00	216.00	60.00
Ronggur Nihuta	-	-	-
Pangururan	11.00	49.50	45.00
Simanindo	53.00	397.50	75.00
Source Url: https://samosirkab.bps.go.id/indicator/55/103/1/luas-panen-produksi-dan-produktivitas-tanaman-bawang-merah-menurut-kecamatan-di-kabupaten-samosir.html			
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Chain Resources

Chain resources owned by chain members include physical resources, technological resources, human resources and capital resources (Lu et al., 2023). The physical resources owned by shallot farmers are land for planting shallots with an area ranging from 200-3000m2. The physical resources owned by collecting traders or wholesalers are means of transportation that support the efficiency of delivering goods. The technological resources applied have followed existing technological developments for both farmers and traders. One way of using mobile phone communication media is that you can channel information quickly so that you can streamline the product supply chain. The human resources found in members of the farmer chain are on average dominated by those who are quite old and have low education (Wardhana et al., 2020). Even though the human resources available to traders do not have a good management educational background, the traders are able to work quite well based on the experience they have. The capital used by farmers generally uses their own capital, which means they do not borrow capital from

other parties. Farmers set aside money from the harvest from crops planted intercropping. Business capital for traders is also their own business capital obtained from the sale of shallot products.

Chain Business Process

There are 4 things in the business process relationship, including procurement, manufacturing, replenishment and also customer orders (Danese et al., 2004). Not all of these four cycles occur in shallot supply chain activities in Samosir regency. The distribution pattern of shallots in Samosir regency depicts 3 flow patterns, namely product flow, financial flow and information flow. The product flow starts from the farmer as the shallot producer, then the farmer will go to the trader with samples of the clean product and bargaining will occur over the price. If an agreement is reached, the product will be delivered by the farmer or picked up if there is a lot. From there the trader will distribute it to the next buyer. Financial flows flow from downstream or consumers to upstream or farmers as shallot producers in Samosir regency. Starting from the consumer paying a certain amount of money from the retailer in cash at the location until there is a financial flow in each chain down to the farmer. The flow of information in the shallot supply chain includes price information, quality information and quantity information on shallots. Unlike product flows and financial flows, information flows reciprocally from shallot farmers and vice versa.

Supply Chain Performance

To determine supply chain performance in a measurable manner, measurements are carried out using metrics that refer to the SCOR (supply chain operation reference) model.

1. Supply Chain Performance

Supply chain performance measurement is based on the SCOR (Supply Chain Operation Reference) work matrix. Supply chain performance indicators use the same formula as that used in Defrizal et al. (2020) research, entitled Evaluation of organic vegetable supply chain performance using the SCOR approach.

a. Delivery Performance

The percentage of the number of deliveries that meet the customer's wishes is expressed in % units :

$$= \frac{\text{Orders Delivered On Time}}{\text{Total Orders Shipped}} \text{x} 100\%$$

b. Order Fulfillment

The amount of consumer demand that can be fulfilled without waiting is expressed in % units :

$$= \frac{\text{Orders are sent without waiting}}{\text{Total Orders Shipped}} \text{x} 100\%$$

c. Conformity to Standards

Conformity of requests sent according to the desired standards is expressed in percent:

$$= \frac{\text{Orders Sent According to Standars}}{\text{Total Orders Shipped}} \text{x} 100\%$$

d. Lead Time

Lead Time is the time required to fulfill consumer orders expressed in days.

e. Order Fulfillment Cycle

The Order Fulfillment Cycle is the time required in the process of fulfilling consumer requests expressed in hours :

Planning Time + Packing Time+ Delivery Time

f. Cash to cash cycle time

The time between the merchant paying the supplier and receiving payment from the consumer is expressed in days :

= Average inventory + Time it takes consumers to pay traders – time it takes traders to pay suppliers for goods that have been received

g. Daily Inventory

Daily Inventory is the length of time the inventory is sufficient to cover if there is no further product supply :

$$= \frac{\text{Average Inventory}}{\text{Average Requirements}}$$

h. Supply Chain Costs

Total Supply Chain Management Cost is the total cost of post-harvest management and logistics of vegetables as a percentage of existing revenues, expressed in percent units :
= Planning Costs + Procurement Costs + Packaging Costs + Shipping Costs + Service Costs

Table 2. Analysis of Price Distribution in Shallot Sales Channels

NO	Description	I	
		Rp/Kg	Share %
I	Producer Farmers		
	Farmer's Selling Price	14.000	40
	Cost	8.960	25,6
	- Production cost	8.890	25,4
	- Transportation	70	0,2
	Profit Margin	5.040	14,4
	Profit Margin Ratio	0,56	
II	Collecting Traders		
	a. Collector's Purchase Price	14.000	40
	b. Selling Prices from Collecting Traders	28.000	80
	c. Cost	4.886	14
	- Marketing Loss	4.200	12
	- Transportation	149,8	0,4
	- Weigh	46.2	0,1
	- Sorting	490	1,4
	d. Profit Margin	9.114	26
	e. Profit Margin Ratio	1,86	
III	Retailers		
	a. Retailer Purchase Price	28.000	80
	b. Retailer Selling Price	35.000	100
	c. Cost	2.800	8
	- Marketing Loss	1.400	4
	- Transportation	1.400	4
	d. Profit Margin	4.200	12
	e. Profit Margin Ratio	1,5	
IV	Consumer Prices	35.000	100

In Table 2 it can be seen that the share at the farmer's share is 40%. This means that from the price received by consumers, farmers receive 40% of the money, including production costs, farmer functional costs and farmer profits therein. Likewise with collectors with a 40% share, retail traders with 20%. This means that from the price paid by consumers, collectors earn 40% of the money, and retailers get 20%. These shares are not much different from each other, so the indirect distribution of profits will also be even. Total Supply Chain Management Cost is the total cost of post-harvest management and logistics of vegetables as a percentage of existing revenues,

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expressed in percent units: = Planning Costs + Procurement Costs + Packaging Costs + Shipping Costs + Service Costs. After the value for each indicator is calculated and known, it is then compared with the Superior Food SCOR Card value that has been determined by the Supply Chain Council.

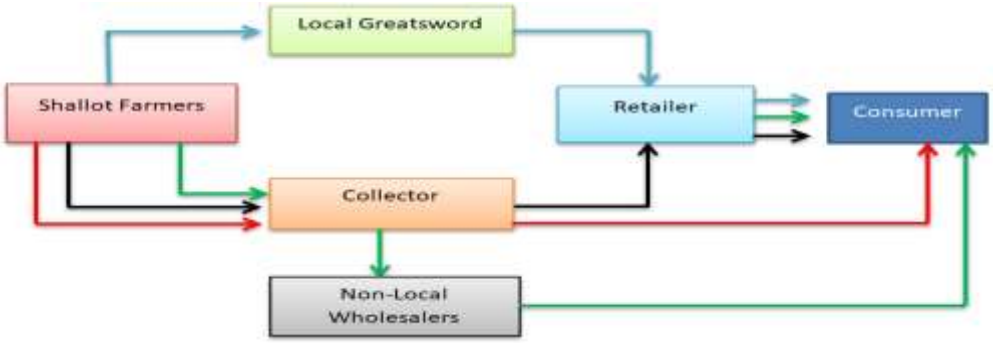

Figure 1. Shallot Supply Chain Structure in Samosir Regency

Caption :

: Chain Channel 1
: Chain Channel 2
: Chain Channel 3
: Chain Channel 4

Planting Shallots in Samosir Regency

The activity began with counseling by the Head of the Ketapang Agriculture Department, Dr. Tumiur Gultum to 11 farmer groups *(Kelompok Tani, Poktan)* in Holbung Village. The 11 farmer groups that attended the counseling were Poktan Bermakna, Poktan Subur, Poktan Lestari, Poktan Damai Sejahtera, Poktan Multipurpose, Poktan Sukacita, Poktan Benaan, Poktan Saroha, Poktan Sejahtera, Poktan Gabe, Poktan Setia. In his direction, Tumiur Gultom conveyed to farmer groups that to encourage the improvement of shallot farming which is being launched in Holbung Village, the Samosir Regency Government through the Samosir Regency Food Security and Agriculture Service is implementing the Farm Field Day Program for shallot planting. The Farm Field Day program is a one-day activity carried out to learn together directly in the field/farm location. Farmer groups that have planted can become resource persons for other farmer groups. Farmer groups that have been successful can provide knowledge on how to plant, what fertilizers to use and how to care for them to other farmer groups. So that later, other farmer groups can also experience success in planting shallots. The red onion variety that is being developed at the PPL Pangula Nature Demonstration Plot location is the Tajuk F1 variety of red onion using an area of 0.1 hectare.

Figure 2. Samosir Regency Government Carries Out Shallot Farming Development in Sitiotio District (Dinas Komunikasi dan Informatika Kabupaten Samosir, 2023)

Farmer groups to take advantage of the use of organic fertilizer they make themselves (Sherman, 1980). Agricultural instructors have provided examples of how to make your own organic fertilizer, so that we can compare the results using homemade organic fertilizer with purchased fertilizer. Compost chopping machines can be lent in turn to each farmer group. Chairman of the Bermakna Farmers Group, Sartika Purba, representing the farmer groups in Holbung Village, expressed his gratitude to the Samosir Regency Government through the Food Security and Agriculture Service for the attention given to the farmer groups in Holbung Village. It is hoped that shallot farming in Holbung Village will become more advanced and can increase the income of farmers in Holbung Village. The next activity was to carry out the first harvest with farmer groups at the PPL Pangula Nature Demonstration Plot location. The samples from the shallot harvest will later be checked for suitability both in terms of quality and quantity. Regent of Samosir Vandiko T. Gultom accompanied by Plt. Head of Ketapang Agriculture Department Tumiur Gultom, Head of Pangururan Sub-district Rostar Naibaho together with the Mekar Tani Farmers Group carried out the first harvest of the Red Onion Demonstration Plot in the *Pangula Na Ture* (Good worker) Program in Saitnihuta Village, Pangururan District.

Figure 3. Samosir Regency Government Harvesting Shallots in Saitnihuta Village, Pangururan Distric

That based on the plot of red onion demonstration plot area of two rows or 0.1 Ha with the help of 75 kg of seeds, it can produce 2.2 tons or 22 tons/ha wet weight using organic and liquid fertilizer. Tumiur said that the *Pangula Na Ture* program will be combined with the Independent Farmers Movement *(Gerakan Mandiri Petani, Gempita)* which will start this year. Gempita is a program where farmers can independently make organic fertilizer under the guidance of Field Agricultural Instructors (PPL). The Regent of Samosir Vandiko T Gultom, in his speech expressed his gratitude for the success of the first harvest of shallots in the *Pangula Nature* demonstration plot program. This demonstration plot (demonstration plot) is the result of assistance from the Ketapang Agriculture Service. In this assistance, the farmer group was also given training in making liquid and solid organic fertilizer as well as assistance with seeds that were planted last July. It is hoped that activities like this can be an example to other farmer groups, where by using organic fertilizer we can harvest satisfactory results. Thank you to the farmer groups who are willing to learn and are patient in caring for them, so that now we can see very satisfying harvest results.

At the end of his speech, the Regent appealed to all farmer groups in Samosir Regency not to hesitate to use liquid or solid organic fertilizer. The Samosir Regency Government, through the Ketapang Agriculture Service, is ready to provide assistance in making organic fertilizer, because

the results from liquid and solid organic fertilizer are no less than chemical fertilizer. Apart from satisfactory harvest results, the benefits of using organic fertilizer can maintain soil fertility. Meanwhile, the representative of the *Mekar Tani* Farmers Group, Omri Sipangkar, expressed his thanks to the Regent of Samosir for the *Pangula Na Ture* development program carried out by the Agriculture Service. Through our *Pangula Na Ture* program, the farmers are happy because they can grow onions with satisfactory results using seeds and liquid organic fertilizer provided by the Agriculture Service. With satisfactory harvest results, it is hoped that the economic level can improve the welfare of farmers in Samosir Regency.

4. CONCLUSION

Shallot supply chain activities in Samosir Regency are based on a food supply chain networking model where fluctuating prices and weather are the main inhibiting factors in supply chain activities starting from product availability to delivery. Measuring the performance of the shallot supply chain using the Supply Chain Operations Reference (SCOR) method has not shown optimal results on all indicators such as delivery performance, standard compliance and conformity with standards. Collector traders' profit share is 43.4% of marketing margin. 7.4% greater than farmers. This means that collectors take a profit of 43.4% of the additional price from producers to consumers. Meanwhile, retailers have a profit share of 20%, meaning they gain 20% profit from marketing margin, while the rest is functional costs and marketing losses. Judging from the profit shares of producers, collectors and retailers, they differ from each other, this reflects the unequal profits of each trading system so that the trading system in this area is not yet efficient. In general, the shallot trading system in this village is not yet efficient. It is a good idea for farmers themselves to sort and sort small, medium and large shallots. So, that the selling price can also increase and be more profitable. For the sale of the shallot harvest, there are also buyers who come directly to the shallot farmer's house, and also order directly from agents. There are even buyers who contact him via social media, because several shallot farmers also share their agricultural activities on social media accounts. Such inspiring things are really needed by local agriculture in Samosir Regency, North Sumatra Province.

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