



# Mapping the Spatial Linkages in the Ginger Supply Chain of Bandung Regency: Analyzing Structure and Performance

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**Abstract:** Bandung Regency has considerable potential for ginger production. However, weak supply chain management was linked to the limited involvement of farmers in the value chain. This study aimed to analyze the ginger supply chain in Bandung Regency using a descriptive method. The supply chain structure was evaluated using the FSCN framework, while the spatial flow of ginger was mapped using ArcMap. The performance of the supply chain was measured by calculating marketing margins and farmers' share. The results indicated that the ginger supply chain operated through three main channels, with collectors playing a dominant role. Spatial analysis revealed integration between marketing channels and distribution volumes. The smallest marketing margins were found in channel 3, with Rp—2,500 for Ginger Elephant Chinese and Rp 3,500 for Ginger Paris/Emprit. Similarly, the highest farmer's share was also observed in channel 3, with 85.29% for ginger elephant China and 79.41% for ginger paris/emprit. This highlighted that channel 3 provided the most favourable returns for farmers.

**Keywords:** Ginger, Supply Chain, Food Supply Chain Network (FSCN), Spatial Linkages

## Introduction

Biopharmaceutical plants are increasingly being chosen as herbal medical efforts because one of their benefits is that they can increase the body's resistance to reduce the potential for the spread of viruses, one of which is since the COVID-19 pandemic began in 2020 ([Suliasih & Mun'im, 2022](#)). One of the commodities in the biopharmaceutical plants that has potential in Indonesia is ginger ([Bangun, 2019](#)). Bandung Regency is one area with ginger potential in West Java with good development, marketing, distribution, and spatiality ([Suhartono, 2023](#)). Data from Statistics Indonesia (BPS) states that ginger production in Bandung Regency in the last five years has continued to increase. The amount of production in 2023 reached 1,223,079 Kg. In the Master Plan for the Economy of Bandung Regency for the 2021–2026 period, published by the Division of Natural Resources and Investment Planning, Bandung Regency's Regional Development Planning Agency (Bappeda), the agricultural sector is identified as one of the priority flagship sectors in regional development planning. The primary strategy for implementing this economic

master plan includes developing flagship economic clusters in potential locations, including the agricultural sector. The agricultural sector in Bandung Regency has shown positive growth (0.19%) since 2020 ([BPS, 2023](#)). The master plan identifies challenges in the ginger supply chain, including weak coordination, limited capacity, and poor sectoral integration. To address this, Bappeda of Bandung Regency introduced the innovation hub ecosystem, a region-based economic model designed to strengthen coordination, integrate sectors, and enhance supply chain performance, aligning with the Master Plan's vision for sustainable growth.

According to a news article published on Kumparan in August 2019, the Head of the Agricultural Quarantine Agency (Barantan) stated that since 2019, Bandung Regency has started exporting ginger commodities to Bangladesh, with the total first export reaching 54 tons of ginger ([Barantan RI, 2019](#)). However, the main issue with the marketing of ginger commodities has been the weak supply chain management, where the profits gained by supply chain actors are unequal. The focus on product value is insufficient ([Sujianto et al., 2021](#)). Other issues that may arise include uneven distribution, limited transportation accessibility, the small role of farmers unable to empower ginger into value-added products, and delivery time ([Zilberman et al., 1979](#)).

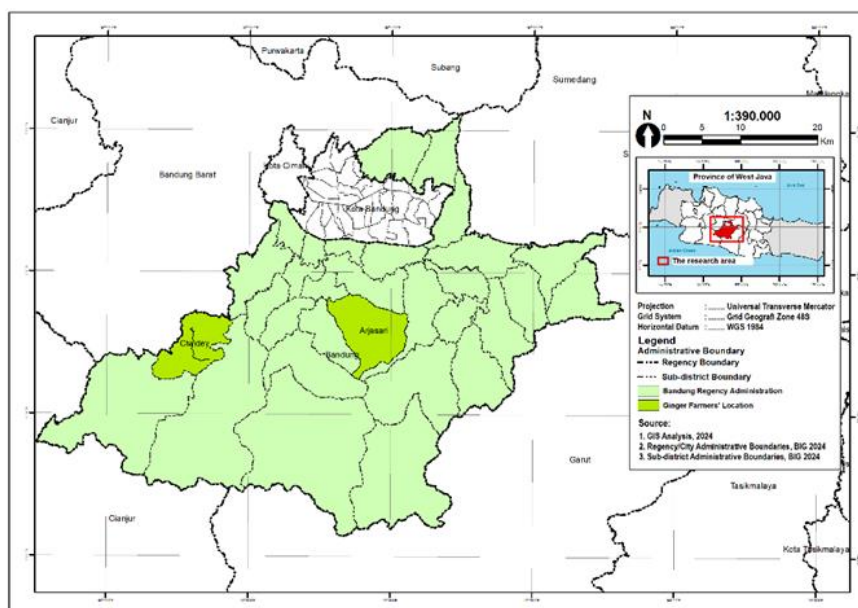
Supply chain actors must consider the characteristics of the commodity, which requires ample storage space and costs, especially since ginger is also a seasonal commodity produced during specific periods, with inconsistent product quality and other challenges ([Verdugo, 2019](#)). A long supply chain generally leads to higher operational costs for supply chain actors ([Kavota et al., 2024](#)). The supply chain related to agricultural products includes producers, wholesalers, and retailers. Supply chain management is crucial for optimizing production cycles and reducing cost losses ([Juhara, 2024](#)). With increasing globalization and the growing demand for global market scales, continuous improvements in the supply chain of agricultural products can be achieved by effectively and efficiently applying technology and being more responsive to management methods and collaborative relationships between suppliers and retailers to help enhance customer satisfaction.

Supply chain studies play a role in optimizing agricultural activities or businesses to ensure sustainability by involving aspects such as economy, social value, and the environment ([Ikhwana, 2018](#)). Proper supply chain management can lead supply chain members to an optimal level of efficiency and effectiveness, which can increase profits. On the other hand, poor management may lead to losses, such as high logistics costs, information management costs, and reduced production capacity ([Afianto, 2019](#)). This potential study and mapping includes analysis of the conditions and mechanisms of the ginger supply chain, performance using a marketing efficiency approach, and mapping the spatial interconnections of the ginger product flow.

## Methods

The study was conducted in Bandung Regency, West Java Province (**Figure 1**). The research specifically focused on ginger farmers in Baros Village, Arjasari District, and Rawabogo Village, Ciwidey District, which were selected as potential areas for ginger production in Bandung Regency ([Aisyah et al., 2024](#)). Respondents were chosen using snowball sampling, a technique employed to trace the ginger supply chain from producers to consumers. Snowball sampling effectively traces supply chains by leveraging referrals to map complex stakeholder networks, demonstrating its efficacy in uncovering inter-organizational relationships and identifying supply chain disruptions ([Swierczek, 2016](#)). The study uses a descriptive and mixed-methods approach, combining qualitative and quantitative techniques to understand the phenomenon (Abubakar, 2021) comprehensively. This study employs a convergent parallel mixed-methods design, involving the simultaneous collection of quantitative and qualitative data to complement insights not fully captured by a single method ([Vebrianto et al., 2020](#)).

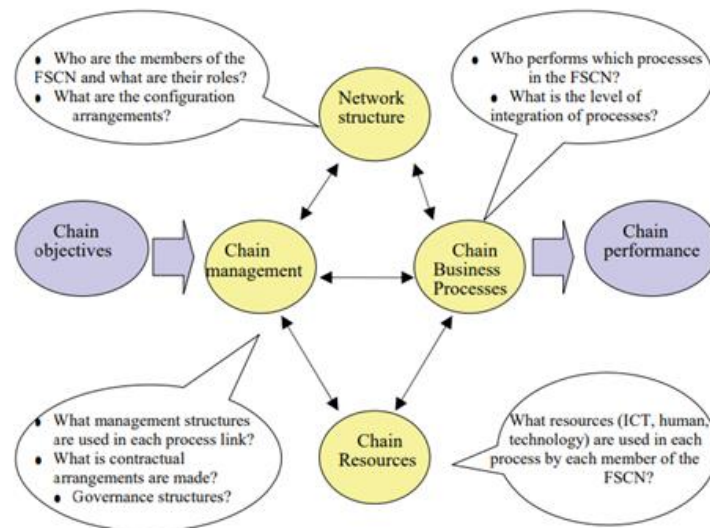
The conditions and mechanisms of the supply chain are analyzed qualitatively and descriptively using the Food Supply Chain Network ([Vorst, 2006](#)) framework by conducting direct data collection in the field. The spatial relationships of product flows map the volume or value of ginger commodities from the research location to surrounding areas, illustrating the marketing chain in Bandung Regency using ArcGIS software ([Bellamy & Basole, 2013](#)). A descriptive spatial analysis of product flow relationships is then conducted. Subsequently, the supply chain performance is measured using a marketing efficiency approach by calculating marketing margins and farmers' share to achieve the research objectives ([Dzulfiqar et al., 2019](#)).



**Figure 1.** Map of the Study Area

## Analysis of Food Supply Chain Network (FSCN)

The conditions and mechanisms of the ginger supply chain in Bandung Regency are discussed descriptively using the Food Supply Chain Network framework. This framework is analyzed through four key interconnected supply chain elements: structure, business processes, management, and supply chain resources (Vorst, 2006). The FSCN method's flow, as Vorst (2006) proposed, can be seen in Figure 2.



**Figure 2.** Framework for chain/network development (Vorst, 2006)

## Spatial Linkages in Ginger Flows

Spatial linkages map ginger commodities' location and volume flows in Bandung Regency, using ArcGIS route analysis to visualize distribution routes and endpoints within the supply network (Bellamy & Basole, 2013). A descriptive analysis of the spatial linkages of product flows follows this.

## Performance Assessment Framework for Supply Chains

The performance of the ginger supply chain in this study is comprehensively evaluated using a marketing efficiency approach, which involves the calculation of marketing margins and farmers' share as indicators to assess the efficiency of the supply chain (Dzulfiqar et al., 2019).

### a. Marketing margin

Marketing margin is derived by subtracting the acquisition price from the selling price at each stage of the marketing chain or by summing the total marketing costs incurred by the involved institutions. This calculation quantitatively measures the value added through the marketing process. The formula for marketing margin is expressed as follows (Rosmawati, 2011).

$$M_{pi} = H_{ji} - H_{bi}$$

Description:

$M_{pi}$  = Marketing margin of marketing institution  $i$  (marketing routes 1, 2, and 3)

$H_{ji}$  = Selling price of marketing institution  $i$  (Rp/kg)

$H_{bi}$  = Purchase price of marketing institution  $i$  (Rp/kg)

#### b. Farmer's Share

Farmer's Share is an indicator of marketing efficiency that measures whether the share received by farmers is in accordance with the price paid by end consumers. It is formulated mathematically as follows ([Rosmawati, 2011](#)).

$$F_s = \frac{H_p}{H_k} \times 100\%$$

Description:

$F_s$  = Farmer's Share (Percentage received by farmers (%))

$H_p$  = Price at farmer level (Rp/Kg)

$H_k$  = Price paid by the final consumer (Rp/Kg)

The criteria for knowing that a product's marketing is economically efficient are that each marketing channel has a low marketing margin percentage value and a high farmer's share percentage value. If the farmer's share is less than 50%, it means that marketing is not yet efficient, and if it is more than 50%, then marketing is said to be efficient ([Sudiyono, 2004](#)).

## Results and Discussion

### Conditions and Mechanisms of the Ginger Supply Chain

The condition and mechanism of the ginger commodity supply chain in Bandung Regency are reviewed descriptively using the Food Supply Chain Network framework, which is broken down into several aspects consisting of supply chain targets, supply chain structure, supply chain business processes, supply chain resources, and supply chain management.

#### a. Supply Chain Targets

In the FSCN framework, the objectives to be analyzed in a supply chain include market and development objectives. In the ginger supply chain in Bandung Regency, the primary objective is to meet the local market demand in West Java while expanding the marketing reach of ginger to national and international levels. Some ginger collectors in Bandung Regency have expanded their market reach to areas such as Jakarta and Lombok.

Additionally, despite the traditional management practices, they have successfully maintained ginger export activities in international markets, particularly Bangladesh and Iran, which have a high demand for spices like ginger. [Srai & Gregory \(2008\)](#) highlight the importance of implementing innovative and sustainable agricultural practices to enhance productivity and quality. [Kwak et al. \(2018\)](#) also emphasize the significance of supply chain innovation, which significantly impacts risk management capabilities and competitive advantage, supported by improvements in infrastructure and technology, such as efficient irrigation systems and optimal use of information technology. [Beske \(2012\)](#) suggests integrating dynamic capabilities in sustainable supply chain management can enhance agility and overall supply chain performance.

In developing ginger commodities, the main goal is to improve productivity, efficiency, and value-added through product diversification, such as herbal beverages, traditional medicine, and food products using ginger as a raw material. [Trienekens \(2011\)](#) indicates that product diversification in agricultural supply chains can enhance competitiveness and economic value. This diversification also creates job opportunities for local communities, contributing to sustainable development and improved living standards. The implementation of this strategy aligns with research emphasizing the importance of product innovation and collaboration among stakeholders to maximize value-added and competitiveness in agricultural products. The development of innovative products is expected to strengthen the competitive position of ginger in the global market and support local economic growth.

#### b. Supply Chain Structure

The supply chain structure explains the role of each member and key actor in the network ([Vorst, 2006](#)). The supply chain structure explains the role of each member and key actor in the network. The ginger supply chain in Bandung Regency is a complex and structured system involving various actors who play a crucial role in ensuring the availability of ginger from farmers to the end consumer. Based on the research findings, three main ginger supply chain routes are formed: Route 1: Farmer → Collector → Wholesaler → Retailer → Household End Consumer. Route 2: Farmer → Collector → Wholesaler → Retail and Entrepreneurs. Route 3: Farmer → Collector → Exporting Company. The structure of the supply chain relationships can be seen in **Figure 3**.



**Figure 3.** Ginger Supply Chain Structure in Bandung Regency

### 1. Ginger Farmers

Farmers play a central role in the ginger supply chain in Bandung Regency, serving as the starting point of the entire distribution process. Farmers are positioned upstream of the supply chain, initiating the production cycle by providing the main commodity. On average, ginger farmers manage land areas ranging from 0.5 to 1.5 hectares. Each farmer, with their land, can produce 1 to 2 tons of ginger. In Baros Village and Rawabogo Village, farmers independently manage ginger cultivation. They usually sell their harvest directly to local collectors. In the long term, sustainability is required to maintain the availability of ginger in Arjasari and Ciwidey sub-districts, given the supply of ginger from other regions within West Java. Ginger farmers in the study area currently lack the capacity to develop fresh ginger through local community empowerment due to limited access to capital, information, and knowledge. [Gary Gereff et al. \(2001\)](#) highlight that enhancing farmers' capacity through training and access to market information can help them gain a stronger position in the supply chain. Additionally, [Trienekens \(2011\)](#) in "Agricultural Value Chains in Developing Countries" within A Framework for Analysis of Global Value Chains suggests the importance of strengthening farmers' organizations, such as cooperatives, to enhance their bargaining power.

### 2. Local Collectors

Local collectors play an important role in connecting farmers to various market segments, both domestic and international. The collectors who were respondents in the study have effectively utilized the presence of social media, particularly Facebook, for promoting ginger in their regions. Additionally, both responding collectors have successfully partnered with companies to expand the ginger distribution network. Collectors sell the farmers' harvest to wholesalers, with an average sale ranging from 1 to 5 tons per shipment to a wholesaler, typically occurring every 1 to 2 weeks. The tendency for farmers to sell their harvest directly to collectors indicates a strong dependence of farmers on collectors. [Alwaysheh & Klassen \(2010\)](#) indicate that a high dependence on

intermediaries can reduce transparency and weaken farmers' negotiating positions. However, in this context, intermediaries also play a crucial role in expanding the supply chain network to its full potential. [Defee & Stank \(2005\)](#) emphasize the importance of strategic alignment within the supply chain. In this case, intermediaries function as strategic connectors, ensuring ginger products effectively reach various market segments.

### 3. Wholesaler

The wholesalers included in this study are ginger wholesalers at the central market level, specifically at the Caringin Central Market in Bandung City, West Java. These wholesalers purchase ginger in large quantities from collectors. Wholesalers play a role in the supply chain by consolidating ginger from various sources to ensure a sufficient and consistent supply. The sorted ginger is then purchased by different types of customers, such as small traders or retailers who buy ginger to resell at traditional markets within and outside of Bandung, as well as entrepreneurs and retailers. These entrepreneurs and retailers require ginger in smaller, yet regular quantities. Wholesalers are also often involved in setting selling prices based on market supply and demand dynamics, while providing valuable market information to collectors to help them adjust their production ([He et al., 2023](#))

### 4. Small Market Traders

Through direct interaction with consumers, small market traders also gather feedback on product preferences in the form of information regarding the characteristics of ginger at the retail level, which can vary significantly depending on the type of consumer. For instance, households may require ginger in small quantities for daily use. Meeting these needs ensures that ginger remains an important and highly sought-after commodity across various market segments. For example, consumers may require ginger in smaller quantities for daily use, and understanding this helps small traders cater to specific needs, ensuring the product remains highly demanded across different market segments ([Byrne, 2020](#); [Hecht et al., 2020](#))

### 5. End Consumers

In the ginger supply chain study in Bandung Regency, three primary routes connect farmers to various categories of end consumers: exporting companies, entrepreneurs and retailers, and household consumers. PT BTC Universal Indonesia, based in Tangerang, Banten, exports companies procure ginger in large volumes from collectors for sale in international markets. These companies prioritize high quality and export standards, meaning that the ginger must meet stringent criteria regarding cleanliness, size, and active ingredient content. Furthermore, entrepreneurial consumers purchase ginger as a raw material for producing traditional ginger-based beverages, such as "*wedang jahe*",

which require small but consistent quantities of fresh ginger. Retailers, such as Borma, acquire ginger to resell as raw products. In contrast, household consumers purchase ginger for everyday use, both as a cooking ingredient and for traditional remedies, with a preference for fresh ginger that is readily accessible in local markets. This multi-route structure ensures that ginger meets the diverse needs of various consumer segments, from international markets to local household consumption, highlighting the importance of effective supply chain management across different levels of production and distribution ([Dahal & Rijal, 2020](#); [USAID Nepal, 2011](#)).

### c. Supply Chain Management

The management of the ginger supply chain encompasses transaction systems, partnership structures, contracts and regulations, government support, and collaboration among various stakeholders throughout the supply chain, from upstream to downstream ([Vorst, 2006](#)).

#### 1. Transaction System

The payment system implemented reflects the adaptation of technology and the practical needs at each transaction level. Transactions between farmers and collectors use a cashless payment system, with payment settled when the ginger is received at the collector's warehouse. Transactions between collectors and wholesalers, as well as between collectors and exporting companies, demonstrate more complex payment systems. Cashless payments are applied with varying mechanisms, such as over-invoice and instalment payments. The payment system implemented reflects the adaptation of technology and the practical needs at each transaction level. [Koufteros et al. \(2005\)](#) emphasize that using technology in payment systems can enhance operational efficiency and reduce transaction costs within the supply chain, and flexibility in the payment system can enhance trust and collaboration among supply chain actors.

#### 2. Partnership Forms

The forms of partnership in the ginger supply chain in Bandung Regency are based on trust and mutually beneficial relationships. Ginger farmers partner with local collectors through informal agreements without written contracts. These agreements ensure the harvest purchase at pre-agreed prices, providing income certainty for farmers and a consistent ginger supply for collectors. The collectors then sell ginger to wholesalers, retailers, and exporting companies under more formal and stricter agreements. This partnership reflects long-term relationships built on trust. [Mentzer et al. \(2001\)](#) suggest that long-term relationships based on trust can improve supply chain stability and efficiency.

### 3. Contract and Regulation Systems

The contract and regulation systems within the ginger supply chain in Bandung Regency are primarily based on trust and reciprocal relationships without significant government intervention. Informal agreements between farmers and collectors, as well as between collectors and wholesalers, are built on reliability and mutual commitment. However, written contracts are applied in collaborations between collectors and exporting companies to ensure certainty and transparency. [Ghosh and Fedorowicz \(2008\)](#) explain that clear contract systems can enhance transparency and reduce risks within the supply chain.

### 4. Government Support

Government support in the ginger supply chain in Bandung Regency remains minimal. The ginger supply chain in Bandung reflects the independence and success of business actors in managing the production process through to export without active government intervention. In this context, the role of collectors is crucial in facilitating the ginger trade, which is ultimately successfully exported to other countries. Supply chain actors operate independently, relying on local knowledge and traditional experience in managing ginger cultivation. [Henson and Reardon \(2005\)](#) assert that government support through regulations and incentives can strengthen agribusiness supply chains.

### 5. Supply Chain Collaborator

Collaboration in the ginger supply chain in Bandung Regency involves a series of interactions based on trust, personal relationships, and informal agreements. Ginger farmers provide the raw materials that form the foundation of the supply chain, establishing direct relationships with local collectors. [Lambert and Cooper \(2000\)](#) emphasize the importance of coordination within the supply chain to ensure efficiency and smooth goods flow. Wholesalers then distribute ginger to broader markets, forming partnerships with retailers to meet end-consumer demands. The relationship between wholesalers and retailers is based on mutual trust and benefit, with both parties gaining advantages from the cooperation. Trust and collaboration are essential in supply chains for improving communication, coordination, and risk management. It underscores the mutual benefits of strong partnerships and suggests that these factors significantly enhance efficiency, reduce costs, and foster profitability ([Bakalo, 2024](#)).

### d. Supply Chain Business Process

#### 1. Business Relationships in The Supply Chain

The business relationships within the ginger supply chain in Bandung Regency illustrate adopting business process cycles and a push or pull approach, aligning with market demands. Research on the ginger supply chain reveals the underlying dynamics

of product, information, and financial flows in this commodity's business processes. The supply chain encompasses three key cycles: procurement, replenishment, and customer orders. The procurement cycle involves the ordering and acquiring of raw materials by farmers and collectors. Replenishment refers to stock replenishment by wholesalers and retailers based on market demand, while the customer order cycle focuses on direct orders from the final consumers.

The pull approach governs the procurement cycle. Production and distribution decisions are based on market demand, establishing a responsive coordination network. This allows farmers to align planting schedules with market needs, optimizing profits and cultivation efficiency ([Rackl & Menapace, 2023](#)). Conversely, the replenishment cycle follows a push approach, where collectors and wholesalers increase stock based on demand forecasts, anticipating market needs and reducing the risk of stockouts. Farmers' production decisions follow a push approach, driven by long-term forecasts to ensure consistent ginger availability ([Zhang et al., 2011](#)).

In the ginger supply chain of Bandung Regency, product flows from upstream to downstream, beginning with ginger cultivation by farmers and ending with distribution to final consumers. [Aung and Chang \(2014\)](#) discuss the critical role of traceability and information integration in improving food supply chain safety and efficiency. This is reflected in the ginger supply chain in Bandung Regency, where adequate information flow among farmers, collectors, and traders aids in planning and decision-making. Their perspective underscores the importance of responsiveness to demand uncertainties, supporting a pull-based procurement approach to enhance supply chain performance.

## 2. Distribution Patterns

Distribution patterns capture the flow of information, products, and finances, forming the foundation for efficient and effective operations within the supply chain ([Vorst, 2006](#)). The distribution patterns are shown in Figure 4.

### a) Product Flow

In the ginger supply chain of Bandung Regency, the product flow involves a series of stages requiring significant time, from planting to reaching the final consumer. The first stage begins with ginger planting by farmers, which requires 6 to 12 months of cultivation before harvesting. Young ginger is harvested 5 to 6 months after planting, while mature ginger is harvested after 12 months. After harvesting, the ginger is collected by collectors, who take a few days to a week for second sorting and repackaging in storage warehouses before distribution. From markets or distributors, ginger is further distributed to retailers and final consumers. Depending on the location and distribution methods, the entire process may take several days to a week. This demonstrates a product flow from upstream to downstream, with each stage

requiring different timeframes for completion. Coordination among farmers, collectors, wholesalers, and retailers ensures smooth product flow and optimal ginger quality for consumers.

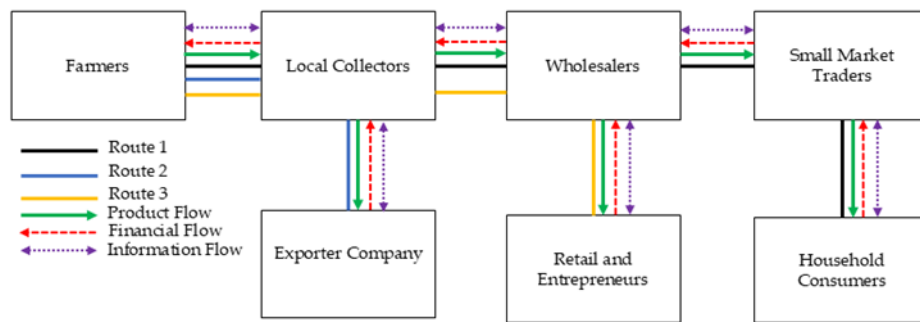
b) Information Flow

Information flows both upstream and downstream, playing a key role in maintaining coordination among all actors in the supply chain. Farmers provide information about planting and harvesting timelines, enabling collectors to plan the collection process efficiently according to market demand. In return, collectors inform farmers about market demand, price trends, and consumer preferences, assisting in planning future planting and harvesting. Subsequently, collectors share information with wholesalers about ginger availability, product quality, and market demand gathered from farmers. Wholesalers use this data to plan ginger distribution to other markets and retailers. Retailers also collect information about price trends and consumer demand, which they convey to wholesalers or collectors to aid in future stock planning and procurement.

c) Financial Flow

Financial flow plays a crucial role as the main driver for maintaining smooth operations and the sustainability of businesses at each stage of the supply chain. This financial flow, which moves explicitly from downstream to upstream, reflects payments from final consumers back through the supply chain stages. At the downstream end, consumers pay the sales price for ginger to retailers, who pass this payment to distributors or markets. At the wholesaler level, funds received from retailers are used to pay collectors for the ginger purchased, creating a circular financial flow. This payment only covers the price of the ginger, excluding additional costs like collection, transportation, or sorting, which the collectors bear.

Collectors then use part of the funds to pay farmers for the ginger they collected. This payment only covers the cost of the ginger itself, while farmers' efforts and investments in planting, maintaining, and harvesting ginger remain their responsibility. The sustainability of this financial flow from downstream to upstream is vital in maintaining cooperation and ensuring the continuity of operations across the supply chain, enabling all parties to conduct their operations efficiently and fairly. The picture that shows the distribution patterns in this research can be seen in **Figure 4** below.



**Figure 4.** Ginger Distribution Patterns in Bandung Regency

#### e. Supply Chain Resources

Findings in this aspect reflect how each actor in the supply chain utilizes resources according to their roles and responsibilities. The supply chain resources examined in the ginger supply chain consist of 3.

##### 1. Physical Resources

Farmers in Bandung Regency use private or family-owned land, measured in tumbak units (14 m<sup>2</sup>). In addition to rainfall, water from the village pipe network is used for agricultural needs. Simple tools like hoes and manual sprayers are still used. For transportation, farmers utilize pick-up trucks. Collectors own storage warehouses and use personal vehicles to distribute ginger to larger markets. Wholesalers and retailers use kiosks for transactions and stock storage. The importance of good infrastructure in reducing losses and costs in the supply chain. With adequate storage and transportation facilities, ginger can remain fresh until it reaches consumers, minimizing losses due to product damage during distribution.

##### 2. Human Resources

Human resources include the characteristics of the supply chain actors. Farmers typically have an education level equivalent to junior high school and use traditional farming methods. They are known for their diligence and dedication, utilizing local environmental conditions for ginger cultivation. Collectors, who possess adequate management skills, utilize social media for business information. Daily workers at collector warehouses show gender differences in task division, with more women involved in Cangkuang, while men dominate in Ciwidey. Wholesalers and retailers possess strong market analysis and stock management skills. [Mentzer et al. \(2001\)](#) highlight the importance of good managerial skills in supply chains to improve operational efficiency, which is strengthened by a deep understanding of the market and consumer behaviour, especially for wholesalers and retailers adapting their strategies. As

found in this study, collectors' use of social media demonstrates their adaptation to information technology to improve market knowledge.

### 3. Technological Resources

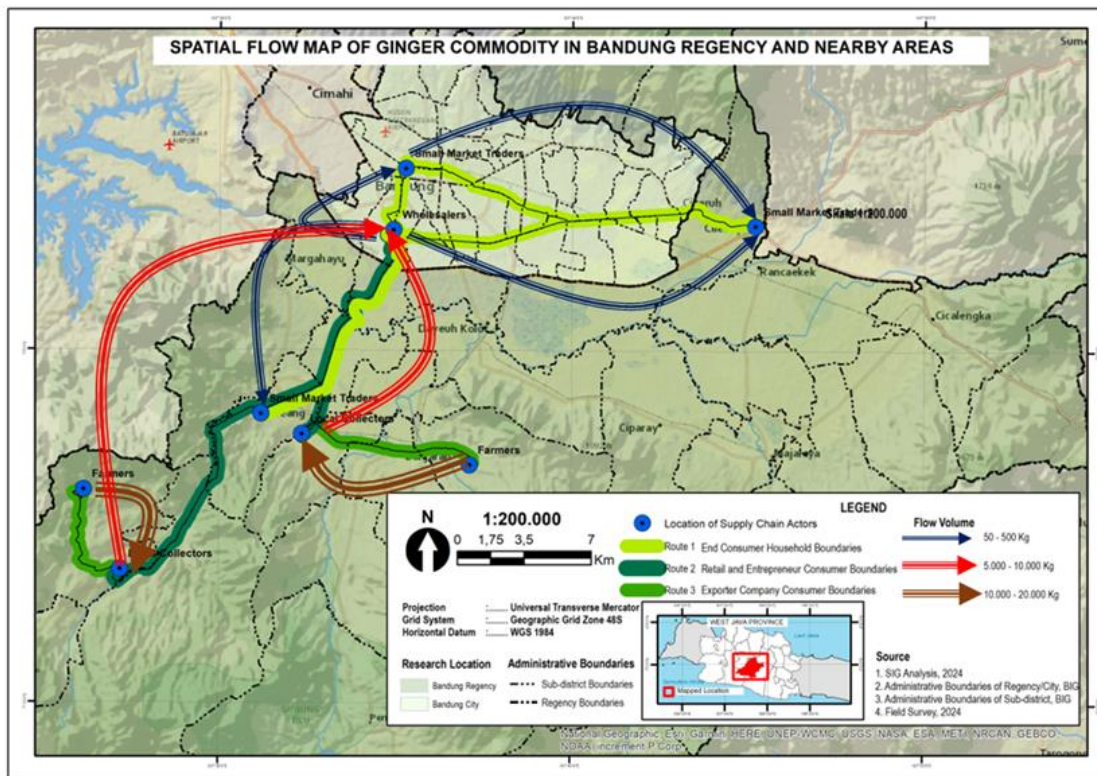
The use of technology in the ginger supply chain remains simple. Farmers rely on traditional methods with tools such as hoes and manual sprayers. Collectors and wholesalers also use simple, manual technologies in their operations. Manure is the primary choice for maintaining good production yields. [Vorst \(2009\)](#) asserts that technology used in agricultural supply chains should be adapted to the needs and capabilities of the actors. Although the technology is simple, effective management can still improve efficiency. Modern technology can enhance efficiency; technology adaptation must be gradual, considering the readiness of farmers and collectors.

### Spatial Linkages of Ginger Flow

Spatial linkages in the ginger supply chain in Bandung Regency reveal close relationships between the locations of supply chain members, production sites, marketing channels, ginger distribution volumes, and the forms of regulations and partnerships within it. In the ginger supply chain, ginger producers (farmers) are located in Baros Village (Arjasari Subdistrict) and Rawabogo Village (Ciwidey Subdistrict). In contrast, collectors are located in Rawabogo Village (Ciwidey Subdistrict) and Panyirapan Village (Cangkuang Subdistrict). Wholesalers are located at Caringin Central Market in Bandung City. At the same time, retailers purchase ginger from various markets in different areas, including Sehat Soreang Market, Cileunyi Market, and Ciroyom Market in Bandung. Ginger is distributed in varying volumes: between farmers and collectors, wholesalers and collectors, and collectors and exporters, measured in tons. Retailers receive smaller volumes, usually measured in tens to hundreds of kilograms, to maintain product freshness. Retailers operate on a smaller scale than wholesalers, requiring a more regular and manageable supply.

This variation in distribution volume reflects the complex and integrated structure of the ginger supply chain. The spatial relationships can be visualized in Figure 2, showing the geographic locations of supply chain members and ginger distribution volumes between them. This map provides a clear view of how ginger flows from farmers to the subsequent actors in the supply chain, highlighting key production points, distribution centres, and logistical routes. The contract and regulations established between all supply chain members in Bandung Regency are entirely based on trust and reciprocal relationships, without government intervention. Ginger farmers establish informal agreements with local collectors through personal relationships and mutual trust. This trust is built through routine interactions and long-term cooperation, ensuring farmers are confident their harvest will be purchased fairly, while collectors guarantee a consistent and quality ginger supply.

Collectors then engage with wholesalers through similarly informal agreements, grounded in reliability and mutual commitment developed over the years.



**Figure 5.** The Spatial Flow Map of the Ginger Commodity Supply Chain in Bandung Regency

### Supply Chain Performance

The performance of the ginger supply chain in this study was analyzed through a marketing efficiency approach by measuring marketing margins and farmers' share. Marketing margin measures the difference between the purchase price and the selling price between supply chain actors. The results showed that marketing margins vary depending on the distribution channel used. Higher ginger marketing margins in Bandung Regency tend to be found at the retailer level to household consumers, indicating that the location of the final market and the number of members in the supply chain greatly affect the margin obtained

#### a. Marketing Margin

Marketing margin is calculated based on the difference between the selling and buying prices at each marketing institution or route, or the sum of the marketing costs incurred by the marketing institutions. The marketing margin analysis in this supply chain study is divided into two sections, each for Chinese elephant ginger and Paris/empiret ginger. The analysis of the selling price and buying price at each route in the supply chain for Chinese elephant ginger and Paris/empiret ginger is shown in Tables 1 and 2.

**Table 1.** Analysis of the Marketing Margin in the Gajah Cina Ginger Supply Chain in Bandung Regency

Route Type	Route 1	Route 2	Route 3
<b>Farmer</b>			
Selling Price	14.500	14.500	14.500
<b>Collector</b>			
Purchase price	14.500	14.500	14.500
Selling price	16.000	16.000	17.000
Marketing Margin	1.500	1.500	2.500
<b>Wholesaler</b>			
Purchase price	16.000	16.000	
Selling price	20.000	24.000	
Marketing margin	4.000	8.000	
<b>Small Market Trade</b>			
Purchase price	20.000		
Selling price	28.000		
Marketing margin	8.000		
<b>Entrepreneurial and Retail Consumer</b>			
Purchase order		24.000	
<b>Household Consumers</b>			
Purchase order	28.000		
<b>Export Company</b>			
Purchase order			17.000
Total marketing margin	13.500	9.500	2.500
Marketing margin percentage	48,12 %	39,58%	14,70%

Source: Primary Data Processing (2024)

**Table 2.** Analysis of the Marketing Margin in the Emprit/Paris Ginger Supply Chain in Bandung Regency

Route Type	Route 1	Route 2	Route 3
<b>Farmer</b>			
Selling Price	13.500	13.500	13.500
<b>Collector</b>			
Purchase price	13.500	13.500	13.500
Selling price	15.000	15.000	17.000
Marketing margin	1.500	1.500	3.500
<b>Wholesaler</b>			
Purchase price	15.000	15.000	

Route Type	Route 1	Route 2	Route 3
Selling price	19.000	22.000	
Marketing margin	4.000	7.000	
<b>Small Market Trade</b>			
Purchase price	19.000		
Selling price	26.000		
Marketing margin	7.000		
<b>Entrepreneurial and Retail Consumer</b>			
Purchase order		22.000	
<b>Household Consumers</b>			
Purchase order	26.000		
<b>Export Company</b>			
Purchase order			17.000
Total marketing margin	12.500	8.500	3.500
Marketing margin percentage	48,07 %	38,63%	20,58%

Source: Primary Data Processing (2024)

Table 1 shows the marketing margin for the three distribution routes of Gajah Cina Ginger. The prices displayed are for one kilogram of ginger. In Route 1, the highest marketing margin occurs at the transaction level between retailers and household consumers, with a margin of Rp 7,000 and a total margin percentage of 48.07%. Similarly, in Route 2, the highest marketing margin occurs at the transaction level between wholesalers and entrepreneurial or retail consumers, with a margin of Rp 7,000, but a lower marketing margin percentage of 38.63%. Meanwhile, in Route 3, the marketing margin occurs at the transaction level between collectors and exporting companies, with a margin of Rp 3,500 and a margin of 20.58%.

Table 2 presents similar information regarding the marketing margin for the three Emprit/Paris Ginger routes. There is no significant difference between the two types of ginger. However, the sale price of Gajah Cina Ginger from farmers is higher than that of Emprit/Paris Ginger. Similar to the marketing margin for Gajah Cina Ginger, the highest margin for Emprit/Paris Ginger in Route 1 is at the transaction level between retailers and household consumers, in Route 2 at the level between wholesalers and entrepreneurial or retail consumers, and in Route 3 at the level between collectors and export company consumers. The total marketing margin percentage for Emprit/Paris Ginger in Routes 1, 2, and 3 is 48.07%, 38.63%, and 20.58%, respectively.

## b. Farmer's Share

Farmer's Share is the percentage of the final product selling price received by farmers. Farmer's share provides an overview of how much profit farmers get compared to other actors in the supply chain, such as intermediaries, distributors, and retailers. Farmers' share in this study is divided into two parts: the farmers' share of Chinese elephant ginger and emprit ginger.

**Table 3.** Gajah Cina Ginger Farmer's Share Analysis

Route Type	Farmer'Share	Amount
Route 1	Farmer Price (Rp/Kg)	14.500
	Consumer Price (Rp/Kg)	28.000
<i>Farmer's share (%)</i>		<b>51,78%</b>
Route 2	Farmer Price (Rp/Kg)	14.500
	Consumer Price (Rp/Kg)	24.000
<i>Farmer's share (%)</i>		<b>60,41%</b>
Route 3	Farmer Price (Rp/Kg)	14.500
	Consumer Price (Rp/Kg)	17.000
<i>Farmer's share (%)</i>		<b>85,29%</b>

Source: Primary Data Processing (2024)

**Table 4.** Emprit/Paris Ginger Farmer's Share Analysis

Jenis Saluran	Farmer's Share	Amount
Route 1	Farmer Price (Rp/Kg)	13.500
	Consumer Price (Rp/Kg)	26.000
<i>Farmer's share (%)</i>		<b>51,92%</b>
Route 2	Farmer Price (Rp/Kg)	13.500
	Consumer Price (Rp/Kg)	22.000
<i>Farmer's share (%)</i>		<b>61,36%</b>
Route 3	Farmer Price (Rp/Kg)	13.500
	Consumer Price (Rp/Kg)	17.000
<i>Farmer's share (%)</i>		<b>79,41 %</b>

Source: Primary Data Processing (2024)

The farmer's share analysis presented in Tables 1 and 2 highlights the significant variation in the portion of final consumer prices received by farmers across different routes for both Gajah Cina and Emprit/Paris ginger. The shortest marketing route (route 3) consistently yields the highest farmer's share—85.29% for Gajah Cina ginger and 79.41% for Emprit/Paris ginger—while the longest route results in significantly lower percentages, 51.78% and 51.92%, respectively. This indicates that shorter supply chains are more efficient and beneficial for farmers.

This pattern indicates that extended supply chains, characterized by higher marketing margins, can diminish the proportion of the final price received by farmers, potentially impacting their income and the sustainability of the supply chain. [Dewi & Suprapti \(2022\)](#) highlighted that high marketing margins often reflect inefficiencies, such as increased costs due to multiple intermediaries, which can reduce competitiveness and threaten the long-term viability of the supply chain. Lower margins are associated with greater supply chain efficiency, benefiting producers and the overall system.

To enhance economic efficiency and sustainability, it is crucial to streamline the supply chain by reducing the number of intermediaries, lowering marketing margins and increasing the farmer's share ([Mani & Joshi, 2018](#)). This approach improves farmers' income and contributes to a more resilient and sustainable supply chain. Yanita & Wahyuni (2021) noted that efficient supply chains with lower marketing margins and higher farmer shares are more sustainable and beneficial to all stakeholders involved.

## Conclusion

Based on Vorst's food supply chain network framework, the condition and mechanism of the ginger supply chain in Bandung Regency include the supply chain objectives, supply chain structure, business processes, supply chain resources, and supply chain management. The supply chain structure identifies three main routes in the ginger supply chain, with collectors playing a dominant and strategic role in connecting farmers with various market segments, both domestic and international. Ginger supply chain management includes a transaction system where non-cash payment systems have improved operational efficiency. Partnerships are based on trust, with informal agreements between farmers and collectors and formal agreements between collectors and export companies. Government support is minimal, but the private sector has managed the supply chain independently. The business processes of the ginger supply chain in Bandung Regency adopt a business process cycle involving three primary cycles: procurement, replenishment, and customer orders. Spatial linkages within the ginger supply chain in Bandung Regency reveal the integration between supply chain members, production locations, marketing channels, distribution volumes,

and the forms of regulation and partnerships in place. The smallest marketing margin for ginger in Bandung Regency, observed in Route 3 for both Gajah Cina and Paris/Emprit ginger, highlights the efficiency of shorter supply chains, with margins of IDR 2,500 and IDR 3,500, respectively, and Farmer's Share percentages of 85.29% and 79.41%. To address the high marketing margins on other routes, integrating technology into the distribution process could enhance efficiency by optimizing logistics and reducing intermediary layers. Additionally, developing ginger-derived products, such as essential oils or processed food items, could increase added value for farmers, ensure more equitable income distribution, and enhance the overall competitiveness of Bandung Regency's ginger supply chain.

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