

# Business Process of Red Chili Supply Chain Based on Food Supply Chain Network in Yogyakarta Indonesia

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**Abstract.** Red chili is one of the horticultural crops that has a selling value for farmers. However, the distribution system is an inhibiting factor in farmers' income. This study aims to analyze the red chili supply chain and business process from the production center in Yogyakarta to consumers in Jakarta, Indonesia. Kulon Progo Regency served as the study's primary location. The sampling for this study was conducted in stages. A total of 80 farmers were selected purposively as the sample. From farmers to consumers in Jakarta, 67 supply chain actors were gathered using snowball sampling. The Food Supply Chain Network (FSCN) model was employed to structure the data analysis. According to the findings, eight actors and three distinct chains were involved in the red chili supply chain. The product and money flow across the three chains ran smoothly; however, the information flow did not. Both three-cycle and push or pull views made up the business process relationship, with all three chains being in the same state. Nine supporting actors were involved in the red chili supply chain, and several agencies and educational institutions performed collaborative studies. The chain actors were exposed to six risks, and no brands were associated with the distributed products. The contract did not formally bind cooperation along the supply chain.

## 1 Introduction

Horticultural crops have become a significant component of the agricultural sub-sector, contributing to its growth. Horticulture is a branch of agriculture producing many goods and boosting the economy. Vegetables, fruits, ornamental plants, and biopharmaceuticals are all examples of what can be grown in the horticulture industry. Moreover, chilies have become a staple crop grown on a massive scale in the horticulture industry. The popularity of chilies as a culinary ingredient is supported by data revealing that consumption of vegetables has risen rapidly in Indonesia over the past five years, growing by an average of 20% annually [1]. Chilies can thus be seen as an important commodity favored by consumers which meets their household needs [2]. Additionally, chilies are used as raw material in the chili processing

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and medicine or herbal medicine industries. In general, chilies contain many nutrients and vitamins, including calories, protein, fat, carbohydrates, calcium, vitamin A, vitamin B1, and vitamin C [3]. Red chilies (*Capsicum annum* L.) are one variety of chili crops frequently farmed. The selection of red chilies is based on their strong demand from consumers, reasonable selling price, and promising future in the market. In addition to their adaptability to a wide range of climates, including those on the coast, inland, and in the mountains, red chilies are the selected crop [4].

Red chili production from 2006 to 2015 yielded an annual average of 50.79%, with the remaining 43.21% coming from outside Java [5]. Kulon Progo Regency on the island of Java recorded the most significant red chili production in 2015, with 16,828 tonnes, or 71.92% of the entire production in the Special Region of Yogyakarta. Red chili production in Kulon Progo Regency expanded yearly from 2013 to 2015 [6]. This regency's high red chili production has established it as a major red chili production center in the Special Region of Yogyakarta. Twelve districts make up Kulon Progo Regency: Samigaluh, Kalibawang, Nanggulan, Girimulyo, Kokap, Pengasih, Sentolo, Lendah, Galur, Panjatan, Wates, and Temon. Panjatan District has become the primary producer of red chilies in Kulon Progo Regency, with production rising from 6,434,300 kg in 2016 to 9,403,900 kg in 2017 [7].

Unfortunately, farmers' income is not necessarily proportionate to the quantity of red chilies they produce due to the ineffective distribution system in Kulon Progo Regency. The red chili distribution system will function properly if every party understands the commodity's product, money, and information flows. The key to a successful distribution system lies in the optimal product, money, and information flows on the red chili commodity. Every farm should consider the supply chain structure of the commodity it grows while trying to maximize the distribution. A supply chain is a set of rules governing the product, money, and information flows [8]. The business process is one of four components used to describe, assess, and build a food supply chain [9]. Supply chain management (SCM) refers to the business' well-defined, repeatable, and quantifiable activities to make consumer products and services [10]. The supply chain business process is a holistic way to explain the activities involved in SCM. The supply chain business process provides a more in-depth understanding of their interrelationships, the distribution patterns they reveal, the results of joint planning and research, the assurance of brand identity, the risks involved, and the methods by which trust is built. If the many actors in the supply chain of a product work well together, the business process is successful.

One of the obstacles in distributing red chilies to the hands of consumers is the large number of actors involved with various interests, causing red chili prices to fluctuate. Red chili prices may fluctuate due to high demand and limited supply. It is also hard to predict whether red chili prices will go up or down because sellers in Kulon Progo Regency can set the prices any way they want. Constant fluctuations in red chili prices might result in financial losses, such as when farmers receive poor payments during the major harvest due to declining prices. In addition, if red chili prices increase, consumers will suffer. If these price swings persist, inflation will follow, threatening the stability of the national economy. Red chilies contributed to national inflation between November 2015 and November 2016, with the most outstanding contribution value of 0.17 in December 2015 [11].

Red chilies are challenging to predict due to an assortment of price fluctuations. The availability of red chilies on the market is unpredictable since farmers have a hard time estimating how many they will be able to grow. Panjatan District has established an auction market to combat the problem of fluctuating red chili prices. The problem of price volatility is seen to be solvable by creating an auction market, prohibiting sellers from continuously determining prices as they see fit. It is envisaged that farmers would alter their routine of mass-producing red chilies at set times in response to the auction market. Accordingly, red chili commodity distribution will be hampered if this practice is maintained. Everyone

involved in the supply chain should be familiar with this notion since red chilies grown in Panjatan District are delivered to Kramat Jati Central Market, where they are sold to consumers in Jakarta. Since Jakarta serves as Indonesia's primary horticultural consumption center, the Kramat Jati Central Market was selected.

The Center for Agricultural Socio-Economic and Policy has researched red chili supply chain management for the curly red chili commodity in Central Java, among other relevant studies. This study investigated the red chili commodity supply chain in Central Java to better understand its structure and dynamics. Six studies were conducted on various aspects of the red chili supply chain in 2013, 2014, 2018, and 2019. Studying how effective various marketing channels, marketing margins, and distribution channels are in red chili marketing is crucial to this study's overarching goal of analyzing the supply chain for this product.

As a result, the authors spent some time this year investigating the red chili supply chain in Panjatan District, Kulon Progo Regency. This research aims to describe the structure of the red chili supply chain in Kulon Progo Regency concerning activities and to define the business process of this commodity regarding business process chain relationships, distribution patterns, supporting actors, planning and collaborative research, brand identity assurance, risk considerations, and trust building. This study updates the relevant data because the supply chain business process for red chilies has not been explored in the available literature.

## 2 Methodology

The descriptive method, defined as a research strategy that systematically and accurately describes phenomena concerning their factors, characteristics, and relationships [9], is central to this study. The descriptive method assisted researchers in conducting research on the business process of the red chili supply chain in Kulon Progo Regency by describing the analysis results. Kulon Progo Regency was purposively selected as the study area since it had the most remarkable red chili production rate in the Special Region of Yogyakarta. Sampling in this study was carried out with the following stages.

1. The Panjatan District was determined deliberately as it possessed the highest production of 10,565.3 tonnes in 2018 in Kulon Progo Regency.
2. The second stage was at the village level, determined from 11 villages in Panjatan District. Subsequently, three villages with red chili auction markets were taken. Of these three villages, one village was taken, namely Garongan, for having the most auction market participants.
3. The third-stage decision was made at Garongan Village's Hamlets 1 and 3, considered sub-villages. Eighty farmers were selected as respondents from among the auction market members in the village on the proviso that they were actively selling red chilies to the auction market and farming red chilies as the main crop.
4. Other than farmers, snowball sampling was employed to determine the following respondents: two intermediaries in Garongan Village, the chairman of the auction market management in Garongan Village, two regency-level collecting traders, three dealers in the Kramat Jati Central Market, ten *centheng* (small traders) from the Kramat Jati Central Market, 20 retailers, and 30 consumers.

The supply chain relationship structure concerning actors and their activities was explored using a descriptive analysis method. The supply chain business process was analyzed to determine the relationship between business process chains, distribution patterns, supporting actors, planning and collaborative research, brand identity assurance, risk aspects, and trust building. This analysis followed the framework of food supply chain development [7]. A

score range of 1 to 5 was applied to analyze the supply chain business process. There were nine indicators in product flow, four in money flow, and 11 in information flow.

### 3 Result and discussion

#### 3.1 Supply Chain Relationship Structure

The relationship between actors in the red chili supply chain in Panjatan District, Kulon Progo Regency, was investigated to better understand the supply chain's structure. From producers—red chili farmers in Panjatan District—to household consumers who buy from retailers in Ciracas and Kramat Jati Markets, both located in East Jakarta, the red chili supply chain included actors involved in the product, money, and information flows. In Panjatan District, eight actors formed three chains performing various activities covering red chili farming, sorting, packaging, pricing, bidding, updating information, purchasing, transporting, shipping, receiving payments, selling, and cleaning or separating.

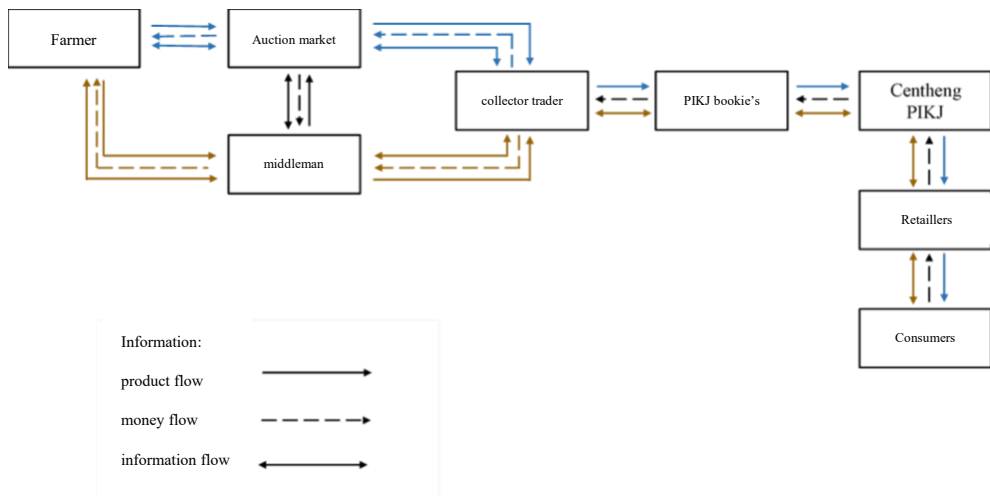


Fig. 1. Supply Chain Relationship Structure

#### 3.2 Supply Chain Business Process

##### 3.2.1 Business Process Relations of Supply Chain

The supply chain business process can be seen from two perspectives: the cycle view and the push or pull view, as described by [12]. Supply chain processes have a major influence on global business and trade [13]. Supply chain management plays a very important role in a business process [14]. The red chili supply chain's three-cycle view involves procurement, replenishment, and customer order cycle. The fresh food product had no processing steps in its supply chain. Farmers of red chilies in Garongan Village, Panjatan District, Kulon Progo Regency, were responsible for the procurement cycle. Moreover, the replenishment cycle was carried out by intermediaries, auction markets, and collecting traders in Kulon Progo, dealers and centheng of the Kramat Jati Central Market, and retailers at the Kramat Jati and Ciracas Markets. Household consumers completed the customer order cycle by directly purchasing in East Jakarta's Kramat Jati and Ciracas Markets.

The push and pull view on the business process of the red chili supply chain categorized consumer demand into two states: one in which demand is known with certainty and another in which it is unknown and must be anticipated. The ordering procedure performed by the final consumers marked the boundary between push and pull in the supply chain business process [12]. Consumers placed orders directly with sellers in the red chili supply chain through the consumer order cycle, making retail a pull operation. Meanwhile, red chili producers, intermediaries, auction markets, collecting traders, and Kramat Jati Central Market's dealers and centheng carried out a push procedure to buy and replace stock before the final consumers placed orders.

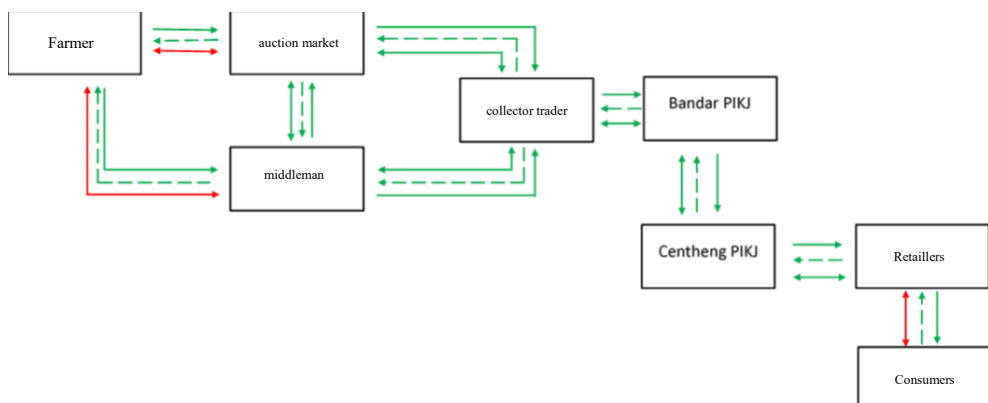
### 3.2.2 Distribution Pattern

Product, money, and information flows between all red chili supply chain entities revealed the distribution pattern. Red chili distribution in Panjatan District, Kulon Progo Regency, depicted the smooth product and information flows. In contrast, the information was both smooth and not.

Panjatan District had a streamlined red chili distribution system. The number of red chilies and their packaging were the most significant variables in this supply chain. Given its correlation with market demand, the number of red chilies had the most sway over the subsequent quantities supplied to the market and the resulting consumer pricing. As for the red chilies sold to consumers in Jakarta, their quality was directly tied to the packaging indicator.





The red chili supply chain had a smooth money flow. The indication of payment timeliness was secondary in this research because every actor in the red chili supply chain had high trust and tolerance. As long as payments were completed within five days after sales, both parties were fine with the arrangement.

There were two types of information flow in the red chili supply chain: smooth and not smooth. Farmers, intermediaries, auction markets, and consumers experienced a choppy information flow. Neither the auction markets nor the intermediaries provided the relevant information to farmers, contributing to the friction between farmers and the market. Meanwhile, there was a breakdown in communication between retailers and consumers since nobody ever shared information about red chilies. The overall red chili distribution pattern is as follows.



**Fig. 2.** Distribution Pattern of Red Chilies

Notes:

Smooth Product Flow	
Smooth Money Flow	
Smooth Information Flow	
Non-Smooth Information Flow	

### 3.2.3 Supporting Actors

In a supply chain, supporting actors aid in the smooth flow of products, money, and information between nodes in the network. The following entities served as supporting actors in the red chili supply chain in Panjatan District, Kulon Progo Regency.

#### 1. Farmer Family

Farmers frequently asserted that family was the most crucial supporting actor because relatives were the first to pitch in and offer assistance whenever needed. Family members were the first to pitch in daily, from sowing seeds to planting to fertilizing to watering, in the labor-intensive process of farming red chilies.

#### 2. Community

Planting red chilies was a community effort in Garongan Village, Panjatan District, Kulon Progo Regency. It explains why the community emerged as the subsequent entity assisting in growing red chilies. In addition to engaging in cooperative endeavors with one another, farmers frequently hired locals from the community to work on their land, allowing them to get their work done more quickly.

#### 3. Farmer Group

The administrators of farmer groups were the next supporting actor because they helped farmers access resources like infrastructure, seeds, and fertilizers. In addition, farmers who participated in farmer groups could access the most recent insights about red chili production and disease management. Furthermore, farmer groups made farmers aware of market fluctuations in chili prices.

#### 4. Farm Shop and Product Facilities

Some farmers preferred to purchase at farm shops and production input suppliers for seeds and fertilizers that their farmer associations did not subsidize. The shop was essential for procuring fertilizers, seeds, and various farming tools and medicines.

#### 5. Gas Station

Fuel was a need for all actors in the supply chain. Farmers necessitated gasoline to help them water their plants daily with a minimum of 2 liters. Each actor additionally employed gasoline to power their vehicles to distribute red chilies.

#### 6. Pulse Shop

All actors in the supply chain relied on mobile devices, particularly smartphones, to process orders and provide information on the state of the red chili market. Therefore, the availability of a pulse shop was crucial for facilitating the ordering of red chilies.

#### 7. Bank

Many farmers borrowed money from the bank since it provided a program to help them obtain capital loans for farming. Farmers preferred to borrow money from the bank because it was more reliable, required less paperwork, and eliminated the need to feel guilty about burdening others. The payment for red chilies was processed through a bank-owned facility, an ATM. To simplify the payment procedure, all parties employed transfer technology. Therefore,

financial institutions like banks and ATMs became essential to maintaining the red chili supply chain.

### *3.2.4 Planning and Collaborative Research*

Given that the primary challenges were still pests and diseases that commonly affected red chili plants, collaborative planning focusing on OPT control, higher production, and quality should be a priority in the red chili supply chain. Under the guidance of red chili farmers, the best use of farmer groups as an institution became possible to pursue. It could be conducted to better prepare farmers for the coordinated and developed future of red chili farming and commercialization. As a result of this initiative, the selling of red chilies became a primary focus for farmer groups.

Various agencies and universities have worked together to enhance red chilies' yield and marketability. The government has actively pursued research on pest management and the discovery of novel types that farmers could employ through the Ministry of Agriculture and the Center for Agricultural Technology Studies. Universities worldwide have spent public and private funds to study the best strategies for promoting and selling red chilies and developing sustainable farming practices and distribution networks. Farmers were included as a resource for other farmers throughout red chilies' production and marketing. The Center for Agricultural Socio-Economic and Policy has researched Central Java's curly red chilies' supply chain management. This study aimed to learn more about the pattern of supply chain management for the red chili commodity in Central Java.

### *3.2.5 Guarantee of Brand Identity*

No brands were placed on the fresh red chilies from this supply chain. From Kulon Progo's intermediaries, auction markets, and collecting traders, red chilies were netted at 30 kg each box before being shipped to Kramat Jati Central Market's dealers. After being distributed to dealers and centheng of this central market, fresh red chilies were packed in transparent plastic bags of varying sizes per store requests. The red chilies sold to consumers typically came in brightly colored plastic containers.

### *3.2.6 Risk Aspects*

In an effort to reduce management risk, farmers need to form business partnerships in order to share risks [15]. Each red chili supply chain actor in Panjatan District, Kulon Progo Regency, encountered different risks when conducting the business.

1. Crop failure and pest and disease attacks were two of the most prevalent production risks encountered by red chili farmers in Panjatan District.
2. Every actor in the supply chain felt the effects of the risks of price reduction.
3. Every supply chain actor felt the risks of decreasing the quality of red chilies. Decreasing quality affected the prices of red chilies, both at the farm and final consumer levels.
4. All actors in the supply chain felt the financial risks of a lack of capital.
5. Farmers must take environmental risks like weather uncertainty. Red chili production was extremely weather-sensitive. If conditions are favorable, farmers can maximize red chili production; otherwise, poor weather will reduce plant quality.
6. Common risks to partnerships were labor shortages and fraud.

### *3.2.6 Trust Building*

The trust building process carried out is a process that can establish good cooperation to create a smooth and harmonious supply chain relationship. One manifestation of the strength of a supply chain is characterized by strong trust between chain members. A weak relationship of trust can cause reluctance to collaborate so that information sharing becomes hampered [16]. Because of the productive cooperative relationship between all actors in the red chili supply chain in Panjatan District, Kulon Progo Regency, trust was built among them.

The red chili supply chain operated under an informal, verbal agreement rather than a written contract. However, the red chili supply chain actors still had a strong sense of trust. The information gained by each actor in the red chili supply chain contributed to the development of trust among them. It was possible to conduct marketing operations smoothly to satisfy the final consumers even though the flow of information between farmers and the auction market, as well as between retailers and consumers, was not smooth.

## 4 Conclusions

The analysis results led to the following conclusions.

1. The structure of the red chili supply chain relationship in Panjatan District was formed by eight actors consisting of three chains and having various activities such as red chili farming, sorting, packaging, pricing, price bidding, updating information, purchasing, transporting, shipping, receiving payments, sales, and cleaning or separating.
2. The relationship between the business process of the red chili supply chain in Panjatan District was depicted in two ways: cycle view, consisting of three cycles, and push or pull view.
3. Red chili products and money flew smoothly along the three-tiered supply chain. There was an interruption in the flow of information within the field. The distribution pattern of the red chili commodity in Panjatan District was overall stable.
4. There were nine actors in the red chili supply chain in Panjatan District, and various agencies and universities have collaborated to research to boost red chili production and sales.
5. Red chili supply chain actors in Panjatan District encountered six risks due to the lack of branding on freshly produced red chilies from this supply chain.
6. No formal contract governed the cooperation along the red chili supply chain.

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