

Supply Chain Management Analysis of Coffee Beans: A Case Study in Ulu Belu District, Tanggamus Regency

Azra Wijaya^{1*}, Rr Erlina²

^{1,2}Management Department, FEB Universitas Lampung, Bandar Lampung, Indonesia

Author Correspondence: azrawijaya05@gmail.com*

Abstract. Coffee is an important commodity in Indonesia with high economic value. In Ulu Belu District, coffee distribution through long channels causes high distribution costs, so supply chain management (SCM) is needed to improve efficiency. This study aims to measure the cost efficiency and effectiveness of coffee distribution using qualitative descriptive analysis method. The results showed that coffee marketing efficiency in Channel I amounted to 11.98%, and Channel II amounted to 11.92%, both classified as efficient. Delivery accuracy was also high, with Channel I reaching 98.89%, while Channel II was 85.83%. Channel II is more cost-effective despite Channel I being more effective in delivery. Cost-efficiency is important because coffee is a perishable product, and weather-related delays are rare. Channel I, which involves many members, increases distribution costs, so Channel II is recommended for optimal efficiency. It is suggested that improvements to transportation infrastructure, road access, and storage facilities at trader locations can increase distribution efficiency, maintain coffee quality, and reduce losses.

Keywords Supply Chain, Supply Chain Management, Efficiency, Effectiveness, Coffee Beans.

1. INTRODUCTION

Coffee is a key plantation commodity in Indonesia, offering high economic value and boosting foreign exchange. The country produces various coffee types, mainly robusta and arabica, each with unique traits. Robusta thrives in more locations, even those unsuitable for arabica, and has high caffeine content and a robust taste (Pradipta et al., 2024). In Lampung, coffee plantations cover 156.4 hectares, making it the second-largest coffee-producing region in Indonesia (PPID Lampung, 2023). The coffee industry has widespread economic impacts, supporting not only farmers but also coffee shop businesses, food sectors, and other related industries.

Lampung, located in the southern part of Sumatra, plays a crucial role in Indonesia's economy, particularly in agriculture. Covering around 35,376 km² with a population of over 9 million, it is a strong contributor to the plantation sector. Lampung's plantations significantly boost exports and the national economy, with robusta coffee being a key commodity. Coffee cultivation in Lampung began during the Dutch colonial era and became a major economic asset by the early 20th century. Tanggamus is a major coffee-producing area with 51,370 hectares of coffee plantations and a production of 38,108 tons, managed by local communities. In Ulu Belu district, robusta coffee is cultivated on 7,549 hectares, producing an average of 4,970 tons annually.

The coffee distribution chain in Ulu Belu starts from farmers and ends with consumers, passing through a long distribution process. This lengthy chain results in high costs, increased consumer prices, and reduced farmer profits. There are two distribution channels in Ulu Belu: the first involves farmers, middlemen, wholesalers, and consumers, while the second includes farmers, wholesalers, and consumers. The distance between communities and sales warehouses contributes to the reliance on longer distribution channels. Such long chains create large margins, making the supply chain inefficient. Supply chain efficiency can be measured by marketing margins and farmer profit shares. Improved efficiency occurs when related institutions operate effectively, ensuring profits for all stakeholders. Therefore, implementing Supply Chain Management is essential to enhance the efficiency and effectiveness of the coffee supply chain.

Supply chain management involves planning, procurement, production, distribution, and inventory control to optimize visibility, reduce costs, and add stakeholder value (Kurniawan, 2024). Qadri et al. (2022) highlight its role in connecting goods, services, and relationships among producers, suppliers, and distributors. Romanto et al. (2022) describe it as converting raw materials into finished goods for timely delivery (Nilam & Maula, 2022). Effective supply chain management organizes distribution mechanisms, balancing product, information, and financial flows (Tompodung et al., 2016), with benefits including streamlined production, efficient distribution, and better fulfillment of consumer needs.

Previous research by Rahayu et al. (2021) identified four palm fruit supply chain networks in Bengkalis, with Network IV in Pinggir achieving the highest farmer's share of 78.21%. Purnama et al. (2021) found that the chili supply chain in Ciandum involved multiple actors, including farmers, traders, and consumers, with a farmer share of 62.5%, indicating inefficiency. Despite similar distribution channels, these studies show varying efficiency levels, highlighting the need for the current research on coffee supply chain management in Ulu Belu, Tanggamus.

2. LITERATURE REVIEW

Operational Management

Operational management is a crucial process in a company, aimed at achieving goals such as reducing production costs and avoiding resource waste (Hasan et al., 2023). It involves transforming inputs into outputs of goods or services through planning, organizing, controlling, and supervising activities to ensure efficiency and effectiveness (Suwandi et al., 2023). According to Heizer (2017), ten operational management decisions that support mission and strategy include: product and service design, quality management, process and capacity design,

location selection, layout strategy, human resources and job design, supply chain management, inventory management, scheduling, and maintenance.

Supply Chain

A supply chain is a series of relationships and activities that deliver goods or services from the source to the customer (Assauri, 2011). It involves the continuous flow of products, money, and information. Horizontally, it includes five key components: supplier, manufacturer, distributor, retailer, and customer. Vertically, it consists of five main elements: buyer, transporter, warehouse, seller, and others (Assauri, 2011).

Supply Chain Management

Supply chain management (SCM) is a strategic approach that integrates planning, procurement, production, distribution, and inventory control to optimize efficiency, quality, and customer satisfaction. It involves coordinating activities across suppliers, manufacturers, distributors, retailers, and consumers to achieve full visibility, reduce costs, and improve market responsiveness (Kurniawan, 2024). SCM focuses on managing the flow of goods and information, ensuring timely production and distribution in the right quantities and locations to minimize costs and meet customer needs (Radhi & Hariningsih, 2019; Suwandi et al., 2023).

Coffe Bean

Coffee is a valuable plantation commodity with significant economic importance for Indonesia. There are two main coffee varieties: Robusta and Arabica. Robusta coffee, known for its higher caffeine content, stronger taste, and lower costs, can grow at lower altitudes and is more resistant to pests and diseases. Arabica coffee, on the other hand, requires higher elevations and specific growing conditions. Originally from Africa and South Asia, coffee plants can grow up to 5 meters tall, with oval-shaped fruits that change color from green to yellow to black when roasted. Coffee beans are typically harvested after 7-9 months of growth (Supiyandi et al., 2022; Syahputra & Arifitama, 2023).

Marketing

Marketing is a business function aimed at creating, communicating, and delivering value to customers to meet their needs and achieve company goals (Fatma et al., 2023). It involves offering products or services that satisfy customer needs by exchanging valuable goods or services (Kotler & Keller, 2006).

Farmer's Share

Farmer's share is the percentage of profit farmers earn by comparing the price they receive with the consumer price (Abbas et al., 2022). While it indicates supply chain efficiency for farmers, a high farmer's share does not always guarantee efficiency if involved institutions

lack satisfaction (Pratama & Nuswantara, 2020). Farmer's share and marketing margin are inversely related; a higher farmer's share results in a lower marketing margin, and vice versa.

Marketing Efficiency

According to Darus (2018), efficient marketing channels determine smooth product distribution, with success indicated by short channels, high farmer's share, and low marketing margins. Simorangkir and Rosiana (2022) argue that marketing efficiency is achieved through minimal involvement of marketing institutions, complete marketing functions, low marketing margins, high farmer's share, and balanced profit-to-cost ratios. Efficiency can be improved by: satisfying consumers without increasing marketing costs, reducing marketing costs without compromising consumer satisfaction, or increasing both costs and satisfaction, with greater consumer satisfaction outweighing higher expenses.

3. METHODS

Research Design

This research uses both primary data (surveys and interviews with farmers and traders) and secondary data (literature and relevant sources). The study is conducted in Ulu Belu, Tanggamus District, over a 4-month period. Samples are selected using snowball sampling for traders and purposive sampling for farmers based on criteria such as participation in coffee supply chains and willingness to be interviewed. Data collection involves primary data about supply chain characteristics, coffee prices, distribution channels, and marketing costs, while secondary data includes information on harvest areas, coffee production, geography, and local livelihoods, obtained from sources like BPS and the Tanggamus Plantation Office. The research employs literature reviews, field observations, and structured interviews, ensuring comprehensive data gathering through direct engagement and documentation.

Data Analysis Method

Uses qualitative and quantitative descriptive analysis to evaluate, distribution costs, margins, farmer's share, and marketing efficiency and effectiveness.

- 1) **Analysis of Supply Chain Member Characteristics:** Uses descriptive analysis to identify the characteristics of farmers, collectors, retailers, and consumers (age, gender, experience, and family size). Conducted through surveys, observations, and interviews.
- 2) **Analysis of Supply Chain Distribution Effectiveness:** Uses qualitative descriptive analysis to assess the flow of goods, information, and finances in the coffee supply chain in Ulu Belu District.
- 3) **Analysis of Marketing Efficiency and Effectiveness:** Uses qualitative descriptive analysis to evaluate distribution costs, distribution margins, and farmer's share.

Table 1. Calculating Marketing Efficiency

Calculating	Formula	Explanation
Marketing Efficiency	$EP = \frac{TBP}{TNP} \times 100\%$ <p>Jumiati et al., 2013 (in Sari et al. 2021)</p>	<p>Description: EP = Marketing Efficiency in the Supply Chain (%) TBP = Total Cost (Rp/Kg) TNP = Total Production Value (Rp/Kg)</p> <p>The decision criteria for marketing efficiency in the supply chain are:</p> <ol style="list-style-type: none"> 1. 0–33% = Efficient 2. 34–67% = Less efficient 3. 68–100% = Inefficient
Marketing Cost	$BP = B1 + B2 + B3 + B4$ <p>(Soekartawi, 1993)</p>	<p>Description: BP = Marketing Cost (Rp/Kg) B1 = Transportation Cost (Rp/Kg) B2 = Loading and Unloading Cost (Rp/Kg) B3 = Sack Cost (Rp/Kg) B4 = Rental Cost (Rp/Kg)</p>
Marketing Margin	$Mp = Pr - Pf$ <p>(Sudiyono, 2001)</p>	<p>Description: Mp = Marketing Margin (Rp/Kg) Pr = Consumer-Level Price (Rp/Kg) Pf = Producer-Level Price (Rp/Kg)</p>
Farmer's Share	$Fs = \frac{Pf}{Pr} \times 100\%$ <p>(Sari et al, 2021)</p>	<p>Description: Fs = Farmer's share (%) Pf = Farmer-Level Price (Rp/Kg) Pr = Consumer-Level Price (Rp/Kg)</p>

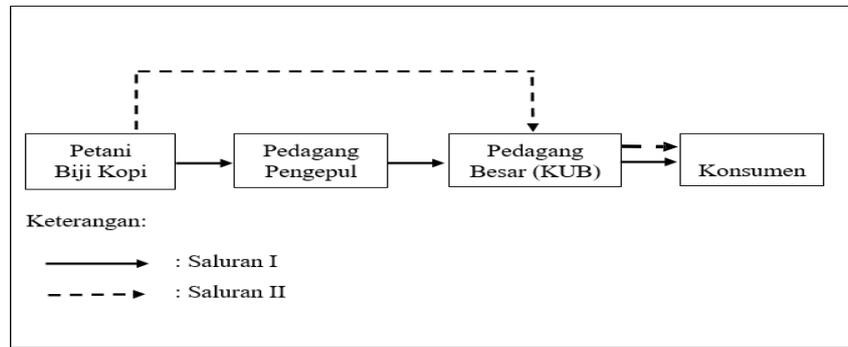
Table 2. Calculating Marketing Effectiveness

Calculating	Formula	Explanation
On Time Delivery Rate (OTD)	$= \frac{OTD \text{ Rate}}{\text{Total Order}} \times 100\%$	<p>On-time orders refer to the number of deliveries that reach customers on schedule, while total orders represent the total shipments made during the measured period. If the OTD value is below 90%, the distribution channel is considered inadequate, whereas a high OTD value indicates effective business operations and strong customer trust.</p>

4. RESULTS AND DISCUSSION

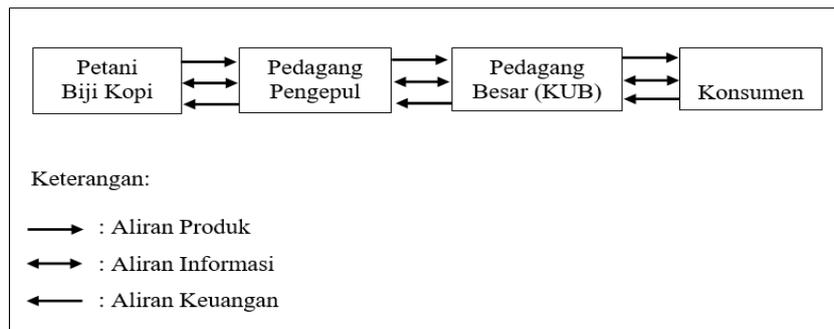
Supply Chain Distribution Mechanism

Supply Chain Management (SCM) involves three flows: goods, money, and information. Goods flow refers to products circulating through the supply chain, money flow to the financial transactions, and information flow to shared data within the chain (Fachrezi et al., 2024). The coffee bean supply chain in Ulu Belu District, Tanggamus Regency, comprises two channels shown in Figure 1.



Picture 1. Coffee Bean Supply Chain Distribution Channel in Ulu Belu

Channel I: Farmers – Traders/Gatherers - Wholesalers - Consumers



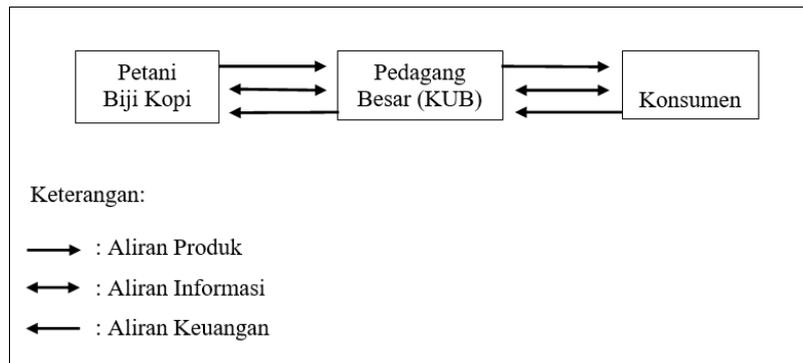
Picture 2. Channel I of The Coffee Bean Supply Chain in Ulu Belu

Explanations:

1. **Product Flows:** The coffee supply chain in Ulu Belu, Tanggamus, involves three main flows: farmers to collectors, collectors to wholesalers, and wholesalers to consumers. Farmers sell beans to collectors, who then supply wholesalers like KUB Mawar. Wholesalers, in turn, distribute coffee to consumers. Each stage focuses on maintaining timely deliveries, quality, and stock availability, with risks including price fluctuations, pests, weather conditions, and storage challenges. Despite occasional obstacles, the supply chain operates effectively and efficiently from farmers to consumers.
2. **Information Flows:** The information flow in the coffee supply chain is crucial for ensuring smooth product and financial operations. In Channel I, information exchanges occur between farmers and collectors, collectors and wholesalers, and wholesalers and consumers. Farmers inform collectors about coffee availability, while collectors share market prices. Collectors also communicate stock availability and delivery plans to wholesalers, who, in turn, share purchase prices. Finally, wholesalers and consumers exchange information about coffee prices and purchase quantities, primarily through phone communication, ensuring a well-integrated and efficient information flow throughout the chain.

3. **Financial Flows:** The financial flow in the coffee supply chain involves payments made throughout each level of the chain. At the farmer level, collectors pay Rp 65,000/kg based on market prices. Farmers incur costs such as transport (Rp 74,000), fertilizer (Rp 7.3 million), and storage (Rp 1.3 million. At the collector level, costs include transport (Rp 10.8 million), storage (Rp 13.2 million), and unloading (Rp 36 million). Wholesalers face transport costs of Rp 1.025 billion, unloading costs of Rp 1.9 billion, and storage expenses of Rp 60 million. Finally, consumers purchase coffee from wholesalers at a transfer payment price of Rp 74,000/kg.

Channel II: Farmer - Wholesaler - Consumer



Picture 3. Channel II of The Coffee Bean Supply Chain in Ulu Belu

Explanations:

- Product Flows:** The coffee supply chain in Channel II involves moving coffee from farmers to consumers. In this channel, farmers sell coffee directly to wholesalers, who then supply it to consumers. Farmers harvest and dry coffee beans to maintain quality, selling an average of 1,345 kg per year. Risks for farmers include fluctuating prices, pests, and adverse weather. Wholesalers sell coffee to consumers based on market prices, with an average annual sale of 5.4 million kg. Their risks include price changes, storage quality issues, and weather affecting supply. The process remains efficient due to wholesalers maintaining sufficient stock, despite occasional delivery delays.
- Information Flows:** Information flow in Channel II of the coffee supply chain is essential for ensuring smooth product and financial operations. It involves communication between farmers and wholesalers, where farmers notify wholesalers about available coffee stocks, and wholesalers share market prices. Additionally, wholesalers and consumers exchange information about coffee prices, availability, and purchase quantities, primarily through calls, direct interactions, and transactions, maintaining well-integrated and efficient communication across the supply chain.

3. **Financial Flows:** The financial flow in Channel II of the coffee supply chain includes payments from sales transactions. Farmers receive money from wholesalers at an average purchase price of Rp. 69,000 per kg, adjusting based on quality. Farmers incur costs such as transportation (Rp. 76,364), fertilizer (Rp. 7,454,545), maintenance (Rp. 2,440,909), sacks (Rp. 49,000), and storage (Rp. 1,337,455). Wholesalers incur significant expenses, including transportation (Rp. 1.025 billion), unloading (Rp. 1.89 billion), sacks (Rp. 135 million), and storage (Rp. 60 million). Consumer transactions with wholesalers are usually through cash or bank transfers, with an average purchase price of Rp. 74,000 per kg.

Distribution Efficiency of Coffee Bean Supply Chain

1. **Distribution Costs in the Supply Chain:** In the coffee supply chain, distribution costs include expenses incurred by intermediaries in marketing coffee to consumers. In Channel I, farmers face production costs of Rp. 7,682/kg (fertilization, maintenance, storage) and marketing costs of Rp. 83/kg (transportation, packaging), totaling Rp. 7,765/kg. Collectors incur Rp. 587/kg in costs (transport, unloading, rent, packaging, storage), while wholesalers spend Rp. 576/kg (transport, unloading, packaging, storage). In Channel II, farmers have higher production costs of Rp. 8,349/kg (fertilization, maintenance, storage) and marketing costs of Rp. 93/kg (transport, packaging), totaling Rp. 8,442/kg. Wholesalers also incur Rp. 576/kg in distribution costs. These costs reflect typical expenses for coffee distribution per harvest cycle.
2. **Supply Chain Distribution Margin:** Distribution margins compare the selling price of coffee by farmers to the buying price by traders and consist of selling and purchasing prices. In Channel I, the distribution margin is Rp. 9,000/kg for farmers, Rp. 5,000 for collectors, and Rp. 4,000 for wholesalers, with operational distribution costs of Rp. 8,928/kg. Farmers incur Rp. 7,765/kg, collectors Rp. 587/kg, and wholesalers Rp. 576/kg in distribution costs. In Channel II, the distribution margin is Rp. 5,000/kg, with operational costs of Rp. 9,018/kg. Farmers face Rp. 8,442/kg, and wholesalers Rp. 587/kg. Channel I has the highest marketing margin of Rp. 9,000.
3. **Farmer's Share in the Coffee Bean Supply Chain:** Farmer's share is the percentage of the final consumer price that farmers receive, serving as an efficiency indicator for distribution activities. If the farmer's share is over 40%, it is considered efficient. In Channel I, the farmer's share is 87.84%, while in Channel II, it is 93.24%. Both channels are efficient, as their farmer's share exceeds 40%. In Channel I, farmers sell

coffee to collectors at an average of Rp. 65,000/kg, and in Channel II, they sell to wholesalers at Rp. 69,000/kg.

4. **Marketing Efficiency:** The efficiency of a marketing channel is influenced not only by its length but also by margin values and farmer's share. In the coffee supply chain in Ulu Belu, Channel I has an efficiency of 11.98%, while Channel II has 11.92%. According to Jumiati et al. (2013), marketing efficiency is categorized as efficient (0-33%), less efficient (34-67%), and inefficient (68-100%). Lower marketing costs relative to product value indicate higher efficiency, with Channel I showing the highest efficiency percentage of 11.98%.
5. **Marketing Effectiveness:** Marketing effectiveness in the coffee supply chain is measured by on-time delivery (OTD) across each distribution point. In Channel I, from farmer to collector, all 4 shipments were on time, resulting in a 100% OTD. From collector to distributor, all 48 shipments were punctual, also achieving a 100% OTD. From distributor to consumer, 174 out of 180 shipments were on time, with a 96.66% OTD due to unforeseen travel conditions. Overall, Channel I has an average OTD of 98.89%, indicating high effectiveness. In Channel II, from farmer to distributor, only 3 out of 4 shipments were on time, resulting in a 75% OTD due to distance and road conditions. From distributor to consumer, 174 out of 180 shipments were timely, achieving a 96.66% OTD. The overall average OTD for Channel II is 85.83%, showing good but improvable effectiveness. Channel I outperforms Channel II with the highest on-time delivery percentage of 98.89%.

5. CONCLUSION AND LIMITATION

Conclusion

The coffee supply chain in Ulu Belu, Tanggamus, consists of two channels: Channel I, involving farmers, collectors, wholesalers, and consumers, and Channel II, consisting of farmers, wholesalers, and consumers. Both channels include product, information, and financial flows. Marketing efficiency is 11.98% for Channel I and 11.92% for Channel II, both considered efficient as their values fall within the 0-33% range, with Channel II being slightly more efficient. On delivery effectiveness, Channel I achieves a 98.89% on-time delivery rate, while Channel II reaches 85.83%, indicating Channel I as highly effective and Channel II as improvable but still functional.

Limitation

The limitations of this study include the restricted scope to the coffee supply chains in Ulu Belu, Tanggamus, which may not represent broader regional or national supply chains. Additionally, data collection relied on interviews and observations, which can be subject to biases from respondents' perceptions and experiences. The variability in factors such as geographic distance, infrastructure quality, seasonal harvest patterns, and unpredictable weather conditions also impacted the findings. These limitations suggest that while the results provide valuable insights into the efficiency and effectiveness of the supply channels in this specific area, caution should be exercised when generalizing these findings to other regions or contexts.

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