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Integrated Marketing Chain Pattern of Smallholder Rubber Commodities in The Southern Region of Papua Province, Indonesia

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ABSTRACT

Smallholder plantations drive economic growth, provide livelihoods, and support conservation, such as rubber, coffee, and cocoa widely cultivated, including rubber in Papua since the colonial era. This research aims to analyze rubber cultivation's history, development, and challenges in Southern Papua and identify strategies to optimize rubber commodities' supply chain and marketing. The study used qualitative and quantitative approaches, including historical data analysis, interviews with farmers and traders, and analysis of rubber prices from 2009 to 2016. The data are analyzed using the QSPM method to determine strategic priorities based on internal and external factors. The results show that since 1969, rubber development in the region has been facilitated by Catholic missionaries, who played a key role in education and the distribution of rubber seedlings. However, the global decline in rubber prices since 2013 has reduced farmer incomes, with many halting rubber sheet production. Supply chain barriers, such as difficult transportation and a lack of partnerships between farmers and traders, further exacerbate the situation. To address these challenges, the research recommends several strategies. In the short term, rubber plantation rejuvenation and strengthening partnerships between farmers and traders are needed. In the medium term, strengthening cooperatives and financial institutions and supporting production and marketing should be prioritized. In the long term, new processing machinery should be introduced, and medium-scale rubber processing factories should be established—rubber plantations in Merauke face price fluctuations, transportation issues, and weak partnerships. The research suggests rejuvenating plantations, strengthening cooperatives, and building processing factories to improve sustainability.

Keywords: *Rubber commodities, supply chain, marketing mapping, strategic initiatives*

INTRODUCTION

Smallholder plantations are a vital source of income, employment opportunities, and foreign exchange, and they drive economic growth in emerging regions across Indonesia. Key commodities involving local communities in plantation development include rubber, coffee, and cocoa. Rubber plantations in Indonesia have been extensively developed in Sumatra, Kalimantan, and Papua. Rubber cultivation has been known in Papua since the Dutch colonial era. Rubber plantations are considered part of environmental conservation and biodiversity efforts (Direktorat Jendral Perkebunan 2019).

Despite rubber's high potential and significant contribution to local and regional incomes, there has been a notable decline in recent years. From 2012 to 2015, a decrease in exports significantly impacted national income, particularly affecting the smallholder farmers who own these plantations (Graph 1).

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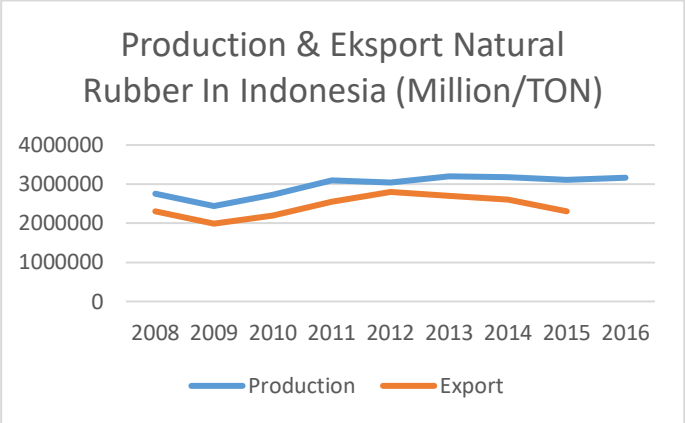

Figure 1. Production and Export of Raw Rubber in Indonesia
Source: Association of Natural Rubber Producing Countries, Indonesian Rubber Association (Gapkindo), and Food and Agriculture Organization of the United Nations, 2016 (Investment, 2016)

The most significant contributor to Indonesia's rubber production comes from South Sumatra, accounting for 23.22% of the total production with 702,610 tons. North Sumatra ranks second with 458,262 tons, followed by Riau with 360,042 tons, Jambi with 295,837 tons, West Kalimantan with 262,816 tons, and Central Kalimantan with 212,792 tons (Investment, 2016). Other provinces contribute a total of 733,784 tons, including Papua, which also has significant rubber plantations.

The development of rubber plantations in the southern region of Papua Province is significant, particularly in Boven Digoel, Mappi, and Merauke. According to BPS Merauke (2018), the total rubber production in Merauke amounted to 3,881.00 tons, sourced from the districts of Semangga, Tanah Miring, Jagebob, Sota, Muting, Elikobel, and Ulilin. The most significant production was from Muting District, which had 980 tons, Ulilin, 895 tons, and Elikobel, 874 tons. BPS Kabupaten Boven Digoel (2016) recorded that in 2015, the total rubber production in Boven Digoel was 3,817.56 tons, with the highest production from Kiki District at 904.2 tons and Fofi District at 865.5 tons. Meanwhile, the total rubber production in Mappi was 13,850 tons, with the highest production in Bade District at 6,350 tons, followed by Obaa District with 5,250 tons and Nambai District with 2,250 tons (Mappi, 2016).

This data indicates the substantial rubber production potential in these three southern Papua districts, with many rubber farmers. Additionally, government programs through related Regional Work Units or Local Government Work Units (SKPDs) have supported the development of rubber plantations by providing quality seedlings to farmers. However, due to the decline in rubber prices since 2014, rubber, once a source of cash income for families, no longer provides sufficient earnings. Farmers are no longer motivated to tap and sell rubber sheets. These potentials and challenges highlight the need to prioritize strategies to develop southern Papua's rubber market.

Numerous studies have been conducted to enhance the rubber industry in local areas, focusing on the supply chain and commodity availability while maintaining quality and standards. The hindrance factors of infrastructure supporting the transportation of rubber commodities for marketing are closely related to food security and the lack of information from actors involved in the supply chain, including producers, collectors, and buyers, in coordinating and responsibly collaborating to address food crises or food security (Ssennoga et al., 2019). According to Fazio (2016), a short supply chain approach is a model that can be used to obtain natural, healthy, and high-quality commodities produced by farmers, reducing costs by cutting the distance between producers and consumers. It also serves as a tool to commercialize products and ensures income for agricultural producers by providing quality commodities that satisfy consumers, thereby enabling competitiveness and growth in local areas. Similarly, Zilberman et al. (2018) emphasize short supply chains in agricultural commodities, focusing on product certification for market orientation and facilitating traceability of commodity origin, making certified commodities more prepared for increased demand. Thus, the social networks formed by commodities facilitate the sharing of information and technical assistance for faster supply chain responses.

Similarly, examining the supply chain relationship impacts the quality of commodities, where two factors that can enhance the strength of relationships in the supply chain are trust and communication. Trust is built between producers and suppliers, enabling them to establish long-term partnerships. Establishing a communication mechanism is essential in the rubber commodity supply chain network; communication in sharing information and networks will enhance the desired quality of commodities, thus avoiding conflicts and risks (Liu, 2018). An approach to improving communication by collaborating in decision-making, income distribution and

distribution, sharing risks, and agreeing on quality standards for commodities before production can ensure that the supply chain can achieve the desired food security. In contrast, Muloi et al. (2018) see the need for government intervention to mitigate cleanliness or quality risks in the commodity supply chain through the health department and livestock services, focusing on the supply chain in producer areas, traders, and processing industries. This ensures that the channels maintain quality until they reach the end consumer.

Kipling et al. (2019) address climate change by adapting new agricultural models based on scale and source interactions for the model, namely bio-economic and bio-physical models focusing on the content aspects and relationships of the models used desires and information between institutions and different disciplines in responding to the evolving climate change affecting agriculture. The sustainability of commodities globally can also be seen through the transparency of the supply chain involving actors such as governments, the private sector, and communities, strengthened by access to information and appropriate information mechanisms to achieve sustainability. The more transparent the supply chain system is built, the more effective, sustainable, and significantly contributing to the sustainability of agricultural commodities (Gardner et al., 2019).

Transparency in the supply chain is possible when there is built trust among the actors involved, where trust will balance between large-scale companies in meeting production needs and corporate accountability. Zilberman et al. (2018) focus on perishable commodities; the risks inherent in each region in the supply chain allow decision-making in commodities' production, storage, and distribution (transportation). Perishable commodities are based on thirty sub-criteria grouped into five categories: knowledge and information, technology management, financing and government permits, food security, commodity security, comfort, assurance or guarantees, good commodity appearance, maintenance management, cooling systems, and storage capacity. They are divided into two major groups of risk in practical decision-making, namely, the criteria cause (which influences) and the category effect (which is influenced) (Raut et al., 2019).

Wu et al. (2018) state that in supply chain risk, there needs to be a collaboration between risk estimation and risk management so that the limitations of information sources in risk estimation can be efficiently utilized. This includes incorporating the necessary data into monitoring report plans for risk estimation and having organizational planning for manager training activities for local and national risks.

Success in agricultural development requires considering all components, such as climate, soil, water, agronomy, pests and diseases, plantation systems, management, planning, supply chains, infrastructure, labor, services, markets, ecosystem impacts, and community impacts (Ash et al., 2017). The agricultural irrigation supply chain implications depend on managing the complexity of the entire agricultural system and value chain so that success can be achieved. However, trust is also required within the supply chain, which is a crucial factor influencing transaction decisions by buyers, where the strength of the network built between parties is an essential element in integrating agricultural development efforts. In the study by Mutonyi et al. (2018), the supply chain needs to consider the relationship between trust, financial capability, honesty, communication, closeness, and trust. Song et al. (2018) indicate the need to optimize land as a sustainable natural resource, even when developed for a green supply chain sustainability, where optimization is divided into subsystems, including technology, economy, energy, and environment, encompassing input, production, and output subsystems.

Relating to market orientation, Le et al. (2018) found in their research that there is no relationship between consumer orientation or interest, competitor analysis, inter-institutional coordination, and financial strength if not supported by policy direction regarding the development of supply chain capabilities in fostering the economy. Innovation and supply chain capabilities development can overcome consumer and institutional orientation deficiencies towards the supply chain. Therefore, policies should increase small producers' awareness of consumer needs without overlooking competitors' strengths and weaknesses. Zilberman et al. (2017)emphasize that innovation can influence supply chain models in food commodities. Entrepreneurs, through innovation, can create new markets and products. Products resulting from innovation will transform traditional market transactions into agricultural contracts and vertical integration. Innovation will expand widely across economic sectors, increase product value, enhance prices, improve responsiveness to changes in the supply chain, and reduce risks. Sehnem et al. (2019) indicate that sustainable supply chains can be enhanced by examining and adopting circular economy practices with the Upper Echelons theory. This involves effective management and consideration of success factors supported by top management for competitive advantage in the circular economy.

Naik and Suresh (2018) discuss the study, which addresses gaps in integrating regional strategies, consumer dynamics, and institutional collaboration in agricultural supply chains, offering a novel approach through tailored zones, industrial training, and consumer-focused risk management. To address these challenges, Gopal Naik and D.N. Suresh suggest developing agricultural zones or regions based on strengths and weaknesses, setting production targets, and enhancing sales infrastructure with a focus on logistics. They also advocate encouraging agricultural companies or industrial-scale groups to train farmers, significantly contributing to research by research institutions and providing facilities connecting regions within the marketing chain. A different perspective on adapting to climate change is crucial for achieving better long-term production and rapid market

penetration to meet consumer needs. From a socio-demographic viewpoint, Ariyawardana et al. (2018) highlight that these factors significantly influence how consumers bear the additional costs resulting from price changes due to climate change adaptation. Consequently, these challenges lead to new consumer perceptions where business success is directly related to risk management strategies, which can be addressed through effective marketing strategies.

To address climate conditions in production, Zilberman et al. (2018) suggest that social quality factors significantly impact sustainable production systems. Social quality refers to the resilience and quality of commodities over time, compared to other factors such as economic (income or wealth levels) and environmental (including SCI, fertilizers, P-index, and N-index). By integrating global and local supply chains, Gómez-Luciano et al. (2018) assert that considering sustainability indicators and perspectives from global and local value chains can foster dynamic interactions among organizations within the supply chain. This dynamic interaction enhances information flow and environmental management in supply chains of developing countries, known as the Global approach. The Glocal Sustainable Supply Chain (GSSC) promotes environmental sustainability, economic development, and social welfare. However, a balance between global and local trade is needed to meet consumer expectations and maintain national identity. This balance can drive marketing chains to align producer and consumer desires, enhance information flow, improve distribution networks between local and global markets, promote sustainable consumer initiatives by producer organizations, facilitate technology access, and improve environmental impacts, eco-friendly packaging, and sustainable logistics and distribution systems. Considering the impact on regions like Merauke, which relies on rain-fed agriculture, climate change significantly affects production sustainability. According to Olayide et al. (2016), the frequency of rainfall necessitates proper irrigation, which positively and significantly impacts overall agricultural production. Effective water management planning is essential to mitigate the effects of climate change, ensuring food security and agricultural production sustainability across all sub-sectors. Differing from previous statements, identified risks in the early stages of production include market criteria compliance, production delays, product returns, equipment durability, storage damage, demand fluctuations, quality standard discrepancies, chemical contamination, stock or raw material shortages, quality-related losses, over-demand, and contamination during production. Muchfirodin et al. (2015) highlight that weather, market, and operational management risks influence agricultural commodity profits. The research explores strategies for integrating sustainable production practices and supply chain management to address climate-related challenges, focusing on balancing global and local trade, enhancing resource availability, improving production inputs, and mitigating risks to ensure agricultural sustainability and food security.

RESEARCH METHODS

This research was conducted in the regions of Merauke Regency, Boven Digoel Regency, and Mappi Regency, which are part of the Southern Papua Province, during the research period from 2016 to 2020, using an exploratory quantitative research approach. Primary data sources were obtained through observations in these three regions.

The research informants included representatives of rubber traders or businesses engaged in rubber collection for export, local government agencies involved in palm oil development policies (such as the agriculture and horticulture departments, social services, trade departments, environmental departments, investment departments, and integrated service offices), as well as representatives from local non-governmental organizations such as the traditional communities of Southern Papua. Heads of households were selected using purposive sampling, targeting individuals with informative knowledge or experience in the development of the palm oil industry in Merauke Regency, as well as those directly impacted by the rubber plantation population. Data were collected using questionnaires with open-ended questions and closed statements measured on a Likert scale ranging from 1 (no impact) to 5 (very impactful).

Secondary data were obtained from government agencies related to rubber plantations, general data from the Central Statistics Agency, literature reviews tailored to the research needs, reports, databases, and information from official palm oil industry websites in Merauke Regency.

The analysis method utilized PRA (Participatory Rural Appraisal), a participatory research approach used to understand the conditions and dynamics of the rubber industry in the Southern Papua Province. Sampling techniques for identifying supply chain activities were conducted using non-probability sampling, specifically snowball sampling. This method involved selecting respondents from rubber farming communities in each regency, who would refer to traders (collectors and intermediaries) and subsequently to marketing areas or processing industries. Sampling continued until the information obtained was considered sufficient. The parameters observed in this study included: 1) participation or actors in the supply chain, their roles, and interconnections; 2) the supply chain map; and 3) aspects of product quality management practices.

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RESULTS AND DISCUSSION

Rubber Production Conditions in the Communities of Merauke, Boven Digoel, and Mappi

Rubber planting in Merauke and its newly established regions, Boven Digoel and Mappi dates back to the Dutch colonial era. The development of rubber cultivation was also facilitated by Catholic missionaries, such as Pastor Cornelis J.J. de Rooij, who began in 1969. He continuously raised awareness, provided counseling, and trained the Muyu, Auyu, and Mandobo communities in rubber cultivation. Between 1988 and 1990, Pastor Kees brought thousands of rubber seedlings to Kepi District, Bade District in Mappi, and Getentiri District in Boven Digoel. Besides distributing seedlings to the community, the church established a 2.5-hectare demonstration plot. In addition to providing seedlings, the church also acted as a buyer for the rubber sheets produced by the communities.

Before 2013, farmers received relatively high prices ("Rupiah" is the currency of Indonesia) for their rubber sheet products. The price increase from 2009 to 2011 was as follows:

a. 2009: Rp. 14.000
b. 2010: Rp. 18.000
c. 2011: Rp.21.000 to Rp. 26.000

In 2011, the total income from 250 rubber farmers amounted to Rp. 2,870,612,000. When averaged, it is known that the income farmers receive from the sale of rubber sheets is Rp. 11,482,448 per year, or approximately one million rupiah per month. This is also supported by interview results from several villages in Mindiptana, Mawan Village in Boven Digoel, and Ima, Katan, and Yatan Villages in Mappi Regency, which revealed that the income from rubber cultivation ranged from Rp. 1,000,000 to Rp. 3,000,000. Even when the price reached a maximum of Rp. 25,000-28,000, some farmers could earn up to Rp. 5,000,000 per month. However, due to the fluctuation in rubber prices dependent on the global market since 2013, where rubber prices declined, the purchasing power of large collectors such as PT. Montelo, a Korean-based company acting as a major collector, weakened. Consequently, the company could no longer operate or purchase rubber sheet commodities from rubber farmers and collectors. As a result, rubber farmers and collectors experienced decreased income, leading to a decline in rubber cultivation activities and collection from the community. The annual decline in rubber prices is as follows:

a. In 2013, the price of rubber was Rp. 20,000 - 25,000 per kilogram.
b. In 2014, the price of rubber was Rp—15,000 per kilogram.
c. In 2015/2016, it reached Rp. 5,000 - Rp. 6,000 per kilogram.

This has led farmers to no longer want to produce rubber sheets because their income is relatively low compared to the labor they have to put in. Farmers choose to cultivate other agricultural lands instead.

Figure 1. An unmaintained Press Tool left by rubber farmers in the Rubber Plantation.

Eventually, the equipment owned was left unattended in the community's plantation, causing it to rust and requiring expenses for repairs if it were to be used again later. This can be seen in Figure 1, where the press tool has already rusted and is no longer usable.

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Figure 2. Stack of Rubber Sheets at Collector's Warehouse

In addition to farmers who no longer wish to produce rubber sheets, there has been an accumulation of rubber sheets in the storage warehouses of collectors because they cannot be sold. This is because when the collectors buy them, the prices are still relatively high, but when they try to sell them, the prices drop. The rubber that remains unsold begins to deteriorate, decreasing its quality (see Figure 3).

Many collectors have stopped buying from farmers, but some are still willing to accept rubber sheets from farmers at prices ranging from Rp. 6,000 to Rp. 8,000. As a result, the marketing channels have drastically declined in the past 1 or 2 years. Some collectors are still trying to find opportunities to market their products to large retailers or the tire, rubber, sandal, or shoe industries.

Marketing Chain Pattern of Rubber Commodities in Southern Papua Region.

Essentially, the supply chain concept involves the flow of upstream and downstream activities that connect the supplier chain to the distribution (logistics) level, aiming to meet the lowest commodity stock and the highest order necessary for the sales process. The condition of the Rubber Commodity Supply Chain in the last 3 years, or since 2017/2018, has encountered significant obstacles, leading to almost no economic activity related to the rubber commodity.

Due to low prices, rubber farmers in several villages are seeking alternative livelihoods such as daily wage labor, fishing, hunting, searching for agarwood, gambling, and so on. Changes in the supply chain pattern have resulted in impacts on the value of the rubber commodity.

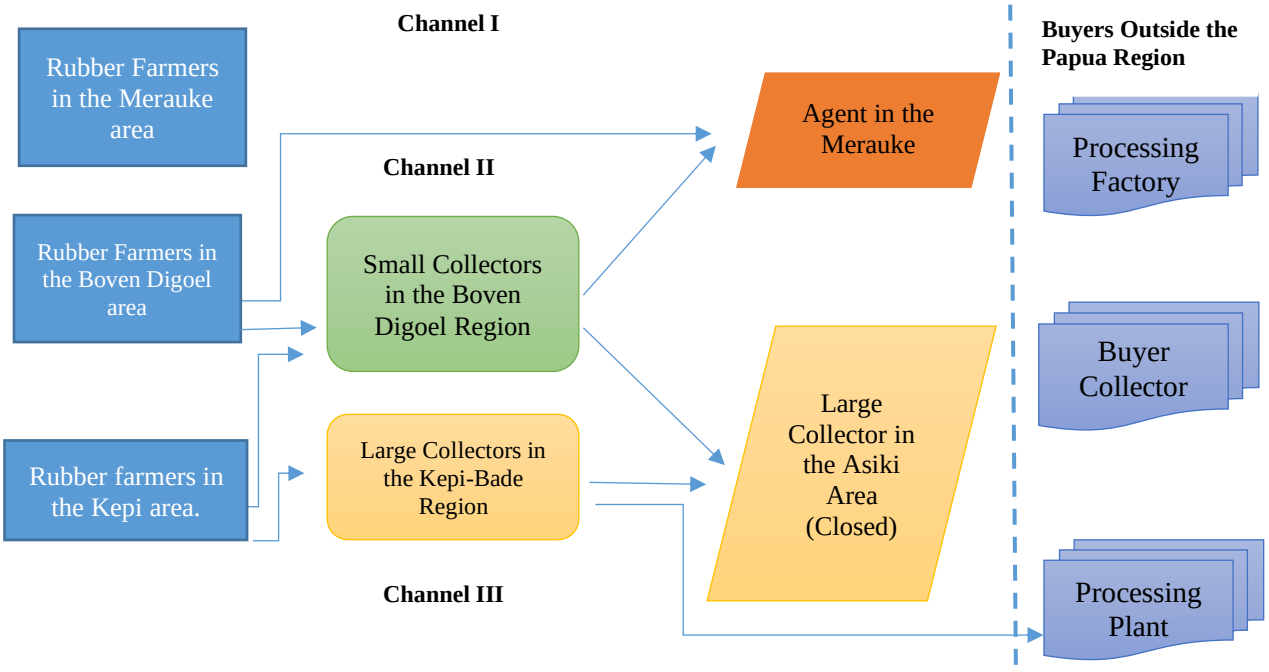

Figure 3. Supply Chain Integration for the Southern Papua Region (Merauke Regency, Boven Digoel Regency, and Mappi Regency)

From Figure 3, it can be observed that there are three channels formed from the rubber commodity chain activities based on their distribution areas, as follows:

a. For the Merauke regency area: Rubber farmers in the Merauke region - Agent in the Merauke region - Buyer outside Merauke regency (export).
b. For the Boven Digoel regency area: Small collector in the Boven Digoel region / Large Collector in the Asiki area (closed) - Agent in the Merauke region - Buyer outside Merauke regency (export).
c. For the Kepi regency area, there is a large collector in the Bade sub-district, a large collector in the Asiki area (closed), and a buyer outside of Papua.

There have been changes in channels 2 and 3 due to the closure of the large collector in the Asiki area, resulting in the large collector in the Bade area directly selling outside of Papua to each collector.

Rubber Commodity Transportation Routes in Southern Papua Region

The southern Papua region's transportation routes are traversed using sea, land, and air transport. Specifically, air transportation routes are used in urgent or necessary situations where shipment via sea/river and land routes is not feasible. The difficulty in accessing transportation factors results in a low rubber supply for collector traders, leading to increased transportation costs for traders collecting rubber from rubber farmers or a decrease in costs due to transportation calculations borne by the rubber farmers.

According to Hasdiana (2018), transportation issues for farmers arise when direct sales processes to modern market production chains cannot be carried out due to the distance from the production area, resulting in challenges with transportation equipment and high costs incurred. As a result, many rubber farmers have abandoned their plantations due to the lack of competitiveness in prices at the trader level and the difficulty in transportation for distribution. For a more precise understanding, please refer to Figure 5.

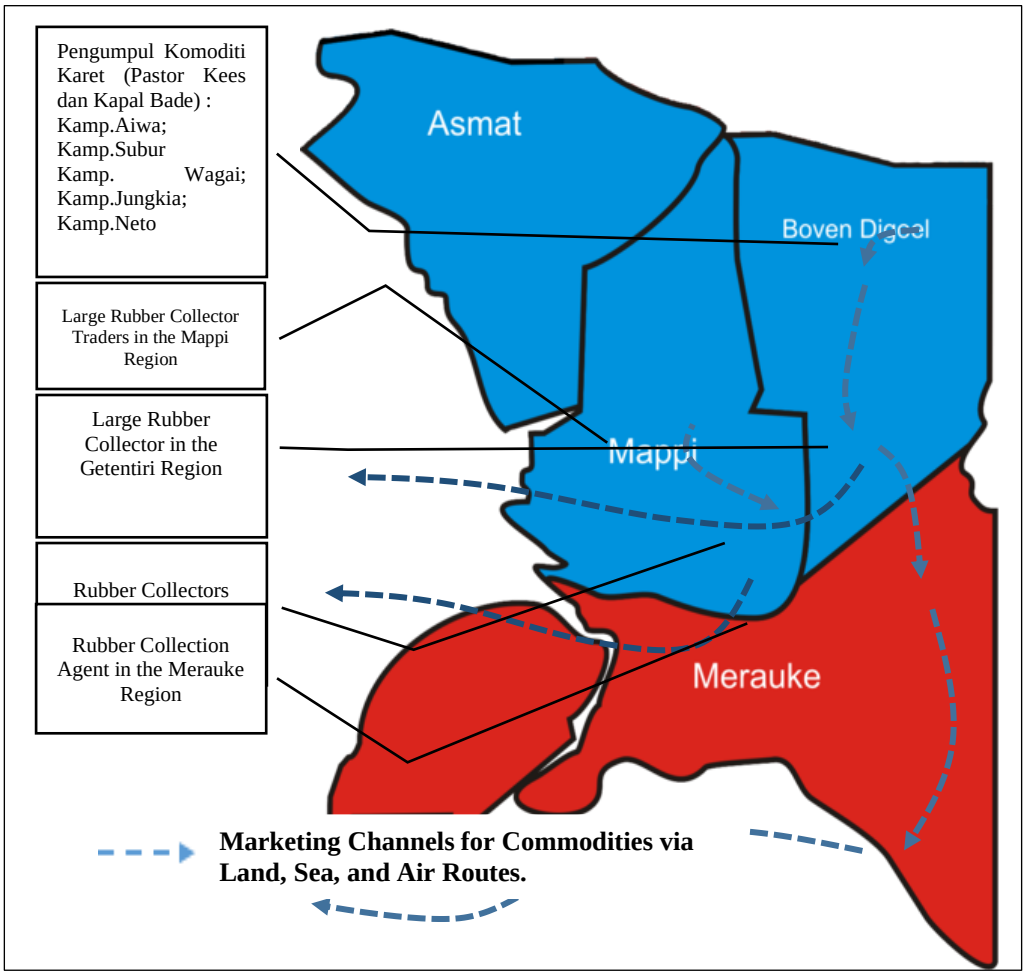

Figure 4. Transportation Routes Based on the Map of Merauke, Mappi, and Boven Digoel Regencies.

There is no partnership between traders (small and large collector traders), resulting in farmers having no certainty in distribution and no bargaining power. Thus, farmers only receive supply information based on the needs of collector traders, not agents. Similarly, price decisions are made only by traders. For the scheme of integrating the rubber supply chain in the southern part of Papua, refer to Figure 5.

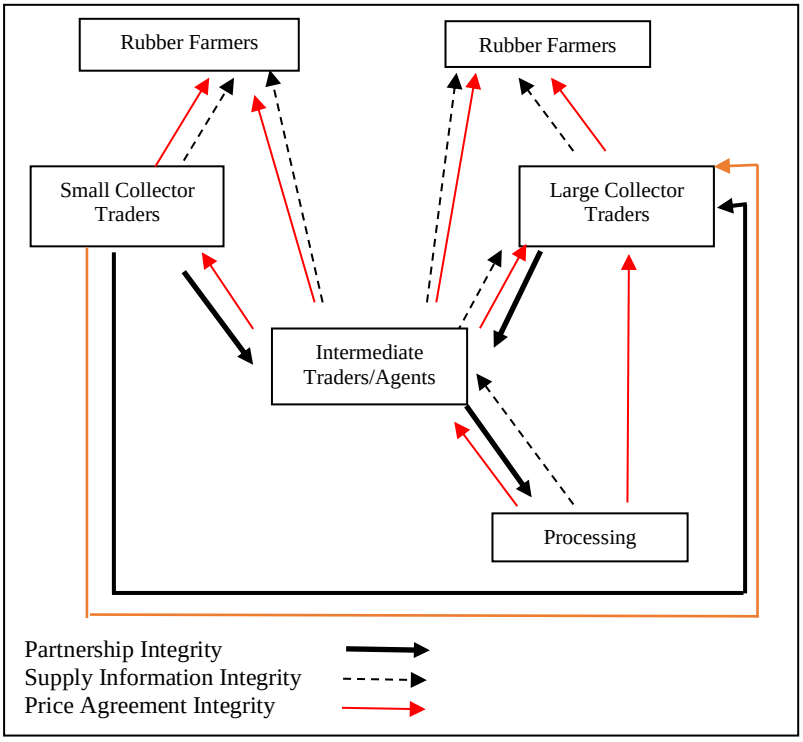

Figure 5. Pattern of Integrated Supply Chain for Smallholder Rubber Commodities, Adopting Diagram, Structure integration supply chain to traditional and modern markets (Simatupang, 2017)

Figure 5 shows that the lack of support from the government and the private sector in developing smallholder rubber cultivation has also resulted in inadequate sustainable processing. Establishing partnerships that maintain commitment and loyalty by meeting basic needs is an effective strategy to foster sustainable and mutually beneficial collaboration. Moreover, the significant price decline has caused rubber farmers to shift their business models, prioritizing quantity over quality to achieve higher sales volumes. This shift has led to a lack of trust from major agents and industries in the quality of rubber produced in the southern regions of Papua, particularly in the three central rubber-producing districts: Merauke, Kepi, and Boven Digoel. The volatile global rubber market necessitates a marketing buffer, which is not currently functioning in the region. The absence of local rubber processing industries has resulted in high transportation costs for shipping raw rubber commodities to industries outside Papua. The findings from the supply chain integration observations can be explained for each region as follows:

Suppliers (Rubber Farmers)

a. The farmers have cooperatives formed by the local government through the Department of Agriculture but lack regional-scale farmer associations.
b. They do not have partnerships with collectors and have weak bargaining power in pricing decisions.
c. Market information regarding prices and the demand for rubber commodities is lacking.

Collectors (Small, Large, and Agents)

a. They have strong price-setting power.
b. They have storage capacity (inventory) that meets the export needs of the rubber industry.
c. They possess land transportation for the collection process of rubber commodities.
d. They have good information on market prices and demand.

Prioritizing Strategic Initiatives for Rubber Commodities

Using the QSPM, strategic initiative priorities are determined and evaluated to identify and implement strategies through objective selection by experts utilizing good intuitive judgment based on internal and external factors.

Table 1. Strategic Initiative Priorities for the Rubber Commodity in Southern Papua.

No	Strategic Initiative	Weight	Level	Score	Priority Strategy Initiatives
1	Building partnerships by developing marketing through enhancing cooperation between farmers and collectors as well as among farmers themselves, and similarly among large-scale collectors with export potential and networks in the processing industry.	0,19	3	0,57	II
2	Optimizing plantation rejuvenation by possessing extensive rubber plantation land in Merauke, Boven Digoel, and Mappi districts with 3,047 hectares, 2,882 hectares, and 3,260 hectares. This optimization of productive land can increase the production of raw rubber, which has a high export value.	0,16	4	0,64	I
3	Renewing rubber press machines by refurbishing existing ones owned by rubber farmers and adding new machines to increase production. Advanced technology machines facilitate the addition of value and time efficiency in the initial processing before selling to the collecting traders.	0,15	3	0,45	V
4	Establishing a processing plant as a regional government-owned entity to simplify the marketing process and stabilize rubber prices at the regional level. This enables the region to address market price fluctuations, with the government acting as a buffer for the prices of rubber produced by local farmers.	0,15	2	0,3	VI
5	The intensive provision of support and guidance to farming communities by agricultural institutions at the district level regarding processing, production, and marketing aspects.	0,17	3	0,51	IV
6	Establishing cooperatives and financing institutions supported by the government and the private sector.	0,18	3	0,54	III
	Total Weight	**1**			

Source: Primary Data Processing 2018

Based on Table 3, the strategy initiative with the highest attractiveness value is the Optimization of Plantation Rejuvenation. As the first step in developing rubber commodity marketing, this strategy initiative aims to increase production through intensification, extensification, and rejuvenation (Fakhthurahman & Nofrizal, 2017). Strategies are prioritized based on their implementation time frame, in line with the statement that weighted decisions can only be proven over time, meaning that decisions taken will only be genuinely proven after a certain period (Nafi'ah & Suryaningsih, 2022). The strategies are as follows:

1. Short-Term Strategy: Rejuvenation of rubber plantations can be implemented to optimize the production yield of the rubber commodity. Additionally, strategies for developing partnerships and collaborations between farmers and potential high-exporting rubber collectors, especially those collaborating with rubber processing industries, can be pursued.
2. Medium-Term Strategy: The revival of cooperatives and financing institutions capable of providing storage and financial assistance for local farmers' rubber production is essential. Both private and governmental institutions should provide gradual assistance for production and processing activities up to the marketing stage.
3. Long-Term Strategy: Renewing processing machinery to increase production volume and improve efficiency in time and costs associated with rubber commodity production is crucial. It is recommended to establish a rubber processing plant as a medium-scale local industry tailored to the supply volume and determine its location for the entry of rubber from the three producing regions.

CONCLUSION

The cultivation of rubber in Merauke and its surrounding areas, namely Boven Digoel and Mappi regencies, has a long history dating back to the Dutch colonial era, supported by Catholic missionaries since 1969. These development efforts have increased prosperity for the local communities over several decades. However, the dynamics of world rubber prices since 2013 have led to a significant decline in farmers' incomes, resulting in decreased production and the closure of many rubber collection businesses.

This research finds that fluctuating rubber prices have caused economic uncertainty for farmers and collectors, prompting many farmers to shift to other livelihoods. The rubber commodity supply chain system in southern Papua also faces serious challenges, including transportation issues and a lack of solid partnerships between farmers and traders. Moreover, the lack of government and private sector support has led to sustainability issues in rubber processing.

To address these challenges, the research recommends short-term, medium-term, and long-term strategies, including rejuvenating rubber plantations, strengthening cooperatives, and establishing medium-scale rubber processing factories. These strategies are expected to increase production, optimize the supply chain, and rebuild sustainable partnerships for the welfare of rubber farmers in southern Papua.

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