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Mango value chain analysis in the Vietnamese Mekong Delta

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In emergent economies, conventional fresh produce supply chain procedures are transforming into new "supermarket-led" supply chains. The sudden shifts in the fruit and vegetable industry result from the insane popularity of supermarkets, convenience stores, hypermarkets, etc., which also affects smallholder producers. The abovementioned changes impact intermediaries because of the demand for high-quality, safe fruits and vegetables. Since procurement issues in conventional supply chain practices impact transaction costs, it is essential to evaluate the area. Therefore, the study aims to analyze the current income of mango farmers in the Vietnamese Mekong Delta from 2008 to 2018 and make recommendations to better their income so they can participate in the global value chain. The Vietnam Household Living Standards Survey (VHLSS) for 2012 to 2018 was utilized for this study. Among the solutions that will be implemented shortly are the following: strengthening agricultural production planning; developing policies to encourage the development of effective value chains; establishing internal governance policies to increase links in the chain and ensure sustainability; and enhancing the role of state management in the value chain.

Key words: value chain; mango trees; agricultural production; Vietnamese Mekong Delta.

1. INTRODUCTION

In recent years, particularly during agricultural restructuring in Vietnam, the fruit industry in the Mekong Delta has flourished, contributing positively and effectively to the reorganization of the agricultural sector by better adapting to climate change and meeting market demand. Market dynamics primarily drive the produce industry.

The fruit-growing regions of the Mekong Delta in Vietnam are important commodity-producing regions that focus on market demand. The region of fruit trees flourishes on both sides of the lower Tien and Hau rivers in Dong Thap, Tien Giang, Vinh Long, and Hau Giang provinces, where nutrient-rich alluvial soil is abundant and virtually no harm from floods and saline droughts. Additionally, fruit trees began to flourish in the dyke areas, less susceptible to inundation. The total fruit area of the region increased by 21.6% between 2005 and 2017, particularly during the restructuring period from 2013 onwards, when the average fruit area of the Vietnamese Mekong Delta increased by 2.6% per year, double the rate of the previous period. In 2017, the fruit area of the entire region reached 326 thousand hectares or roughly 40% of the country's total land area. Citrus (increased by 12,500 hectares), mango (increased by 23,3 hectares), banana (increased by 4.5 hectares), grapefruit, durian, mango, and banana are examples of rapidly expanding fruit trees.

The Mekong Delta contributes 60% of the country's total produce production by supplying over 3.5 million fruits to the market each year. The Ministry of Agriculture and Rural Development's fruit planting program for five varieties of fruit, including mango, dragon fruit, longan, rambutan, and oily fruit, has yielded positive results. Increasingly, safe and environmentally responsible agricultural practices (GAP, VIETGAP, Global GAP) are being implemented, along with numerous planting and care instructions for fruit rice in mangrove and arid conditions.

According to statistics, the area devoted to fruit cultivation in the Mekong Delta in 2019 was 1,1 million hectares. Mekong Delta is the greatest fruit-producing region in Vietnam, accounting for nearly 35 percent (Anh et al., 2020). Although mango is considered the most famous tropical fruit, it is more prevalent in Asia. According to the statistics, Vietnam ranked eleventh globally and seventeenth in Asia regarding mango volume. Moreover, the nation ranks third in Southeast Asia, behind Thailand and Indonesia, which hold the first and second spots, respectively (FAOSAT, 2019). In 2019, mango production was 815,200 tons in volume and 104,000 ha in production area (GSO, 2020).

Even though the pandemic reduced the export value of fruits and vegetables in 2019 and 2020, Vietnam's exports increased from 68 million to 279 million USD between 2016 and 2020 (Khoi, 2021). According to GSP, the Mekong Delta has the highest mango production percentage. As discussed, the region is regarded as the country's greatest mango-producing region, accounting for 46.3% of the national total. The region is also considered a mango cultivation hub, accounting for 62.8% of the total mango production in Vietnam, or approximately 511,945 tons. The mango project MSG study conducted in 2020 revealed that the mango volume structure of the Mekong Delta region was 45.5% Tuong-mango, 22.6% Chu mango, 9.4% HaaLoc mango, and 22.2% other mango

varieties. Although Chu-mango ranks second in volume, it stands out due to its diverse consumption markets and wide range of derivative products. Tuong-mango highlights the Chinese market with raw fruit, whereas Hao-Loc mango caters to local consumers with ripe, fresh fruit (Troung et al., 2022).

A Giang, Hau Giang, Dong Thap, Tien Giang, Vinh Long, and Ben Tre have begun to cultivate mangoes and citrus fruits in specialized regions. Plantations dominate the fruit region, and crops are frequently switched to diversify income and reduce risk. Models such as the Mekong Delta fruit cooperative were developed relatively recently (primarily after 2006), and many formal models that are not fruit marketing cooperatives support farmers in consumption. However, after five years of reorganization, the connection between fruit businesses and cooperatives is receiving attention and is being encouraged to grow. Several cooperative models link well with businesses in the Vietnamese Mekong Delta, such as Tan Thuan Tay Mango Cooperative (Dong Thap province), which has been cooperating with Long Uyen Company to supply and consume mangoes; Hoa Loc Cooperative links mango supply and consumption with several companies in Ho Chi Minh City to consume mangoes. The fruits produced in cooperatives associated with companies are made under the VietGAP or GlobalGAP process as the main growing area for famous specialty trees certified to meet VietGAP and GlobalGap standards in Tien Giang, such as Tan Lap cluster (Tan Phuoc), Ngu Hiep durian (Cai Loi), Hoa Loc sand mango (Cai Be), dragon fruit (Rice Market), or mango cultivation models with sufficient conditions for safe production in Cao Lanh district, Cao Lanh city (Dong Thap).

In recent years, the expansion of export markets and the diversity of fruit tree products have significantly affected the increase in the Mekong Delta's fruit export turnover. Since 1994, exports of fruit trees in the region have begun to rise again, reaching 66.14 million US dollars in 2005. From 2005 to 2010, the export turnover increased by an average of 10% per year, reaching 107.29 million USD in 2010. In the five years from 2012 to 2017, the export turnover of produce from the Mekong Delta grew rapidly, averaging 43% per year and reaching $1.7 billion in 2017. Numerous products from the region's fruit trees are exported to many countries around the globe with increasing quality and have become the region's primary export. However, fruit and vegetable exports are highly reliant on the Chinese market; China presently accounts for 75.68 percent of Vietnam's fruit and vegetable export market share. Some branded fruits include the Hoa Loc sand mango, the Cao Lanh mango, the Nam Roi citrus, and the Lo Ram star apple.

In addition to aquaculture and rice, the Vietnamese Mekong Delta's fruit industry must be restructured to further integrate into the global value chain and contribute to the region's sustainable development. Mangos are among the fruits of the Mekong Delta in Vietnam, with a high growth rate and numerous potential consumer markets.

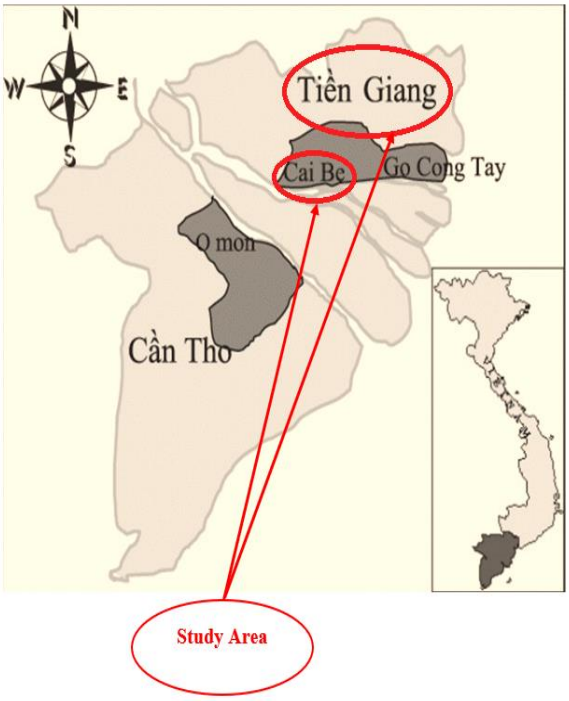

Figure 1: Study Area in Mekong Delta

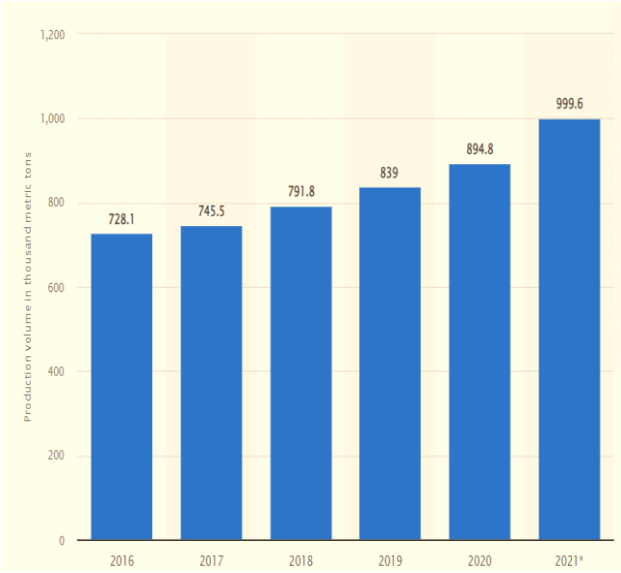

Figure 2: Production Volume of Mangoes in Vietnam 2016-2021 (Source: Statista)

This study aims to analyze the current situation of the mango value chain in the Vietnamese Mekong Delta from 2008 to 2018 and evaluate the chain's current status in terms of value addition to provide policy recommendations to improve the added value of the Vietnamese Mekong Delta's mango tree chain so that it can participate in the global value chain.

2. LITERATURE REVIEW

Fernandez-Stark et al. (2011), von Hagen and Alvarez (2011), and C. S. Dolan and Tewari (2001) argue in their

study of value chain upgrading solutions that participation in supply chains with different governance models will impact the upgrade and innovation capabilities of the actors involved in that supply. For instance, participation in the vegetable and fruit supply chain for the UK market has a significant influence on the upgrading and innovation of African actors (growers, intermediaries, exporters, etc.). These studies have summarized four categories of supply chain enhancements: process enhancements, product enhancements, functional enhancements, and chain enhancements. Consequently, following the proper governance model, it is essential to determine the target market's requirements before selecting and implementing the most appropriate chain upgrade solutions for each product group.

Similar to Jaffee and Masakure (2005), Gereffi et al. (2005), Cook and Wang (2004), and C. Dolan and Humphrey (2004), Jaffee and Masakure (2005) focus on supply chain management and agricultural supply chain specifically. Methods for managing the farm supply chain include markets, agricultural contracts, and vertical integration. In the supply chain of agricultural products, the research reveals numerous connections between actors, the most important of which is the link between the primary actor (leader) and suppliers (farmers, cooperatives, and other intermediaries). The supply chain management method will determine which actors are involved in the chain, the mode of participation, the capacity to innovate and enhance, and the distribution of profits within the chain.

Humphrey (2006) analyzed global value chains for agribusiness by determining the function of leading companies, the competitive position of the chain, and the governance of inter-company relationships along the value chain. This study offers a comprehensive comprehension of the effects of value chain dynamics on the structure of production in developing countries and the income distribution among value chain components. This is also confirmed by the research of Wysocki (2000), C. S. Dolan and Tewari (2001), and Gereffi and Christian (2009), who examined the forms of distribution and supply chain of agricultural products in developed nations like the United States and developing nations like Cambodia and the Philippines. The results confirm differences in food supply chains between developed and developing countries in terms of chain organization, chain activities, chain actors, and food safety and hygiene standards that must be met and enforced in the chain to access those markets.

Similar to Chemnitz (2007), Gereffi and Lee (2012), Henson and Humphreys (2009), Jaffee and Masakure (2005), and Reardon and Farina (2001), Gereffi and Lee (2012), Henson and Humphreys (2009), Jaffee and Masakure (2005), and Reardon and Farina (2001) believed that participation in various supply chains affects issued and enforced food safety standards. From production to ultimate consumption, supply chains for developed markets typically require higher food safety standards than those for developing nations. Developed nations also use food safety standards as an entry barrier for food producers and processors from developing nations. To enter the market, developing nations must employ the food safety standards of developed nations (Reardon & Farina, 2001). According to Jaffee and Masakure (2005), manufacturers and processors in the food industry can gain a competitive advantage by adopting and meeting food safety and hygiene standards.

Hu et al. (2004), Dobson et al. (2003), Gehlhar and Regmi (2005), Hagen and Simons (2003), Reardon et al. (2003), Reardon et al. (2005) believed that there is a trend of centralization in the field of processing and providing inputs for food production in the food industry. In addition, retailers such as supermarkets play a growing role in coordinating, organizing, managing, innovating, and distributing revenue along the value chain.

GTZ (2007) disseminated the ValueLinks methodology to aid in the analysis and development of tools that promote the value chain in practice efficiently and uniformly. GTZ's approach is practice-oriented, dividing value chain analysis into modules that include principles and standards for selecting analytical tools, creating effective intervention strategies, monitoring, and evaluation. These modules are not fixed duties but standards and principles; implementation in practice is extremely flexible.

Documents published by IFAD in 2014 provide guidelines for the development and promotion of agricultural value chains, such as guides on (i) developing value chain development projects, (ii) monitoring the implementation of value chain development, and (iii) public-private cooperation in value chain development. Similar to the Value Link's Handbook (2007), this collection of documents guides the value chain development process from chain selection to data collection, analysis, making interventions, and devising an action plan and a program/project monitoring plan. Specifically, the document emphasizes the importance of public-private partnership mechanisms in promoting value chain development. In addition, IFAD (International Fund for Agricultural Development (2011) provides a set of practice guidelines for value chain development via 25 suggested questions to select, analyze, propose intervention strategies, and implement these strategies to develop the established value chain. Additionally, the International Labour Office (2015) disseminated guidance documents on value chain development about labor issues in the value chain.

Forming vertical connections through agricultural contracts is one of the crucial components of promoting value chain development. Numerous documents such as UNIDROIT (2015) and IFAD (2015) detail the implementation guidelines for this hyperlink. In these documents, the role and participation of third parties in agricultural contracts and the agreement of product quality standards, pricing, and constraints are discussed and implemented.

Donovan and Poole (2014) analyzed and contrasted eleven research methodologies and intervention design guidelines for value chain development. The authors argue that the policies provide an adequate framework for comprehending the market and the participation of actors along the supply chain, emphasizing institutional strengthening and the design of sustainable interventions. However, the governing documents do not discuss the specific conditions and traits for developing each operating chain. The author emphasizes the importance of regular chain summarization, synthesis, and monitoring for sustainable growth.

Fernandez-Stark et al. (2011) analyzed the role of human resource development in several developing countries (Chile, Jordan, Kenya, Honduras, and Morocco) and participation in the global fruit and vegetable industry in their analysis of economic upgrading and human development in the global fruit and vegetable value chain. In the document, the authors emphasize that the development of these countries' fruit and vegetable value chains is associated with a functional improvement strategy or a transition to higher value-added activities in the industry, such as a shift from promoting products to promoting packaging, processing, and then the complete management of distribution and marketing channels. However, nations must complete the preceding stages to upgrade effectively. To concentrate on improving the processing stage, for instance, the production stage must be implemented first to have sufficient raw materials for processing, and no investment capital is wasted. In addition, to gain access to the global fruit supply chain, the application of the product improvement strategy and chain operation process associated with the application of science and technology, management solutions in the operation of the chain, and compliance with quality standards (GAP for production), other SPS standards for other stages of the chain, and HACCP for processing are crucial. In addition, the author stated that countries must give close attention to human resource training to develop the output chain if these strategies are to be successful.

A general evaluation of previous empirical studies can demonstrate that, even though agricultural value chain research includes common characteristics of agricultural products, each item has its characteristics, benefits, and drawbacks. The study of the value chain of fruit trees in the Mekong Delta that participate in the global market has its characteristics (market, technology, governance, and information). This study examines the unique characteristics of the mango value chain in the Mekong Delta that are inapplicable to the standard analytical framework and instruments for agricultural products. This is another significant research lacuna.

3. OVERVIEW OF MANGO PRODUCTION AND VALUE CHAIN IN THE MEKONG DELTA REGION

3.1 Overview of Mango Production, Processing, Storage, and Distribution and Consumption in the Mekong Delta Region

3.1.1 The Overall Situation of Mango Production in the Mekong Delta

Mango is a prominent tree in Vietnam, where it is grown in 59/63 provinces and cities on an area of approximately 100 hectares, ranking second in fruit tree planting areas after banana. Particularly, mango acreage decreased from 87.6 thousand hectares in 2009 to 83.7 thousand hectares in 2015 and has since increased (Table 1).

The country currently has 57 varieties of mangoes of all types, but only four varieties of high-quality mangoes: Hoa Loc, Chu mango varieties, Chau Nghe, and Tuong mango varieties. However, the Hoa Loc mango is the cultivar with the highest quality and most concentrated cultivation.

Table 1: Mango Cultivation Area in Vietnam, 2009-2018 (Unit: Thousand Hectares)

Region/Year	2009	2010	2015	2016	2017	2018	Average
National scale	**87.6**	**87.5**	**83.7**	**86.6**	**92.7**	**99.6**	**1.4**
Red River Delta	1.9	1.8	2.2	2.2	2.4	2.4	**2.5**
Northern midland and mountainous	8.5	8.4	8.3	8.7	12.2	15.9	**7.2**
Central Region	14.2	13.8	14.2	14.2	14.7	15.2	**0.8**
Central Highlands	2.1	2.2	2.7	2.4	2.9	3.2	**4.9**
Southeast	17.4	18.1	17.4	17.2	17.8	17.8	**0.3**
Mekong Delta	43.5	43.2	39	41.9	42.7	45.1	**0.4**

(Source: Ministry of Agriculture and Rural Development, 2019)

Table 2: Mango Cultivation Area in Vietnam and Localities in the Mekong Delta, 2005 – 2017 (Unit: ha)

	2005	2009	2010	2015	2016	2017
National scale	**80–100**	**87,600**	**87,500**	**83,700**	**86,700**	**92,700**
Mekong Delta	**38,200**	**43,500**	**43,190**	**39,000**	**41,900**	**42,725**
Dong Thap	6,143	8,892	9,300	8,656	8.768	9,128
Tien Giang	6,072	6,612	6.657	4,574	4,693	4.710
11 other provinces.	25,985	27,996	27,233	25,770	28,439	28,887

Source: General Statistics Office, (2018)

In the Mekong Delta, mangoes are primarily grown in the provinces of Dong Thap and Tien Giang. The mango area in the Mekong Delta increased from 43.5 thousand hectares in 2009 to 45.1 thousand hectares in 2018. Particularly, the mango areas of Tien Giang and Dong Thap account for approximately 32% of the region's total mango area but account for about 50% of the total mango production in the Mekong Delta (Table 2). Due to individuals occupying the space formerly inhabited by ineffective trees, mango cultivation has steadily expanded over the years.

3.1.2 The Overall Situation of Mango Processing in the Mekong Delta

Throughout the years, the selling price of mangoes and most other fruits in the Mekong Delta during peak harvest has frequently been unstable. The regulation of product consumption is difficult, but mangoes are primarily consumed in their raw form in the region and the nation, causing stagnation and damage. Therefore, developing post-harvest processing technology for the mango industry is crucial for the global consumption of mangoes. Mangoes are currently processed into value-added products, including mango marmalade, candy, mango juice, dried mango, mango vinegar, soot mango, and mango wine. However, processing and preservation for export to significant markets such as Japan, the United States, and the European Union remain extremely difficult due to the small annual harvest output. The technology and preservation equipment system is still inadequate, making it difficult to meet export standards for discerning markets. In other words, it is still difficult to develop the mango industry so that it can access the global market.

3.1.3 The Overall Situation of Mango Preservation in the Mekong Delta

The mango harvest typically occurs between the dry season's conclusion and the wet season's start. This harvest season is earlier than the southeastern provinces and distinct from the northern provinces. This advantage is partly attributable to the favorable natural conditions and refining methods for fruit production. This is a benefit of the mango industry in Vietnam, which supplies mangoes to the global market.

However, the majority of mango products are consumed as fresh fruit, and the shelf life of fresh mangoes is very brief; therefore, the technology of preserving fresh fruits is crucial. To date, however, keeping fresh produce still relies on traditional methods. No technological advancements have occurred, so the consumption period cannot be lengthened.

The country continues to rely primarily on manual preservation techniques for mango products consumed domestically to sell fresh produce. Businesses mainly process frozen mangoes for export (slicing for the flesh, removing the seeds, freezing, and exporting), but the quantity is not substantial.

After being harvested, each carton will typically be packed with fresh produce. Depending on the transport distance, the fruit may be packaged in wooden crates, foam crates, cartons, or even bamboo baskets, which must be covered with paper cushions, foam bags, straws, or papyrus. Using plastic and foam containers to store exported mangoes has substantially reduced the rate of transportation damage in recent years.

After harvest, mangoes are rarely refrigerated for transport or chemically treated. In the export of fresh mangoes to other countries, preservation techniques are performed in phases, including packaging and storage in specialized cold storage at the port.

In general, the harvesting, preservation, and transportation of fruits to the site of consumption are all performed manually and entirely by merchants; consequently, the quality of mangoes, when they reach consumers, is diminished, and the post-harvest loss rate is still quite high. The purchasing network is completely confident. The promotion of investment in post-harvest technology should therefore continue to receive sufficient attention. In contrast, technology development for preserving, storing, and processing mango products should be geared toward product and market diversification.

3.1.4 General Situation of Mango Distribution and Consumption in the Mekong Delta

Mangoes are one of the most significant fruits, second only to bananas, which are widely consumed and have a lengthy history. In addition to its use as a delicacy or nutritious food, mango is frequently consumed on holidays, memorial days, and full moons. During these periods, the consumption of mangoes fluctuates dramatically.

After bananas and oranges, mango is currently Vietnam's third most consumed fruit. According to VHLSS, the average mango consumption per Vietnamese citizen in 2010 was 4.7 kg annually. Consumption of mangoes has increased over the years, and competition is intensifying, even displacing traditional fruits like oranges and avocados.

According to the calculations of the Institute of Agriculture and Rural Development, the price elasticity coefficient of mangoes is (-0.91 - when the price decreases by 1%, the consumption rises by only 0.91%), and the income elasticity coefficient of luxury goods is (1.13) - when the income rises by 1%, the consumption rises by 1.13%. In contrast to other fruits, such as bananas, whose income elasticity coefficient is less than one (1), mango consumption is anticipated to increase as living conditions improve.

It is difficult for other suppliers to penetrate markets such as the United States and China on the global market. Due to the demand for mango exports, we still have opportunities in other markets, including the European Union, South Korea, Australia, and New Zealand. Moreover, mango products with "organic" and "fair-trade" certifications are gaining popularity, and processed mango

products will be a new development focus for the Vietnamese mango industry.

4. OVERVIEW OF THE MANGO VALUE CHAIN IN THE VIETNAMESE MEKONG DELTA

In the Mekong Delta of Vietnam, mangoes are primarily consumed in their unprocessed, unripe state, while relatively few are consumed after processing. Mango products are mainly distributed through the four channels shown in Figure 1:

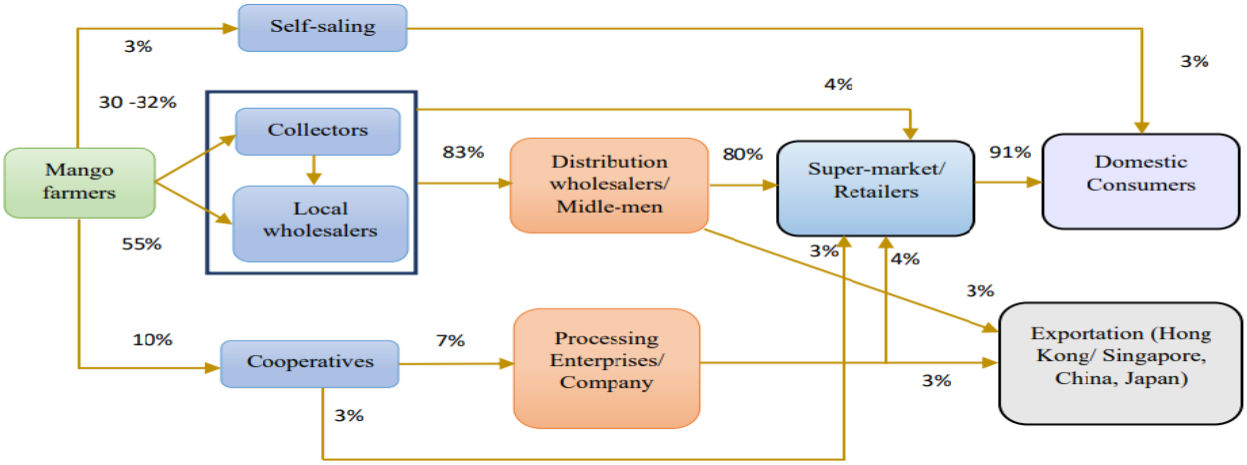

Figure 1: Mango supply value chain diagram of the Vietnamese Mekong Delta region, 2019 (Source: Drawn from results of the focus group discussion; 2019)

4.1.1 Channel 1: Mango Growers – Consumers

Mango producers sell directly to consumers via this channel. Farmers or merchants in mango-growing regions establish roadside stands to sell to motorists. When the farmer sells through this channel, they earn 10 to 20% more than when selling to local collectors or shippers. However, only about 3% of mangoes are consumed through this channel, as farmers lack the time and space to trade, and this channel cannot consume a significant quantity of mangoes.

4.1.2 Channel 2: Mango Growers – Collectors – Local Collectors – Distribution Wholesalers/ Merchants - Retailers/Supermarkets - Consumers

Mango cultivators sell mangoes to collectors, who purchase them at a garden or a collectors' meeting place near the mango plantation. Collectors organize and transport products to local packaging stations in markets or larger product aggregation centers. Mangoes are sorted and packaged once more before being sold to long-distance traders or transported to distribution warehouses or large cities. In addition, mango producers can harvest mangoes and sell them directly to local collectors after negotiating prices over the phone. This is how mango producers who harvest 100 kilograms or more sell their fruit. If sold this way, mango producers can fetch a slightly higher price than when selling to collectors. Mango cultivators in this channel are typically traditional growers who employ the "bucket" selling format (selling at the same price without classification). More than 80 percent of mangoes produced by farmers are ingested through this channel.

4.1.3 Channel 3: Mango Growers – Cooperatives – Processing Enterprises/Companies – Retailers/Supermarkets - Consumers

The quality factor takes precedence because the consumer is a processing business or company. Typically, mango producers in the channel adhere to the GAP technical process, resulting in greater productivity and product quality than in conventional production. The cooperative is responsible for accumulating and classifying packaging before its export to enterprises/companies engaged in processing. Businesses can either sell raw mangoes or slice them, package them, and sell them to grocery stores. However, only about 10% of the region's mangoes are consumed this way.

4.1.4 Channel 4: Exported Mangoes

In the Mekong Delta of Vietnam, raw and processed mangoes are exported. Local farms obtain mangoes in their fresh state from farmers or collectors. Local farms resell their produce to long-distance distribution/merchant depots to export to foreign nations. Exporters resell to foreign importers, who then resell to supermarkets and other retail outlets. Typically, the quantity of mango consumed through this channel is negligible.

4.2 Value-added Formation of the Mango Value Chain in the Vietnamese Mekong Delta

4.2.1 Mango Growers

The value-added of the mango supply chain begins to take shape during the production phase. Different techniques, methods of production, and methods of sale will result in varying levels of output and prices. In other words, it will result in a different value-added tax rate. Currently, there are two groups of mango farmers: the traditional farming group and the farming group adhering to the VietGAP

technical process, with the two primary types of sale (Table 3) being the sale of "buckets" (unsorted sale) and sale with classification to meet two distinct consumption channels.

In certain phases, such as harvesting, watering, weeding, and fertilizing, mango-growing households incur intermediate expenses for fertilizers, pesticides, raw materials, and service rentals. These costs differ based on each household's technique, awareness, financial ability, and, most importantly, production method. The average cost is the basis for calculating the added value in mango production (Table 3).

The survey's average productivity is 8.74 tons/hectare, greater than the national average productivity (8.41 tons/hectare). The group of mango growers under the VietGAP process has an average yield of 10.25 tons/hectare/year, significantly higher than the national average. In contrast, the group of traditional mango growers has an average yield of 7.22 tons/hectare/year, which is only 70.46 percent of the yield of mango growers under the VietGAP process (Table 3).

This variation depends on several variables, including mango age, mango variety, and cultivation method. This indicates that the potential for increasing mango productivity to increase the value-added of mango products is still quite large (Table 3) if mango areas are intensified following sound agricultural practices.

Table 3: Value-added of Mango Growers in the Vietnamese Mekong Delta Region

Category	Traditional production group	Production households, according to the VietGAP process			
		Type 1 *(30%)*	type 2 *>50%;*	Type 3 *20*	Total
No. of samples	n = 50				n =10
Production value per 1 hectare					
Average mango yield (ton per hectare)	7.22	3.08	5.13	2.05	10 - 25
Selling price (million VND per ton)	22.00	35.00	25.00%	12.00	25.40
Gross Output (million VND)	158.91	107.63	128.13	24.60	260.35
Intermediate cost over 1 ha (million VND/ha)					
Cost of fertilizer	38.70				33-50%
Expense for pesticides	35:50				30.68
Cost of fuel, other costs	3.92				5.66
Outsourced service cost	19:57				20:41
Depreciation of orchards[1]	2,81				2.54
Total cost	100.50				92.78
Value added (million VND)					
Gross output per hectare	158.91				260.35
Production cost per hectare	100.50				92.78
VAT per hectare	58.41				167.57
VAT per ton	8.09				16.35

(Source: Compiled from results of the survey)

In addition, exploratory factor analysis is performed to Not only is the productivity of mangoes grown traditionally lower, but their selling price is also lower. Because the quality is not good and uniform, these households sell unclassified (in buckets) mangoes so that the owner can sell all the good and bad mangoes at once and not have to spend time selling each variety separately (bad types are often more difficult to deal and fewer buyers are interested). Typically, these households' mango production structure consists of 20% type 1, 40% type 2, and 40% type 3. Even though mangoes cultivated by mango farmers under the VietGAP process are of high quality and uniformity, this group of households frequently chooses to sell based on product classification: Type 1 typically accounts for 30% of production, Type 2 for 50%, and Type 3 for 20%. Each variety of mango will be sold at a different price, with a significant disparity between them. This resulted in a Gross Output of 158.91 million/ha for the traditional household planting group, significantly lower than the Gross Output of 260.35 million/ha for the VietGAP household planting group.

VietGAP's total production costs per hectare of mangoes are 7.72 million/hectare less than those of the traditional mango cultivation group. The primary reason is that the GAP production method will minimize using fertilizers and pesticides, resulting in significant cost savings (Table 2). The Mekong Delta's VAT per hectare of mangoes is computed using Gross Output and Intermediate Cost data (Table 3). The survey results indicate that the value-added per hectare of mango varies significantly between distinct groups of farmers. The mango-growing households that followed the VietGAP process obtained an extremely high VAT rate of 167.57 million VND/hectare. In contrast, the mango-growing households that followed the traditional method only reached 58.41 million VND/hectare.

According to mango production, it is estimated that mango growers following the VietGAP process will earn approximately 16.35 million VND per ton of mangoes for sale. In comparison, traditionally, households producing mangoes will only earn about 8.09 million VND per ton of mangoes for sale.

[1]Assumption: Mangoes are harvested after 3 years of planting, the stable harvest time of mango is 50 years

Consequently, the organization of mango cultivation following the VietGAP process will earn a higher VAT than traditional producers. This may be a policy recommendation for reorganizing mango cultivation and technical assistance in the Mekong Delta to enhance mango quality.

4.2.2 Collectors

Mango producers may also be collectors. They have sold mangoes to familiar packaging warehouses for many years. When mango season arrives, they purchase mangoes from local manufacturers to resell in packaging warehouses. The collector may also be a friend of the proprietor of the packing department who collects mangoes for the owner in exchange for the price differential. Collectors are the link between the proprietor and the farmer, playing a crucial role.

The VAT calculation for the collection group is based on the sale price of products to local farms, the purchase price of products from mango farmers, and intermediate costs incurred during the purchasing process (Table 4).

Table 4: VAT of mango collectors in the Vietnamese Mekong Delta

For 1 ton of fresh mangoes

Category	Value (million VND)
Expenses for mango collection	
Cost of transportation, loading, and unloading	0.30
The expense of renting collectors	0.20
Cost of sorting and packaging	0.38
Other expenses (electricity, small equipment, interest...)	0.20
Cost of loss	0.40
Total costs	1.48
Value added (million VND)	
Purchase price of input	22.00
Intermediary costs	1.48
Selling price for fruit warehouses/retailer	25.00
VAT/ton mango	1.52

(Source: Compiled from results of the survey)

According to the survey results, this category's VAT per ton of mangoes reached 1,52 million. The costs for this activity have been minimized regarding utilization quota, so they can only increase because it is difficult to reduce input costs (fuel, labor, etc.). Based on a stable procurement organization and improved preservation to minimize losses and improve mango quality, the possibility of increasing VAT at this time is minimal, if at all.

5. LOCAL FARM

The local farm is the most important link in the supply chain. Local farmers conduct business by purchasing mangoes from collectors or directly from cultivators. Most local farm owners buy mangoes from collectors at higher prices than from farmers because the quality of mangoes collected by collectors is typically superior, more consistent, and categorized to their specifications. In the meantime, owners frequently must reclassify when purchasing mangoes from producers. In contrast, when purchasing mangoes from collectors, the daily purchase quantity can be estimated, whereas the yield from farmers is unknown, making it difficult to organize transportation.

More than eighty percent of the mango collected by the farms is sold to distribution depots in other cities, such as Ho Chi Minh City and Hanoi. The owners do not receive payment until the distribution department outside the province has sold all of the products (typically within a month).

Only Cai Be district, Tien Giang province fruit farms were surveyed in this investigation. The cost of a fruit farm per ton of mango typically includes the price of mangoes, the cost of preservation, the cost of sorting, the cost of transportation, the cost of loss, and additional costs such as the cost of tools, the cost of electricity, the cost of interest, and the opportunity cost of capital (Table 5).

Table 5: Value-added of mango local farm in the Vietnamese Mekong Delta

Calculated for 1 ton of mango, UNIT: million VND

Category	Value (million VND)
Expenses for mango collection	
Cost of transportation, loading, and unloading	0.40
Storage expenses	0.20
Cost of sorting and packaging	0.38
Other expenses (electricity, small equipment, interest...)	0.20
Cost of loss	0.30
The opportunity cost of capital	0,23
Total costs	1/71
Value added (million VND)	
Purchase price of input	25.00%
Intermediary costs	1/71
Sale price	29.00
VAT/ton mango	2.29

(Source: Compiled from results of the survey)

VAT per ton of mangoes reached $2.29 million at this point. As with collectors, the costs for this activity have been minimized in terms of usage quota, so the likelihood of increasing VAT at this stage is minimal if at all, based solely on stable procurement and storage, faster and better transportation to consumption locations to reduce losses and improve mango quality.

5.1.1 Cooperatives

The functions of mango-purchasing cooperatives are comparable to those of local collection agents and plantations. The cooperative will purchase mangoes from mango farmers (typically members) and resell them to processing companies or supermarkets. However, the cooperative only purchases mangoes from GAP-compliant producers to guarantee quality and satisfy the needs of consuming partners. Typically, the cooperative and its associates conduct purchases and sales using the contract method, and the proceeds from the sale of mangoes are refunded to the cooperative between one-half and one month later. This is another factor that reduces the cooperative's added value (Table 6).

The cooperatives value-added consists of the price difference between the selling price to consumption partners and the purchase price from mango producers, plus the intermediate cost incurred during the purchasing process.

Table 6: VAT of mango purchase cooperative

For 1 ton of fresh mangoes

Category	Value (million VND)
Expenses for mango collection	
Cost of transportation, loading, and unloading	0.30
The expense of renting collectors	0.20
Cost of sorting and packaging	0.45
Other expenses (electricity, small equipment, interest...)	0.30
Cost of loss	0.25
The opportunity cost of capital	0.24
Total costs	1.74
Value added	
Purchase price of input	25.50
Intermediary costs	1.74
Sale price	30,00
VAT/ton mango	2.76

(Source: Compiled from results of the survey)

The cost of loss is considerably reduced by 0.25 million/ton (compared to the collecting agent's cost of 0.40 million/ton) due to the higher quality of mango and copper of the purchased product than the two groups of agents listed above. Despite the increase in the cost of sifting and packaging (0.45 million/ton), the price is still quite high due to the high quality of the products and the fact that supermarkets and processing companies are the end consumers. This group of agents had a higher value-added tax per ton of mango than collection agents (1.52 million) and local plantations (2.29 million).

5.1.2 Wholesalers

The value-added of the distribution unit, which is identical to that of the collector and the local farm, is determined by subtracting the department's selling price from its costs (including mango purchase costs and intermediary costs). The intermediate cost of the distribution unit consists of storage, transportation, sorting, and other expenditures. The VAT generated per ton of mango reached 2.62 million (Table 7).

Table 7: Value-added of Mango Distribution Warehouse

For 1 ton of fresh mangoes

Category	Value (million VND)
Expenses for mango collection	
Cost of transportation, loading, and unloading	0.30
Storage expenses	0.20
Cost of sorting and packaging	0.38
Other expenses (electricity, small equipment, interest...)	0.20
Cost of loss	0.30
Total costs	1,38
Value added (million VND)	
Purchase price of input	29.00
Intermediary costs	1,38
Selling price for fruit farm/retailer	33.00
VAT/ton mango	2,62

(Source: Compiled from results of the survey)

6. RETAILERS/ SUPERMARKETS

Similar to intermediate groups, which include collectors, local farms, and distribution warehouses, retailers and supermarkets calculate their VAT by subtracting their revenue from their expenditures, including mango purchase and intermediary costs. The retailer's/grocery store's/supermarket's intermediary costs per ton of mangoes include storage, transportation, classification, and attrition

costs (Table 8).

Table 8: VAT of Retailers and Supermarkets

For 1 ton of fresh mangoes

Category	Retailer	Supermarket
Costs of purchasing mangoes		
Cost of transportation, loading, and unloading	0.30	0.30
Cost of sorting and packaging	0.38	48
Other expenses (electricity, small equipment, interest...)	0.20	0.40
Cost of loss	0.20	010
Total costs	1.08	1.28
Value added (million VND)		
Purchase price of input	33.00	36.00
Intermediary costs	1.08	1.28
Sale price	38.00	42.00
VAT/ton mango	3.92	4.72

(Source: Compiled from results of the survey)

Due to the socioeconomic characteristics of large cities, food markets, grocery stores, and fruit and vegetable markets can be found in residential areas. Due to the abundance of retailers, they operate with modest capital and have few daily sales. 70% of their capital is between 2-4 million VND, while only 30% is between 10-30 million VND. Due to the small quantity of capital that can be turned over rapidly, retailers visit wholesale markets every two to three days to purchase 50 to 150 kg of mangoes and other fruits. This quantity of mangoes is typically sold within two to three days for an average of 30 to 50 kilograms.

The supermarket system is also a retail channel, albeit one with greater output, higher quality, and distinct consumer groups than retailers. Therefore, the purchase and selling prices are also increased, but the retailer's loss cost will decrease more. In other terms, the supermarket system will generate greater value-added than the retailer. Specifically, according to Table 7, the retailer's VAT is 3.92 million /ton, 17% less than the supermarket system's 4.72 million /ton mango.

7. PROCESSING ENTERPRISES/ COMPANIES

VAT per ton of mangoes is determined by the difference between the selling price of one ton of mango products and the intermediate cost of processing one ton of mango products. The intermediate costs of factories consist of petroleum costs, transportation/loading costs, packaging costs, and processing costs, as well as additional costs such as energy costs for processing, costs for purchase and sale procedures, and environmental management/sanitation costs. According to the survey's aggregate results, the intermediate cost at this stage is 1.89 million VND per ton of completed mangoes, while the VAT generated is 4.11 million VND per ton (Table 9).

Table 9: VAT of Processing Enterprises/ Companies (Unit: 1 ton of mango)

Category	Value (million VND)
Purchase price of input	30,00
Intermediary costs	1.89
Sale price	36.00
VAT/ton mango	4.11

(Source: Compiled from results of the survey)

8. CONCLUSION AND POLICY IMPLICATIONS

This study analyzes the current situation of the mango value chain in the Vietnamese Mekong Delta from 2008 to 2018. It assesses the current situation of value-added formation in the chain, thereby identifying policy implications for enhancing the Vietnamese Mekong Delta mango tree chain's ability to participate in the global value chain. Among the solutions shortly are:

8.1 Planning Solutions

Construct a national plan for the produce industry's growth. This is the premise for the development direction and the implementation of other value chain development-promoting solution packages. In addition, the Ministry collaborates with localities to develop a project on sub-sector development planning and direction to prevent unplanned local development. Concentrate on the national main product categories, such as mango, longan, orange, lychee, grapefruit, dragon fruit, pineapple, durian, lemon, rambutan, jackfruit, soursop, tangerine, and guava.

Coordinate with the Ministry of Industry and Trade and the Ministry of Transport to integrate sector development planning with the planning of transport, electricity, and logistics systems; so that they can synchronize infrastructure to ensure the development of the value chain and the formation of clusters linking the fruit region with the industrial cluster of processing, preservation, and cold storage services.

Identify and announce the planned land areas to ensure that the infrastructure has been invested synchronously (irrigation systems, transportation, electricity, etc.) or has committed to invest by the schedule to develop the value chain and to develop clusters of the industry to link

planting areas and processing collections while preserving preliminary processing and logistics services.

8.2 Develop Policies to Encourage the Development of Effective Value Chains

Expand value chain financing to the fruit industry so that businesses that invest in the intensive processing of fruit products can take advantage of this benefit.

In addition, it is necessary to continue researching additional suggestions for supporting enterprises investing in rural agriculture, particularly enterprises investing in deep processing and enterprises affiliated with farmers and cooperatives. Support is suggested for lowering income taxes for businesses and individuals involved in producing and selling agricultural products.

8.3 Internal Management Policies Increase the Chain's Linkages to Ensure Sustainability

To guarantee the connection between agents, include additional policies: Add the direction of support for increasing linking capability, expanding trade marketing (creating a website, participating in fairs and exhibitions), and assisting in developing a system to monitor the origin of products along linked supply chains.

Assist chain actors in gaining access to preferential policies by bolstering their capacity and assisting affiliated individuals or organizations and other related topics, such as negotiating skills, establishing affiliate contracts, affiliate projects, production plans, and market development.

8.4 Enhancing the Role of State Management in the Value Chain

Develop a national database system on fruits, concentrating on key fruit groups and growing areas, to improve the fruit value chain application of the state management solution package.

Strengthening origin management: Developing an identification system using codes for agents involved in the fruit business and the production chain, as well as connecting the database system to connect agents through identification codes, to support the operation of the origin-tracing system and enhance the chain's capacity for quality management and food safety.

Increase the proficiency of chain actors in contract negotiation and drafting to actively support the management of contract violations and boost the effectiveness of agricultural contracts. Create a method for the court system to resolve convenient and/or procedurally flexible disputes, such as arbitration or mediation. Increase the participation of associations and local judges in contract violation dispute resolution.

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