



The Study of the Fruit Wholesale Routes to Enhance Supply Chain Efficiency: A Case Study of Thai Charoen Fruit Wholesale Market

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Abstract

Thai Charoen Fruit Wholesale Market located in Phitsanulok province is the most well-known and biggest fruit wholesale market in the Lower North of Thailand. Many kinds of fruit are distributed from the market to all regions of Thailand. This study aimed to explore the route of the main kind of fruit and develop a guideline for efficiency improvement. The data of the market and discussion of the value of fruit showed that there are five main kinds of fruit composed of durian, orange, watermelon, pineapple, and mango respectively thus the five kinds of fruit were focused in the study. The statistics of fruit sources from statistical data from the Office of Agricultural Economics and the information from informants were considered for the field area to collect data. The qualitative research was employed, and semi-structured questions were used in the interviews from the informants to collect data from the players in the fruit supply chain. The snowball technique was used to find the target. The total informants were 47 informants who were 36 farmers, 22 collectors/traders, 30 wholesalers, and 12 retailers (several informants play more than 1 role). The number of informants of each fruit are depends on the data saturation to find the fruit routes. Content analysis was employed for data analysis. Due to the Thai Charoen Fruit Wholesale Market supporting fresh fruit in the region, the author aimed to study and apply Short Food Supply Chain (SFSC) to the fruit routes of the market. Surprisingly, the research results showed that most fruits, especially durian, orange and watermelon differ from the SFSC assumption. The reason behind this is the farmer and middleman could earn more revenue by distribution to far away in other regions. Durian is the favorite fruit which are exported to China by the big middleman. The rest of the fruits in the research were distributed to all regional domestic markets. The route of fruit in the market was found that most kinds of fruit come from the nearby areas and other regions. Moreover, the research result found that SFSC can applied to some fruits especially in the fruits which can be developed to be more value-added as Agro-tourism which can earn more money with the story of fruits and farms.

Keywords: 1) Short Food Supply Chain 2) Fruits Wholesaler Routes 3) Lower Northern 4) Supply Chain Efficiency

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Introduction

Thai Charoen Fruit Wholesale market, Phitsanulok, is the biggest wholesale fruit market in the Lower North of Thailand which has various fruits including domestic and imported fruits and was supported by the Department of Internal Trade, Ministry of Commerce. Most of the fruits are distributed to consumers in nearby areas and provinces by wholesalers and retailers. The main reason is the biggest size of the market which can be gathered various fruits in this region. Moreover, the market provides sufficient space for unloading and parking for all kinds of trucks and cars which satisfy all people. The intermediaries buy the fruits from farmers who don't have their own trucks and then distribute them to the wholesalers at the market. Most farmers including small to big size can sell their fruits to the market, and customers in the surrounding area have fresher and cheaper fruit for their lives. Finally, all of them have more quality of their lives. Not only the key actors in the chain but also local employment and related businesses are growing and increasing their revenue and profit.

The objectives of this research comprise 1) To study the fruit distribution route from farm to the Thai Charoen fruit Wholesale market and consumers 2) To understand the distribution model from the sources to consumers at the Thai Charoen Fruit Wholesale market 3) To develop guidelines for increasing the efficiency of the fruit supply chain in the Lower North of Thailand.

Previously, farmers brought their fruits to sell and distribute to Talat Thai located in Pathum Thani Province (nearby Bangkok)

where far away from Phitsanulok province. The Thai Charoen Fruit Wholesale Market is the place that enhances all stakeholders in doing business which contributes a lot of benefits in terms of lower cost of consumers, and increased revenue to the whole chain including farmers, intermediaries, transportation, and related businesses including food trucks or food market. Since the Thai Charoen Fruit Wholesale Market was established in 2004, the market is the new place to support fruit in the Lower North of Thailand in terms of shorter distances than previous situation. Thus, the fruits distributed to Talad Thai are decreased (Leam-precha, personal communication, November 20, 2022) the farmers who have their trucks can bring their fruit to sell to the market and then they can earn more revenue for their effort and they are more convenient than previous. Thai Charoen Fruit Wholesale Market plays a key role in supporting and contributing to the upstream and downstream of the fruit supply chain. The market is an alternative distribution channel for farmers in nearby areas, thus the related activities and jobs can be created and extended which can enhance employment in the area. Eventually, the market supports the sustainability of the community.

Five kinds of fruit were picked from the top five of fruit value which will be explained in the detail of the article. The top five fruits value are durian, orange, pineapple, watermelon and mango. A qualitative method with the semi-structured interview was used to collect data to the informants by secondary statistic information and snowball techniques.

According to prior reasons and the

Thai Charoen Fruit Wholesale Market located in Phitsanulok could support the demand and supply in the lower North of Thailand, this study aimed to apply SFSC to comprehend the contribution of the market. Moreover, enhancing the fruit supply chain would improve the quality of life for the local community both the demand and supply side in terms of higher income or lower cost and more convenience to do their business in the region. In addition, a research result would guide the interesting topic in the future.

Based on the SFSC concept which tries to make the short supply chain by reducing middlemen, we can see SFSC obviously in the local market where the farmer sells their fresh agricultural products to the market. The farmers can communicate and deliver their products directly to the consumers. The farmers can earn more profit because they can sell at the market price with the lower cost of transportation (short distance), and the consumer can buy fresh products without middlemen. However, the situation is suitable for small volume of sale, and small size of farmers because of demand limitation.

There are many players in the supply chain for the large market because of the volume and various products. This research employed the SFSC concept in studying and investigating the players and model of the fruit supply chain at the large market as the Thai Charoen Fruit Wholesale Market to find the guideline to enhance fruit supply chain efficiency.

The route of the fruit supply chain of Thai Charoen fruit Wholesale market contrib-

utes to the quality of life of the people in the Lower North of Thailand and the surrounding area. It is interesting to study the route of the fruit supply chain of Thai Charoen market.

Literature Review

The Council of Supply Chain Management Professionals (2022) defined Supply Chain Management as “Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies.”

The objectives of Supply Chain Management are the products or services can be delivered to consumers which satisfy consumers including the right quantity, right quality, right place, and right time with the right cost. There are many constraints in the fruit supply chain including season, perishable, and shelf life of fruits. The longer it takes to transport, the more it will rot. The selling price becomes very low because nobody wants to buy bad fruits.

Short food supply chains (SFSC) as defined by the European Commission (AgriShort, 2022) is that there are the least middlemen in SFSC. The producers and consumers can communicate directly and then the producers can respond to the consumers' requirements correctly. These issues provide benefits to



both producers (farmers) and customers (consumers). SFSC for the agricultural products, the farmer is the producer and sells their products in the community. This way can stimulate and sustain the economy in the community, especially in rural areas in terms of income increases. Moreover, SFSC can collaborate, broaden, and link among tourism and food industries to support sustainability development which can reduce transportation costs and carbon dioxide. Further, SFSC can reduce road damage in rural areas, reduce traffic jams, and reduce accidents on the road. Eventually, SFSC can support to the sustainability in terms of economic, environmental, and social development especially in the local supply chain.

From the study of Jarzębowski, Bourlakis and Bezat-Jarzębowska (2020, p. 4715). in "Short Food Supply Chains (SFSC) as Local and Sustainable Systems". They referred to the Special Report on Climate Change and Land prepared by the Intergovernmental Panel on Climate Change that "the consumption of locally produced food and efficiency of food processing/transportation results in minimizing food losses, enhanced food security, and reduced greenhouse gas (GHG) emissions". SFFCs can support sustainable and healthy farming methods and generate resilient farm-based livelihoods. SFSCs would be the idea to apply for local food supply chain. They mentioned that an increasing number of consumers want to buy food produced near their residences because they search for high-quality products which is the term of SFSCs and leads to sustainable consumption. Moreover, SFFCs can support sustainable and safety farming meth-

ods. It was observed that SFSCs have the potential to improve farmers incomes, encourage sustainable farming systems, and contribute to local economic development. Thus SFSCs is the potential for sustainability.

Previous studies found waste in the fruit supply chains and eventually affected end consumers. "Study and Analysis of the Supply Chain Management of Mangosteen Producers in Chanthaburi Province", of Boonpitak, Ruttanawijit and Khamsom (2016, pp. 100-115) found waste time as waiting time for products 21% in the transportation route farmers-middlemen-traders-exporter which the value of non-value added activities 20.21%. Non-value-added activities include the transport of agricultural products to non-regular customers and time spent by merchants waiting for products to gather into full truckloads of containers.

There was prior research, "A study of efficiency improvement for the watermelon supply chain in Thai Charoen market, Phitsanulok of Sae-lee, Puangyeam and Wichitpongsa (2019, pp. 64-76). which found an interesting situation about contract farming in watermelon. The result found that the wholesaler in the market plays the role as capitalist who provides money and resources for cultivation to farmers but no price guarantee or any document. The farmers might take the risk of price fluctuation which was pricing by the capitalist. Moreover, the farmers cope with the disease in Watermelon cultivation in the same field. They have to change to the new area for watermelon cultivation. They found that the capitalists might take advantage of these farmers in this situation. Moreover, the farmers lack of

knowledge in the cultivation of watermelons to cope with plant diseases. The recommendation is the government should take action as supervision including knowledge providing and forming the farmer group or Cooperative to strengthen the farmers. This research focused in depth on the watermelon supply chain from upstream to downstream distributed in the Thai Charoen Fruit Wholesale Market.

The study of smallholder Avocado contract farming of in Kenya of Johnny, et al. (2019, pp. 91-112) they found that contract farming is an alternative for the welfare enhancement of smallholder farmers. Contract farming in Avocado was implemented in officially among the governments of Kenya and the Netherlands to improve avocado production by providing a good quality of seeds on credits, a training program in Good Agricultural Practice (GAP), and collaboration to exporters with formal contracts. The result of the implementation identified that contract farming is an important way to improve smallholder access to markets. They mentioned that contract farming supports reducing the total production cost and uncertainty risk. However, Contract farming has been criticized for leading small farmers through increased land ownership concentration and loss of grower autonomy. The practice of contract farming is a tool to motivate smallholders for crop integration in rural areas. They studied the factor decision of smallholders to participate in contract farming. From the result, they found that the important factors to contract participation included the number of Hass avocado trees owned, household assets, hired labor, training

agronomy, information received on avocado production and marketing, cost of transporting avocados, and frequency of avocado meeting attendance.

From SFSC, Thai Charoen Fruit Wholesale Market can serve SFSC which supports the concept of sustainability because the market can be a good distribution channel for the fruits in the lower North of Thailand which a shorter route than transportation to Talad Thai, a big various fresh products from all regions of Thailand where is located in Pathum Thani Province. The Thai Charoen Wholesale Market can be part of supporting SFSC not only by reducing waste, lowering cost and increasing revenue to farmers but also the market can serving and improving the quality of life to consumers in the lower North of Thailand with fresher and cheaper fruits.

The research "The Critical Success Factor of Fruit Distribution: Case Study of Ratchaburi Province, Thailand of Waiyawuththanapoom and Tirastittam (2019, pp. 276-281) survey with Fixed response interviews among farmers and fruit distributors in Ratchaburi Province. They found 5 factors related to fruit distribution including quality, price, equipment and supply standard, custom process, and distribution pattern. The result found the most important of success factor in fruit distribution is the quality of fruit in Ratchaburi Province (4.9 from 5), and the success factor of fruit distributors is the quality of fruit distribution (4.78 from 5). From this study, the quality of fruit is the success factor of fruit distribution with the shorter route, the fresher and cheaper fruits. Moreover, the shorter route can reduce the risk



of rotten and bad fruit, eventually increasing revenue to farmers and reducing fruit prices to consumers.

There was research on the food supply chain in Germany, six case studies (Marsden et al., 2000) in vegetable, dairy products, and livestock and butchering. They mentioned that there is potential for SFSC in rural development.

There was a previous review of the risks in the agricultural supply chain of Vin-ittiyakul and Phuangsubsin (2022, pp. 29-38). The research objective was to study and gather the risk factors in the agricultural supply chain to apply to the guidance for planning and managing risks in the agricultural supply chain in domestic and international contexts. They concluded that risks in agricultural supply chain comprise supply risk, demand and market risk, Production process risk, information risk, logistics risk, accounting and finance risk, weather risk, human risk, equipment and technology risk, policy and political risk, and land. All risks depend on kind of product, type of product and cultivation characteristics and the cultivation area. Because various fruits differ from each other, the appropriate methodology is considered for studying how to manage and sustain the agricultural supply chain.

From the prior pieces research and reasons above, even though there was a research focusing on Watermelon distributed to The Thai Charoen Fruit Wholesale Market, there is still have more interesting perspective which differs from prior research to study fruits supply chain with SFSC concept, a case study of Thai Charoen Fruit Wholesale Market. As SFSC

is implement in EU successfully, a researcher is interested in applying SFSC to the fruit supply chain in the Thai Charoen Fruit Wholesale Market and intends to find how SFSC is suitable for which kind of fruit.

Methods

The qualitative research method was employed with a semi-structured interviews to the informants who involved in fruit supply chain. Five kinds of fruits were selected from the top five values of fruit based on a 5-year (2017-2021) data recorded of the market (weight transported by trucks at the entrance). The five kinds of fruits were prioritized by the value of fruits which was calculated by the weight multiplied by the price index to select the main fruits by the top five fruits for the study (Table 1). Price index was a weight to calculated the importance of fruit refers to an average price per kilogram (developed by a researcher and staff of the market). The season was not considered for the fruit selection because a researcher intended to scope the key fruits for the study by total value. The five fruits are composed of Durian, Orange, Watermelon, Pineapple, and Mango, respectively. The interview was used to collect data in the field area.

Table 1 Value calculations used data recorded of the Thai Charoen Fruit Wholesale Market
5 years Data (2017-2021)

	Fruit	(1)	(2)	Value
		Percent of Amount (by weight)	Price Index	(1)*(2)
1	Durian	3.76	100	375.52
2	Orange	10.32	10	103.16
3	Watermelon	9.04	10	90.36
4	Pineapple	17.50	5	87.49
5	Mango	14.44	5	72.21
6	Coconut	3.80	10	38.00
7	Rambutan	4.03	8	32.21
8	Longan	3.20	10	31.99
9	Lanzones	3.82	7	26.71
10	Dragon Fruit	3.74	5	18.68

Source: The Thai Charoen Fruit Wholesale Market

The routes of the fruits were studied from the sources of fruit to the market and consumers. The research was started by interviewing at the Thai Charoen Fruit Wholesale market to find the sources of five kinds of fruit. Moreover, a researcher used the secondary statistical data from Office of Agricultural Economics (2022) and the information provided by interviewees who were key wholesalers at the market, the field areas for data collection were identified for the main source areas in the Lower North of Thailand. There were Uttaradit Province and Chanthaburi Province for durian, Sukhothai Province for Orange, Phitsanulok Province and Phichit Province for Watermelon, Phitsanulok Province, Loei Province and Uttaradit Province for Pineapple, and Phichit Province and Phitsanulok Province for Mango.

Based on the Snowball technique, the appointment with the key players was made in advance, nevertheless, a researcher could not meet them due to their cultivation. Some-

times, the informants were very busy with their businesses, so the interview by telephone was arranged. The rest of the informants were collected from the field area of the fruit sources.

The questions for the research were developed and discussed with two experts. One expert is a businessman and another is a scholar to check the validity of the interview form to meet the research objectives. The official interview was started from interview to the wholesaler in the Thai Charoen Fruit Wholesale Market to investigate the players in the fruit supply chain. The snowball sampling technique is employed to investigate the next informants who feel free and convenient to respond and provide the information. The basic questions to screen the informants are “Do you know The Thai Charoen Market”? If so, next question is “Are you a stakeholder in fruit supply chain (five selected fruits)?” And then continued to interview including the current situation in fruit supply chain.



There are three parts to interviewing which comprise of part I) the general information of the informants Part II) The detail in Operation and Business of informants related to the fruit supply chain, for example; what is the role or player of the informant in the fruit supply chain?, What resources do you have for the business? How does the informant operate in the fruit business?, How do you distribute fruits and why?, Have you ever distributed your fruit to the Thai Charoen Fruit Wholesale Market?, How long for your experience in the fruit business?, What are the reasons to sell or not sell to the Thai Charoen Fruit Wholesale market?, etc. Part III) Observations and Problems/ Threats. Due to the time and budgeting for the research, five to ten informants based on data

saturation for each kind of fruit were collected. The content analysis based on the player as a basic supply chain was employed to analyze data to comprehend the fruit routes.

Results

Based on the data recorded of fruits in terms of value brought through the Thai Charoen Wholesale fruit market, five kinds of fruits were studied which are Durian, Orange, Watermelon, Pineapple, and Mango. The majority of these fruits come from the Lower North of Thailand excepted Durian which found that they come from Rayong Province, Chanthaburi Province and the South of Thailand.

The informants in this study were as follows:

Table 2 Informants of Each fruit

Fruit	No. informant	Role*				Field area for data collection	
		Some informants had more than 1 role					
		Farmer	Collector	Wholesaler	Retailer		
1	Durian	8	7	4	4	2	Chanthaburi and Uttaradit Province
2	Orange	9	6	3	9	2	Sukhothai Province
3	Watermelon	8	6	4	4	3	Phichit, Sukhothai and Phitsanulok Province
4	Pineapple	16	11	8	9	4	Loei, Uttaradit and Phitsanulok Province
5	Mango	6	6	3	4	2	Phichit, Phitsanulok, and Sukhothai Province
Total		47	36	22	30	13	

From Table 1, there were 47 for total informants which played different roles. There were 36 Farmers, 22 Collectors, 30 Wholesalers and 13 Retailers (several informants played

more than one role). The amount of informants depended on the data saturation.

The route of five kinds of fruits are as follows:

1) Durian

The result found that durian distributes in the Thai Charoen Fruit Wholesale market comes from Chanthaburi Province and Uttaradit Province. durian, 'Monthong' is the most famous Durian for both foreign and Thai consumers. Traders/middlemen offer to the farmers to buy durian from the farmer directly at the farm. Most of the farmers who don't want to cope with the difficulty sell all durian to the traders. The traders arrange all processes include cultivation and then pay in cash for all durian. It was very convenient for farmers to do this way. Some farmers who rich of experience to sort durian, they can carry to sell in a higher price to wholesalers and retailers. Some farmers who have their own truck bring durian to sell to the retailers in the Thai Charoen Fruit Wholesale Market. Surprisingly, the result found long supply chain, traders /middlemen come from Chanthaburi Province to collect durian to sell in Chanthaburi Province, and then the retailer orders to resell to the Thai Charoen Fruit Wholesale Market in the Lower North of Thailand.

The research result showed that currently, in general durian was not supported by SFSC because of the season of durian. This fact affects to short and long supply chain from Uttaradit Province and Chanthaburi Province. Moreover, durian is the favorite of the Chinese. Thus, a lot of durians are exported to China. In addition, the specific local kind of durian, for example, 'Long' or 'Lin', premium durian, can be employed by SFSC but it's out of the scope of this research which focuses on the fruit distributed to the Thai Charoen Fruit Market. In the premium kind of durian, the farmers can

sell directly to consumers through online and offline.

2) Orange

The results from this study showed that there are oranges available in the Thai Charoen Fruit Wholesale Market the whole year. The oranges come from two main sources which are Chiangmai Province (Sai Namphueng Orange) and Sukhothai Province (Mandarin Orange). Under the limitation of time and budget, a researcher studied orange in Sukhothai Province only.

The route of orange (Mandarin orange) starts from Maesin, Sukhothai Province, and is distributed to the Thai Charoen Fruit Wholesale Market through collectors/traders/ middlemen. There are 'Long' or collectors/ traders/middlemen who collected oranges from farms and then distributed them to all regions of Thailand. Selling oranges to 'Long' is very convenient because the farmers can get money at their farms. 'Long' provides people, machines and equipment to harvest and buy oranges by themselves from the farm at the same time. The oranges are put in the 22 kg airflow plastic basket with a cover to avoid damage for transportation and sale. The price is calculated by weight as kilograms and the price depends on the size of the orange and the time of harvest. Some traders have the sorting machine for the size of the orange.

There is the "A LARGE AGRICULTURAL EXTENSION SYSTEM PROJECT" (Kaset Plang Yai) in the field area which is the collaboration among farmers forming in the same group cultivation . Kaset Plang Yai was called for "A LARGE AGRICULTURAL EXTENSION SYSTEM PROJECT", a group of farmers in the same cultivation



cooperating to deal with the government and company for any support. The group supplies and distributes large amounts of oranges to retailers. The result showed the obstacle of the project that the quality of oranges could not be controlled for the quality standard and then became discredit to the farmer group. Many farmers resigned from the group and did their business individually.

Some farmers who have their trucks carry oranges to distribute and sell in faraway area markets because they can earn more revenue and profit even though they have more transportation costs. Some farmers sell their oranges to small local traders and the traders sell oranges, 10 kg bag beside the road near the cultivation areas.

The result found that educated farmers expanded the scope of their businesses to organic orange farms and served home-stays in the farm area. They sell organic oranges directly to consumers through their online platforms such as Facebook. Moreover, the result found the farmers expand the scope of their businesses to develop and produce products from organic oranges, for example, soap, shower cream, and candles, and distribute them to local and online customers. In addition, the oranges are supplied to a factory to produce ready-to-drink orange juice.

SFSC can apply to oranges in some parts of the farmers who got orders and delivered oranges directly to their consumers.

3) Watermelon

The result showed that the cultivation of watermelon is quite different from other fruits. There are two types of farmers which are independent and contract farming. The ma-

jority of watermelon in the Thai Charoen Fruit Wholesale Market is contract farming. There is a capitalist who is a key trader in the Thai Charoen Fruit Wholesale Market. Key trader provides inputs for cultivation including seeds (specific kind as customer needs), fertilization and knowledge to farmers. After harvest, the farmers were paid money as the total value after deduct of the inputs cost by the key trader or capitalist. In some areas, there is no watermelon for harvest because of the weather and disease, the capitalist takes the risk. No document and no price guarantee for the contract farming, only trust among each other who have long collaboration was used for business. The traders can provide and distribute enough amount of watermelon to their customers with contract farming. Regularly, the farmers move and change the land/location for cultivation because of disease. The farmers rent the land for the cultivation of watermelon and move around to productive harvest.

The results of the study found the sources of watermelon distributed in the Thai Charoen Fruit Wholesale Market are Phichit Province, Phitsanulok Province and Sukhothai Province. watermelon is distributed to the Thai Charoen Fruit Wholesale Market and all regions through the capitalist who acts as the trader. The transportation cost is paid by customers. According to Covid-19, the cultivation areas were decreased and lead to less watermelon. It's quite shortage of watermelon while customers as hotels and restaurants have high demand through the whole year. Contract farming can support the traders to supply and distribute watermelon to customers including domestic and exporters.

The result showed the routes of watermelon included short (local market) and long distance (regional market and export). SFSC can be applied to the local watermelon supply chain.

4) Pineapple

The research result showed that the sources of pineapple distributed to the Thai Charoen Fruit Wholesale Market are Phitsanulok Province, Uttaradit Province and Loei Province. There are two kinds of pineapple which are for fresh fruit and for factory. There are several kinds in cultivation in the lower North of Thailand which comprise 'Smooth Cayenne' or the people call 'Pattavia', 'Nam phueng' and 'Huay Moon' which the same kind of 'Pattavia' but when change the location for cultivation to Tambon Huay Moon, it becomes a specific kind and more delicious than original. Pineapple is a famous fruit for fresh fruit, processed to juice, and canned product. Currently, the amount of pineapple is less than previous time because farmers turned to cultivate other plants, for example; rubber, instead of pineapple due to higher revenue. There is higher demand of pineapple as fresh fruit from hotels and restaurants, and for factories as juice and canned products, it's quite shortage of pineapple in the upstream. The connection between traders or wholesalers and farmers is the most important to acquire the amount of pineapple to supply and distribute them to their customers. To supply in sufficient quantity, traders/wholesalers must order in advance to farmers. Some farmers have their trucks gather and carry Pineapple from their farm and their neighbors to sell in the mobile area in

the Thai Charoen Fruit Wholesale Market. The market supports to small traders and farmers by providing the space in mobile area with a cheap daily service charge rate and the small traders or farmers can stay overnight on their trucks in the area. The farmers have a reason behind doing this way because they can earn more money even though they spend longer time.

The research results showed that the routes of pineapple are included in short and long distance. The route of Pineapple distributed to the Thai Charoen Fruit Wholesale Market is short and effective supply chain. From the upstream, pineapple is quite shortage for traders/middlemen because it was needed for customers including consumers, hotels and restaurants, factories and retailers. There is no public central market for pineapple to gather farmers and traders/middlemen, thus no standard price for pineapple in the community. Nevertheless, pineapple still is needed in plenty of demand from many customers as mentioned above. SFSC can be implemented to pineapple distributed to the Thai Charoen Fruit Wholesale Market.

5) Mango

The results showe that most mangoes distributed to the Thai Charoen Fruit Wholesale Market are from Sukhothai Province, Phichit Province, and Phitsanulok Province. There are many kinds of mangoes, for example; 'Phet Ban Lad', 'Kiaew Sawoei', and 'Nam Dogmai' which were distributed to the Market. Sometimes, mangoes ('Kaew Kamin') distributed to the market are imported from Cambodia. Mangoes are arranged in the air through plastic



baskets to prevent damage from transportation and are convenient to sell and carry.

Mango can be eaten as fresh fruit and can be produced as preserved mango, juice, fresh fruit, and ingredients of food as a salad.

The local route of mango distribution to the Thai Charoen Fruit Wholesale Market was starts from the farm. There are 'Long' or traders/middlemen from local and other areas who gather and buy all mangoes harvested at the farms. Traders from other areas buy mangoes from the market and distribute them to other areas including domestic and neighbor countries. Further, there are mangoes distributed to the market by farmers in nearby areas, Phichit Province and Phitsanulok Province. In case of Wholesalers in the market, they are supplied by the farmers who are familiar with and have good relationship for long time.

The research result found interesting story from a field of study in Tambon Nam-khum, Amphoe Srinakon, Sukhothai Province. According to improper weather and water conditions for rice cultivation, the leader of community motivated people in the community to develop and change from rice cultivation to 'Chok-Anan' Mango. This area became admired and well-known as the large source of 'Chok-Anan' mango. This community strengthens farmers in Mango cultivation with "A LARGE AGRICULTURAL EXTENSION SYSTEM PROJECT" or "Kaset Plang Yai". The group of farmers was supported and promoted by local government in education and marketing. Many farmers became cultivated mango. Group members of "Kaset Plang Yai" can earn more money because the group can deal with many

big companies with higher price.

From the research results in overview, the findings of five fruits which are durian, orange, pineapple, watermelon and mango were investigated the fruit routes from the source of cultivation areas to the Thai Charoen Fruit Wholesale Market, and distributed them to retailer and consumer. A researcher analyzed the players in the fruit supply chains with the basic supply chain members and their roles. The result showed that SFSC is suitable for orange, pineapple, watermelon and mango. SFSC of fruit supply chain in the Thai Charoen Fruit Wholesale Market impacts to the whole fruit chain which could not quantify to the impact. A researcher can imply from the research result that SFSC of fruit route at the market impact to sustainability including supply chain efficiency, sustainability, and farmer income than previous time. The shorter supply chain, the lower of cost, time and pollution. SFSC impacts to sustainability in social, economic and environmental dimensions. The quality of life to all members in the supply chain, eventually consumer can buy fresh and safety fruits in lower price which is the social dimension. SFSC impact to farmers to self-employed in higher income because of few (watermelon) or without (direct sale of organic orange through social media) intermediaries is the economic dimension. Finally, SFSC impacts to the environment dimension because of short transportation and less waste due to long distance transportation. Thus, SFSC contribute to all members in the chain, and it can support to sustainability as the critical agenda of the world. Each fruit has specific supply chain from short to long supply

chains. The results will be concluded and discussed in the next part.

Conclusion and Discussion

The Thai Charoen Fruit Wholesale Market is the largest fruit market of the lower North of Thailand. The market located in Phitsanulok Province. There are plenty of fruits distributed for wholesale in this region. The market contributes to the quality of life including farmers, traders, wholesalers, retailers and consumers in the Lower North of Thailand. The consumers have fresh fruit to consume at a lower price.

The top five of fruits of the market are durian, orange, watermelon, pineapple, and mango. Even though most of the fruits (the five kinds of fruits), are from the nearby area in the Lower North of Thailand, durian are transported from Rayong Province and Chanthaburi provinces, and some areas from the South of Thailand. The results found that some kind of fruit is distributed to the North Eastern or far away areas because they can sell at higher prices. A 'Short Food Supply Chain', SFSC, is expected to reduce middlemen and distribute products to the nearby area but in this research found that the farmers/traders could earn more profit even though they have higher costs. Due to large amount of the same fruit in the same area and nearby, the people have a low demand for the fruit which lead to lower price. The solution is selling and distributing their fruit in faraway area, farmers/traders can earn more revenue and profit.

The findings showed that the Thai Charoen Fruit Wholesale Market found that SFSC can be applied for orange, pineapple, wa-

termelon and mango which are quite the same as definition, as European Commission. SFSC aims to reduce the middlemen, the finding is similar to Agrishort project (Agrishort, 2022) and Jarzębowski, Bourlakis and Bezat-Jarzębowska (2020, p. 4715) but some middlemen involved with the fruit supply chain at the market. The Thai Charoen Fruit Wholesale Market contributes to and sustains the local economy and the market supports to increase in the revenue to the people in rural areas which the finding is similar to Waiyawuththanapoom and Tirastittam (2019, pp. 271-286) because the less number of middlemen, the more cost saving. From this situation, consumers can buy fruit in a cheaper price. Eventually, there is potential to develop at the rural area (Marsden et al., 2000) as grass root of economic because farmers can earn more revenue.

Moreover, the findings showed that durian could not be employed SFSC because it transports from Chanthaburi Province, Rayong Province and the Southern of Thailand. The finding is different from the scope of the SFSC (Waiyawuththanapoom and Tirastittam , 2019, pp. 271-286) which mentioned that consumers can buy the fresh fruit from the short supply chain. Due to the distance and domestic boundary which good structure of the transportation system of Thailand, durian can be transported and delivered in domestic within short time, 1-2 days which is not affected to the quality of durian. Durian is still good quality at the destination.

The result found that some farmers carry their fruits to the big market in the North Eastern and other regions of Thailand. it's



worth doing this way because they gain more revenue and profit eventually, even though they have more expense in transportation costs. For some fruits, for example; watermelon, the personal trust of the wholesaler as a capitalist who is the wholesaler located in the Thai Charoen Fruit Wholesale market, is the most important for the business. The contract farming was employed to watermelon and the personnel trust can make confidence to the wholesaler in terms of the amount of watermelon in specific type such as 'Kinnaree' as red color, or 'Srichan' as yellow color as market demand.

The results from the research found that there are several risks which similar to the risks in supply chain of Vinitpittayakul and Phuangsubsin (2022, pp. 29-38). The finding can summarize the risks in fruit supply chain in The Thai Charoen Fruit Wholesale Market including supply risks (pineapple, durian, watermelon and orange), demand and supply risks (Seasonal fruitful; Orange and Mango), weather risk (five kinds from the study), and land for cultivation risk (watermelon).

Even though, SFSC is effective for food supply chain management, but it could not be implemented to all kinds of fruit. The situation is not the same as SFSC because farmers/traders can earn more money from the faraway areas but farmers/traders have to manage the risk as previous mentioned above.

The finding shows that the community can strengthen farmers by 'Kaset Plang Yai' because farmers can be supported education and marketing by the government and non-government. In case of some farmers from the 'Kaset

Plang Yai' discredited quality standard of orange of the group, to cope with the situation, a group leader should have the rule to punish those people. Moreover, they should have regulation and system for the group members to follow. In addition, committee of the group should have the role in monitoring all members to maintain quality standard of orange. Thus, the farmers can strengthen and manage their group and then they can earn more money with dealing with big companies. Farmers who educated, resigned from the group because of discredit situation. The result found that the member had potential to develop his cultivation to organic farm and produce their products. This way is fit to SFSC to sustain the business in terms of social dimension which concern in food security, food safety and healthy nutrition (Vittersø, et al., 2019, p. 4800).

Moreover, contract farming is found in watermelon cultivation at the Thai Charoen Fruit Wholesale Market. The finding is similar to the study of Sae-lee, Puangyeam and Wichitpong (2019, pp. 64-76) which found that under contract farming, there is no document and price guarantee to farmers but there is no problems found. Interestingly, based on the Thai Charoen Fruit Wholesale Market, the result found both small scale and large scale of farmers participated contract farming because of thrust in the certain income. The finding are contrast with the contract farming which Johnny, et al. (2019, pp. 91-112) found that small scale or smallholder participated in contract farming. The reason behind is both small and large scale of farmers trust the capitalist in terms of financial stability and marketing

ability. According to the close and long-term relationship among farmers and capitalist, contract farming with the capitalist (who play the role as wholesalers) is the good solution for them because both farmers and capitalist benefit from the situation. The capitalist gains the margin at the farm in reasonable price and the farmers satisfy to gain the income in low investment (land rent) in terms of finance, and contribute to pay attention and utilize their time. Moreover, the result found the most important thing is trust among the farmers and capitalist. From the trust among farmers, the capitalist as a key trader can ensure the quantity of watermelon for selling and distributing to local and all regions of Thailand as customer demand. Even though, some negative point of issue of contract farming which often mentioned that the capitalist might take advantage from the farmers, the research result found the positive point. The farmers in contract farming satisfied with the capitalist and they are partner in the watermelon supply chain. From the case study at the Thai Charoen Fruit Wholesale Market, found win-win situation in watermelon contract farming, farmers ensure their income in cash (after deducting the cost) from watermelon selling to the capitalist while the capitalist (as a wholesaler) ensure enough watermelon to his customers. Nevertheless, the recommendation is contact farming should be involved with farmers such as financial support and training. Moreover, the government can participate and monitor the document in contract farming to prevent unfair business. A kind of contract farming with trust affects to the social impact as a good relationship and provides fresh fruit to the community as

a partner in the supply chain, and economic impact in terms of increase income to farmers and labor employment in cultivation. In addition, from the field study, the research result found in the cultivation area that independent watermelon farmers have more capital for investment. This kind of farmers were not distributed watermelon to the Thai Charoen Fruit Wholesale Market. Farmers can choose customers by themselves. The research result found that this kind is the short supply chain because they bring their watermelon to sell at the farm and local market. The farmers feel free to sell. Some farmer became smart farm by utilize drone for fertilization and insecticide. This kind of cultivation of watermelon can save money from the direct labor, and avoid to human risk (Vinitpittayakul and Phuangsubsin, 2022, pp. 29-38). It is interesting to study in further research.

Based on SFSC which aims to reduce the middlemen to sustainability in terms of social, economic, and environmental dimensions, the findings showed that middlemen are still important to the fruit supply chain because a plenty of fruit can be collected and distributed from the middlemen to customers and consumers. However, neither short, nor long food supply chain could support to fruit supply chain in the community which affected to the farmers. At least farmers can produce bigger lot size and finally higher income and improve quality of their life in the cultivation areas. From the research result found that the Thai Charoen Fruit Wholesale contributed to fruit supply chain in the Lower North of Thailand and other regions. SFSC can be applied to orange, watermelon, pineapple, mango



and premium durian (local type as “Long’ or “Lin” for example), especially in organic fruit as orange which potential farmers sell directly to their customers by post or carrier. Fruit Market under a supervision of local government in providing, supporting knowledge, and monitoring the middlemen to prevent unfair transaction should be concerned for the situation. Several interesting research topics emerge from this study which will be investigated for further research.

Limitations and Future Research Directions

1. Due to the scope of research and limitation of time and budget, many interesting stories might not be covered by this research.

2. This research focus on the route of fruit supply chain based on a case study of the Thai Charoen Fruit Wholesale Market which would be created new further research.

3. The starting point of the research is the Thai Charoen Fruit Wholesale Market, the market contributed to this research widely perspective in overview. The researcher intends to apply SFSC of the fruit route in the Lower North of Thailand. Thus this research would not quantify the result of the study.

4. The technology and innovation are not focused in the study which would be useful for the further research.

5. The future research in specific kind of fruit in one area would be more benefit in terms of in depth story to comprehend the problem to find a solution, for example; the guidance to develop organic farm in orange to agro-business and tourism program.

Recommendation

Based on the research results and findings, the guideline to improve fruit supply chain in the Thai Charoen Wholesale Market are as follows:

1. The government should strengthen farmers by providing education in cultivation to farmers. “A LARGE AGRICULTURAL EXTENSION SYSTEM PROJECT” or ‘Kaset Plang Yai’ might be the model for the solution.

2. The leader in cultivation areas should arrange knowledge sharing among farmers in the same kind of fruit to strengthen fruit supply chain and network in the community.

3. The local government should provide a place to the public central market with standard machine to sort and weight fruits. Moreover, at the central market should show the average daily price for selling and buying for fair transaction. In addition, the local government might monitor the cooperation and documentation in contract farming to prevent unfair transaction.

4. The fruit supply chain in lower North of Thailand can be developed to enhance value-added to farmers, for example; produce the product from fruit, arrange program or activity for tourist.

5. The Thai Charoen Fruit Wholesale Market should provide a billboard to show standard daily price for buying and selling each kind of fruits.

6. The Thai Charoen Fruit Wholesale Market might contribute to promote and support some kinds of government project of seasonal fruits.

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