

Supply Chain Analysis of the Production and Marketing of the Marian Plum in the Case of San Khao Farmers, Phitsanulok, Thailand

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Abstract

This research purposes capital analysis related to the marketing system and supply chain management from costs and returns analysis of the Marian Plum production of agricultures in the local ridge area by employing the quantitative approach and having the interviews of 70 members of Ban Bua Sawan community enterprise located in the areas of Noen Maprang and Wang Thong districts follow the principle of Yamane (1967) at 95 percent confidence level and not over 5 percent missing values. The results from **the marketing part** shows that at present Marian Plum are in highly demand but the farmers cultivate Marian Plum are not enough to supply market demand. Marian Plum cultivation should be planned to increase in the production areas 1500 rai in order to cover the Marian Plum production about 25 Tons per rai. The direction of supply chain management reflects an increase in both Marian Plum production and the GAP standard as well as knowledge management (KM) to develop, collect, grade size selection and packaging ready for domestic and export standard. The research result of the **economic valuation part** shows that the farmers have high income and returns, in particular, returns increase in the fourth-year onwards. The benefit-cost (B/C) ratio of each Marian Plum tree in this area is about 6.99 - 21.86 which depends on the selling price or the season. Meanwhile, the average estimation of the B/C of the ridge farmers members' community enterprise is about 2.70. The suggestions to the farmers should have household account to get the real benefit and cost. Moreover, the members of community enterprise should collaborate the planning and joint marketing to create price negotiation and market support the Marian Plum products together with the study of plums breeding which generate high value creations. The knowledge development of production, species, pest prevention and control should be concerned in order to increase in the export market.

Keywords

Marian Plum, Marketing, Economic Valuation, Agriculture Community Enterprise

1. Introduction

The northern region consists of 17 provinces with an area of 106 million Rai, or about a third of the entire country, with the majority of the terrain being forested. There are approximately 29.2 million Rai which is agricultural land, or 20% of the whole country's area is used for agriculture in 2009. The population in this region is 11.7 million people or 18.5% of the country's population, which has declined over the past 9 years (compared to the population back in 2000, which was 12.1 million). The average income per capita for 2009 was THB 71,105 (USD 2367), which is lower than the average per capita income of the whole country that is approximately THB 135,281 (USD 4502), which was almost double that of all regions, except the northeast region. The Northern products focus on industrial, agricultural goods and services. The agricultural crops consist of rice, sugarcane, corn, tobacco leaves, nuts, vegetables and fruits. The industrial products are electronic components, processing agricultural products, ceramics, sugar, cement and handicrafts.

A study of Phitsanulok Province from Provincial Products (GPP) found that the population of this province, about 40% of the total workers, was mainly in agriculture. This province is divided into 9 districts, 93 sub-districts, 1048 villages and 321,635 households. Phitsanulok province is an agricultural society since the Sukhothai period. Most of the population is engaged in agriculture, especially farming and gardening. Phitsanulok has a suitable landscape for agriculture because the city itself is located between two river banks of the Nan River. Its northern and middle geology are plateaued, while the east and north-eastern sides of the province are mountainous. Wang Thong and Noen Maprang districts are fruit farming areas of Phitsanulok Province (Wattanadumrong & Larkwararak, 2017). Marian Plum farming is mostly found in Wang Thong and Noen Maprang districts of Phitsanulok, and Sak Lek District of Phichit, both of which are located near the borders of these two provinces.

Research objective

- 1) To analyze the cost and return of the Marian Plums of the ridge farmers.
- 2) To analyze the marketing and supply chain management of the Marian Plums between the manufacturer and the consumer, as well as providing information for the ridge farmers.
- 3) To adjust and arrange the supply chain to be more effective at the community level, such as a case study of ridge farmers. The target areas consist of 2 districts; Chompoo Sub-district within Noen Maprang district and Wang Nok-An, a Sub-district within Wang Thong district, with 6 villages in total, and a group of

farmers community enterprises.

Scope of the study

The scope of the study consists of the production line, marketing, along with the feasibility of selling the Marian Plums, as well as studies the value chain and the relevant factors which affect them, and the farmers who are involved in growing these fruits in Ban Bua Sawan of Wang Thong and Noen Maprang districts. This research also focuses on related theories for better understanding and initiates the methodology with reliability. Although the administrative areas are bordered between village No. 9, 10, 13 and 14 of Wang Nok-An subdistrict, and Village No. 7 and 9 of Chompoo sub-district within Noen Maprang district¹, who were part of Bua Sawan's integrated agriculture community enterprise group of the ridge farmers, back in December 7, 2010. This group was founded by 17 members, who aimed to gain better living conditions, develop the economy within the areas and eradicate poverty in the communities, due to the people who suffered from the loss of mono-cultural crops and low income in 2016, and in 2019, there were 126 members shown in **Figure 1**.

The main principles of ridge farmers: improving the academic knowledge on agricultural activities, systematically and efficiently, and runs a campaign to monitor the soil quality before the planting phase, under the cooperation of local assistances and the farmers themselves with the help of the knowledge transfer center (24 hours). This office mainly focusses on sharing information among the community, which includes the marketing at local and domestic levels.

The production targets of ridge farmers on both areas are to promote and develop production processes, cost reduction and develop products that will meet quality standards, as well as increase the seasonal production at the household level. Each community will arrange a meeting between the administrator and its members to discuss various agricultural problems on the 15th day of each month, regarding agricultural market activities, knowledge exchange between members,

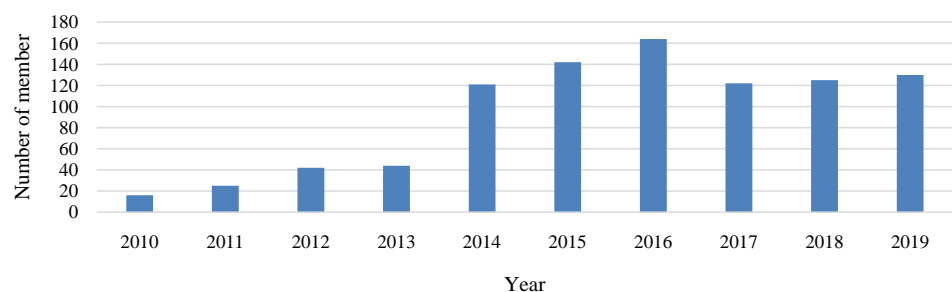


Figure 1. The number of annual ridges farmers. Source: Bua Sawan's integrated agriculture community enterprise.

¹Wang Thong district was established in 1895, this district is 17 km³ away from the central district of Phitsanulok, surrounded by the forests and mountains, connected with Noen Maprang district, which separated from this district during 1976. Noen Maprang district was originally a rainforest, full of wildlife and surrounded by over 300 million years old mountain and caves, while there were hunters who temporarily went on hunting, 42 years later, there was a group of people who migrated and settled in the area of Ban Chomphu, Ban Mung, Wang Phrong, Sai Yoi. This area was also known as one of the terrorist lairs.

and monitoring the situation within the community. The important planted fruits in the area, which are longan, mango, Marian Plum, durian, giant sour tamarind, bitter bean and rambutan, respectively. In the future they have plans to expand the area for farming Marian Plums. The research objectives are to investigate the supply chain of Marian Plum and also the economic value of production in terms of benefits and costs analysis, how to generate income for the ridge farmers in short and long run which sustainability and wealthy production, processing and marketing.

2. Literature Reviews

The study of Marian Plum value, using the case Study of Ban Bua Sawan community enterprise to observe the Marian Plum in both the farming and marketing phase. *Sonklion (2013)* studied the agricultural support for the farmers, who are involved with Marian Plum farming, in Nakhon Nayok Province, and to analyze the supportive factors and gather suggestions for further development in the area. Using a questionnaire which includes both open and closed questions in the sample group of 346 households, in order to analyze the problems found during the production phase by using frequency, percentage, arithmetic mean and the standard deviation, including both minimum and maximum values.

The study found that 66.8% were male farmers, with an average age of 52, graduated from secondary school, and consists of 4 member per household, all of which were involved with Marian Plum farming, approximately 1 to 5 Rai. There were 88% of the farmers who were the landlords themselves, 61% were funded by agricultural support, and 34.5% were funded by the bank for agriculture and agricultural cooperatives. Most farmers use soil solarization before planting, instead of the ridge-till method. The farming area was 36 square meters, with the most planted species being “Klao”, at approximately 88%, using soil-fertilizer and insecticides.

Most of the farmers did not preserve the Marian Plums by wrapping them with plastic bags, instead, they harvested them by cutting off the branches and selling them to the middleman. The recent capital of Marian Plum farming was THB 33,717 (USD 1122) and the revenue was approximately THB 106,106 (USD 3532). The problems found in the marketing phase includes; 82% encountered insect problems, followed by higher capital, fertilizer costs, fungi within the fruits, and limited support from the government officials. As for the study of farmers’ need for agricultural assistance, there were five needs including; 1) the need for knowledge to be used in the production phase, 2) the need for individual support, 3) the need for group support, 4) the need for promotion through the media, and 5) the need for government support. Overall, this study found that all the farmers required assistance in all aspects. Most of the farmers suggested that they needed assistance with the reduced production quantity over the last few years.

Pengchom (2012) conducted a study on the Marian Plum cultivation in

Chiang Mai, to study the basic information on its characteristics, production, factors which affects the production and farmers' problems. In order to analyze the capital, revenue and feasibility of investing in the Marian Plum. The sample groups are the two farmers who will be used for comparative analysis or benchmarking, along with a farmer who has Marian Plum farm in Chiang Mai. the first group consist of the domestic level, which is Boonchob Aim-Im garden, who won the provincial farm contest of Sukhothai in 1997, and the provincial level; the Phu Fa garden, where the Marian Plum had been planted for more than 11 years, the second group is a farmer who has Marian Plum farm in Chiang Mai. The costs and revenues of the garden in Mae-Sod, where Marian Plum had been planted for 6 years, were analyzed in the financial section during the early stage of business, using statistical analysis (percentage, average). The result found that 1) the marketing section; this fruit costs 50 Baht per kilo, 67% of the farmers in Chaing Mai had already sold their products, 50% were sold through the middleman and other were sold by themselves. 2) Planting Marian Plum in different areas might result in difference product quality and quantity, it also depend on several variables; its species, climate, monitoring and watering the fruits, some farmers might not fully understand how to treat the Marian Plum properly. 3) Compared and estimated the cost of the production with 3 Rai of the farming areas, if a person wants to invest on this business by him/herself, the initial capital should be approximately THB 633,606 (USD 21,091) in the first year, the expenditure between the 2nd to 10th years are approximately THB 14,675 (USD 489), and during the next 14 years, it will increase to THB 17,583 (USD 585) at the beginning of the 25th year, the farmer will have THB 697,618 (USD 23,222) of their debt. on the contrary, if that person loans the landlord instead of direct investment, the initial cost will be approximately THB 122,776 (USD 4087) on the first year, followed by the expenditure around THB 17,627 (USD 587) during the 2nd to 10th years, THB 20,533 (USD 684) on the next 14 years and at the beginning of the 25th year, the farmer will only have to pay THB 257,906 (USD 8585) of their debt. In conclusion, the mutual factors from these cases were; the debt, time-consuming and uncertain revenue, therefore, Marian Plum farming in Chaing Mai were not recommended.

Chonwathit (2013) studied the way of exporting "Marian Plum" fruit to China, due to the problems found in the latest export and why the market expansion in China was limited. This method conducted in-depth interviews with a sample group of 4 people, namely 2 exporters business and 2 farmers in Prachinburi. The data was analyzed by content analysis and logical analysis, results of this study showed that the problems and obstacles can be resolved by the governments of the two countries, in order to maintain their relations and benefit from mutual trade. Considering all 10 factors that related with the exports, it was found that there had high chance of success, if it had a cooperation between the farmers, exporters, relevant agencies and the diplomatic relation on the open trade between both countries.

3. Methodology

Field of the study this research mainly focuses on the farmers, middleman and processors in the ridge area of Noen Maprang and Wang Thong district, despite having the highest number of Marian Plum and mango farming, this community had recently won the provincial farming award.

Sample group of the study was the farmers who involved in Marian Plum farming in Noen Maprang and Wang Thong district of Phitsanulok, especially in Ban Bua Sawan community, using interviews as a research instrument. The data analysis based on 2019 of the production in the specified area, using Yamane's (1967) method, with 95% of reliability, equal to 52 person who were picked from the total members².

Research Data consists of the primary data which obtained from the number of farmers who planted Mango and Marian Plum in Noen Maprang and Wang Thong districts, using interviews and sample groups. The data were later assessed and analyzed.

Data analysis: using the financial analysis of the investment project, by comparing the costs and expenditures with the revenues from the project, the analysis consists of 2 methods:

- 1) Net Present Value: NPV, or the difference between the current value of the revenue from the project and the current value from the investment, in accordance with the criteria that if $NPV > 0$, it is expected that the current value of the revenue is more than the costs.
- 2) Benefit-Cost Ratio: (B/C) which is the current value of the revenue, compared with the costs of the project, in accordance with this criteria; if $B/C > 1$, it is expected that the benefit is more than the costs of the project (Boardman, Greenberg, Vining, & Weimer, 2001; Chaileart, 2013; Chaipanya, 2002).

4. Research Findings

Marian Plum, or *Bouea macrophylla* (Mayongchid), belongs to the cashew family (Anacardiaceae). The ripe fruit is yellow-orange, mango-like in character, roundish, and juicy with a sour to sweet taste according to the variety, and has a faint turpentine smell. Its characteristic consists of; the cylindrical shape with 15 to 30 meters height of the tree, due to the strong roots, this fruit can endure the drought weather, and the fruit has green in color and mature to an orange/yellow, with the seed being pink. As for Maprang's characteristics, it depends on the species, regarding the fruit shape, size, color and taste. These plants can grow well in the tropical geography, especially in the south east Asia continent, for example, Myanmar, Thailand, Laos, and Malaysia. Maprang is considered to be one of the unique goods in Thailand's market. In Thailand, the flower can be seen in November to December, whereas the fruits appear from April to May.

Type of Marian Plum in Thailand, categorized by the fruit's size and taste;

²The number of San Khao farmers' members has been calculated through Yamane's method to get the number of observations), with 95% of reliability, equal to 52. However, 70 San Khao farmers accepted to get interview.

1) the “small-leaf plum”, the most planted type all over the regions, which has a small fruit size, approximately 2.5 - 3.5 centimeter, or approximately 25 pieces per kilogram. 2) the “large-leaf plum”, only found in specified areas, such as Sukhothai, Phitsanulok, Phichit, Angthong, Nonthaburi, Nakorn Nayok and Prachinburi, with 3.5 centimeter of the fruit size, less than 25 pieces per kilo, though having a larger size, the latter fruits are more profitable and suitable for the marketing in Thailand. There are 3 species that mostly found in Thailand’s plum farming: the Khlang-dong, Toonklao and Bhang Khunnon.

Farming guide: the most suitable area for Marian Plum cultivation are the fertile loam or sandy soil, though the fruits itself can be adapt to many types of soils, the suitable soil should have 5.5 - 7.5 pH value, as well as the systematic drainage, and the temperature between 20 - 30 degree Celsius. The farming season should be during the rainy season and cultivate afterward, this fruit can be harvested by 3 different periods; during January, February and March. The climate change, and monitoring may consider as factors of whether it might affect the cultivation period. The current Marian Plum farming mostly found in Phichit, Uttaradit and Phitsanulok, respectively. The most planted area in Phitsanulok are located in Noen Maprang and Wang Thong districts, despite having low temperature and high geological area that meet the planting condition. From the interview with the farmers in both areas, it was found that Marian Plum can grow effectively with 20 degree Celsius, with the approximate cost of THB 150 to 250 (USD 5 - 8.3) per kilogram (kg.) shown in **Figure 2**.

This research is a quantitative analysis which consist of two section:

The study of costs and revenues from the farmers, who planted Marian Plum and Mango in Noen Maprang and Wang Thong districts, Phitsanulok, was aims to understand the process of these productions, using the quantitative method and interview with the total of 70 farmers from both areas.

Section 1: Marketing analysis and supply chain management between plum farmers and consumers, as well as provide an information to improve the supply chain productivity within the community level, by using interviews as a research instrument (Porter, 1985; Kankhla, 2016; Pengchom, 2012; Banditrak, 2013; Sonklin, 2013; Narawanna, 2011; Greenberg & Weimer, 1996). The data analysis based on 2019 of the production in the specified area, using Yamane’s (1967)

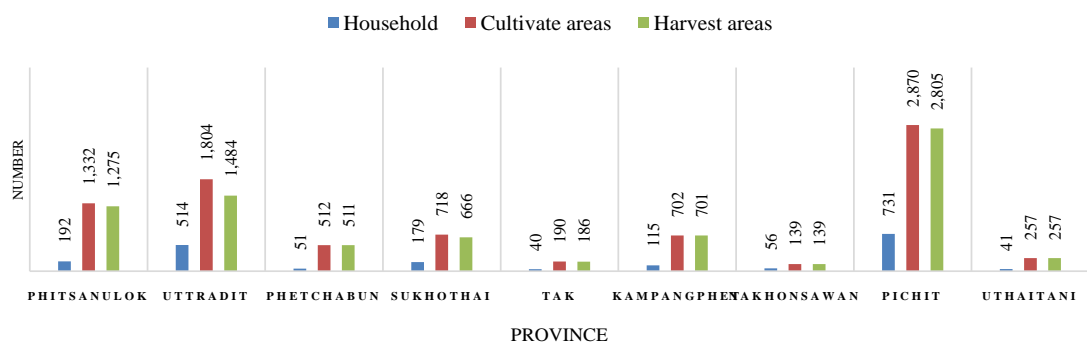


Figure 2. Marian Plum farming in the lower northern region. Source: Office of Agricultural Economics.

method, with 95% of reliability, in accordance with less than 5% of the deviation, resulting in 70 people who were picked as a sample group.

Section 2: Capital and revenue analysis of plum farming in ridge farmer group, using the following factors: Financial analysis of investment project, costs, benefit from the project. The analysis consists of 2 methods: 1) Net Present Value (NPV), which shows the different between current income and current capital from the investment (expense), If $NPV > 0$, it can be referred that the current income is more that the expense. 2) Benefit to cost ratio: B/C shows the different between current income and current expense of the project. If B/C ratio is more than 1, it can be referred that it has a profit.

This research suggests that, during 2019-2020, the ridge farmer group (Bua Sawan community enterprise at Chompoo subdistrict of Noen Maprang) produced 226,180 kg of the plum from 25,000 trees in total, with 8 years average age in each tree. While in Wang Nok-An produced 36,700 kg of the plum from 7500 trees, with 7 years average age of each tree. Total produced plum from both areas is 262,880 kg from 32,500 plum trees, with 7 to 8 years average age. Regarding 70 plum farmers from both areas, 40 males (57%) and 30 females (42.9%) were shown in **Table 1**.

Table 2, the basic information of ridge farmer at Bua Sawan community enterprise. Most of them are between the age of 51 - 60, followed by 41 - 50 years old. The overall education level consists of: 38.3% graduated from secondary school, 25.7% graduated from vocational school, 21.4% graduated from primary school and 8.6 graduated from bachelor degree and the others were uneducated.

Table 1. Data of the Marian Plum farming in Noen Maprang District and Wang Thong District, 2016-2020.

The number of farming	Sub-district/District			
	Chompoo subdistrict, Noen Maprang district		Wang Nok An subdistrict, Wang thong district	
Number of plant (Unit)	25,000		7500	
Product (Kg)	226,180		36,700	
Average age (year)	8		7	
Number and percentage of farmers	Male	Female	Male	Female
Village no.7	19 (54.3)	16 (45.7)	-	-
Village no.9	15 (79.0)	4 (21.0)	1 (100.0)	-
Village no.10	-	-	1 (25.0)	3 (75.0)
Village no.13	-	-	3 (75.0)	1 (25.0)
Village no.14	-	-	1 (14.3)	6 (85.7)
Sub total number of farmers	34 (63.0)	20 (37.0)	6 (37.5)	10 (62.5)
Total	54 (100.0)		16 (100.0)	

Source: Community enterprise of vocational promotion group in Bua Sawan. Note: the number in * show a percentage.

Table 2. Basic information of ridge farmers in Bua Sawan community enterprise.

	Marian Plum farmers	
	Total farmer (person)	%
Age		
21 - 30 Year	1	1.5
31 - 40 Year	12	17.1
41 - 50 Year	15	21.4
51 - 60 Year	35	50.0
61 Above	7	10.0
Education level		
Uneducated	4	5.7
Primary school	15	21.4
Secondary school	27	38.6
Vocational school	18	25.7
Bachelor degree	6	8.6
Status		
Single	4	5.7
Married	45	64.3
Divorce	6	8.6
Widow	15	21.4
Household worker in house		
1 - 2	26	37.1
3 - 5	35	50.0
6 - 8	6	8.6
8 or above	3	4.3
How they spent their money		
Cash	59	84.3
Credit	11	15.7
Experience		
1 - 5 Year	8	11.4
6 - 10 Year	39	55.7
11 - 15 Year	21	30.0
16 - 20 Year	2	2.9
21 Years or above	0	0
Total land used in farming		
1 - 10 Rai	55	78.6
11 - 20 Rai	13	18.6
21 - 30 Rai	0	-
31 - 40 Rai	0	-
41 Rai or above	2	2.8

Source: Survey.

As for their relationship status in the group; 64.3% were married, 21.3% were widows, 8.6% were divorced and 5.7% were single. As for the workers per household in the community, 50% had 3 - 5, followed by 1 - 2 equating to approximately 37%, and 8.6% had 6 - 8 and 4.3% had more than 8 workers per household. While the farmers who were involved in Marian Plum farming were 3 - 5 persons per household, approximately 44%, followed by 6 - 9 (36%), and 1 - 2 (20%). 84% of production was sold to retail outlets and the other 16% was sold on credit. Most of them have experience in farming for 6 - 10 years, accounting for 56%, followed by 11 - 15 years, representing 30%, 1 - 5 years of experience, approximately 11% and 16 - 20 years, representing 3%. The amount of land used for farming consist of: 79% had 1 - 10 Rai, followed by 19% had 11 - 20 Rai, and 2.8% had more than 41 Rai. Additionally, both farming area, Wang thong is considered to be located in Land reform area, while Noen Maprang district is forested area.

From the interview with the ridge farmer to study a supply chain of plum productivity, it contains five phases of farming: **1) Preparation phase:** the farming area should consist of a sandy loam, with good drainage and abundant soil. The recommend temperature should be between 18 & 25 Celsius, which is important for the budding, fruiting and ripening period. **2) Plant preparation after the cultivation phase:** in this phase, the damaged branches from both the harvest or insects will be cut, followed by applying fertilizer to the soil (15-15-15 formula) to accelerate the growth rate at approximately 2 kg per plant, and after they enter the budding phase, they should monitor and protect from insects and mold. **3) The flowering phase:** when the inflorescence and the flowers begin to bloom in the wet season, they require more water, and there should be special treatment to prevent them from insects, mold and plant diseases afterwards. **4) The ripening phase:** during this phase, they require insecticide to prevent mold and aphids from destroying the fruits. Then after 3 weeks the fruits should be wrapped in order to raise their quality. The last phase will be harvest period. **5) The harvest phase:** this stage will have step care before harvest. The highest quality products should have yellow skin, and be picked carefully with special equipment for cultivation, followed by storing them in a cool dark room. Most of the farmers will hire 5 to 10 local workers to help harvest the plums, with an average wage of THB 250 to 300 (USD 8.33 - 300) per day.

The supply chain of Marian Plum production and processing of the ridge group farmer's community enterprises: this fruit is considered to be an important goods and currently on demand both in domestic and international markets. Although there was limited by the seasonal cultivation and lower number of farming areas, this fruit is also known as the local fruit of Nakorn Nayok, where it considered as one the most important farming area of the eastern region. According to the agricultural information center (2015), Marian Plum farming can be found in the ridge farmer groups of Phitsanulok, where it currently known as the most profitable of Mango farming in Thailand, as well as making 4th ranked profit from Marian Plum farming. The supply chain of the Marian

Plum of the ridge farmers, most of which distribute their good by retail, or processed the downgraded fruits. However, according to the interview with farmers, the middleman was taken part in the product distribution and export to increase the price in 2019, resulting in THB180 (£3 or USD 6) per 3 pieces in British shopping mall. **For the processing phase**, most of the product will be processed into preserve fruits or juices, using the locals processing without food preservatives. As for the processing plum product in the community enterprise, it was found that there was only process at the first level, most of the product will be processed into preserve fruits or juices, using the locals processing without food preservatives. The problem found in plum farming mostly consist of insect and mold, follow by the climate that decrease its productivity and market price. **The marketing of the plum had both export and domestic**, the retail products can be distributed into various ways: in case of domestic distribution; there are likely to distribute to the larger exporters which directly sent to the central market in Bangkok, the provincial shopping malls or the factories. The plums is also required to meet the global standard at second level (Global G.A. P). The export market is such as the UK, Malaysia, Japan, while the domestic market also purchased the plum from its farm and distribute to the mall, typical market or a grocery store). All of which as shown in **Figure 3**.

The capital and revenue of Marian Plum in ridge farmer. Regarding Marian Plum revenue, consist of the capital for the project, fertilizer, pruning, insecticide, herbicide, wager. While the revenue consists of the profit from selling the plum, the details were provided in **Table 3** as follow (Wattanadumrong & Lamprecha, 2016).

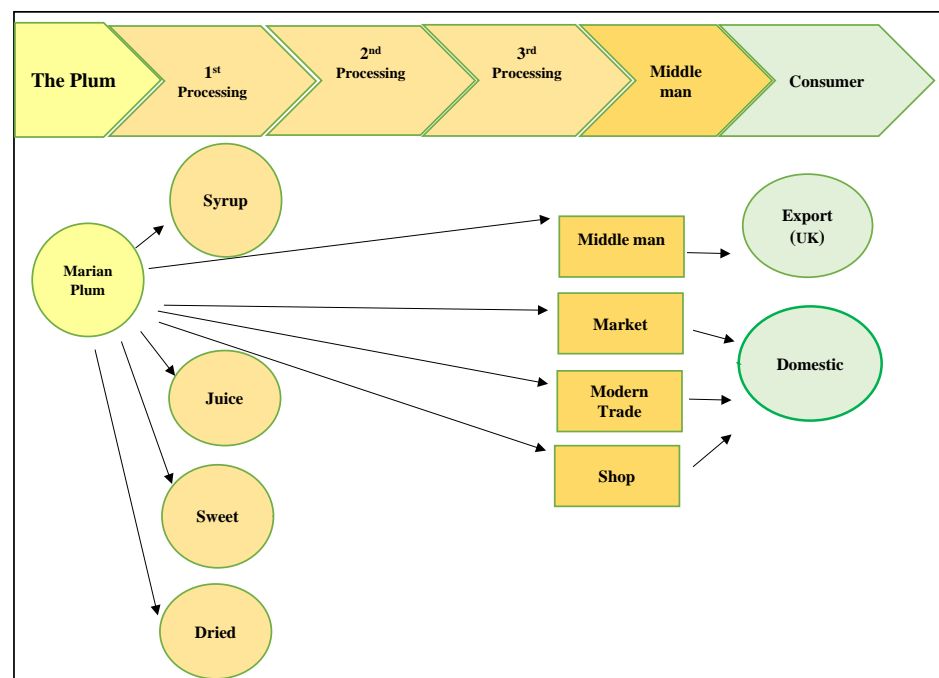


Figure 3. Marketing (supply chain) of Marian Plum of the community enterprise members (ridge farmer). Source: Bua Sawan community enterprise.

Table 3. The capital of Marian Plum tree (USD/each).

List item	USD per each tree	Total
Benefits (B): Income (30 kgs per a tree)	2.67 - 8.34	80.11 - 250.33
Costs (C): Land	-	
Fertilizer	1.34	
Pruning	2.50	
Herbicide	8.00	
Insecticide	3.34	
Labour	4.01	11.45
B/C ratio:		6.99 - 21.86

Note: Ridge farmer land is located in the area of Agricultural Land Reform Office (ALRO) and accepted forest area.

There are 25 Marian Plum trees farming per rai. Regarding the average selling price, it is worth THB 80 [USD 2.67] per kilogram. During the beginning of the cultivate season, it can be sold at least THB 250 [USD 8.34] per kg. Each Marian Plum tree will produce 30 kgs.

From an analysis of the capital and revenue of the Marian Plum per each tree, it was found that the revenue of the investment consists of; the total capital approximately THB 343 [USD 11.45] per plant, it can produce around 30 kg per each plant. During the beginning of the cultivate season, it can be sold up to THB 250 [USD 8.34] while the average price is THB 80 [USD 2.67], resulting in the farmers to have income between THB 2400 - 7500 [USD 80.11 to 250.33] per each plant. The calculated ratio between the revenue to the capital are 6.99 - 21.86.

For the analysis of the revenue and capital of the ridge farmers, shown in **Table 5**. It was found that during the first 3 years (the production phase). There was not any revenue until the 4th year, the farmers began to have a return from their cultivation. It was found that in the 9th year, farmers received the highest returns.

From **Table 4**, the analysis on the capital and revenue from the Marian Plum farming of the same sample group, it was found that during 1 - 3 years, because there weren't produce any product yet, while after the 4th years, the revenue started to increase more and more. The total capital on the 10th year was THB 5,350,367 (USD 178,161) per Rai, and the total revenue was approximately THB 15,210,576 (USD 506,495) per Rai, with the overall net profit of THB 9,860,209 (USD 328,334) per Rai.

When the discount rate is 3 percent (which is the average interest rate in the market), the results of the analysis of the revenue from the mango farmers is approximately THB 2,758,883 (USD 91,868) per Rai, and the current value of the expense is approximately THB 1,766,003 (USD 58,806) per Rai. The current Net Present Value (NPV) is THB 992,880 (USD 33,062) while the income-expense ratio of the Marian Plum farmers (B/C) is 1.56%. The result shows the current

Table 4. An analysis of capital, revenue and Net income of the farmers (Baht per Rai in each production role).

Plant age (year)	Capital (USD)	Revenue (USD)	Total income (USD)
1	6764.19	-	-6764.19
2	3336.46	-	-3336.46
3	3851.36	-	-3851.36
4	5061.11	19,508.69	14,447.57
5	6875.02	21,680.93	14,805.92
6	5800.22	23,044.29	17,244.07
7	6083.27	24,230.28	18,147.01
8	6434.95	25,424.59	18,989.64
9	6789.24	26,951.53	20,162.29
10	8532.08	28,391.76	19,859.68
Total	59,527.90	169,232.06	109,704.16

Source: From the ridge farmer (Community enterprise members) (2020).

Table 5. Net Present value and income to expense ratio of the ridge farmers community enterprise.

Value	Marian Plum farmers' income
B/C ratio of the income-expense	2.70

Source: Data analysis (2020).

income value is THB 4,099,981 (USD 136,525) per rai and the current expense value is approximately THB 1,514,820 (USD 50,442) per Rai.

Based on the data analysis result (Table 5), due to the positive NPV, it means that farmers who invest in the Marian Plum farming will earn their profit from the revenue, resulting in higher income than the expense, regarding the B/C ratio, the revenue is approximately 1.5% and 2.7%, compare with 1 baht. From Table 5, it was found that the Marian Plum garden has the highest revenue with resulting in the increasing of growing plum and raising its price. Regarding the study on the revenues from the Marian Plum farming of 70 samples, it was calculated that the capital and revenues per Rai, and the B/C ratio was equal to 2.7, therefore, it is worth investing in this type of farming. Considering the B/C ratio of the farmers, it was found that Marian Plum farming tended to increase, along with various factors that made more profit for them, such as; it can be cultivated 1 month before other areas, has beautiful skin, better taste and better price as well as the increasing number of plum farmers.

5. Conclusion

The supply chain analysis of the production and marketing for the agricultural products at community-level focuses on “Marian Plum” (Mayongchid in Thai

name) in Phitsanulok Province, Thailand. The areas are suitable landscape for mainly in agriculture based, especially farming and gardening which lead to a positioning of a junction of trading connected area from other provinces before going to other regions of the country. This province is divided into 9 districts, 93 sub-districts. Wang Thong and Noen Maprang districts are fruit farming areas of Phitsanulok Province (Wattanadumrong, Poonchareorn, & Larkwararak, 2017). Marian Plum farming is mostly found in those areas. The target of this research is to concentrate on the marketing and economic valuation analysis.

The marketing system and supply chain management from costs and returns analysis of the Marian Plum production of agricultures in the local ridge area are estimated by employing the quantitative approach and having the interviews of 70 members of Ban Bua Sawan community enterprise. It locates in the areas of Noen Maprang and Wang Thong districts coverage 6 villages. The methodology and data collection approaches have been designed and tested in these areas. The results from the marketing part shows that at present Marian Plum are in highly demand but the farmers cultivate Marian Plum are not enough to supply market demand. Marian Plum cultivation should be planned to increase in the production areas. The results of the economic valuation part shows that the farmers have high income and returns, in particular, returns increase in the fourth-year onwards.

The benefit-cost (B/C) ratio shows that the ridge farmers in those areas can generate income from getting the products and cost recovery in the short terms compared to cultivate other fruit products. In case the fruit production and marketing in small areas can be operated continuously since the processes are not highly investment, the sustainability of “Marian Plum Production” to the areas will distribute income to the others; inside and outside the village. In the long run, in case the Bua Sawan local community enterprise, the ridge farmer members and other networking of the Marian Plum can extend to other areas such as knowledge sharing management, accounting, marketing or other of their production experience, these can be the “Marian Plum Model” for the others at community-level which can raise up and generate income in other areas. The limitation of this study is uncontrolled situations each year such as the market selling price and the climate impacts of each season. At the beginning of Marian Plum seasoning, the price is increased from USD 8.34 per kg each tree for the first yield, later on of the Marian Plum products has over supply, the market mechanism leads the price dropped to USD 2.67 per kg. each tree. Also, the temperature increase reduces the yields of Marian Plum each year.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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