

How can Producer organizations help on solving the quality problems that occur in the pineapple processing industry of Thailand

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Preface

This research project is performed by Mongkol Suhusbhaisal. It is the major thesis project, a part of master degree in Food innovation and management at Wageningen University, the Netherlands.

I would like to thank Dr. Jos Bijman and Dr. Geoffrey Hagelaar for their contribution on supervising, supporting, and guiding me during the project. Without them, this project cannot be completed. This project gives me great experience both in the academic and social content.

Moreover, I would like to thank all the interviewees for their time on providing the valuable time information to my data collection and the warm welcome they gave to me during the interview. This information is very important for my research.

Finally, this research gives great experience and I hope that it will be contributed in the society and useful for the producer organization on adjusting their roles on improving the quality of pineapple.

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Executive summary

Agriculture is one of the most important businesses of Thailand, accounted for 9.9 percent of GDP in 2005. As the country is located in the area which climate is suitable for growing the tropical fruit, this fruit is one of the major fruits that make a lot income to the country. One of the most important tropical fruits in Thailand and the main focus of this research project is pineapple. The pineapple product of Thailand mainly for processed product. Roughly 80 percent of production is destined for processing (especially canning). Products of processed pineapple are canned pineapple and pineapple juice. In Thailand, 2.5 million tons of fresh pineapple is annually used in processing the pineapple products.

Small farmers account for more than 95 percent of producers in Thailand's pineapple industry. Farmers in Thailand are the people at grassroots level, whose have low income. They are facing poverty problems. There is one organization that helps the farmer in Thailand called the producer organization. The producer organization becomes important for farmers because it is the organization that is owned, controlled and conducted by farmers themselves. They are increasingly more important in the national and international agri food supply chains as intermediaries between individual farming households and chain actors such as buyers and processors.

Quality is very important for exporting product to developed countries like countries in Europe and America. Thailand faces a lot of problems in exporting tropical fruit to other countries. Quality problem is one of the weaknesses for the export from Thailand. The quality problems can come from various causes. The origins of them are also different for each problem.

“How can Producer organizations help in solving the quality problems and improving the export of tropical fruit chain from Thailand?” is the research question in this project. The roles and functions that cooperatives in the pineapple industry of Thailand could have on improving the quality of pineapple is the main focus of this project. The research strategy of this project includes two methods, desk research and case study. Literatures about pineapple industry and producer organizations are used in order to indentify the problem of pineapple, the condition of pineapple industry, and producer organizations. In order to get the information on the actual roles of the cooperative in improving the quality of product, the interview approach has been used. The interviews included the provincial officer that is in charge of helping the producer organizations and 4 producer organizations in Prachuap kirikhun, the largest pineapple producing province of Thailand and 3 producer organizations in Chaburi and Rayong, second and third largest pineapple producing provinces in Thailand.

Firstly, the quality problems of pineapple in Thailand can be classified into three main parts: the quality problems in the production, the uniformity problem of product, and the standard of pineapple is not reached. The quality problems in production can be classified into three main stages; growing, harvesting and post harvesting stages. Disease of pineapple is the major cause of all stages of production. Moreover, lack of knowledge and skills is another cause of the problem in production. There are many measures that can be applied in order to solve the quality problems in these three stages. For example, the measure or management on disease of the product and the post harvest treatment.

The uniformity problems of products can be divided into the uniformity in quality and quantity. The causes of the uniformity problems can range from the poverty problems to the technical problem of pineapple. Small size of farm, lack of capital to invest, information asymmetry and fluctuation of price can cause the uniformity problem in product in the economic term while the uncertainty in

ripeness of pineapple. On the other hand, lack of good planning can be the technical causes of this problem. The solution of the problems can be using the chemical to force the flowering, sorting and grading, and good planning for production.

Unreached standard of pineapple by the farmer is another consideration that becomes a quality problem. Due to the standard is required by the processing factory, the farmer needed to improve their farms and product to reach the standard. In order to reach these standards, help must be provided by either the PO or the governmental organizations. The technical solution of this problem is the standardization of the production. There are many standards that can be applied on the production to improve the quality of product. The good example is the GAP which improves the production process.

Producer organizations, based on the functions that they have, can be classified in two types; community based and commodity based organization. The difference between these two types is the function that POs provide to members. The community base includes social, political and economic functions while the commodity base only focuses on the economic function. When looking at the roles of the cooperatives, they can also be classified into two major types; the traditional economic functions and the new functions. The aim of the first function is to enhance the prosperity of members by providing the economic functions while the latter aims at value creation of the product. The traditional economic functions compose of enhancing bargaining power, reducing information asymmetries, improving quality of product and sharing risk activities. Moreover, the new functions compose of reducing information asymmetry, set up quality assurance and traceability system, providing information, and coordinating the activities of supply chain partners.

The actual quality problems that happen in Thailand's pineapple industry and role of POs in solving them are determined. In the production problems, the marbling disease, mealy but wilt, and Fusarium stem rot are considered as the big problems that often occur and cause the big damage on the pineapple production. The uniformity problem can be divided into a quantity and quality element. Both problems are considered as normal problem, but the uniformity problem in quantity tends to be more serious problem. On the other hand, the problem of unreached standard of pineapple seems not to be a quality problem in pineapple production. This might be because the processing plants in Thailand do not require high standard pineapple.

Producer organizations in Thailand have several roles and functions that help their members in three kinds of activity, economic, social, and political. The main economic roles and functions of pineapple POs in Thailand are about the production and marketing activities. Providing fertilizers and inputs, develop and exchange technological knowledge, physically collect the farm products are examples of important economic roles that POs in Thailand have. On the marketing activity, marketing and contract and price negotiation are roles that POs in Thailand have, but they do not pay much attention like they do on the production activity. Another activity that POs in Thailand have is the provision of credit. This activity is the second most important activity that they are doing. Coordination with other actors in supply chain and collaboration with other POs is not normally found in the interviewed POs. The main aim for coordination is for exchanging the technical knowledge and better price for buying inputs and fertilizers.

On the basis of the analysis, the following recommendations on the activities of the PO's can be made:

Develop and exchange technological knowledge

This role is one of the three most important roles for solving the quality problems. The technological information could be updated in order to get more effective solution. By doing this, the expert in the technical field could be invited to help on the technical problem or improving the quality of product. The technological information could be up to date. For example, the effective measure on managing the production to deal with the disease of the pineapple, such as integrated pest management and other management on disease, could be applied. Moreover, the exchange of technological knowledge could be intensively conducted. The method of some POs is effective in solving some quality problems. For example, the crop circulation in pineapple farmer groups in Rayong province is effective in solving the problem caused by pests and insects.

Coordinate the activities of supply chain actors

In order to solve quality problems, POs need to pay more attention to this role because it could help on solving all quality problems that occur in pineapple production in Thailand. By having more coordination, the technical and market information can be transferred easier between the producer and processor. The producer could have better information on adjusting or planning of the production. Moreover, the producer could plan the production together with the support from the processor. Beside the support from the processing company that POs could get, the support from the governmental organization is also important in solving some quality problems. Some cause of the quality problems needs the support from the governmental organization. For instance, the fluctuation of price needs the governmental organization to help in negotiating to set the fair price for both producer and processor.

Applying quality assurance and traceability system

POs in Thailand could pay more attention on applying quality assurance and traceability system in order to solve the quality problem and improve quality of the production which supports the future market requirement. The problems in production and uniformity of product could be solved as the causes of the problems are figured out by the record keeping. By applying this program, the method of production can be improved. The reason why POs should apply this system is because they are in the interface position between the producer and the processor. It is the good position to set up the quality control system. By doing this, POs will also have more opportunity to do business with customers that require particular standards.

Providing fertilizers and inputs

The role in providing fertilizers and inputs is considered as the most important role for POs in Thailand. Every PO in Thailand pays much attention on it. For solving quality problems, this can be considered as important role because it helps to solve problems in production and the uniformity of products. It is good to perform this activity but the time and attention could be divided to other roles that are more important on solving the quality problems like three roles that are stated before.

Provision of credit

POs have provided credit for members for long times both in cash and credit for buying inputs and fertilizers. By performing this activity, it can help to solve the problems in production and unreach standard of product. Lack of capital to invest is one of the important causes that lead to the quality problems. Therefore, by helping them with the credit, members will have more capital to invest in

their farm and production. In the mean time, although this role is considered as important for them, the method of loaning should be more formal in order to avoid the problem that the debtors do not pay the POs back when the loaning period finish. The legal contract should be applied on the loan. The help from the governmental organization should be provided on this issue because it is over the capability of POs to deal with them.

Physically collecting of farm product

In the present day, some farmers directly deliver product to processing plant without pooling at POs' site. By lacking of collecting of product, some measure that can improve the quality of pineapple is not done. POs in Thailand should pay more attention on this role. It does not only make more bargaining power, but the sorting and grading can also be done in order to make product more uniform. The product can be checked whether it reaches the standard before delivery to the processing plant. This method can also make more trust for the customer on the quality of the product. As the nature of delivery of farm product to processor changes, it is not feasible to POs to collect all products from their members. The POs should

Abstract

Pineapple is an important fruit in Thailand because it is the biggest exporter of processed pineapple. Quality is very important for exporting product. Thailand faces a number of quality problems in exporting tropical fruit. They mainly relate to the problems in production, such as in growing, harvesting, and post harvesting stages. Related to the small size of pineapple farm in Thailand is the low ability of the producer to improve and solve the product quality problems. The producer organization is one of the organizations that can help on solving the problem. PO is chosen to study in this research because it is very important in the development of agricultural sector and it is the closest organization with the farmer.

The present research is a practice oriented research aiming at “making recommendations for producer organizations in Thailand on solving quality problems that occur in the production of pineapple by making an analysis of the quality problems and the ideal roles of the producer organizations”. The qualitative method is used by means of desk research for a literature study, and interviewing in the empirical study. The abundant problems that affect the quality of pineapple are discussed in the literature study. They can be classified as the problems that occurred in the production, uniformity problem of product, and unreached standard problem. The roles and functions that PO can help farmers on these issues are also included in the literature review. In the empirical study, interviews were conducted with the cooperative officer and 7 producer organizations in Thailand’s three main pineapple producing provinces.

The result of this research shows that the quality problems are mainly caused by producers themselves. The processor is also one of the actors that cause the problem of unreached standard of product. Producer organizations have some roles that can help farmers on solving the problems but they still are lack some important roles. The recommendations are made for producer organizations on helping their members to adjust the roles in order to solve the quality problems.

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Chapter 1: Introduction

1.1 Background Information

1.1.1 Tropical fruit

Tropical fruits are fruits that grown in the tropical area. They can be found in the countries that located near the tropic of cancer line such as Thailand, India, Philippine, Indonesia, Malaysia, Vietnam, Mexico, Brazil and so on. These kinds of fruit require the hot climate to grow and prosper. Tropical fruits can be considered as one of the major fruit in the world. In 2007, the amount of tropical fruit production of the world is around 17 million tons (FAOSTAT, 2009).

1.1.1.1 Tropical fruit in Thailand

Agriculture is one of the most important businesses of Thailand, accounted for 9.9 percent of GDP in 2005 (FAOSTAT, 2006). Thailand is located in the tropical area which has a damp and warm atmosphere (CIA, 2009). This type of climate makes this country suitable for growing the tropical fruit. This statement can be confirmed by Vichitrananda, the total fruit area in Thailand covered about 1.55 million hectares in 2003 (2008). According to Vichitrananda, the tropical fruit in Thailand can be divided into two groups according to the economic importance. The first group is fruits of major economic importance and with a great potential to support the demand to both local and overseas markets; they are durian, longan, mangosteen, lychee, mango, pomelo, rambutan, pineapple, young aromatic coconut and tamarind. The second group comprises a number of economically less important fruits, which are cultivated for domestic demand rather than for export purpose. These fruits are santol, java apple and sugar apple (2008). Not only feeding the domestic demand of tropical fruit consumption, tropical fruits are also exported to other countries around the world. The growing areas of the tropical fruit are spread all over the country but the provinces in the Eastern area along the coast of the gulf of Thailand are the major growing area.

1.1.1.2 Supply Chain of tropical fruit in Thailand

Figures 1 and 2 show the overview of supply chain of tropical fruit in Thailand both for domestic and international market. There are many actors in the supply chain of tropical fruit in Thailand; small, medium and large farmers, producer organization, dealer, international and domestic market, processing plant, wholesaler, retailer and the most important actor, customer. Product can be gathered at the cooperatives' pooling site or the dealer's sites to further distribute to processing plant. After this step, the fruit is distributed to the retailer via the wholesaler, to exporter for exporting the final goods and the fresh market. In present, the procurement process of manufacturer is changed from the past. The processing plant directly buys pineapple from the medium and large farmers that can produce pineapples in the amount and standard that is required. The quota, set by the processing factory, is applied on each dealer that buys products from the processors and sells to manufacturers. This quota is also applied on the cooperatives. The medium and large farmers, that are the members of the cooperative, can directly deliver the product to the factory in the quota of cooperatives. Small farmers that do not have high amount of product still need to rely on the cooperatives in gathering the product to reach the level. On the other way around, the information from the customer or feedback of the product is transferred along the supply chain from the downstream actors to the upstream actors in the opposite direction of the transfer of product. The inputs for the farmer are provided by the cooperatives.

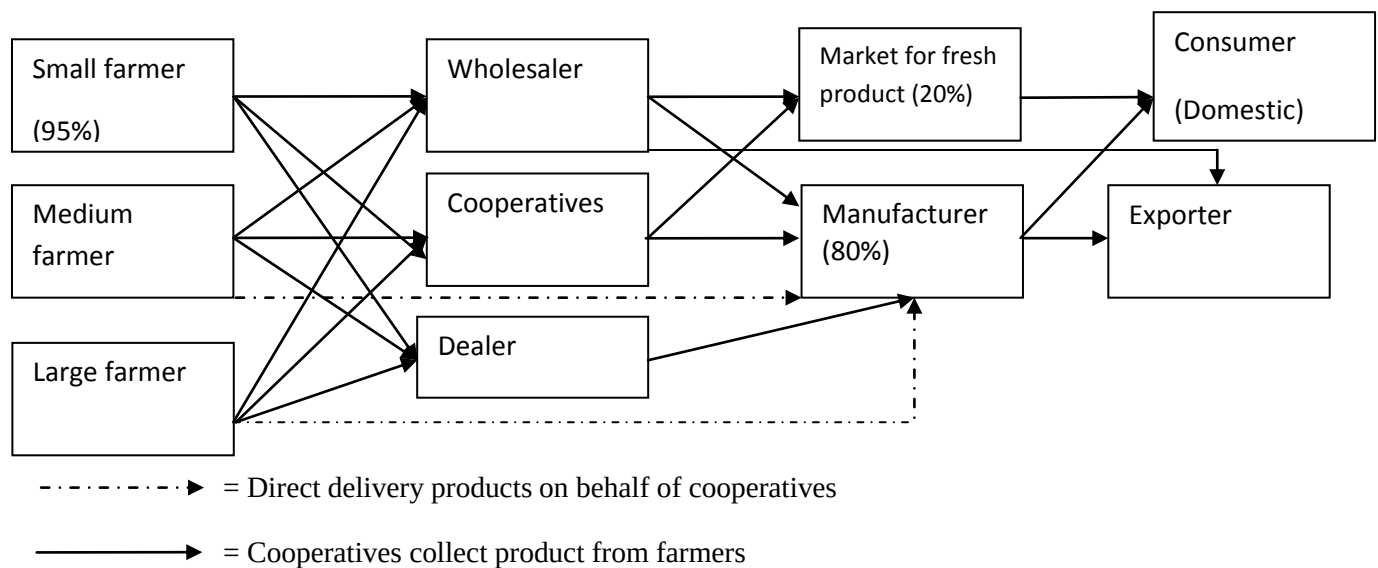


Figure 1: Supply chain of pineapple in Thailand

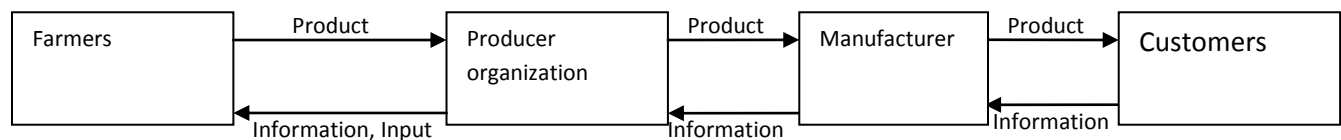


Figure 2: The flow of product, input and information of the supply chain

1.1.1.3 Exporting and market conditions of tropical fruits in Thailand

Thailand is an important exporter of tropical fruit product: 157,474 tons of tropical fruits were exported in the year 2007(FAOATAT, 2007). It can be considered as one of the largest export country of tropical fruit in the world. Although the amount of export is very high, the value of the unit (dollar per ton) is still low when comparing with other countries such as Philippines and Indonesia. Thailand is also the major exporting country of processed tropical fruit. The canned pineapple and canned pineapple juice are two products that Thailand is the world's largest exporter. The amount of export for these two products can satisfy 54% of the world demand. The US and Europe (primarily Germany and the Netherlands) imported the majority of canned pineapple. The Netherlands and the US were also the largest buyers of pineapple juice (Vichitrananda, 2008). The major importing countries that buy the tropical fruit from Thailand are China, Japan, ASEAN country, America and countries in EU. Although Thailand is one of the largest exporters of tropical fruit, the amount of export is still low when compared with the capacity of the production. By comparing the amount of tropical fruit produced with the export amount, the export amount is still so far behind. The amount of tropical fruit production in Thailand is 770,000 Tons (FAOSTAT, 2007). The amount of export is account for 20 percent of overall production. As the amount of fruit consumption worldwide keeps increasing every year. The data from FAOSTAT states that the fruit consumption in year 2003 is 123,779,046 tons which increases from the year 1993 that are 89,257,360 tons (2009). This is one of the good opportunities for the tropical fruit in Thailand on exporting. There are many problems that occur in the export of tropical fruits from Thailand. These problems will be discussed in the next section.

1.1.1.4Pineapple industry in Thailand

The pineapple product of Thailand mainly relies on the processed product. Only small amount is sold in the form of fresh product. Roughly 80 percent of production is destined for processing (especially canning) (Anupunt et al., 2000). There are many pineapple processing plants operating around the country. According to the data from the office of industrial economics (OIE)(2002), the pineapple processing plants in Thailand accounted for 27 plants. These processing plants aim on selling products to the international market. Products of processed pineapple are canned pineapple and pineapple juice. 2.5 million tons of fresh pineapple is used annually in processing the pineapple products (OIE, 2002). There are 6 processing companies which are the big players in the industry. Their market shares account for 60 percents of the industry. The market share is shown in table 1.

Company	Market share (%)
1.Dole (Thailand) Co.,Ltd	14
2. Vita food company	13.6
3. Thai pineapple company	9.5
4. Canned pineapple industry of Thailand company	8.9
5. Malee (Sampran) company	7.4
6. Siam pineapple industry company	7.2
7. Other company	39.4

Table 1: Market share in pineapple industry

Source: the office of industrial economics, Thailand. (2002)

1.1.1.5 Quality problem in exporting fruit of Thailand

Quality is very important for exporting product to developed countries like countries in Europe and America. Thailand faces a lot of problems in exporting tropical fruit to other countries. Quality problem is one of the weaknesses for the export. The quality problem, mainly relates to the problems in production, occurs at the production field or farm. They can be classified as the problems that happen in the growing, harvesting, and post harvesting stages. These problems relate to cultural practices, disease, excessive use of chemicals and the need for compliance with international quality standards (Vichitrananda, 2008). The details of the problems in production are further described in the next chapter.

Another important problem in production is the uncertainty of the production both in quality and quantity aspect. The cause of uncertainty of quality can be explained with the lack of knowledge among farmers in technical term. On the other hand, the fluctuation of price can cause problems in the uncertainty of the amount of product. It can be explained to a large extent by changing of prices. When the price of pineapple drops, the small farmers shift to other crops that they can make more profit (Sriwichailamphan, 2007).

Moreover, the unreached standard is also the problem that occurs in the pineapple production of Thailand. This problem is caused by many factors, both from producers and processors.

1.1.2 Small scale producer

Small scale producer is the important player in the supply chain of tropical fruit in Thailand. As in the case of pineapple production in Thailand, more than 95% of all producers are smallholders that generally occupy between 1 to 5 hectares of land (Anupunt et al., 2000). Nowadays, small scale producers face many problems that are posed by the emerging of the modern chain. Small scale producer has both strengths and weaknesses for participating in this chain (Ruben et al., 2006). The major strength is the low cost of production compared to the commercial farm. The overhead costs of the small scale farmer are a lot lower than of the large scale commercial farm. Moreover, the paid labors are less motivated than the self employed farmers (Ruben et al., 2006). As the producer is small, the knowledge of markets and technology and proper use of input is low. The poverty in farmer makes the small scale farmer neither being affordable nor accessible to the capital for the improvement and development of facility and technology. These are the major weaknesses of the small scale farmers on competing in the changing value chain (Ruben et al., 2006).

1.1.2.1 Problems of small scale producers on changing market conditions and exporting

Tropical fruits in Thailand are widely grown by many small-scale producers. Nowadays, farmers all over the world are facing the changing in market conditions. These conditions include the market liberalizations, new priorities (environmental sustainability and food safety), the better quality, more variety and safety of food product that the customer requires. The rise and consolidation of supermarkets also changes the structure of food markets (Bijman and Ton, 2008). The changed conditions give many opportunities for the small scale producer, but it also gives the big challenge for them. For example, the market liberalization has cut the support services provided by the state, and forced producers to face the risks of often weak and volatile market (Penrose Buckley, 2007). It forces many producers to stand on their own without any support from the state. They have to compete with large commercial producers and the highly required standards. Beside from these problems, small scale producers also face the quality problems which are caused by the low capability and affordability of the producers. For example, the problems in production need an investment to solve which is hard for the small scale producer to afford for the credit. Moreover, small scale producers also have problems with the uncertainty in quality and quantity of products as they have small amount of production and less technical knowledge to deal with. These are examples of the problems that the small scale producers face in the present condition of the market. More detail of problems will be identified in the later part of the project

1.1.3 Producer Organization

Farmers in Thailand are the people in grassroots level, which has low income. They are facing the problem of the poverty. This leads to the problems in the production of their farms. The ways to solve these problems can be from many parties; Government, NGO, producer organizations and so on. The producer organization becomes important for farmers because it is the organization that is owned, controlled and conducted by farmers themselves (Penrose Buckley, 2007). Profit is also given back to the farmer. Helps from other organizations are sometimes not useful because the farmer sets the barrier against their helps. The fact from the World Bank's recent Voice of the Poor study was that poor people do not want to be consulted or participate in outsiders' programs. They want their own strong organizations to advance their interests and ideas, and external support to focus on increasing the capacities of these organizations (Hussein, 2001). This factor makes the producer organization

important for the development of farmers and quality of products. Producer organization can have good helps for their members because it is the middle actor between the farmers and the chain actors such as buyers and processors (Ton and Bijman, 2006).

1.1.3.1 Definition and types of POs

Hussein (2001) gave the definition of producer organizations as the groups of any category of rural producers that come together voluntarily to found organizations based on the principle of free membership, to pursue common interests of their members, specifically, developing technical and economic activities that benefit their members and maintaining relations with partners operating in their economic and institutional environment. Producer organizations are increasingly more important in the national and international agrifood supply chains as intermediaries between individual farming households and chain actors such as buyers and processors (Ton and Bijman, 2006).

There are many forms that the POs exist and they provide different services (Bijman and Wollni, 2009). The form of producer organizations can be classified according to degree of formal; from the formal institution, such as cooperative, to the informal producer groups and village associations (Bijman and Ton, 2008). There are advantages and disadvantages to formalization, depending on the particular, political and legal context (Bijman and Ton, 2008).

Formal POs

Formal POs include cooperatives, associations and societies that are distinguished by a formal constitution and the legislation that applies (Bijman and Ton, 2008). The formal POs can enter into contracts and borrow money. This cannot be done in the informal POs. The advantage of formal POs is the POs can make a contract with buyers for the delivery of special quantities and qualities of farm products. This form of POs seems to be a basic requirement for POs that want to establish downstream relationships with other participant in the value chain (Bijman and Ton, 2008).

Informal POs

Informal POs may be formed by a group of producers that come together to share the market information, exchange the experience, or help each other in the difficult time. There are both advantages and disadvantages of informal POs. In the country that the legislation is restrictive, the informal POs are more flexible in adapting to the changing environments. It also matches the countries that the cost of registering as a PO is too high. On the other hands, the contract with the third party cannot be done with the organization. It has to be done with the individual member of the PO.

1.1.3.2 POs in Thailand

Producer organizations in Thailand have a long history. It can be traced back to 1914(Thuvachote, 2006). The POs in Thailand can be classified as the formal POs, cooperative. The law about the cooperatives has been enacted since 1916 and it is continuously developed which the last act of cooperatives was amended and replaced in 1999 (Thuvachote, 2006). At present, the cooperatives in Thailand are officially categorized into seven types which are (Thuvachote, 2006).

- Agricultural Cooperative
- Land Settlement Cooperative
- Fisheries Cooperative

- Consumer Cooperative
- Saving and Credit Cooperative
- Service Cooperative
- Credit Union Cooperative

1.1.3.3 Business Scope and Performances

Agricultural cooperatives in Thailand engage in a variety of business in responding to their members' needs. Three main businesses are involved which are Financial serviced business (credit, saving and deposit), marketing business and purchasing business (Thuvachote, 2006).

Credit, saving and deposit business – Credit facilities provided by cooperatives cover a variety of activities such as paddy farming, animal husbandry, debt redemption and household consumption. There are three types of loan that the cooperatives provide; short (2 months), medium (18 months) and long term period (more than 5 years). The sources of fund for agricultural cooperatives are from their own capital, deposit from members and mainly the loan from the Bank for Agricultural and Agricultural Cooperative (BAAC) (Thavachote, 2006). Saving can also be used to generate the profit to both cooperatives and their members. Members can deposit their money with their cooperatives.

Marketing business- The cooperative helps to sell the product, especially the products from their members. Farmer can obtain good prices, while fair weights and measures are guaranteed.

Purchasing business- The selling of major agricultural inputs as fertilizer, seeds, gasoline and farm supplies and equipment gives the benefits to the members on the reduction of production costs. The members can be sure that they buy with fair prices through cooperatives.

Government Supporting System- The agricultural cooperatives in Thailand receive both technical and financial support from the government because it is considered as an important factor for economic and social development. The government established three organizations to give the support which are; 1) the office of Registrar of Cooperative Societies, 2) The Cooperative Promotion Department (CPD) and 3) The Cooperative Auditing Department (CAD). The government also set the Cooperative Development Fund (CDF) to promote the affair of the cooperatives (Thavachote, 2006).

Recent developments of agricultural cooperatives in Thailand – As the needs and challenges from the farmers and the market in Thailand change, the agricultural cooperative needs to adapt themselves to response the market and help their members to achieve their needs. Some agricultural cooperatives have tried to transform themselves and implemented new strategies to this new economic environment. The new directions of agricultural cooperatives in Thailand are; 1) Collaboration with private sector, 2) Product of high quality and traceability, 3) Electronic commerce and use of internet, 4) Cooperative woman group, 5) The concept of cooperative company, 6) Associate members and 7) Value addition (Thavachote, 2006).

1.2 Problem Definition

After presenting the background information, it is now reasonable to present the problem that will be investigated in this thesis.

The quality problems in the pineapple production in Thailand have an impact on the exporting of pineapple. They can occur in all stages of production; from seeding to post harvest. The uncertainty in

both quality and quantity of Thai tropical fruit is one of the problems that affect the export and domestic market (Lertprasert, 2003). This can come from many causes which are improper use of pesticide, lack of good producing, harvest and post harvest technology, (Lertprasert, 2003). In order to solve the problem, producer organizations can play an important role since they are the middle actor between the farmers and the chain actors such as buyers and processors. This project will a) indicate the sources of problem that occur in the product's quality of the tropical fruit chain and b) identify the role that the POs actually have and the optimal role that they could have in solving the quality problems in order to improve the export.

In the rest of the chapter, the conceptual and technical design of the project will be presented.

1.3 Conceptual Design

The conceptual design, presented below consists of the research objective, the research issue, the research framework and finally the definition of the concepts that have already been and that will be used in the research project.

1.3.1 Research Objective

The research objective is formulated as:

“To make recommendations for producer organizations in Thailand on solving quality problems that occur in the production of pineapple in order to improve the ability to export by making an analysis of the quality problems and the ideal roles of the producer organizations on solving the quality problems and improving the capability of producers on the supply chain”.

This project is practice oriented research which can be categorized as the design-oriented research. In this project, the quality problems of the tropical fruit chain in Thailand that leads to be the problems of exporting will be identified, and also with the role of the producer organizations in the supply chain will be analyzed. The optimal roles for the producer organizations in the tropical fruit's supply chain will be figured out and stated as the recommendations to follow in order to improve the quality of the product

1.3.2 Research Issue

The central research question of this research project is quoted below:

“How can Producer organizations help on solving the quality problems that occur in the pineapple processing industry of Thailand?”

The sub-questions which are needed to be answered in order to conclude and lead to get the answer for the central research question are listed below:

A. What are the quality problems that occur in the tropical fruit supply chains?

In order to answer A in more efficient way, 3 questions that relate to the concept of the main research question is set to be answered

A1) What are the quality problems that occur in the domestic and export market?

A2) What are the causes in the quality problems?

A3) Where is the cause of quality problems in the supply chain?

B. What are the solutions for quality problems that occur in the tropical fruit supply chains?

In order to give a clear answer to question B, two questions which relate to the main research questions are conducted to be answered.

B1) Which types of solution are matched to the problems?

B2) In which stages of the supply chain can the solution be applied?

- Technical
- Organizational
- Institutional

C. How can POs help to solve the quality problems?

C1) How can POs help to solve the quality problems in the production level?

C2) How can POs help to solve the quality problems in the marketing level?

D. What are POs in Thailand doing in solving the quality problems and improving the quality of the tropical fruit in Thailand?

1.3.3 Research Framework

The framework of this research project consists of four main parts, excluding the introduction.

The first part is the literature review of quality problems and solution, producer organization and improving of quality, and national and international standard of tropical fruits.

The second part of this project is the empirical study. The results from the literature study are used to inform the data gathering on the tropical fruit industry. The empirical study will get the practical data on the tropical fruit industry and the current role of POs.

In the third part, the finding from literature and practice are compared. The result comes out in this intermediate step between the second and the last part.

The final part of this project is the conclusion that gives the recommendations for the POs on their role in the tropical fruit industry, particularly on quality improvements.

In order to get better understanding, the research framework is shown in figure 3.

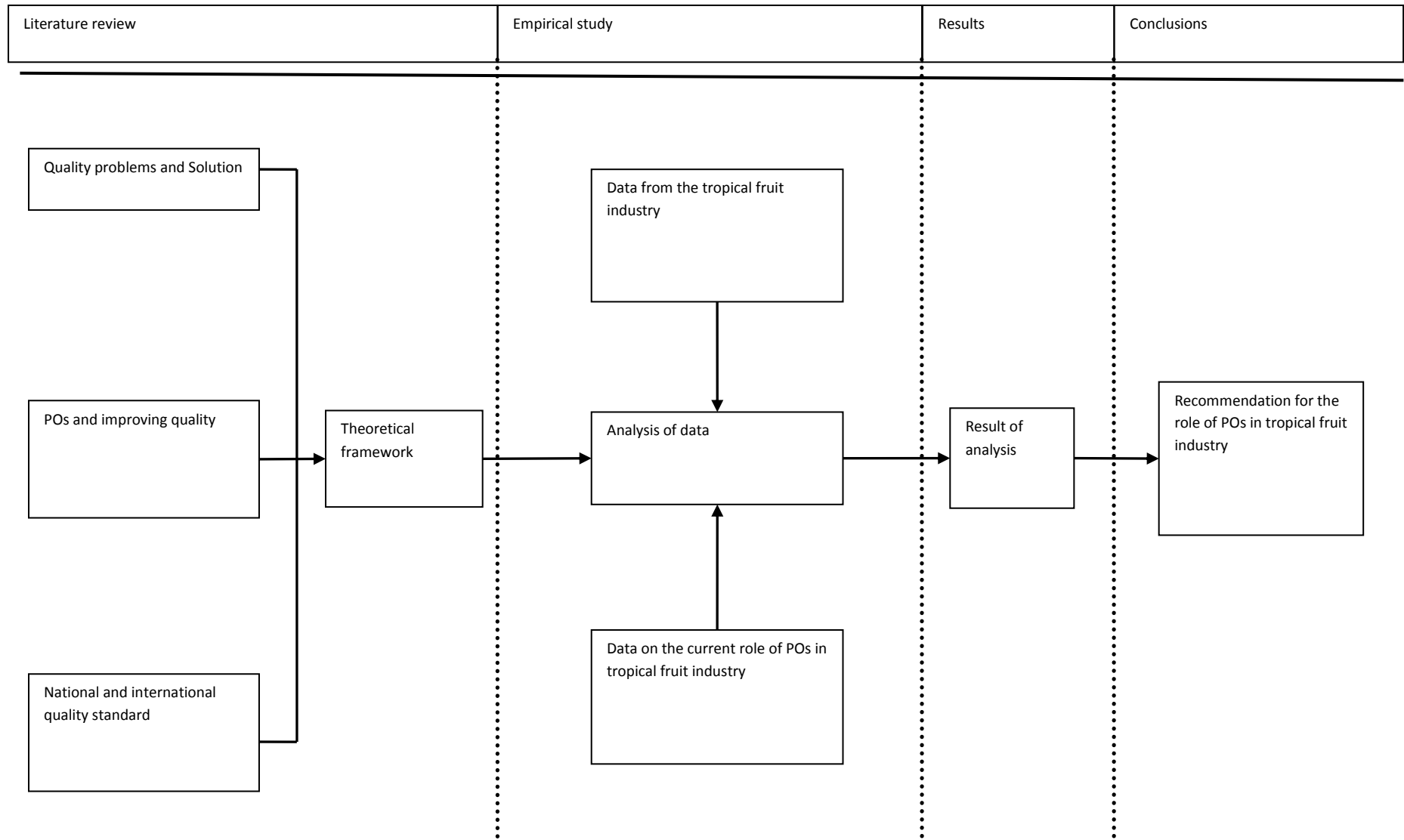


Figure3: The research framework

1.3.4 Definition of Concepts

Producer Organization: Penrose Buckley (2007) gave the definition of PO as the rural business which is a producer owned and controlled organization. This organization has to engage in collective marketing activities. In the governance aspect, the PO is the group of any category of rural producers that come together voluntarily to found organizations based on the principle of free membership, to pursue common interests of their members, specifically, developing technical and economic activities that benefit their members and maintaining relations with partners operating in their economic and institutional environment, Hussein (2001).

Supply chain: A set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer (Mentzer et al, 2001).

Quality and quality problem: The word “quality” means attribute, property or basic nature of an object. However, the destination or use can also determine different criteria for judging quality within the same crop (Camelo, 2002). For this research project, attributes for the grower are used to define as the quality of pineapple. The external appearance, safety of product, uniformity of product and morphological and physical defects are used as the indications for the quality problems of pineapple.

Small scale producer: Small-scale producers are producers operating at a small scale, used to distinguish from industrialized producers. The line separating small- and large- scale producers is arbitrary. The small scale producer is the producer that occupies the planting area between 1 to 5 hectares (Anupunt et al., 2000).

Tropical fruit Industry: It is defined as a number of firms (from grower to exporter) that constitute the industry that involves with the tropical fruits.

1.4 Technical Research Design

The technical research design of this project composes of research material, the research strategy and the research planning. All of them will be presented below.

1.4.1 Research Material

The research material of this project is set in the respect to the central research question. Regarding to the central research question “How can Producer organizations help on solving the quality problems and improving the export of tropical fruit chain from Thailand?” the qualitative character of this project can be identified.

This research project can be divided into two main categories which are the theoretical review part and the empirical study part. At the first stage, theoretical review part, the concepts includes 1) the quality problems of tropical fruit, standard of pineapple and the solutions (chapter2) and 2) the POs and improving quality (chapter3).The knowledge sources of these literatures are searched by the web of science, the Google scholar, and the Scopus databases. The theses from Phd candidate are also included.

In the latter stage, the empirical study, the data on the tropical fruit industry and the current role of POs on the tropical fruits’ supply chain are collected. The collecting of data on this specific field is very challenging because there are very few useful and reliable databases which provide the necessary

information. According to Verschuren & Doorewaard (2005), there are four main categories that this project can use in order to receive data and information from: 1) Individual people, 2) the media, 3) documents, and 4) literature. The methods used in this project are 1) interviewing, 2) content analysis and 3) search method (Verschuren & Doorewaard, 2005). The interviewing method is conducted with the pre structuring question in order to get more precise answer in the topic. 7 pineapple POs will be interviewed to get the data on the current role of POs. After that, the comparative method is used with the ideal roles, from literature review. The recommendation will be given by using the results of comparison. The content analysis of this project is the qualitative type. The information is extracted from a large quantity of the literature that is relevant for the research (Verschuren & Doorewaard, 2005). After that, the data from empirical study and literature study is compared. For the search method, the snow ball principle is used. This method means when the major publications are chosen, bibliography that the author includes will be follow.

1.4.2 Research Strategy

1.4.2.1 Strategy

It is so clear that in order to investigate the objective of this research, the in depth analysis must be conducted in this project. This research project is defined as “qualitative research project”. The producer organization in the tropical fruit industry in Thailand will be deeply analyzed. This content is primarily based on the primary data. In order to complete the report, both primary and secondary data must be collected. The combination of the Case Study and Desk research is used.

Desk research is applied in order to gather the secondary data. For example, the data from researcher, institution, government, related organization in the industry. It also involves the background on the quality problem of pineapple, pineapple industry and its supply chain, the producer organization, quality standard, and for indentifying the producer organizations of the tropical fruit industry. Case study of tropical fruit in Thailand is used in this research as it limits the research unit and the in depth research can be conducted by this method. Moreover, this method also gives the qualitative data to the research. The case study strategy is applied on the data from the tropical fruit industry and data on the current role of POs in tropical fruit industry.

1.4.2.2 Limitations

It is important to state the limitations that are going to face in conducting this research project, so we can manage with these constraints. The first and the most important to state is the scope of this project. This research project is limited to the pineapple sector instead of the whole tropical fruit sector in order to get the accurate and enough data. Moreover, the time limitation is the major constraint for this project. As the normal Msc thesis, 6 months is the period of time to conduct and finish, but the Food Innovation program provides only 5 months to finish the thesis. This can limits the quality of the project.

Chapter 2: Quality Problem of Pineapple and Solution

2.1 Introduction

This chapter shows the quality problems that occur in the production of pineapple by making a literature review on each quality problem that can probably occur on the pineapple production, both in the production farm and out of production farm. The methods to solve problem are also included in the chapter. By completing this chapter, the research question A: What are the quality problems that occur in the tropical fruit supply chains for domestic and export market, including three sub question A1 to A3 are answered. Moreover, by reviewing the solution to the quality problem, the research question B: What are the solutions for quality problems that occur in the tropical fruit supply chains, including the sub questions B1 and B2.

The information in this chapter is collected by literature review on the article about the quality of pineapple and the solution on the quality problems.

In order to follow the chapter, it is structured as beginning with the background information of pineapple, showing about the basic knowledge of the pineapple and the quality criteria of pineapple. After that, section 2.2 the quality problems are shown. It composes of the problem in production, uniformity problem of product, and unreached standard of farmers' product. The technical solutions of each problem are given as followed the stated problems in each section.

In section 2.2.1, the problem in production of pineapple can be divided into the problem in growing, harvesting and post harvesting stages. In section 2.2.2, the uniformity problem of product is classified as the uniformity in quantity and uniformity in quality of pineapple. In section 2.2.3, the standard of pineapple required by various market; fresh market, super market and processing plant are shown.

Background information

Pineapple

Pineapple is one of the tropical fruits that are important in the world's fruit sector. The growth in production of pineapple around the world is much faster than that of fruits in general (Vagnron et al., 2009). Pineapple can be exported both in the fresh and processed form. Thailand is the largest exporter of processed pineapple (canned and juice concentrate) while Costa Rica is the biggest player for the fresh (FAOSTAT, 2008). The United States of America and Europe are the major importers of both fresh and processed pineapple (FAOSTAT, 2008). They are also the main consumers of the fresh pineapple with amount of 2.5 and 2.1 kg per capita per year, respectively (Vagnron et al., 2009).

Pineapple in Thailand

Pineapple (*Ananas comosus*.) has been introduced into Thailand for long time. There are some evidences stated that it was happened between 1670 and 1700. Thailand is the biggest pineapple producer in the world. In the year 2007, 2,815,275 tons of pineapples were produced in Thailand (FAOSTAT, 2007). The ten years average production of pineapple is around 2 million tons. 82% of pineapples in Thailand are for processing. A main product is canned pineapple which is exported around the world (FAOSTAT, 2008). Only 18% of overall production is consumed fresh (Anupunt et al., 2000). Very few fresh pineapples are exported. The export of fresh pineapple in Thailand has been limited by inconsistency in quality (Joomwong and Sornsrivichai, 2005). There are two main categories of the pineapples in Thailand which are 1) for canning industry and 2) for fresh consuming. The first category is the production of Smooth Cayenne cultivar "Pattavia" in Thailand. The main

purpose of this cultivar is for the raw material of the canning industry. The surplus from productions is marketed as fresh fruit (Anupunt et al., 2000). The Smooth Cayenne cultivar “Nanglae” and the Queen cultivars “Sawi”, “Phuket”, and “Trad Srithong” are primarily for fresh fruit consumption. The production areas of pineapple production in Thailand are located along the coastal of the country. The main area is in the province of prachuap Khiri Khan, around 300 kilometers south of Bangkok. This province is accounted for half of the pineapple production in Thailand (Sriwichailamphan, 2007). The other areas such as the area beside the gulf of Thailand (Rayong, Chumphon, Chonburi and Trat) and the area in the middle part of the country (Kanchanaburi and Ratchaburi) are also the big production areas. There are two harvesting periods of pineapple which are the winter and summer harvesting. The production of summer harvesting (April to June) is 3 times more than of the winter harvesting (October to December) (DOAE, n.d.). The winter pineapple is suitable for canning because fruit has a spherical shape, with big crowns, sour taste and pale flesh color while the summer pineapple provides high profit for the fresh consuming market because of high yield, big and heavy fruit.(Joomwong and Sornsrivichai, 2005).

Morphology of pineapple plant and fruit

Plant

Pineapple (*Ananas comosus*) is a perennial plant, whose terminal inflorescence gives origin to a multiple fruit (Eeckenbrugge and Leal, 2003). The main morphological structures of pineapple composed of stem, leaves, peduncle, crown, shoots and the roots (shown in annex 1). The major characteristics of the producing plant are: Average height and width of 1 to 2 m in the adult plant, the leaves have a concave form which allows the plant to collect water. Color of the leaves varies depending on the cultivar (usually green) (Medina and García, n.d.). The propagation of pineapple is done by the lateral shoots of the preceding crop, or with other vegetative propagates, such as the fruit crown, or, in many cultivars, slips produced along the peduncle (Eeckenbrugge and Leal, 2003). The quality and size of fruits will be decreased with the age of the plants. Most of large production fields allow plants to produce only two or three harvests. Lack of renovation produces decreased fruit size and lack of uniformity (Medina and García, n.d.).

Fruit

The fruit has a cylindrical shape with flat barrier of 2.5 cm diameter, pulp from pale to gold yellow. The soluble solids content near 13 % and 0.6 % of citric acid confers the fruit with a particular flavor that is widely appreciated for consumption either fresh or canned. The average weight of the fruit is 2.5 kg although there are important variations caused by the plantation density and handling (Medina J.D.L.C. and García H.S, n.d.). The pineapple fruit composes of shell, ovary, sepal and bract bases, the core, cortex of the core, and peduncle (shown in annex 2). The peduncle and inflorescence develop from the apical meristem, the diameter of which is suddenly increased until the initiation of the peduncle (Eeckenbrugge and Leal, 2003). The fruit’s shield can be divided into the upper half and lower half. The lower half of the shield is covered by the bracteal apex, which is bent upwards; the upper half is covered by the three sepals. External color and texture of bracts and sepals is quite similar (Medina and García, n.d.).

Quality Criteria

The quality of pineapple cannot be measured as the standard. The standard varies with consumer tastes and with ethnicity and may be related to price paid (Paull and Chen, 2003). According to Paull

and Chen (2003), the quality criteria of pineapple are classified as appearance, color, taste, aroma, flesh translucency, texture and fiber content. The skin color is the criterion that is used by the consumer in the fresh pineapple market. Consumers judge the physiological maturity and expected quality by the skin color of the flesh pineapple (Paull and Chen, 2003). The acidity and sugar level of the fruits are the measures of the flavor. Sugar level is measured by the total soluble solid or (TSS). It can be measured by the refractometer as the percentage of sugar (per 100ml of juice). The problem of the taste of pineapple comes from the effect of cultivar, season, maturity stage at harvest, position in the fruit, and fruit-development condition (Paull and Chen, 2003). The acid level is higher in winter season and sugar (TSS) is lower. This makes pineapple more acid taste. On the other hand, in the summer, the sugar (TSS) is higher while the acid level is lower which makes pineapple sweeter. TSS is reported to have highest correlation with taste-panel eating quality and suitable to the year round index (Smith, 1993).

The stage of maturity at harvest depends on the market that pineapple is transported to. Pineapple for domestic market is harvested at the fully ripe stage while unripe but mature fruits are for the export market (White, 1999). Maturity is important in eating quality of pineapple. The small difference in maturity of pineapple at harvest makes the large difference in eating quality and consequently to consumer satisfaction (Smith, 1993). The maturity at harvest is very important in non climacteric fruit such as pineapple. Figure 4 shows the relationship of maturity at harvest of pineapple and the eating quality. After the day 16, the eating quality of pineapple in green, ¼ color and full color drops while of the immature tends to increase but not reach the lowest level of two most matured.

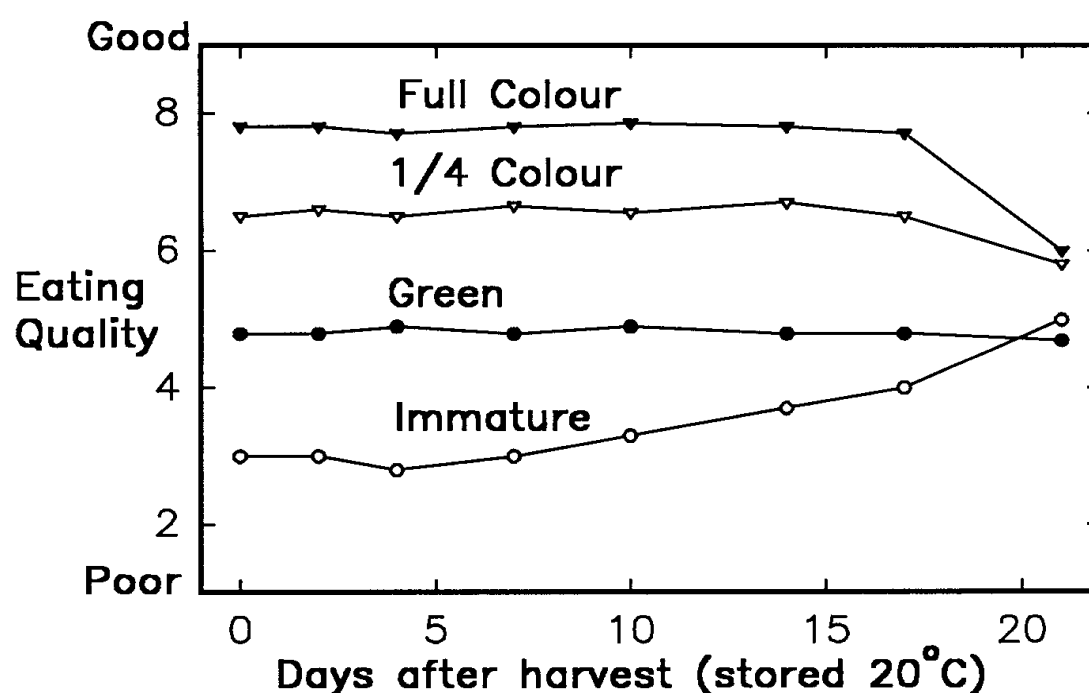


Figure 4: Change in pineapple (Smooth Cayenne) eating quality with time

Source: Smith, 1993

Fruit size and quality

Size of the pineapple fruit is another important criterion for both fresh eating and processing market. There are many factors that affect the size of fruit. The size of plant at forcing, fertilizer and density of the field are the important factors that will be described.

The size of fruit relies on the size of plant at forcing the flower. Each 1 kg of plant weight at forcing gives 1 kg of harvestable fruit (Paull and Chen, 2003).

Fertilizer provides nutrient to the plant in order to support the growth of the fruit. Nitrogen is very important to the growth of pineapple fruit. Many tropical soils contain small amounts of nitrogen, so meeting crop N requirements is an important and challenging task (Malezieux E. and Bartholomew D.P., 2003). Too much nitrogen gives bad effects to the size and quality of pineapple as well. The high nitrite level of pineapple will have the reaction with the tin of the can. This makes the product unacceptable (Hepton A., 2003). Moreover, too much nitrogen fertilization can lead to an increase in number of fruit with double crowns and percentage of plants with collar of slips (Paull and Chen, 2003).

Average fruit weight decreases linearly with increasing density. Both environment (solar radiation) and nutrition influence plant growth and the competition between plants for available resources (Hepton, 2003). Beside from the size of the fruit, there are other factors that affect farmers in choosing the density of the planting. The optimum density for a given farm or region and variety must be determined by the available technology, environmental resources and market requirements (Hepton, 2003).

Fruit availability

Pineapple fruit can be harvested year round. The period of harvesting depends on the time that the plant is forced to first flower. The total period from forcing to harvest ranges from 155 to 300 days (Paull and Chen, 2003). This planning can give benefit to the grower in Thailand in solving the oversupply problem and the uniformity problem in the quantity of pineapple that generally occurs every year.

2.2 Quality problem

The quality problems of pineapple can be classified in to the problem in production, uniformity problems in quality and quantity, and the unreached standard of pineapple. These three problems are stated in the following section. The solutions to each problem are also included.

2.2.1 Problems in Production

2.2.1.1 Problems in Growing

Growing pineapple commercially requires large capital investment in land and processing facilities. This leads to the long-term monoculture. The long-term monoculture contributes to severe nematode problems which make damages to the production (Rohrbach and Johnson, 2003). The pineapple pests, diseases, and weeds occur at different times in the pineapple lifecycle and have various impacts. Figure 5 and 6 show the stages that the diseases occur in the lifecycle from the seeding to the consumer.

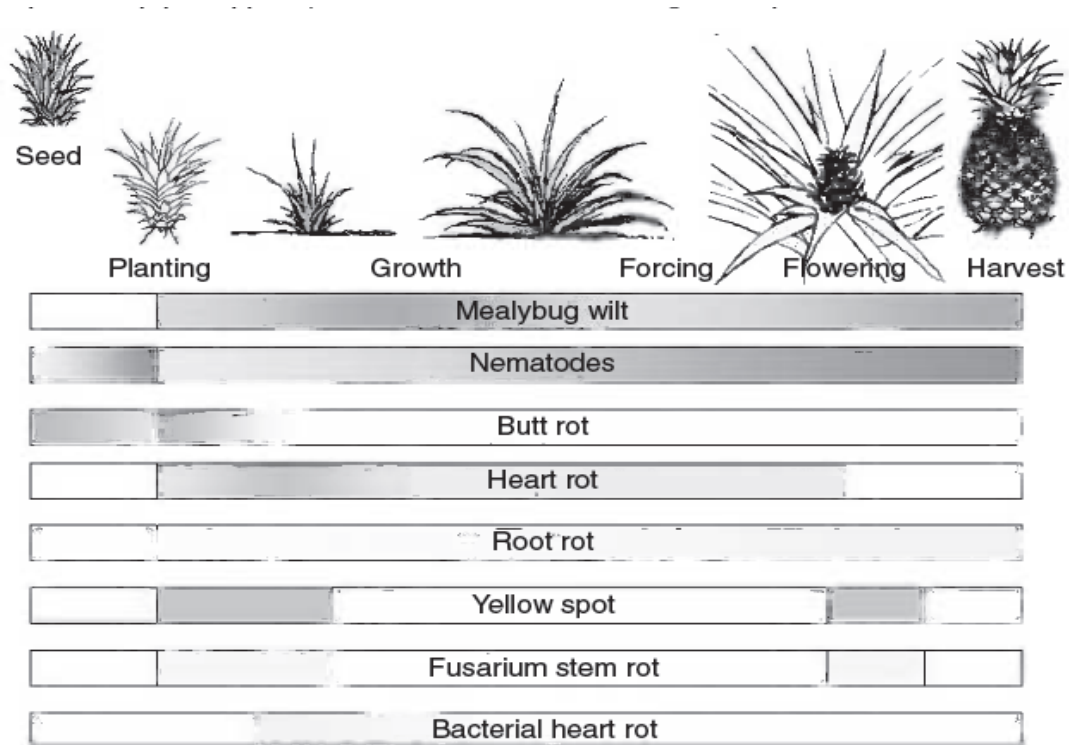


Figure:5 Illustration shows typical disease intensities of the most significant pineapple diseases in relation to a plant-crop pineapple cycle. Darker areas indicate higher intensities.

Source: (Rohrbach and Johnson, 2003)

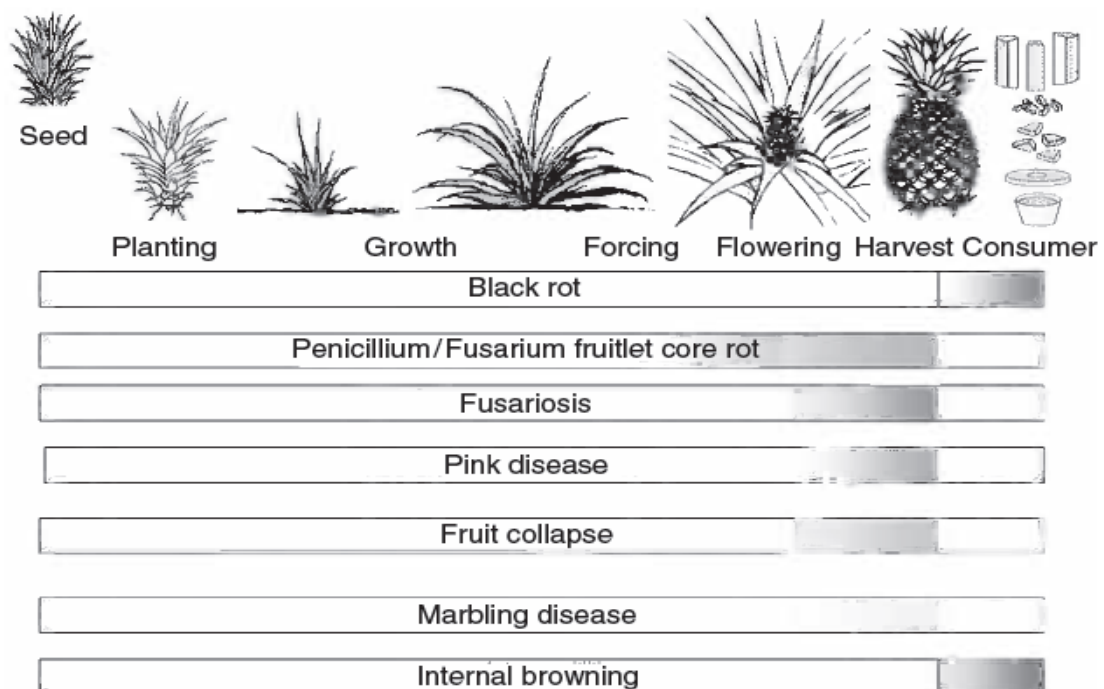


Figure 6: Illustration shows typical disease intensities of the most significant pineapple diseases in relation to a plant-crop pineapple cycle. Darker areas indicate higher intensities.

Source: (Rohrbach and Johnson, 2003)

In order to have better understanding of each pineapple disease, the detail will be described in the order according to the figure 5 and 6

Mealybug Wilt Disease

Mealybug wilt of pineapple is known to occur in most of the tropical and sub tropical area of the world where pineapples are grown commercially (Sulaiman, 1997). The characteristic symptoms of the disease are drying and wilting of the leaves commencing from tips downwards, accompanied by reddish yellow color of the wilting plant (Singh, 2004). The pineapple wilt virus (PWV) is transmitted successfully by species of mealybug. Small ant and bird is also the carrier of this virus (Singh, 2004).

Nematode

There are several species of nematodes that cause most damages to pineapple which are the root-knot nematodes, the reniform nematode and the root-lesion nematode (Rohrbach and Johnson, 2003).

Root-knot nematodes

The most obvious symptom of root-knot nematodes on pineapple is the terminal club shaped gall resulting from infection of root tip. Less obvious symptoms include stunting of plants and water stress, with the terminally galled root resulting in poor plant anchorage (Rohrbach and Johnson, 2003).

Reniform nematode

The reniform nematode causes stunning of plant growth like the root-knot nematode. The infected plants appear to be under water stress, as in drought, mealybug wilt or root rot. In contrast to root-knot nematodes, the plants infected with the reniform nematode is more stable because of the lack of terminal galling (Rohrbach and Johnson, 2003). The primary root is still growing but the secondary one is severely limited (Rohrbach and Johnson, 2003).

Root-lesion nematodes

The lesion-root nematode will leave the black lesion on the root of the plant as they move for feeding. Root and root hair of pineapple plants are also destroyed which leads to the severe damage. The pineapple life can be ended by this kind of nematodes (Rohrbach and Johnson, 2003). The optimum soil temperature for the root nematodes is 25-30 degree Celsius which is the normal temperature in Thailand.

Butt Rot

Butt rot or top rot of pineapple can occur when the pineapple is grown, due to the infected seed materials. The causal fungus, *C.paradoxa* not only spreads on the pineapple, but it also infects the other plants which lead to the different diseases in various fruits. The symptoms of butt rot are a soft rot and blackening of the basal portion of the stem tissue of the seed material (the crown of pineapple) (Rohrbach and Johnson, 2003). Normally, the severely rotted seed will be discarded, but the moderately rotted seed will normally be grown which leads to the slow growth. It is because of the loss of stem tissue which contains carbohydrate reserve and initial roots (Rohrbach and Johnson, 2003).

Heart Rot

There are two types of the heart rot which are fungal and bacterial heart rot.

Fungal heart rot

Fungal heart rot is disease associated with wet environment condition. The plant mortality leads to the reduction of plant density which results in the economic impact to the farmer. The initial heart-rot symptoms are the failure of the young leaves to elongate. The yellowing to bronzing of the young leaves will follow. They may lean on one side of the plant. A slight pull of the symptomatic leaves will remove them from the plants (Rohrbach and Johnson, 2003).

Bacterial heart rot

The symptom of bacterial heart rot is almost the same as the fungal heart rot. It can be distinguished from those of fungal one by the extension of the infection into the mature green areas of the leaf. The infested fruit juice seems to be the source of spread rather than the seed because bacteria do not survive long on the leaf. They need food to survive. There are many ways of transmission of this disease. For example, in Philippines, the pineapple tarsonemid mite has been associated with bacterial heart rot. The mite leaves the wound after they bite on the pineapple plant. This mechanical wound is the entrance for the bacteria to get into the plants. On the other hand, in Australia, the urease in dirty water breaks urea down to NH_4OH , which causes burn and provides the entry for the bacteria (Rohrbach and Johnson, 2003).

Root Rot

The initial symptoms of root rot are a reduction or elimination of growth, the leaf margin becomes yellow and the leaf becomes red. The yield of the plant becomes low. Root rot symptom development is relatively slow when compared to heart-rot symptoms. If the infection occurs in the dry soil condition, the plants may become reddish like when the plants are under severe drought stress. Moreover, plant anchorage in the soil is very poor following loss of roots (Rohrbach and Johnson, 2003).

Yellow Spot

Yellow spot or the tomato spotted-wilt virus always kills the pineapple plants. The initial symptom is a slightly raised yellowish spot, with a darkened centre on the upper surface of the leaf. Shortly after formation of the initial spot, a characteristic chain of a secondary spots develops and progresses into a basal leaf and stem rot (Rohrbach and Johnson, 2003). The rotting on one side of stem causes the plant to bend severely and eventually kills the entire plant. The yellow spot can also occur on the crown of the pineapple. The infection can come from the adjacent weed hosts, leaving the virus in the tissue of pineapple.

Fusarium Stem Rot

The disease is associated with the fruit-rot phrase termed 'fusariosis'. Stem infections of seed material occur at leaf bases, with resulting in reset and/or curvature of the plant. It is because the stem is griddled or killed (Rohrbach and Johnson, 2003). The infection can occur on developing slips and sucker after the fruit is infected. The soil can remain infested for several months, especially in dry soil. It can be spread by wind and insects. The optimum temperature for growth of this fungus is 25 degree Celsius with a range of 5-35 degree Celsius (Rohrbach and Johnson, 2003).

Penicillium/ Fusarium fruitlet core rot

The fungi that cause the FCR are *Penicillium funiculosum* and *Fusarium subglutinans*. The fruitlet structures affected by the infection are tissues surrounding nectary ducts and seed cavities (Petty and Tustin, 2006). They also claimed that nectar may be both secreted and reabsorbed from nectary duct openings into the blossom cups. Re-absorption, under stress condition, permits penetration by pathogens. The infection can occur easier via the cracking of blossom cups, which is the results of moisture stress and the rain- fall during final fruit enlargement (Petty and Tustin, 2006). The insect and mite play roles in the development of black spot.

Pink disease

Pink disease directly affects the processing industry of pineapple because the pineapple will become pink when it is heated. Four bacterial isolates representing three genera, *Gluconobacter*, *Acetobacter*, and *Enterobacter* caused pink disease of pineapple fruit (Rohrbach and Pfeiffer, 1976). Each kind of bacteria gives difference symptom in the infected pineapple. *Gluconobacter* –type symptom gives “cantaloupe-like” aroma and light to bright-pinkish color to the raw fruit. *Acetobacter* type was characterized by no aroma and a light- to dark-brown color while *Enterobacter*-type does not give any character before heating (Rohrbach and Pfeiffer, 1976). In fresh fruit production, low level of pink disease is not a major economic important (Rohrbach and Johnson, 2003).

Fruit collapse

Fruit collapse is caused by *E.chrysanthemi*. Insects such as ants, beetles and flies are vectors of bacteria, transporting them to flowers from collapsed fruit (Rohrbach and Johnson, 2003). The symptoms of Fruit collapse are usually on fruits, 2-3 weeks before ripening. The infected fruit will have juice and gas released out. It can be noticed by the bubble that occurs (Rohrbach and Johnson, 2003).

Marbling disease

The infected tissue generally becomes hard, granular, and brittle in texture, with color variation in the form of speckling (Rohrbach and Johnson, 2003). The disease always affects the group of fruit or the entire fruit in the field. In production areas such as Thailand, where disease incidence is high, from 5 to 20% of the slices in the cannery will be marbled. The incidence and severity of marbling in October and November can be high enough to close down processing operations. Smooth Cayenne has a moderate resistance to this disease. When the disease occurs, the infected fruit can be detected by external appearance and a test to measure fruit firmness (Rohrbach and Johnson, 2003).

Internal browning

The internal browning occurs with the exposure of fruit to low temperature. The disorder is also very important in the marketing of fresh fruit when refrigeration is used to extend shelf life. Low ascorbic acid and increasing in polyphenol oxidase activity are the factors of internal browning. The small grayish translucent zone at the base of the fruit is the beginning of the symptom. When symptoms are severe, the entire fruit will become black or brown (Rohrbach and Johnson, 2003).

These are diseases that can occur on the pineapple plant and fruit in the period of growing which affect both the quality and yield of pineapple. There are many methods that can be used to protect and solve these problems. The controlling methods are stated in the next section.

2.2.1.2 Solution of problem in growing

Management of pests and disease on seed material

In order to prevent the establishment of insects and pathogens in newly planted pineapple, the seed material must be clean of pest and disease. There are many methods to make the seeds free of the contamination. In order to implement the effective control, the mealy bugs, scales and mites must be monitored at the seed source before transporting for planting. Scale and red mite can be controlled by oriented the seed in the vertical position that the seed can get the rainfall or dew. It is because red mite will become the problem only when the seed is stored in the dry condition. It can also be controlled by methyl bromide fumigation of the seed material (Rohrbach and Johnson, 2003). Butt rot can be controlled by harvesting seed material during dry weather and curing it on the mother plants, where there is good air circulation.

Early root-health management

The pineapple nematodes can be easily and economically controlled at the first stage of pineapple plant growth by the soil fumigant 1, 3 dichloroprene, 1, 2-dichloro-propane (DD). There are other methods of nematode management for pineapple, such as cover crops, crop rotation and host plant resistance (Rohrbach and Johnson, 2003). The root knot, reniform and root-lesion nematodes have wide range of host, so the crop rotations are value only if crop susceptibilities are known. The root rot can be controlled by the good management soil water management. The surface water drainage, deep cultivation and raised bed should be well managed (Rohrbach and Johnson, 2003). Mealybug wilt is readily managed by controlling ant and protecting mealy bugs. The use of bait stations increases the efficiency of insecticide use and reduces environment impacts (Rohrbach and Johnson, 2003).

Management of heart rots

Before the widely use of the modern fungicide, the basic traditional method that helps to improve soil drainage is used. Raised bed, cutting of ditch or filling to eliminate standing water can reduce the level of disease. The pineapple trash mulch have generally, but not always, increased disease incidence (Rohrbach and Johnson, 2003). The recent method of heart rot control can be done in many ways. Seed dipping, foliar applications, pre harvest and modified cultivar can be used. It depends on the available of the equipment that the farmer can afford. The important factor that can control the heart rot disease is the sanitation. It helps to reduce the initial low incidences of bacterial heart rot from causing an epidemic (Rohrbach and Johnson, 2003). The infected plants and seeds should be eliminated. Moreover, the crown or slips from the area that has high incident of fruit collapse should not be used.

Management of bacterial disease through flowering to harvest

Insecticide is used to control the insect vector of pink disease. In Phillipines, pink disease epidemics are seasonally predictable. The disulphoton is applied in the red-bud stage with three additional applications at 5 days intervals. This results in high levels of control (Rohrbach and Johnson, 2003). Fruit collapse and pink disease can be controlled by application of ethephon to inhibit flower opening

and reduce nectar flow (Rohrbach and Johnson, 2003). Sanitation is the important factor to reduce the initial bacterial load on the plant. The infected plants and fruits should be eliminated.

Integrated pest management

The Integrated pest management (IPM) is the combination of several techniques to solve specific pest and disease problems for long term rather than short term. The success of this technique relies on an in-depth understanding of pineapple production system, ecology and biological of each pest and disease (Rohrbach and Mau, 2003). The IPM can be applied to solve many production problems that occur during the growing of pineapple. Ants, mealybugs, mealybug wilt, nematodes, heart rot, root, butt rot, and black rot can be solved by this mean of management (Rohrbach and Mau, 2003). The example of method of IPM is the controlling of the mealy bug wilt on pineapple. Ants play a major role in the impact of mealybug and mealybug wilt on pineapple. The rate of establishment of colonies of ant and mealybug is slow, so the soil tillage can eliminate ants and mealybug that cause the problem.

2.2.1.3 Problems in harvesting and postharvest technology

Pineapple is non climacteric fruit which means it does not continue ripening after harvest. Although the fruit is harvested when it is already ripened, there are still some chemical changes occurred. Therefore, the quality of product is affected by these changes.

Postharvest changes related to fruit quality

Pigment change

The ripening and senescence of the fruit on the plant is heralded by the decrease in shell chlorophyll (Paull, 1993). In the last 10 days before fully ripeness, the amount of chlorophyll decreases while the amount of carotenoid keeps increasing. This leads the flesh of pineapple become yellow when it ripe. Although the mechanism of chlorophyll and carotenoid still continues after fruit is harvested, the little effect on rate of shell degreening and carotenoid synthesis occurs (Paull, 1993).

Respiration

Pineapple has a moderate respiration rate, producing around 22 ml CO₂ kg⁻¹ hr⁻¹ at 23 degree Celsius (Paull, 1993). Ethylene production only affects the degreening of the pineapple shell but not the inner content of the fruit (Kader, 2009).

Development change

There are many changes of chemical substances in pineapple after harvesting; acid content, total soluble solid, and phenol compound. The titratable acidity declined during storage of harvested pineapple (Paull, 1993). On the other hand, the sugar content of pineapple keeps increasing after harvest. As Paull and Chen (2003) argued in his article that fruit sugars continued to increase through to senescence, unless the fruit is harvested. These changes in the acid and sugar content make pineapples after harvest sweeter and less sour. The content of phenol compounds in pineapple decreases when the chilling injury occurs.

Not only the changes in fruit after harvest have impacts on the quality of product, but also the problems that occur during harvesting and postharvest handlings. The list of these problems is described below.

2.2.1.4 The problem that occurs in harvesting

Fruit bruising

The fruit bruising is the major problem during harvesting and packing. The bruised flesh appears slightly straw colored and become lead-grey with time (Paull and Chen, 2003). A 30 cm drop is able to cause some damages. They occur during the unloading and grading of pineapple. The bruised area leads to leakage of cell contents and provide opening for disease organisms (Paull and Chen, 2003).

Black rot

Black rot is the major worldwide pineapple postharvest disease. The disease starts at the harvesting phase. The pathogen enters the fruit through the broken peduncle, other wounds or natural opening in the fruit shell. Disease development can be delayed by keeping the fruit in cold storage, but once the fruit is taken out of storage and is put on the display shelves, the disease progresses rapidly (Reyes et al., 2004).

2.2.1.5 Postharvest problems

Mechanical Injury

As pineapple has tender texture and high moisture content, they are very susceptible to mechanical injury. Poor handling, unsuitable container, improper packaging and transportation can easily cause bruising, breaking, impact wounding, and other forms of injury (Liu, 1999).

Postharvest chilling injury

Chilling injury is called differently in each country. The internal browning is the most common term used. The symptoms of chilling injury include 1) wilting, drying and discoloration of crown leaves; 2) Failure of green-shelled fruit to yellow; 3) Browning and dulling of yellow fruit; and 4) internal flesh browning (Paull and Chen, 2003). The chilling injury can occur in the field when developing fruit are exposed to cold temperature (5-10 degree Celsius). The symptoms will develop when fruits are removed from refrigeration and held at an ambient temperature for 2 or more days (Rohrbach and Phillips, 1990). Post harvest wax dipping can be applied to prevent this damage (Rohrbach and Phillips, 1990).

Moisture Loss

Pineapple is considered as the fruit that has high rate of moisture loss after harvested. 6-8% of their fully turbid initial weight begins to show sign of weight loss (Paull, 1993). The moisture loss occurs at lenticels, stomata, and the cuticle of the skin in fruits with a large surface area (Paull, 1993).

Flesh translucency

Flesh translucency is a physiological disorder of pineapple fruit which flesh shows water soaking with low porosity. The intercellular free spaces in translucent fruit flesh are filled with liquid which reduces the porosity and light scattering ability of the tissue, making it translucent (Chen and Paull, 2001). The problem of translucent fruit is the susceptible to disease due to the fragility and prone to mechanical damage during harvest and postharvest handling. This can lead to an unsightly dark bluish

gray *Penicillium* growth in postharvest (Chen and Paull, 2001). The high translucent pineapples also have a sensory problem. Highly translucent fruit has flat and off-flavor.

Sunburn

Pineapples are susceptible to be damaged from solar radiation and high temperatures at various stages during the growing cycle. Sunburn is common during hot ($> 32^{\circ}\text{C}$) period of the year. Internal sunburn, thought to be the result of high air temperatures (Bell et al., 2006). Symptoms of solar damage in mature pineapple fruit include external sunburn or bleaching and internal sunburn or “boiling”. Pineapples with external sunburn show a bleached, yellow-white skin that turns pale grey/brown upon damage to the tissue underneath. These damaged areas are susceptible to disease infection and render the fruit unfit for commercial use. Internal sunburn cannot be detected without cutting open the fruit. Highly translucent fruits appear to be most susceptible to internal sunburn (Bell et al., 2006).

Malformations

The mutation of fruits usually occurs when the flower induction is in high temperatures or too succulent vegetative growth prior to forcing (Paull and Chen, 2003). In the plant that is found to be malformation, fruits should not be sold and the crown should not be used for planting.

Deep eye

Deep eye is the symptom that the seed cavity turns firm and brown and the tissue becomes leathery or corky. It can be caused by the natural opening into the cavity, failure of the carpels to close during development, chemical burns or insect (Paull and Chen, 2003).

Shell surface pitting

Shell surface pitting often occurs where a heavy dew or light shower moistens the fruit. It occurs on the sepals and bracts of fruit. The shell surface pitting also extend into the fruit but not more than 6 mm and causes the affected tissue to shrink (Paull and Chen, 2003).

Parasitic disease

Pineapple has plenty of moisture and nutrients that support microbial growth. This helps the microorganism to invade and spread quickly in fruits. Moreover, the fruit does not have much defense mechanism to protect them from invasion. The control of parasitic disease is hard because the use of pesticide is rarely allowed in the postharvest stage. This is due to the consumer concern for food safety (Liu, 1999)

Oversupply of product

The demand and supply of pineapple is always not equal. Oversupply of pineapple often occurs in Thailand and leads to the problem for farmers. In the worst case, farmer does not harvest the matured pineapple and leave them rotten in the field (Liu, 1999). The consequence of this problem also leads to the problem in the production in the following season. The insect such as mealy bug and scale will dwell in that rotten pineapple and make damages for the next season growing.

2.2.1.6 Solution to post harvest problems

Postharvest fungicides and waxing

After harvested, fruits are dipped or sprayed with fungicide. This application can control postharvest fruit rot, caused by the fungus *Chalara paradoxa* (Paull and Chen, 2003). Waxing is another method for postharvest of pineapple. The major advantages of waxing are to reduce the internal browning symptoms of chilling injury, reduce postharvest moisture loss, and improve appearance (Paull and Chen, 2003).

Postharvest storage

The recommended condition for storing of pineapple is the range of 7.5-12 degree Celsius with relative humidity of 70-95%. The more humidity leads to less moisture loss (Paull and Chen, 2003). Quarter yellow fruit at harvest gains about 1 additional week of storage for every 6 degree Celsius decrease in storage temperature. Half-ripe 'Smooth Cayenne' fruit can be kept for 10 days at 7.5-12.5 degree Celsius and still has a week of shelf-life with no internal browning (Paull and Chen, 2003).

2.2.2 Problem in the uniformity of quantity and quality

2.2.2.1 Uniformity of pineapple's quantity

- **Fluctuation of price**

The problem in uniformity of production mainly comes from the oversupply of the produces. This leads to the fluctuation of price that affects the production of pineapple. Sriwichailamphan et al. (2008) argued that Thailand's pineapple production has fluctuated widely. These fluctuations can be explained to a large extent by changing prices: low prices in 1997 induced farmers to shift to other crops, resulting the following year in a very high price at the farm gate. As a response, farmers expanded the planted area leading to increased pineapple production and relatively low average prices in the years 1999-2001. This again triggered farmers to reduce the planted area. The fluctuation of price also leads to the low quality of pineapple because farmers are not motivated to take care of the production (NFI, 2008). This can be seen in table 2. The price and producing amount of pineapple in Prachuap kiri khun, the main production area of Thailand, shows that in one to two years after the fluctuation of price leads to the fluctuation of pineapple production. This is because farmers turn back to take care of the pineapple plants by applying the chemical in forcing to flower. After applying the chemical, the fruit will be available to be harvested in 6-7 months. Moreover, some farmers that changed to grow other crops also come back to grow the pineapple plants. This will take one year to grow the plant before it is ready to be applied with the chemical.

Year	Average production per day (ton)	Price (Baht)
1996	1994	3.03
1997	1932	3.55
1998	1619	5.49
1999	3500	2.46
2000	2808	2.12
2001	2340	2.39
2002	1789	4.43
2003	2768	4.04
2004	3039	4.57

2005	2952	3.85
2006	4446	2.68
2007	2782	4.93

Remark: represents the low price and production represents the high price and production

1 euro = 50 baht

Table 2: Price and production amount of pineapple in Prachaup kiri khun
Source: Department of internal trade, Thailand (2010).

2.2.2.2 Uniformity of pineapple's quality

Causes of problem in uniformity of pineapple's quality

The manufacture, supermarket and export market need products that have uniformity and high quality. Pineapples must meet certain quality standards for size, color, weight, and sugar/acid content (Takane, 2004). Exporters and supermarket frequently rejected to buy pineapple from the smallholders' produce because of low and not uniform quality. The factors that lead to the quality and uniformity problems are listed below;

Size of the farm

The export market and supermarket chain in Thailand requires bulk and consistent supply of produce. The foreign markets demand large quantities of produce in a timely manner throughout the year. The supplies of produce must also meet the quality and safety standards. Therefore, the whole production and marketing processes need to be carefully planned to assure the required quality, quantity, and timing of supply (Takane, 2004). This makes the exporter more preferred on sourcing the pineapple from the large farm with the capability to produce high and consistent in both quality and quantity. The sourcing from small holder is the last choice for the exporter because of the high cost of transportation from various growers and high risk of the unavailability of the required quality pineapple (Takane, 2004).

Lack of capital to invest in improvement

As the main producer of pineapple in Thailand is the small scale farmer, the capital that is used in improvement is low. In order to improve level and uniformity of quality in the product, the technology in both growing and postharvest must be applied. The producer requires a large amount of capital investment to purchase farm inputs such as expensive machinery. This may work against smallholders who lack capital or have little access to credit markets (Carter et al., 1993).

Information Asymmetry

The demand of the customer, retailer, processor, or the exporter is the important information that is needed to transfer to the producer so that the producer can improve or adjust the production to the demand. There is an information asymmetry between the smallholders and exporters regarding product. The worse case for the export market is the asymmetry of information regarding health and safety requirements in the importing countries, specifying which and what quantities of chemicals are permitted in the production process (Takane, 2004). This is so difficult for the smallholders to obtain. The lack of production information works against the smallholders, resulting in frequent rejections of low-quality pineapples by the exporters (Takane, 2004). Moreover, the smallholders usually lack

knowledge about cultivation techniques (such as timing and frequency of chemical use) to assure the export quality standards of the produce (Takane, 2004).

2.2.2.3 Solution to problems in the uniformity of production and quality

Sorting and Grading

Sorting and grading is one of the measures that can be applied after harvesting in order to classify fruits into the desired requirements. Fruits with any sign of defects such as any signs of fresh mechanical damage, diseases, and the damage that occurs in the growing and harvesting stages will be removed. Remaining pineapples are classified for packing based on size, stage of ripeness, and, if applicable, shape. Fruits of different shape may not be mixed in the same carton (Medina and Garcia, 2010). This grading standard depends on the requirements of consumers. Before sending products to the customer, this method should be done so that the product will be more uniform.

Chemical forced to flowering and ripe

Although pineapple can produce the flower and fruit all year round, forcing to flower is the effective way to make the production volume consistent. Pineapple can be done by using inexpensive chemical, calcium carbide (CaC₂) and Ethyphon. Lin et al. (2009) stated that synchronization of flowering is an important aspect of pineapple cultivation. Through the use of ethyphon forcing, flowering can be induced in pineapple throughout the year. Farmers can choose the period of harvesting by applying these chemical in the desired period for flowering. This measure is one of the help that can be used to manage the problems of shortage and oversupply.

Stabilization of price

One of the causes of the uniformity problem in pineapple's production is the fluctuation of price. When the price of pineapple is high, farmer will grow and harvest their product to make profit. On the other hand, when the price drops, farmers will not have inspiration to produce or improve the quality of their product. Some farmers do not harvest pineapple even it is extremely matured. Stabilization of price is needed to solve this problem. The cooperation between farmers, processors and the government is needed in negotiation to set the fair price and quality for all actors.

Planning of production

By making a plan for the production, farmers will not grow or force pineapple to flower in the same time. According to GAP of pineapple in Thailand, the advice is given to farmers to plan the production to avoid the oversupply of product (DOA, n.d.). The planning includes planning with other farmers and the processing plant. By getting rid of the oversupply of pineapples, the problem in fluctuation of price will be solved and the uniformity of pineapple's quantity will be better.

2.2.3 Standard for pineapple

Pineapple in Thailand can be sold both to the processing factory and the fresh consuming market. The standards for these markets are difference because of difference mean of uses. The standard for fresh consuming market is mainly based on the safety of the consumer while the standard for processing factory is less intensive in this topic. The details of both standard for fresh consuming market and processing factory are shown in this chapter.

Standard for fresh consuming market

Fresh pineapple in Thailand has many distribution channels. It ranges from the local fresh market to the international market. In the domestic market, the traditional fresh markets play the most important role in the fresh fruit and vegetable section. The traditional distribution system for fresh vegetables in Thailand is mainly through so-called “wet markets” that still control about 75 percent of food sales (Ruben et al., 2007). This is the culture of people in Thailand that belief in freshness of food in the wet market. Nowadays, the lifestyle of people in Thailand especially in Bangkok has changed. The rapid growth of the economy leads to a strong expansion of supermarket outlets and convenience stores (Ruben et al., 2007). These supermarket chains developed their own standard for the fresh fruit and vegetable to be the premium standard in order to distinguish their product from the product in wet market. Ruben et al (2007) argued that supermarkets started to develop more integrated supply chains for safe (“hygienic”) and premium quality fruits and vegetables that guarantee higher retail margins. Therefore, there are two standards that are used in the domestic market of pineapple in Thailand which are the standard for the traditional “wet” market and the supermarket standard.

Standard for supermarket

The standard for supermarket is stricter than the one used in the wet market. It is mainly required by the retailers themselves. There are three standards that are used in supermarket in Thailand which are;

- **Codex Alimentarius**

The Codex Alimentarius is the standard that solely focuses on the product itself. The quality and characteristic requirement of product is set which includes quality, maturity, classification, size, tolerances, presentation, marking or labeling, contaminants and hygiene. The detail of Codex Alimentarius is shown in the Annex 3

- **Good Agricultural Practice (GAP)**

The GAP in Thailand is promoted by the department of agricultural in order to help farmers to have better production and yield of harvest (DOA, n.d.). The GAP does not measure on the quality of the product but on the process that product is produced or grown. The good agriculture practice can be the assurance for good quality and uniformity of the products. These products will pass the quality standard’s requirements. The defect can be found but it will be rejected in the postharvest stage before trading to customers. The aim of GAP is to guide farmers to grow crops that have good quality according to the required standard and high yield. Moreover, the method of growing must be safe to the farmers and consumers. The resource must be well utilized and environmental friendly
As mentioned before that GAP concerns on the method of producing of crop, there are five main topics that are mainly focused in this practice (DOA, n.d.);

- 1) Growing
- 2) Caring
- 3) Pest Control
- 4) Postharvest Technology
- 5) Recording and tracking

The full detail of each topics in the GAP are shown in Annex 4

- **Food Safety assurance program (Maximum Residue Levels)**

The maximum residue levels are the maximum allowed concentrations of pesticide residues in or on food products. The aim of this standard is to ensure that pesticide residues in foodstuffs do not

constitute an unacceptable risk for consumers (CBI, 2009). The MRL of one pesticide may vary depending on the crop it is used. For instance, the MRL of a certain pesticide on apple can differ from the MRL of that same pesticide on pineapple (CBI, 2009).

The MRL of pineapple is shown in the table 3

Pesticide	Level	Unit
CARBENDAZIM	5	mg/kg
DIAZINON	0.1	mg/kg
DIMETHOMORPH	0.01	mg/kg
DISULFOTON	0.1	mg/kg
ETHEPHON	2	mg/kg
HEPTACHLOR	0.01	mg/kg
METHIDATHION	0.05	mg/kg
PROPICONAZOLE	0.02	undefined
TRIADIMEFON	5	undefined
TRIADIMENOL	5	undefined

Table 3: MRL of Pineapple

Source: FAO, 2009

Standard for processing factory

The standard for the processing factory is the main focus for this research because the majority of pineapple production in Thailand is for processing. The pineapple for processing plant has the standard that is set by the government (Department of Agriculture Extension). The standard is used as the reference for the manufacturer although it is not exactly the same standard that is used in every factory. This depends on the final market of that manufacturer and the private standard that they apply. The standard for the processing plant classified as 1) Minimum requirement, 2) Classification, 3) Size specification, 4) Provisions concerning presentation, 5) Sales Document, 6) Contaminants, 7) Hygiene, and 8) Sampling and Analysis procedures. The main concerns of the standard for the processing factory are the size, maturity, contamination, and nitrite level of the fruit. The details of each topic in this standard are shown in Annex 5.

Causes and solutions of the problem in unreached standard

The causes of unreached standard of pineapple are the same as the causes of the problem in uniformity of pineapple. Lack of knowledge to use and capital to invest in production are the causes that make the problem of unreached standard occur. There is another cause that is important for this problem which is the uncertainty in using the standard of the processing plant. This cause will be reviewed in the empirical study in Chapter 5.

The technical solution to the problem of unreached standard can be the standardization of the production. There are many standards that improve the product's quality. GAP is the measure that improves the production method in the farm which leads to the better quality of the product (DOA, n.d.). By applying GAP to the farm, the product will have better quality and reach the required standard of the processor. There are other standards that can be applied in order to improve quality of the product depending on the required standard of the processing plant. Codex and food safety assurance program are examples of standards, which may be required by some market that can solve

quality problems. The solution to the cause originated from the processor will be explained in the next chapter.

2.3 Conclusion

In conclusion, data from this chapter can be used as part of the answer on the research question A on “What are the quality problems that occur in the tropical fruit supply chains for domestic and export market?” The quality problems described in this chapter is used in the questionnaire for figuring out what the real quality problems that happen in the pineapple production in Thailand are. Therefore, the combination of data from chapter 2 and 4 must be used to answer the question A. The information in this chapter also explained the causes of quality problems and point out the actors that the quality problems happen on. These are the answer for the questions A1, A2, and A3 which are;

A1) What are the quality problems that occur in pineapple production?

A2) What are the causes in the quality problems?

A3) Where is the cause of quality problems in the supply chain?

After the quality problems of pineapple are described, the technical solutions for the problem are also given. This can be used as the part of answer for the research question B, “What are the solutions for quality problems that occur in the tropical fruit supply chains?” The data in the chapter can also be used to answer sub question B1 and B2;

B1) which types of solution are matched to the problems?

B2) in which stages of the supply chain can the solution be applied?

- Technical
- Organizational
- Institutional

The quality problems of pineapple in Thailand could be classified into three main parts: the quality problems in the production, the uniformity problem of product, and the standard of pineapple is not reached.

For producers, the quality problems in production can be classified into three main stages; growing, harvesting and post harvesting stages. Disease of pineapple is the major cause of the problems in growing stage. It also plays important role in the harvest and post harvest stages of the production. Another cause of the problems in growing stage is the low input used by the farmer. Moreover, Lack of knowledge and skill is another cause of the problem in production. The chemical and biological changes can occur with this kind of perishable fruit. Environment also affects quality of product in the post harvest stage. There are many measures that can be applied in order to solve the quality problems in these three stages. For example, the measure or management on disease of the product and the post harvest treatment. The list of them is described in the chapter. Even when measures are known by farmers, the method of applying is hard for them to be done lonely without any help from the producer organizations or other organizations.

On the other hand, the uniformity problems of products can be divided into the uniformity in quality and quantity. The causes of the uniformity problems can range from the poverty problems to the

technical problem of pineapple. Small size of farm, lack of capital to invest, information asymmetry and fluctuation of price can describe the causes of the uniformity problem in product in the economic term while the uncertainty in ripeness of pineapple and lack of good planning can be the technical causes of this problem. The solution of these problems on the technical term can be done by using the chemical to force the flowering, sorting and grading, and good planning for production. On the other hand, the solution to the economic aspect can be found in the roles and functions of producer organizations (Chapter 3).

Unreached standard of pineapple by the farmer is another consideration that becomes the quality problems. Due to the standard is required by the processing factory, the farmer needed to improve their farms and products to reach the standard. In order to reach these standards, help must be provided by either the PO or the governmental organizations. Not only the technical knowledge that farmers should get, but also the supports in the economics/ business are needed. The technical solution of this problem is the standardization of the production. There are many standards that can be applied on the production to improve the quality of product. The good example is the GAP which improve the production step.

The information described in this chapter is used in formulating the questionnaire for the interviews. In the first part of the questionnaire, questions are about the quality problems and causes that occur. The reviewed literature on the quality problems in production (all 3 stages), uniformity problems, and the unreached standard of pineapple for processing factory are used.

Chapter 3: Producer organization and the role in improving quality of products

3.1 Introduction

The purpose of this chapter is to identify the potential roles of producer organizations on solving the quality problems that could occur in the production of pineapple in Thailand. The stage and development of POs are also reviewed in the chapter. Moreover, the producer organizations in Thailand are reviewed and described in the later part of the chapter. The information from this chapter can be used in answering the research question C “How can POs help to solve the quality problems?” The sub questions C1 and C2 are also answered in this chapter.

The information in this chapter is gathered by the literature review from the article in the topic of producer organization. The article about the roles and development of the cooperatives in Thailand is also used in this chapter.

After this introduction, the history of agricultural cooperatives is shown as the background information.

The stage and development level of producer organizations are firstly reviewed in section 3.2. After that, the types of producer organizations based on the functions are followed in the section 3.3. This can be classified as the community and commodity based functions. In order to identify the potential roles and functions of POs, the section 3.4 discussed about the functions and roles of producer organizations. This included the traditional functions and the new functions of POs. For better understanding of the producer organization in Thailand, the section 3.5 is about the POs in Thailand and their development paths. The governmental support is also described and reviewed in this section.

The conclusion is the last section of the chapter which describes the framework of the quality problems (chapter 2) and the roles and functions of POs that can help on solving the problems (chapter3). This framework will be used in the data analysis when comparing the information from the literature part with the data gathered in the empirical part.

History of agricultural cooperatives

The history of cooperatives can be traced back to the 18th to 19th century. The reason of forming the cooperatives is described by NCBA (2009) as “Cooperatives are formed by their members when the marketplace fails to provide needed goods or services at affordable prices and acceptable quality. Cooperatives empower people to improve their quality of life and enhance their economic opportunities through self-help. Throughout the world, cooperatives are providing co-op members with financial services, utilities, consumer goods, affordable housing, and other services that would otherwise not be available to them.” The types of cooperative can be divided into many types which are; consumer, producer, worker, and purchasing/share service cooperatives. The producer cooperative is the main focus of this project. They are owned by people who produce similar types of product. For instance, farmers who grow crops, raise cattle, milk cows, or by craftsmen and artisans. By banding together, they leverage greater bargaining power with buyers. They also combine resources to more effectively market and brand their products, improving the incomes of their members (NCBA, 2009).

3.2 The stage and development of POs

The stage of POs can be categorized into three stages according to the level of development as; early stage, Intermediate stage and advanced stage. Penrose Buckley (2007) gave the characteristic of each

development stage of POs which are the potential development path, the governance and management, and business development of producer organization. The development paths of producer organization are described in this section.

Development Path of POs

The development of POs starts with the informal organizations and ends with the third level organization or the organization in the national scale. Table 4 shows the development paths of POs which is divided into five considerations including; formality, scope of organization, activity, marketing channel, and value of product.

Development of PO	Early stage	Intermediate stage	Advanced stage
a) Formality	Informal	Formal	Formal
b) Scope of organization	Local, first-level organization	Regional, second-level organization	National, third-level organization
c) Activity	Bulking and marketing activity	Value adding and diversification	Processing and Branding
d) Marketing channel	Local	Local	Export
e) Value of product	Low value	High value	Social and advocacy services

Table 4: Development path of producer organizations. Source: Penrose Buckley, 2007

Although these three stages of development are set, it does not mean these paths, even the advanced stage, will match all producer organization. The producer organization needs to find the right ‘fit’. They need to develop and adapt their structure, size, services, and strategy to find the best fit with their priorities and capacity, target market, and market environment. As the environment of the business changes overtime, POs need to constantly adapt to maintain a good fit between these factors (Penrose Buckley, 2007).

The governance and management

The governance and management of the producer organization develops in every stages of development. The data showed in the table 5 states that the Mature PO has the strongest and most uniform governance and management. The undeveloped PO has weak performance in every aspect. This might because of the informality of the organization. The developing producer organization is the intermediate stage between two extremes.

Governance and management	Early stage	Intermediate stage	Advanced stage
a) Trust and confidence in leadership	Weak	General	Strong
b) Change in elected leaders	None	Occasional	Routine
c) Participation of woman and minority group in active	Excluded	Participate	Participate

decision making			
d) Sense of ownership over PO's activities	Weak	Growing	Strong
e) Ability of the leader on controlling over business and managers	Weak	Some	Strong
f) Ability to adapt to changes in the PO and in the market	Unable	Able	Very Responsive

Table 5: Governance and management of producer organization at different development stages
Source: Penrose Buckley, 2007

Business development of producer organization

The business development can be affected and depends on many aspects such as the product, market and local context. Some general indicators that mark the capacity and sustainability of a PO are used to classify the stages of development of PO (Penrose Buckley, 2007). Table 6 shows the lists of indicators for a PO's business and service development at three stages.

Indicators for development	Early stage	Intermediate stage	Advanced stage
a) Profitability	Loss	Break even	Profit
b) Product, market and marketing channel	Single	More than one	Diversified
c) Market service	Depend on grant funded	Able to access some independent market services	Financially sustainable access to market services
d) Influence on price of product	No capacity or market position	Able to influence some	Has capacity to negotiate fair price
e) Relationship with other actors in value chain	Weak	Some good	Constructive and mutually beneficial
f) Capacity to influence the market environment	No	Some capacity and resource to defend its interest	Has capacity and experience in promoting members' interest

Table 6: Business and service of producer organization at different development stages. Source: Penrose Buckley, 2007

It can be happened that POs have a mixture of capabilities and practices in different areas. Making the POs developed in all area may take several years (Penrose Buckley, 2007). It is important that the POs are moving in the right position. Although the development is in slow pace, there should be the progress in all areas. It should be taken in the consideration that development take considerable

investment and length of time before POs can help overcome the problems that small-scale producers are facing in today's market (Penrose Buckley, 2007). The important tasks for POs is to find the right fit among their structure, activities and strategy, changing needs and capacity of their members, and changing demand of the market (Penrose Buckley, 2007).

3.3 Types of POs based on the functions

The producer organizations occur when the producers come together to work and conduct the activities that each individual have performed on their own. There are many criteria to classify POs, the type of farm, the degree of formality or the function of POs. One of the useful distinctions of POs is the function of POs. It can be classified as community and commodity based organizations (Ton and Bijman, 2006).

Community based

The community based organization provides combined functions; economic, social and political. This kind of organization also represents the wider interests of the community in which they are based (Ton and Bijman, 2006). The social function that POs have does not directly connect to their business but it can help their member on living condition and leads to sustainability of the business activities (Penrose Buckley, 2007). The political function POs usually lobby for favorable state regulation and give smallholder farmers the political voice. They also enable the smallholder farmer to hold policymakers and implement agencies by participating in agricultural policymaking, monitoring budgets and engaging in policy implementation (Bijman and Wollni, 2009).

Commodity based

The commodity based organization primarily concentrates on their economic functions. The main service is the marketing (and processing) of their members' product (Ton and Bijman, 2006). There are many types of commodity based organization which are single purpose cooperatives and multipurpose cooperatives. The latter type provides wide range of services to their members; from supplying of the input to marketing of their members' product. The single purpose cooperatives support their members in the production and marketing on one single cash crop (Ton and Bijman, 2006). When looking at the marketing business of the members' products, POs can be divided into two types; the POs with vertical integration function in the value chain and the POs that centralize and coordinate the selling of the farm products. The first type composes of the forward integration (processing and making farm product) and backward integration (purchasing or producing the farm products). On the other hand, the latter type of POs just help on centralize and coordination the selling of farm products. The difference of two main types of the POs with economic function is the ownership of the product. The vertical integration POs purchase product from the farmer while another type of POs does not take the ownership of the product, but only facilitates the sales process (Bijman and Wollni, 2009).

The examples of services that the POs with economic function give to the members are (Penrose Buckley, 2007);

Input supply: POs often buy input in bulk, which is lower price and supply them to members. This can help small scale producer to get better inputs in the cheaper price.

Production services: Small scale producers have limited asset and resource to perform activities that require expensive equipments. POs can help their members to improve the quality and productivity by providing extension services or access to equipment such as tractors or chilling container.

Financial service: Since small producers do not have strong financial resources to improve the quality and productivity of the product, providing the access to cash loan or credit is very important service for POs

Implementing quality assurance program: In order to meet the required quality and food safety standard of some markets, POs need to monitor and control the quality of their members. Not only for the quality and safety standard, but they also need to be retained.

Training: In order to help the small producers to manage their activities well and improve the quality of their product, extension training in new technology and managerial aspects are provided by the POs

Processing: Some POs engage in processing activities in order to add value to their produce and access along the market or value chain.

Although the type of POs is clearly divided into the political and economic organizations, these functions are not clearly separated in the real practice, especially in developing countries (Bijman and Wollni, 2009). Many POs provide both political and economic functions. They also provide the social function. These POs are called multipurpose organizations.

3.4 The roles and functions of POs in improving the supply chain

The roles that POs have on the supply chain to help their members and improve the efficiency of the supply chain can be divided into two functions; traditional function and new functions (Bijman, 2007). The difference between these two functions is the type of coordination that each functions have. The former function focuses on the horizontal coordination while the later aims at the vertical coordination. Both functions are now discussed in this following section.

3.4.1 Traditional economic functions: Horizontal coordination

The aim of traditional cooperatives is to enhance the prosperity of members, producers by providing the economic functions such as collective marketing of farm products, collective purchasing of inputs, sharing of risks, and collecting and transferring market information (Bijman, 2007).

Enhancing the bargaining power

The bargaining power is always low among small producers when they do business with big firm such as processors and exporters. Bijman(2007) also argued that farmers in the oligopolistic or even monopolistic market are likely to receive a lower price than they would under more competitive conditions. When the cooperative enhance the bargaining power of the producer, their members will get more income because other buyers in the industry have to pay at least the same price as that of the cooperative, to their suppliers (members) (Bijman, 2007). This also implies the price discovery in the markets where there is uncertainty about market supply and demand conditions. The activities that the cooperatives provide in order to enhance the bargaining power are (Bijman, 2007);

- Contract (and price) negotiations

As cooperatives combine many farmers together, the reliability and bargaining power is more than of the sole farmer. This will make the contract or negotiations more profitable and it is harder for big buyers (processors) to take advantage on the cooperatives.

- Physically collecting the farm products

Selling the product separately makes it difficult for both suppliers and buyers. Not only the lower priced that farmer will get because of the low quantity, but also the transportation cost on collecting a low quantity from many small farmers. The sourcing from small holder is the last choice for the exporter because of the high cost of transportation from various growers and high risk of the unavailability of the required quality pineapple (Takane, 2004).

- Assuring the homogeneous quality of products

The homogeneous of product is important for the ease of negotiation. Buyers want product in bulk with same quality. Without homogeneous quality, collective bargaining is more difficult as separate negotiation has to be done for each quality class (Bijman, 2007). Cooperative can manage with the homogeneous quality issue by applying particular quality standard on their members.

Reducing information asymmetries

Information transfer among the actors of the supply chain is very important for the success of market. Well functioning market requires that all market participants have full information regarding demand and supply, both on quality and quantity to be traded (Bijman, 2007). Asymmetry of information does not occur only between farmers and their buyer of farm product, but it also occurs with the sellers of the farm input. For example, farmers individually do not have the knowledge and equipment to access the quality of inputs such as fertilizers and animal feed (Bijman, 2007). The cooperative can help their members to solve this problem by buying and testing the inputs. This enhances the bargaining power and also sharing the cost of the quality assessment equipment (Bijman, 2007).

- Provision of credit

As farmers need to invest in their farm, they have to find the source of loan for their investment. The financial institution does not want to provide credit or provide at high interest rate to the small farmer. In order to help small farmers, cooperative can gather and use the detailed information of creditors and provide to their members who need credits (Bijman, 2007). The advantage of rural credit cooperatives over commercial bank is the economic and social incentives that exist among members to repay the loan. (Bijman, 2007).

- Marketing of farm product

When one of actors in the transaction has better information than another side, the better actor tends to take advantage on the poorer. This also occurs in the selling of the farm product. Ton et al (2007) discussed that when buyers have better information on consumer demand on the market, they can use this information advantage when negotiating price and delivery conditions. Hiring the sales agent is one of the ways that the cooperatives in many countries do to solve this problem. The cooperatives hire the sales agent to gather and process market information. However, the sales agent also involves other informational problems on the contribution of the sales agent when the production and demand are volatile. (Bijman, 2007). In order to solve both problems, the auction market can be done. The

example of the successful auction market is the flower auction in the Netherlands. By doing this, the information asymmetry in supply and demand will be solve because every actor has to auction and the auction clock is the price determination mechanism. The market will become transparent, efficient and fair (Bijman, 2007). This also makes the production efficiency because producers can fully focus on and specialize in production activities (Bijman, 2007).

Improving quality of product

In order to improve the quality and uniformity of the product, technology and facilities are needed. The term of technology means the knowledge that is used to develop the process and the facilities mean the equipment or machine that is used. There are two ways that the cooperative can help their member to improve the quality of the product which are;

- Providing of processing facilities and inputs

Asset is one of the major problems of the small farmer in improving the quality of their harvests. The small holder cannot afford the expensive instruments. Not only the high price that the facilities have, but also return on investment is too low because of the size of producers themselves. This reason makes the outside financiers unwilling to invest in the processing facility (Bijman, 2007). In order to solve this problem, the sharing investment can be done by the cooperatives. Due to the high price of machine and capacity of farm machines exceeds the size of an individual farm, this sharing investment is very useful in the cooperatives (Bijman, 2007).

- Developing and exchanging technological knowledge

The activities in developing and exchanging technology knowledge can range from the simple method, exchanging of knowledge among the farmer to the more complex method which is contracting the agricultural research (Bijman, 2007). The association of farmers always shares and discusses about their technology they use and problems they face to each other in the cooperatives. The contract agricultural research will become important because of the non productive and inefficient regarding farmers' needs of the national research and extension systems. This system is also affected by the reformation of state institutions (Bosc et al, 2001 cited in Bijman, 2007)

Sharing risk

Risks that farmers face can come from nature and market. The more vulnerable producers are to the vagaries of nature or the whims of the market, the more they need risk reduction strategies (Bijman, 2007).The pool system is used to share the price risk in selling farm product while the mutual insurance companies help to share the risks of illness (Bijman, 2007).

3.4.2 New functions: vertical coordination

The new functions of cooperatives aim on value creation while the traditional functions are targeted at cost reduction and soling the market failure.

Reducing information asymmetry

One of the information asymmetry occurs when the producer has better information on quality characteristics that are directly related to on-farm production methods and this information are hard for the buyer to measure (Bijman, 2007). By this reason, buyer will no be willing to buy or buy at the low price. When the cooperatives act as the buyer of the product, this problem will be solved because

of no conflict of interest between two (Bijman, 2007). Moreover, cooperatives have lower costs in guaranteeing compliance of their suppliers (members) to quality requirements. The problem of information asymmetry still occurs between the cooperatives and buyers as the quality of product is difficult to measure. The cooperatives should establish a reputation, often embodied in the trade or brand name that functions as a signal or as a credible commitment (Williamson, 1985 cited in Bijman, 2007). This is very important in trading of farm product as it reduces the transaction cost while the product is sold repeatedly. The private or public quality standard can be applied in order to ensure the customers that the product is of good quality (Bijman, 2007).

Setup quality assurance and traceability system

As the supermarket and export market requires the quality assurance and the traceability of the production. It is the must that producers have to follow if they want to do business with them. The cooperative can have an important role to help these two actors achieve this goal. According to Bijman (2007) a cooperative, being at the interface between production and trade/processing, is in a good position to set up such a quality control system. As the cooperative is the producer- controlled organization, it is easy to obtain information from members and transfer to other actors in the chain. Not only transferring of information to other actors in the chain that cooperative can do, the information from the actors should also be transferred to the member of cooperative. This is the important task for cooperative to help their members

Provide information

The information about market demand both in qualitative and quantitative should be transferred to their members. This can help farmers to 1) keep update with the market trend and the customer requirements. 2) Comply with quality requirements of customers (Bijman, 2007). The cooperative can supply certain inputs, give training and technical assistance, and help them to learn from each other's experience. Moreover, members will be more willing to accept visits by quality supervisors that work for the cooperative than those that work for a commercial customer (Bijman, 2007).

Coordinating the activities of supply chain actors

The quality or required standards from the customers can be used to set as the standard in the cooperative. For example, the standardization of packaging and organizing logistic processes such as storage, sorting and grading, and transport (Bijman, 2007). Moreover, the product innovation can be conducted by the cooperative. The new product can be developed and marketed by the cooperative because they are in the middle of the chain that can link the producer and buyer together in order to make a successful marketing of new product.

3.5 Cooperatives in Thailand

The cooperative in Thailand has very long history. As Thailand is regarded as an agricultural country, the agricultural sector included agricultural cooperatives play an important role in the economy of Thailand. The total number of cooperative in Thailand which is still operating is 6624 cooperatives. 3731 cooperatives are the agricultural cooperatives which accounted for more than 50 percents of overall number (CPD, 2010). Agricultural cooperatives in Thailand are vertically organized in a three-tier system; primary at district level, provincial federation at provincial level and national federation at national level (Thavachote, 2006). The primary cooperative at district level consists of farmers as the member of the cooperative. 5 or more primary cooperatives can come together to form a provincial federation which undertakes joint activities on behalf of their primary affiliates such as processing and

trading of agricultural produces (Thavachote, 2006). On the top level, Agricultural co-operative federation of Thailand (ACFT) is the center for all provincial agricultural cooperatives. The member of ACFT are all Thailand's provincial agricultural cooperative federations which cover more 5,000 agricultural cooperatives in Thailand (Co-opthai, 2008). The governance structure of agricultural cooperatives composes of general assembly of members, board of directors, manager, and officers. The general assembly of members has the power to elect an internal auditor, to consider the annual, approve annual budget, and consider annual statement of account of cooperatives (Thavachote, 2006). They are required to meet once a year after the closure of the fiscal year. The board of director is elected from members that show the outstanding performance and willing to serve the society. The duty of them is to set the policy, plan and program for cooperative and supervision of management (Thavachote, 2006). The person that has the best knowledge in the agricultural cooperative is the manager because he/ she implements plans, programs and policies of the cooperative which are designed by board and approved by the general assembly This person is also considered as the key person in the cooperatives.

3.5.1 Recent Developments

As the situation of the market and demand of consumer changed, it offered both new opportunities and threats to the agricultural cooperatives. The new market economies in which agricultural cooperatives operate bring about the new types of consumers who demand high quality products at reasonable prices, and prefer healthy and chemical free food at international standard (Thuvachote, 2006). They also want to buy food that the origins are known and look for products that social concerned and environmental friendly. Although most of the agricultural cooperatives in rural area still remain their traditional functions, some of them developed and implemented new strategies to this new economic environment. The development of cooperatives in Thailand can be classified into micro and macro developments. Micro development occurs with the cooperatives themselves while macro development is conducted as in the whole industry. In the micro view, the innovative practices as a new direction of agricultural cooperatives in Thailand are (Thuvachote, 2006);

Collaboration with private sector

The main aim of collaboration with the private sector is to gain some advantages from them such as strong marketing channel, popular and brand of the product, etc. This concept is not only used by the agricultural cooperatives but also with other type of cooperatives. The example is the collaboration of 12 cooperatives in the northern part of Thailand with Amway corporation (Thailand) in produing “ Amway Thai jasmine rice “ for consumers in the premium supermarket segment (Thuvachote, 2006).

Product of high quality and traceability

As the demand for high quality and traceability keeps rising among the consumer, it is a great idea to develop this function in order to response the demand. In order to develop this function, the collaboration with other actors in the supply chain and the other controlling measures are needed. In Thailand, the agricultural cooperative that initiates this function is the Thayang agricultural cooperative Ltd. that provided chemical-free banana to the TOTO consumer cooperatives in Japan. Members in the cooperative are advised to use organic fertilizers and avoid farm chemicals. Transportation of product from Thailand to Japan is fully temperature controlled. Moreover, producers and customers work together to share the market information and product information. The inputs, weather condition and yield information are recorded in order to be traceable. TOTO

consumer cooperatives provide consumer information to Thayang Ltd. for adjusting and developing the product quality that is required by the consumers (Thuvachote, 2006);

Electronic commerce and use of internet

Another channel of distributing product with low cost of distribution is the e-commerce. It offers the alternative way for marketing of products and services via the internet. The cooperative development department (CPD) of ministry of agriculture and cooperatives has promoted and supported agricultural cooperatives to set up their website for E-commerce of their products. The development is still limited. Only few cooperatives have their own well functioned websites (Thuvachote, 2006);

Cooperative woman group

The cooperative woman group (CWG) is formed among cooperative members and their family to run micro activities by using indigenous knowledge. Each group has between 20-50 woman-members and conducting various activities relevant to member's needs and skills (Thuvachote, 2006). Generally CWG has 3 major roles which are economic development, family health care improvement and moral activity. The CWG can also generate non-farm income to family by selling their products such as processed food and handicraft product (Thuvachote, 2006);

The concept of cooperative company

In order to quickly carry out business, some agricultural cooperatives have created subsidiary companies which are owned and controlled by them. The example of the company is Thai Agri-Business Co.,ltd (TABCO). TABCO is a company belongs to 74 primary agricultural cooperatives in the country. The company serves its cooperative members by purchasing and distributing fertilizers and equipments for agricultural production, collecting and marketing farm products for their cooperative members to domestic and export markets (Thuvachote, 2006).

Associate members

Associate member is the member of the cooperatives that has no right to vote and not eligible to certain service such as credit and marketing of farm products, but they are eligible for saving services. This member may be disqualified to be the regular members due to many factors such as age or occupation (Thuvachote, 2006). This group of member can provide profit to the cooperatives by using the financial service.

Value addition

The value addition can differentiate product and make the product more competitive in the market. Some agricultural cooperatives in Thailand undertake value-added operation through processing, grading, packaging and branding product in order to gain market competitive advantage (Thuvachote, 2006). The example of cooperatives that do value adding are Kaset –Visai agricultural cooperative ltd., in Roi- Ed province and Tap-Pratan Farmers' group in Ang-Thng province. Kaset-Visai cooperative developed special Thai jasmine rice called "Hom-Mali 105" while Ang-thong farmers' group innovated the herb-coating rice to response the consumers' need (Thuvachote, 2006).

3.5.2 Governmental support

In the macro development, two significant observable features are;

Cooperative policy development

There are two cooperative development plans that are released by the government. The first one is the cooperative development plan 2003-2006 and the later is for year 2007-2011. The important content of the plan that is presently used is to development in the human resource and the organization, and strengthen the network both inside and outside of the cooperatives in order to improve the economy and society (CPD, 2009).

Support from the government

Thai government established the cooperative promotion department in order to develop and support the cooperatives in Thailand. The CPD continuously invest large amountof resources, through various programs for the development of agricultural cooperatives (CPD, 2009). The important development scheme is the establishment of central market for agricultural product in 870 villages and 20 big distribution centers throughout the country (Thuvachote, 2006). CPD also provides a mini MBA program for the management staffs of the cooperatives throughout the country (CPD, 2009).

The government has established three organizations to support the cooperatives in Thailand. Each organization has the difference duty which all supports the cooperatives and the agricultural section. The organizations and their duty are;

The office of Registrar of Cooperative Societies

Under the “Cooperative Act, B.E.2542”, every cooperative society in Thailand has to register prior to its business operation. The office of Permanent Secretary of the Ministry of Agriculture and Cooperative is in charge of these duties which are(maoc,2010);

1. Registering, promoting, assisting, advising and supervising a cooperative
2. Giving the advise to the cooperative on the law
3. Giving the advise and suspend the action of the cooperatives that will have bad effects to the organization or members
4. Investigating or inspecting on the formation, operation and financial conditions of the cooperative
5. Prescribing the system of accounting and standard of audit and forms which the cooperatives have to submit to the registrar.
6. Making regulations or orders to benefit the operation of cooperative.

The Cooperative Promotion Department (CPD)

According to the mission, vision and strategy of the CPD, the main functions and activities of this organization are (CPD, 2010);

1. Strengthening the cooperatives and farmer organizations
2. Developing the marketing of cooperatives’ product
3. Studying and conducting research for cooperative development
4. Providing the training and knowledge for cooperatives

5. Improving the quality of life among the cooperatives' members.

The cooperative Auditing Department (CAD)

Cooperative Auditing Department is a key department to promote, develop and strengthen the cooperative movement in Thailand by performing through the following functions (CAD, 2010):

1. Provide auditing to all types of cooperatives and farmer associations
2. Prescribe suitable accounting systems for cooperatives and farmer associations.
3. Provide regularly advises in accounting and financial matters to cooperatives and farmer associations in order to upgrade the capacity of cooperatives' and farmer associations' officers in accounting and also to observe whether internal control is as efficient as possible.
4. Provide reports on financial and economical situation of cooperatives and farmer associations as major information for decision making and setting up policy and plan.
5. Provide training in financial and accounting aspects for cooperatives' and farmer associations' members, staff and board members.
6. Regulate the cooperative auditing by private auditors.

Support from the government on pineapple research

Thai government support in the improvement of pineapple industry because pineapple is the importance fruit that earned large amount of foreign revenue and a large number of smallholder pineapple growers are dependent upon this trade (Anupunt et al.,2000). The assistance that the government gives can be defined to be the support for both growers and processors. The program includes the development of improved variety, cultivation methods and plant protection techniques.

For the variety improvement, both pineapple cultivars for processing and fresh consumption are developed. The pineapple CV Pattavia, for processing, is susceptible for the marbling disease which is the most important disease found in Thailand. The government has tested the new variety that is also suitable for the processing but resistance to the marbling (Anupunt et al., 2000).

Moreover, the research on the cultivation method is also conducted in order to increase the planting density, irrigation techniques, soil moisture conservation, fertilizer applications, and handling methods during and after harvesting (Anupunt et al., 2000). These researches directly help farmers on the method of farming and increasing incomes.

The weed control which is the solution for some diseases in pineapple production is developed by the plant protection research section. The research aims to reduce the usage of chemical fertilizers and pesticides with no effects on yield and fruit quality.

3.6 Conclusion

By having this chapter in the research, some research questions are answered. The research question that is directly answered is the research question C. "How can POs help to solve the quality problems?" The information in this chapter shows that the POs can help farmers on solving the quality problems that they are facing by providing them the economic, social and political functions. In the economic function, the roles in production and marketing can help to solve the technical

problem that farmers are facing. Moreover, the social roles are important for the living condition of members. This is very important in development of product and solving the problems because when farmers face problems in living, they will not be inspired in the production of their farms. Last but not least, political roles of POs can help their members on lobbying the government or other organizations to give the hand on the problem. Beside from these three functions, PO can be considered as the bridge for the government in providing supports to farmers. Participation and help in producer organization is better than the direct support from the governmental organizations as it is formed by producers themselves.

The stages and development of producer organization is presented to identify the basic and potential of the organizations. The development path and business development are two models that used in this research. The governance and management is excluded from the research because it does not relate to the topic on the quality of the product.

The types of producer organizations, based on the functions that they have, can be classified in two types; community based and commodity based organization. The former is the organizations that combine social, political and economic functions while the latter provides only the economic functions to their members. The political role is important for some industry that needed the lobby on the government in order to help or support the farmer. Although the social function does not directly relate to the production or marketing of the product, it helps the living condition of farmers. These two functions are important for the country that farmers face the poverty problem like Thailand. When looking at the roles of the cooperatives, they can also be classified into two major types; the traditional economic functions and the new functions. The aim of the first function is to enhance the prosperity of members by providing the economic functions while the latter aims on value creation of the product (Bijman, 2007). The traditional economic functions compose of the enhancing the bargaining power, reducing information asymmetries, improving quality of product and sharing risk activities. Moreover, the new functions compose of reducing information asymmetry, set up quality assurance and traceability system, providing information, and coordinating the activities of supply chain partners. The ideal functions and roles of the cooperatives are reviewed by using the literature written by the expert in the field. These roles are summarized and used to formulate the questionnaire for interviews. The functions that are used in the questionnaire can be divided into four main groups which are;

Traditional economic functions:

Increasing bargaining power

- Contract (and price) negotiations
- Physically collecting the farm products
- Assuring the homogeneous quality of products

Reducing information asymmetry

- Provision of credit
- Marketing of farm product

Quality improvement

- Providing of fertilizers and input
- Developing and exchanging technological knowledge

New functions: Vertical coordination

- Setup quality assurance and traceability system
- Coordinating the activities of supply chain actors
- Value addition

After the quality problems, causes, and solutions are identified in chapter 2, the roles and functions of cooperatives are reviewed in this chapter. This information from two chapters is combined and used in formulating the potential roles of the producer organizations that can help members on solving the quality problems that occur. Table 7 shows the functions of POs that can solve the quality problems of pineapple in Thailand. The problem in production, uniformity problem and problem of farmers on reaching the standard of pineapple are listed as the problems in quality of product. The causes and solutions are also given in the table under the chapter 2. The functions and roles that POs should have on solving the problems are listed in the table as the detail of chapter 3. This table will be used in comparison with the actual roles and functions of POs in Thailand.

Quality problems and Solution (Chapter 2)			Functions and roles of cooperatives (Chapter3)
Quality problems of pineapple production among the producer	Causes	Solutions	Role of POs on helping to solve problems (Chapter3)
1. Problems occur in production - In growing stages - In harvesting and post harvesting stages	- Disease - Lack of knowledge / skills - Lack of capital to invest - High infection pressure - Low inputs and pesticides use	- Various management on production - Post harvest treatment - Access to credit - Help from other organizations on technical knowledge - Help from the government on technical knowledge	- Provision of credits - Providing inputs and fertilizers - Developing and exchanging technological information - Coordinating the activities of supply chain actors - Apply quality assurance and traceability system
2. Lack of uniformity in product - In quality - In quantity	- Lack of planning - Fluctuation of price - Information asymmetry - Oversupply - Small amount of product from various farm	- Planning of production - Sorting and grading - Chemical forcing - Stabilization of price - Help from the other organizations on planning of production - Help from the government on the stabilization of price	- Physically collecting the farm products - Providing inputs and fertilizers - Developing and exchanging technological knowledge - Apply quality assurance and traceability system - Coordinating the activities of supply chain actors
3. Unreached standard by producers	- Lack of knowledge - Uncertainty in standard level of the manufacturer - Lack of capital to invest in order to reach the standard	- Access to credit - Make clear standard of the manufacturer - Give knowledge about the required standard - Standardization of production	- Provision of credits - Developing and exchanging technological knowledge - Apply quality assurance and traceability system - Coordinating the activities of supply chain actors - Physically collecting of farm product

Table 7: Quality problems in pineapple production and the ideal roles of POs on solving

Chapter 4: Methodology

4.1 Introduction

“How can Producer organizations help on solving the quality problems and improving the export of tropical fruit chain from Thailand?” is the research question that is attempted to be answered in this project. The roles and functions that cooperatives in the pineapple industry of Thailand should have on improving the quality of pineapple is the main focus of this project. The comparison between the potential role of cooperative in the developed countries and the actual roles of cooperatives in the developing country will be conducted. The potential roles of the cooperatives, which are useful to the improvement of the products’ quality, are reviewed and the actual roles and functions of cooperatives in Thailand will be defined in the empirical research by the interview. In the previous chapters, the problems, standard of pineapple and the potential roles of cooperatives are reviewed by using the literature. These data will be used with the combination with the data from the interview then the recommendation on the role of the cooperatives can be made.

The rest sections of this chapter will describe the methodology that is used in the empirical part in order to reach the answer of this research question. In section 4.2, the technical design of the research is described which composed of the research strategy (4.2.1) and data samples (4.2.2). In the section 4.3, the method for data analysis is shown while the limitation of the research project is described in the section 4.4. Section 4.5 discusses on the interview questions that are going to be used in collecting the qualitative data.

4.2 Technical Design

4.2.1 Research Strategy

In this part, the strategy of the project will be described. Also, the data that is important for the research. The general and specific data on the pineapple fruit chain needed to be collected.

The research strategy of this project includes two strategies, desk research and case study. Verschuren and Doorewaard (2005) described desk research as the type of research that is carried out mainly from behind your desk, in the library and/or in archives. The information is gathered by others. On the other hand, case study is type of research during which the researcher tries to gain a profound insight into one or several objects or processes that are restricted in time and space (Verschuren and Doorewaard, 2005). This research mainly based on desk research strategy (articles about the pineapple, producer organizations, etc.) Moreover, the case study is used to compare and support with the gathered data. The case study is important for this project because the interview provides the data that cannot be found in the literature (the current role of POs in pineapple industry in Thailand). Moreover, the data that is needed is the qualitative data, so the interview is the proper way to get this data. The gathered data are analyzed and the recommendation is based on this analysis. The other strategies are not chosen because they are not suitable for the data that is needed to be collected. This research is characterized as design-oriented research. The role of producer organizations that can help to solve the quality problem of pineapple will be analyzed and stated as the recommendation.

Literatures about pineapple industry and producer organizations are used in order to identify the problem of pineapple and the condition of pineapple industry and producer organizations. These sources of data are also used in identifying the optimal roles that producer organization could have. Documents such as reports from department of agricultural extension, FAO, and department of

foreign trade, Thailand are used. Finally, interviews with producer organizations are conducted for the data collection.

4.2.2 The Data Sample

In the empirical research, the nature of the data sample is important. The data sample characterizes the population of the real situation in the industry that is being investigated. Our sample is chosen by using the criteria that makes the sample represent the majority of the industry. As the main pineapple production sites are located along the sea in the eastern and western area of Thailand. The top three provinces that have the largest volume of production of pineapple are chosen which are Prachuap Kiri Khan, Trad and Rayong. The map of pineapples' growing area is shown in the annex 6. These three provinces can be the representatives of the Producer organizations in pineapple growing area of Thailand. Only in Prachuap kiri khun, the production of pineapple accounts for fifty percents of the overall production of pineapple in the country. Although the cultivar of pineapple is different in each area, the farmers have the same aim, which is to sell to the processing plant. The chosen producer organizations are based on the size and the success level. Both big and small cooperatives are chosen to interview since they can have difference practices in the organization. Moreover, the cooperatives in Thailand are mainly small scale while only few are big. By doing this, the chosen sample can represent the cooperatives of pineapple in Thailand because it covers the most growing area of pineapple, which is mainly the product for manufacturer. In addition, scale of cooperatives that presented in Thailand is also covered.

The aim of interview is to identify the quality problems that POs really face and the role of them on solving these problems and improve the quality of pineapple for the export market. The interviews will include the officer that is in charge of helping the producer organizations in that province and 4 producer organizations in Prachuap kirikhun, the largest pineapple producing of Thailand and 3 producer organizations in Chonburi and Rayong, second and third largest pineapple producing provinces in Thailand. The officer in prachuap kirikhun will be interviewed first. After that, the manager or the director of producer organization will be interviewed.

4.3 Method for data analysis

This project started with desk research method. The article about the quality problem of pineapple, role and function of cooperative, and the international standards of fruits are brought together from the Web of Science, Scopus database, Google Scholar and the collection of book from the WUR library. The snowball method is used in order to find the articles because the relevant literature can be found by tracking back on the bibliography of the major publications of the subject matter (Verschuren and Doorewaard, 1999).

The general data is searched in order to define the quality problem of pineapple and the role of the cooperative. The key words such as: tropical fruit, pineapple, quality problems, cooperatives, international standard of pineapple, etc are used in searching on the Scopus and Google Scholar

The potential roles of cooperative is conducted and presented in Chapter 3. The literature review is done to define the role that the producer organizations could have on helping their members both in the technical and economic practices.

In order to get the information on the actual roles of the cooperative on improving the quality of product, the interview approach is needed. Our sample consists of seven pineapple cooperatives in the three most important production provinces of pineapple which are Prachuab Kirikhun, Rayong and

Trad. The list of the cooperatives that are interviewed comes from the cooperative officer who gives the assistance to the cooperatives in each province. Interview approach is chosen because of the detail explicit and tacit knowledge that the manager of the cooperative has is needed to be given as the data. Also, the qualitative research needs accuracy and validity of the data, so the interview can support these two requirements. The interviewee also needs to explain the answer in detail, so it will be clearer to analyze the role of the cooperatives.

Finally, the comparison is made between the data gathered in the literature study part and data from the empirical study. The information from the literature review is about the quality problems that can occur in the production of pineapple and the potential roles of producer organizations on solving the problems. On the other hand, the information from interviewing shows the actual quality problems and the actual roles of pineapple POs in Thailand on solving the problems.

4.4 Limitations

The empirical study is limited to the pineapple industry in Thailand instead of the whole tropical fruit industry. The reason to do is because the data corrected will be more accurate and reliable than doing on the whole topical fruits industry. Moreover, the time is not permit to do so. The project is done in a short period of time while collecting data in the whole industry will take much longer than the limit.

4.5 Description of the interview questions

The semi structured interview is used to get the in depth information in the topics that have been already planned. According to Saunders et al. (1997), in the semi structured interview; the researcher will have a list of themes and question to be covered, although these may vary from interview to interview. The list of question is prepared for the interviewee to answer (Annex 7). All the interview questions are translated into Thai and the interviews are conducted in Thai.

The questionnaire is divided into three main topics. Topic A: **General Information about the Producer organization**, Topic B: **Quality problems and management**, and Topic C: **Role of producer organizations**

The questions of the topic A are asked in order to characterize the producer organizations and make sure that the chosen cooperative matches the criteria that are set in order to be the representative of the pineapple producer organizations.

In Topic B: **Quality problems and management**, the questions are asked to get the information on the quality of product, the exact quality problems that occur and how important of each problems are asked to be defined. The reviewed problems in all stages, from growing to post harvesting are listed in the table. Question 14 focuses on the quality criteria of the cooperatives. Questions related to the standard and regulation of the supermarket and export markets are asked in number 15 and 16.

Topic C: **Role of producer organizations**. This section is considered as the important section in the interview. First question in this section is asked to define the functions that POs have. All functions that are reviewed in the literature part are listed in the table, asked to be ranked by the importance of the activity. After the ranking are done, the detailed questions about each functions are followed. They are classified as production, marketing, training and financial function. The in-depth questions about the production are aimed to the measures and methods that cooperatives use in solving the quality problems and improving quality of pineapple. Also, questions about assistance from other organizations and the government are included in this area. The questions about the economic functions of the cooperatives are asked in the marketing sub section. They also based on the measures

and practices that cooperatives do on the members. The kind of questions about the practices and functions that cooperatives have are also asked in the training and financial sub sections.

Chapter 5: Results and data analysis

Introduction

This chapter is about the result of the interviews that were conducted with the producer organizations in Thailand. The interviews were conducted in order to identify the actual problems of the pineapple production and the actual functions and roles of producer organizations on solving the quality problems. This chapter helps to answer the research questions D “What are POs in Thailand doing in solving the quality problems and improving the quality of tropical fruit in Thailand?”

The information in this chapter is collected by pre structured interview with the pineapple producer organizations in Thailand. There are seven cooperatives from two main pineapple producing regions of Thailand which are the western and eastern parts of the country. Four interviewees come from the western region while the rest are from the east. In the western part, Prachuap kiri khun is the province that is the main production area. It accounts for 50 percent of overall pineapple of the country. In the past, there are many pineapple cooperatives in Prachuap kiri chun province. Some of them went bankrupt. Nowadays, there are 5 cooperatives in Prachuap kiri khun province that are still operating. 4 out of 5 or 80% of cooperatives in this province are interviewed. The reason why one cooperative in the province is not interviewed is because the interviewer cannot contact the manager or the officer of the cooperative. In the eastern region, the farmer group is the producer organization that can be found. There is no cooperative operating in this region. The function and activity of farmers group and cooperative in Thailand are not different as in the developed countries. In developed countries, the farmer unions are interested in representation in the political arena while the role of the cooperative is to strengthen the economic position of farmers. The roles are usually combined in developing countries (Ton and Bijman, 2006). Chonburi and Rayong are two provinces that mainly produce pineapple. They are ranked as second and third province, respectively, with the highest production of pineapple. There are 5 pineapple farmer groups in this region (1 in Chonburi and 4 in Rayong). The invitation is asked to all farmers groups but only 3 farmer groups accept to participate in the interview. The other two farmers groups do not feel comfortable to be interviewed because they are busy with harvesting of pineapple. Therefore, 3 out of 5 which accounted for 60 percent of producer organizations in Rayong and Chonburi provinces are interviewed.

The list of interviewees is;

1. The cooperative officer of Prachuap kirikhun province
2. Agricultural cooperative of mueng district, Prachaup Kiri Khun
3. Agricultural cooperative of Pranburi district, Prachaup Kiri Khun
4. Sam Roi Yod pineapple grower cooperative, Prachaup Kiri Khun
5. Hau Hin pineapple grower cooperative, Prachaup Kiri Khun
6. Pineapple farmer group of Kao Mai Kaew district, Chonburi
7. Pineapple farmer group of Pluak Daeng district, Rayong
8. Pineapple farmer group of Makham koo district, Rayong

The chapter will begin with the result from the interview with the cooperative officer. After that, the result of interviews with seven producer organization is followed. The summary of the result is shown in Table 11. Section 5.2 will be about the data analysis. The comparison is made between the information from interviews and the information from the literature review part.

5.1 Results

Result of the interviewing with cooperative officer

Background information

Mr. Pravait Intrachome is the head of the cooperatives development and support department in the Prachuap kiri khun provincial cooperative office. The cooperative office is the governmental organization that supports the cooperatives in developing their business. Mr. Pravait has been in this position for 15 years. His duty is to give the technical information and supports for the farmers and cooperatives in the area. Farmers in Prachuap kiri khun province mainly grow pineapple. Therefore, he has very good knowledge on the pineapple industry in Thailand especially the pineapple in Prachuap kiri khun province.

Pineapple Industry in Thailand

Eighty percent of pineapple grown in Thailand is for the processing plant. Almost all exported pineapple is the processed pineapple, canned pineapple and pineapple juice. The standard required by the processing plants is not clear and consistent. The intensity of required standard depends on the level of pineapple available in that time. For example, the processing plant will reject the pineapple that does not reach the maturity level when the pineapple is available or they do not want much pineapple. On the other hand, the maturity level is not considered when the supply is short or they want to increase the production in plant.

The fresh pineapple is exported in very little amount to the country that is near Thailand such as Singapore. The main international market of fresh pineapple, Europe and Japan, cannot be reached because of the far distance and the quality of the product. Pineapple is a non climacteric fruit which means it cannot be further mature after harvesting. Moreover, it is perishable fruit. These reasons make the life of harvested pineapple too short to transport to the far countries as Europe or even Japan. The quality of fresh pineapple is also the main threats. GAP and the MRL value are not reached by Thai farmer. In order to promote the exporting of fresh pineapple, the standard of farming and the new method of packing or transportation must be used. This leads to high investment and cost of production. The GAP promoting program of the government is not successful because they give the farmers only the knowledge but there is no measure or the certain market for farmers to be sure that the GAP that they applied will be worthwhile for the investment. If they do not pay attention to the GAP, they can still sell the product to processing plants.

The oversupply problem of pineapple in Thailand is decreasing because the farm land is used to grow other crops. The best growing area of the pineapple is the foothill or prone area. The farmer likes to grow the pineapple in the combination with Oil palm and rubber. After two to three years of growing the oil palm and rubber, pineapples cannot be grown because of the size of the other plants. They intercept the sunlight to reach the pineapple plant.

The pineapple industry keeps changing from the past. In the past, cooperatives have very important role in collecting product for the processing factory. This procurement system has changed. The quota is applied to each controller. The cooperative is considered as one of them with the big quota.

Result of the interviewing with POs

Question 1-10: general information of the pineapple POs

The general information of the interviewed producer organizations are ask in the interview in order to assure that all POs are in the target group of the research. Table 8 presents the result of the question 1-10 which is the general information of POs.

		Western region				Eastern region		
	Question	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
1	Main product	Pineapple,	Pineapple	Pineapple, Sugarcane, Rubber	Pineapple	Pineapple, Casava	Pineapple, Casava, rubber	Pineapple, Cassava
2	Established year	1975	1970	1987	1987	2003	2001	2000
3	Amount of members	580	489	800	709	120	206	358
4	Minimum Requirement							
	Quality	No	No	No	No	No	No	No
	Quantity	No	No	No	No	No	No	No
5	Turnover in 2009 (Profit, breakeven or lose) (Euro)	260,000 (Profit)	160,000 (Break even)	6,000,000 (Profit)	500,000* (Profit)	N/A	100,000 (Break even)	340,000 (Profit)
6	Size of members' farm (Rai)**							
	Average	25	20	200	15	30	15	40
	Largest	200	80	1000	120	800	300	700
	Smallest	15	10	20	5	30	5	20
7	Main Customer	Processing factory	Processing Factory	Processing Factory	Processing factory	Processing factory	Processing factory	Processing factory
8	Contract with customers	Written	Verbal	Written	Written	Written	Written	Written
9	Other market channel for members	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Final market of product	International market	International market	International market	International market	International market, Retailer	International market	International market

Table 8: The general information of producer organizations

Remark: * the information comes from the provincial cooperative office

** 6.25 Rai = 1 hectare

N/A: the interviewee did not want to disclose the information

Question 11: What are the most important quality problems? Give Ranking;

This question aims on figuring the technical causes of quality problems of pineapple production. By answering this question, the interviewees are asked to give to rank of the importance of each problem that their groups face. The description of each problem is given by the interviewer in order that both parties have the same understanding in each problem. After each problem is asked, the interviewee is asked to tell about the present situation of each problem that occurs to their group. Table 9 shows that the most important quality problems that occur widely in the pineapple producing areas in Thailand are Mealy bug wilt disease, Fusarium Stem Rot disease and Marbling disease. These problems show high scores in the interviews which are 19, 18 and 20 out of 21, respectively. The degree of seriousness is divided into serious, normal and not a problem. These degrees are based on marks given by interpreting from the interviewees. The 1, 2 and 3 are given to “not a problem”, “normal problem” and “serious problem”, respectively. All results from seven interview are summed up and the degree of seriousness is given as; 7-11: Minor problem, 12-16: Normal problem, and 17-21: Serious problem. The important degree of each problem is summarized in Table 9. There is another important problem that occurs in the pineapple production for the processing plant. High nitrite level of pineapple occurs especially in the Western of the country. This can be described by the interviewee³ that the pineapple production in the west is difference from the production in the east as farmers in the west cut the crown of pineapple when they are growing while farmers in the east do not cut. The aim of cutting the crown is to make pineapple big because the nutrient will not go to the crown. It feeds into the fruit only. In the same mean, the nitrite cannot go out of the fruit via leave of the crown, so it is collected in the fruit. This causes the nitrite problem in the western part of Thailand. On the other hand, this problem is not big because when the manufacture found the high level of nitrite, they will hold the pineapple truck for couple hours or until the level goes down and accept the product.

Degree	Problems	Marks
<i>Serious Problem</i>	Marbling disease	20
	Mealy bug Wilt Disease	19
	Fusarium Stem Rot	18
<i>Normal Problem</i>	Uniformity of pineapple's quantity	16
	Sunburn	16
	Nitrite Level	15
	Fruit bruising	14
	Lack of market demand	14
	Root Rot	13
	Shell surface pitting	13
	Fruit collapse	12
	Internal browning	12
	Mechanical Injury	12
	Deep eye	12
	Uniformity of pineapple's quality	12
<i>Minor Problem</i>	Butt Rot	11
	Nematode	11
	Heart Rot	11
	Yellow Spot	11

	Penicilium/ Fusarium fruitlet core rot	11
	Parasitic disease	11
	Black rot	10
	Pink disease	10
	Moisture Loss	10
	Flesh translucency	10
	Post harvest chilling injury	9

Table 9: The quality problems of pineapple in Thailand. Remark: The grading is shown in Annex 8

Question 12: What quality criteria are applied by cooperatives? (For example, maturity, size, and color)

The answer of this question can be classified into two main groups which is the group that the cooperatives do not set the quality criteria for their members and the groups that the quality criteria are set. The first four interviewees (1-4) which represent the cooperative in the western part of Thailand claimed that there is no quality criteria applied on their members. On the other hand, the farmer groups in the eastern area stated that the maturity, size and the nitrite level are the quality criteria used in their groups for the pineapple.

Question 13: What are the quality criteria that the manufacturer requires? Where is the quality measurement conducted?

All interviewees stated that the quality criteria required by the manufacturer are size, maturity and nitrite level. The difference of the answer is the place where the measurement conducted. As the practice in the western area to deliver pineapple to processing plant is direct delivery from farm to factory on behalf of the cooperative, so the quality measurement is conducted at the processing plant. Interviewee 3 stated that although his cooperative pool the product from the small producer, the quality measurement is still done at the manufacturer's place. In contrast, pineapple farmer group in eastern part will collect or buy pineapple from members prior to delivery to their customer, so the measurement is done at the group.

Question 14: What international standard is applied on members? (Ex. GAP, GLOBALGAP, CODEX, SPS)

Almost all interviewees (5 of 7) stated that their cooperative/group applied Thai GAP which is certified and audited by the department of agriculture, Thailand. Interviewee 3 also said that his group has the "Fair trade" standard which is certified and audited by the organization in Germany for the fruit exported to Europe. There are two groups/ cooperatives that do not apply any international standard on their product which are interviewee 2 and 4.

Question 15: What is the function that cooperatives have? Please give the ranking.

This question is asked in order to evaluate the functions and roles that cooperatives and farmer groups have. The interviewees are asked to identify how important of each activity that they are operating. The scoring of this question is based on the five point scale (1-5) and the mean of 7 interviewees is calculated. The degree of important is based on the rank of mean score. The higher mean score means that activity is more important. After that, the ranking is done and the result is shown in Table 10 below. The main functions of pineapple POs in Thailand is providing the processing facilities and inputs, provision of credit, develop and exchange technological knowledge, and physically collecting the farm product. The first function is ranked in "more important" function that POs are applying.

This also means the degree of dedication that they apply on each activity. The second and third functions are ranked in the “medium important” which means that POs pay less time on these activities.

Rank	Functions and Roles	Mean	SD.
1	Provide fertilizers and input	4.43	0.79
2	Provision of credit	3.71	0.49
3	Develop and exchange technological knowledge	3.43	1.27
4	Physically collect the farm product	3.14	1.07
5	Marketing of farm product	3.00	1.15
6	Contract (and price) negotiation	2.86	0.90
7	Apply quality assurance and traceability system	2.29	0.95
8	Assure the homogeneous quality of products	2.29	0.95
8	Coordinate the activities of supply chain actors	2.14	0.90
10	Add value to the product	2.00	1.15

Table 10: The importance of functions and roles of pineapple POs in Thailand. Remark: the grading is shown in Annex 8

Question 16: How do POs help members on solving the problems that occur? Any measure is applied on the farm such as Management of pest and disease on seed material, Integrated Pest Management, etc

This question aims to evaluate what measure the producer organization applies on members to solve technical problems that occur. This can interpret to how much knowledge they have on the management of the disease and quality problem of pineapple production. From the result of interviews, 4 of 7 do not apply any measure or management on solving the quality problems that occur. The only management of problem that is applied by some POs is the integrated Pest Management (IPM). 3 of 7 of interviewed POs have applied this measure on their members' farm. Interviewee 5 and 7 said that the crop circulation is applied on farms. This practice is normally done in the eastern part of Thailand while the western production area does not apply this practice, so the problem of insect and pest in eastern part is not the major problem in production as that occurs in the western part. Only one interviewee (interviewee4) stated that the cooperatives ask the expert for the recommendation, knowledge and the measure to solve the problem, but there is no stated measures applied on members.

Question 17: What does the cooperative do to manage pesticide use by the members?

This question can evaluate on the knowledge that POs have on using the pesticide which can affect the acceptance of the pineapple by manufactures. The result of this question states that the pesticide is not used in the pineapple production in the eastern part of the country while it is normally used by farmers in western area. All interviewees in the western area stated that POs give the knowledge and

advice to their members when they come to buy the pesticide at the PO's place. The prohibited pesticide is not sold and also banned by the POs among members. The period of time on applying the pesticide is suggested in order to avoid the pesticide residue in the product. Only one interviewee (interviewee 1) stated that the using of pesticide follows the GAP practice which is trained by the officer of the government and manufactures.

Question 18: What does cooperative do on solving the uniformity problem?

This question aims to ask the role of the POs on solving the uniformity problem which is one of the main problems in pineapple's quality problem. By the answer of this question, 3 interviewees (4, 5 and 7) said that the planning for applying the flowering chemical is done in the group or cooperatives. This can avoid the product oversupply. Some of the interviewees argued that the forcing is hard to control because the raining period has changed. For example, this year, rain comes in the winter, so the plants grow well and reach the level that should be forced to flower. Therefore, farmers need to apply the forcing chemical; otherwise the size of fruit will be too big for the manufacturer.

For the quality aspect, the only thing that is the obstacle for selling to the factory is the degree of ripeness. POs give the advice for members to harvest pineapple only when the ripeness is reached the required level of the manufacturer. On the other hand, in the season that pineapple is less available, the manufactures do not care about the ripeness of the fruit. They accept all fruit no matter how ripe they are. This is not clear for farmers and POs when manufacturer applies the standard.

Question 19: Which sorting method is done in cooperative?

This question can be analyzed to identify the quality assurance that POs has on the manufacturers. The interviewee 1 to 4 stated that the grading and sorting process is done at processing plant. Only one interviewee (3) said that he will do the sorting for the small producers which do not have high capacity enough to directly send pineapple to the factory. On the other hand, interviewee 5-7 stated that the sorting and grading of the fruits is done at the group before selling fruits to the processing plant.

Question 20: If members cannot produce the product that reaches the criteria, what does the cooperative do for the member?

Most of the interviewees (5 of 7) answer this question as they will find the alternative way to help their members in solving the problem. Interviewee3 stated that the cooperative will give the advice to the member and keep eyes on them intensively until the problem is solved. On the other hand, there is one interviewee (2) said that the product from the cooperatives is easily accepted by the processing plant because of the trust and the name of the cooperative. One cause that happens to farmers which leads to the low quality of the product is the poverty of farmers. Interviewee 5 stated that they will suggest to the member that has a problem to decrease the amount of pineapple grown and take better care of the rest by applying the fertilizers and water in the adequate amount.

Question 21: What quality assurance program does the cooperative apply on members? Is it working or not?

Some of the cooperatives do not have any quality assurance program. 3 of 7 interviewees stated that there is no quality assurance program applied in their cooperatives. For the farmer group in the eastern, the grading and sorting is done at the group place which makes the product uniformity both in the size and nitrate level. This can be the quality assurance for the processing plant to be sure in the

quality of pineapple. On the other hand, in the western area, the grading and sorting is done at the processing plant, so there is no checking before delivery to the processing plant. This sometimes makes the processing plant not trust in the uniformity of the product which leads to the lower purchase price. Two interviewees (3 and 5) state about the quality assurance program and traceability system. Interviewee3 said that the “Fair trade” program is applied by some members. It is audited by the officer from the “Fair trade” organization in Germany and the record is kept for the activity that farmers have done. Another interviewee is 5. His group applied the traceability system on their members to keep a record of every activity conducted in the farm.

Question 22: Does the cooperative get help from other organizations or the government on improving the quality of pineapple? And How?

This question focuses on the institutional support for the producer organization. Based on the answers from the interviewees, it can be concluded that the support from the government is little. More than 50 percent (4 of 7) of interviewees stated that they do not get any support from the government or other related organization on dealing with the quality problem while the rest said that the government supports them but it is not good. The activity that the government supports the producer organization is

1. Providing the inputs and fertilizer in the cheaper amount, but the fertilizer that they provided is not good for pineapple.
2. The government helps to conduct the conference among the farmers, government and manufacturers in negotiating the buying price of pineapple by the processing plant.
3. The training about the quality problem of pineapple and the visit of other producing area are conducted by the governmental organization, but the interviewee 3 stated that the knowledge that the governmental organization gave is outdated and it is not work when applying on.

Question 23: What do other organizations or the government do to comply with the standard for supermarket and international market?

This question is asked to identify the role of the government on supporting the producer organization to be in the international market. The answer is very clear that the government does not pay the real attention on this issue. 6 of 7 interviewees claimed that they did not get any support from the government on the international standard. Only one interviewee (5) stated that the government helps them on applying for GAP.

Question 24: What inputs does the cooperative supply to its members? What are the advantages for doing so?

5 of 7 interviewees stated that the cooperative or group sells the inputs and fertilizers to members in the cheaper price than the one sold in the market. On the other hand, 2 of them said that they sell the inputs and fertilizers in the same price as the market but they pay members back in the end of the fiscal year as the dividend from the profit that they get. All of them stated that selling the inputs to members helps members because they will get a good quality inputs with the fair price. Interviewee7 supported this claim by stating that members do not risk in being cheated by the salesman of the bad quality fertilizers. When the group buys new fertilizers as the sample, they will tell members about the quality and performance of that fertilizer. So, members will get only good fertilizer to use in their farm.

Question 25: When looking at marketing business, how does the cooperative do on the product of members?

- a. The cooperative collects products from members and sell to the customer**
- b. The cooperative buys products from members and sell to the customer**

4 of 7 interviewees collect the pineapple from the members and sell to the customer.

2 of 7 interviewees buy products from members and sell to the customer.

There is one interviewee both collect and buy the product from members which is interviewee 3. This cooperative buy pineapple from the small farmer and gather with other farmer's while the medium and big members that has capacity to fill up the whole truck will directly deliver the product to the processing plant in the quota of the cooperative.

Question 26: Who does the cooperative sell the product (to whom, directly or via wholesaler)?

All interviewee answers that the product is sold directly to the processing plant without passing the wholesaler. Producer organization 5 also sells product to the retailer(Tesco).

Question 27: How does cooperative do on transferring the information from the downstream actors of the supply chain to members and the other way around?

The cooperative or group acts as the media between processing plant and farmers. 6 of 7 interviewees confirm to this statement. If the information is very important, the meeting will be conducted in order to spread the information to members, On the other hand, if the information is not the urgent agenda, the information will be transferred to members by phone or may be when members go to the cooperative to buy inputs or fertilizers. There is one interviewee (1) stated that the information will be directly transferred from the processing plant to the farmer when farmers deliver product to them. In conclusion, the cooperative or group acts as the middle man for transferring the information between customer and producer and in the other way around.

Question 28: What training does cooperative provide to members?

It can be concluded by the answers of interviewees that the training conducted by the cooperative or farmer group is the common training for the production of pineapple. The main topic that can be found in most of the interviewees (4 of 7 interviewees) is the technique for producing and using of the organic fertilizer. Especially, all of the farmer groups in the eastern production area conduct the training on this topic. On the other hand, 2 of 7 interviewees state that there is no training conducted at their groups. The rest interviewee stated that her cooperative conducts the training on the technique of using normal pesticide and fertilizers.

Question 29: Is the training supported by other organizations or the government?

The government supports the training for the cooperatives and farmers groups in many ways. Financial support, training and field trip to other growing areas are the support that the government gave to them. The governmental organizations that take care of this training are the cooperative promotion department, agricultural section of the province and cooperative department of the province. There is also another organization which is the pineapple grower association of Thailand that conducted the training for the producer organization. The training from the government is sometimes considered as poor training. Interviewee 3 stated that the knowledge from the government

is the outdated information that is not useful to the present growing of pineapple. Moreover, the interviewee 7 supported that the cooperative promotion department conducts the conference on the technology and how to solve disease of pineapple, but the technology that they provide is sometimes not work.

Question 30: How does cooperative help members on the financial service? Or is it supported by the government?

In some producer organization, loaning is not allowed in the form of money but members can loan in the form of inputs and fertilizer. Interviewee 1, 3 and 6 said that members can get the inputs and fertilizers first with paying back when they can sell the product. On the other hand, most of the cooperatives or groups provide the money loan to members in the same rate as the bank or lower rate depends on the practice of that cooperatives or groups. Interviewee 2 and 7 provide their members in the same rate as the commercial bank but members will get the dividend back in the end of fiscal year. Interviewee 4 stated that her group provides loans to members in the lower rate than the commercial bank. In both types of loan, members do not need to provide the asset to the cooperative. The money for loaning is supported by the bank of Agricultural and Cooperative (BCAA) and the cooperative department of Thailand. The interviewee5 also said that if the member does not pay back to the group, that member will be disqualified from the group while the nonprofit loan problem cannot be solved in the cooperative of interviewee2. She claimed that a lot of members do not want to pay back both intentionally and they cannot afford to pay back. This problem makes the cooperative loss in net profit. Moreover, debtors come together as the group and set the regulation that the creditor cannot sue them by law on the unpaid loan. When the creditor goes to collect the loan money back, this group of debtors will come to chase the creditor away by the violent method. This black power of debtors who loan from the cooperatives makes the cooperative not be able to force them by law.

Question 31: What value adding activity does cooperative conduct in order to add value to the product?

Three interviewees said that their cooperative/ group applied the international standard on the production. “Fair trade” program is applied on the farm of cooperative 3 while the pesticide free is applied on the cooperative 5 and the GAP is applied on the cooperative 7. On the other hand, other activities that add value to the product are done on the cooperative 4 and 5. The interviewee4 explained that the cooperative has the activity on making the paper from the residue of the pineapple from the processing plant while the interviewee 5 showed the preserved dessert made from the pineapple. Interviewee 1,2 and 6 stated that they did not have any activities that add value to the product.

Question 32: How does cooperative coordinate with the other actors in the supply chain?

4 in 7 interviewees stated that there is not any coordination with other actors in the supply chain. On the other hand, the rest (3 of 7) have the coordination with the other actors. The coordination that occurs in the supply chain is all between the producer organization and the manufacturer. The main activity for the coordination is about the price negotiation. The one interesting coordination is between the cooperative 3 and the manufacturers. They coordinate to make the special quality pineapple (Fair trade pineapple).

Question 33: When the problems occur with the overall supply of product in the country (Oversupply and supply shortage), how does cooperative do to help members?

The shortage of supply is not the problem for the cooperative or group. On the other hand, in the oversupply of the pineapple, the cooperative will lobby the government to subsidize the excess amount. 6 of 7 interviewee support that they will call or lobby the government to negotiate with the processing plant or the government will buy at the low price to feed the animal or throwing away. Two of the interviewees said that they find the alternative market and the new production of the pineapple such as preserved pineapple to help their members on the oversupply of product.

Question 34: Does the cooperative collaborate with other cooperative? What is the advantage for doing so?

Almost all of interviewee (Except interviewee 1) state that the collaboration with other producer organization is very important and it is done in their cooperative or group. Two of them (2 and 3) claimed that the collaboration with other cooperative to buy the inputs and fertilizer is very economic. They can buy at the lower price. Interviewee 4, 5, and 6 stated that the problem of the cooperative can be shared and the experienced group can give the advice for that problem. Moreover, the technology and market information is exchanged among the group of producer organization. The collaboration among the POs can strengthen the power of them in lobbying the government in supporting their activity or solving the problem. For instance, the lobbying for the subsidy of the oversupply of pineapple is done by the collaboration of many POs.

Question		PO1	PO2	PO3	PO4	PO5	PO6	PO7
11	In table 9							
12	Quality criteria applied in POs	No quality criteria applied	No quality criteria applied	No quality criteria applied	No quality criteria applied	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level
13	Quality criteria required by the manufacturer	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level	Size, maturity and nitrite level
14	International standard applied on members	GAP	NO standard applied	Fair-trade, GAP	No standard applied	GAP	GAP	GAP
15	In table 10							
16	Measure applied on solving the production problem	No measure applied	No measure applied	No measure applied	Ask expert to help	Crop circulation	No measure applied	Crop circulation
17	Pesticide management	Follow the GAP (trained by the government's expert)	Give information and advice to members and sell a good pesticide for them	Give information and advice to members and sell a good pesticide for them	Give information and advice to members and sell a good pesticide for them	No pesticide used in production	No pesticide used in production	No pesticide used in production
18	Uniformity problem	Quality: POs give advice to members to harvest only when pineapple reaches the required ripeness.	The problem is over controlled by the POs.	Quality: POs give advice to members to harvest only when pineapple reaches the required ripeness.	Quantity: Planning is done to avoid the oversupply. POs also tech members on applying chemical.	Quantity: Planning is done to avoid the oversupply	The processing plant helps on planning the production	Quantity: Planning is done to avoid the oversupply Quality: No problems occur.
19	Sorting and grading method	No	No	No	Sorting and Sizing(for small producer)	Sorting and Sizing	Sorting and Sizing	Sorting and Sizing
20	Product does not reach the criteria	Coordinate with the governmental organization to help	Problem has never occurred	Help members in strict manner	Give the advice and encourage them to retry.	Encourage them to reduce the growing area ,so they can pay more attention on production	Give the advice and encourage them to retry	Help in adjusting the growing method and using of fertilizers

Question		PO1	PO2	PO3	PO4	PO5	PO6	PO7
21	Quality assurance programs	No	No	Fair trade	No	Record keeping or activities in the farm	No	No
22	Supports from other organizations on improving the quality of pineapple?	The government helps on providing the inputs and technical knowledge	No support obtained	The government helps on providing the inputs and technical. They also helps in setting the fair price	No support obtained	The government helps on providing technical knowledge	No support obtained	No direct support to the group, but the group join the conference conducted by the government
23	Helps from other organizations on complying standard for supermarket and international market	No	No	No	No	Helps on applying GAP	No	No
24	providing inputs to members	Sell in cheaper price than market	Same as market price but dividend in the end of year	Sell in cheaper price than market	Sell in cheaper price than market	Sell in cheaper price than	Same as market price but dividend in the end of year	Sell in cheaper price than market
25	Collect or buy products from members	Collect	Collect	Both collect and buy	Collect	Buy	Buy	Collect
26	The customer of POs	Processing plants	Processing plants	Processing plants	Processing plants	Processing plants Retailer	Processing plants	Processing plants
27	Information transfer among the farmers and other actors in supply chain	Conduct regular meeting	Farmers get information directly from the factory	Conduct meeting	POs get information and gives to members	Urgent meeting with the urgent topic, phone call with normal topic	Urgent meeting with the urgent topic. If not, members will get information when they come to POs.	Urgent meeting with the urgent topic. If not, members will get information when they come to POs.

Question		PO1	PO2	PO3	PO4	PO5	PO6	PO7
28	Training provided to members	No	Usage of fertilizers and pesticides	No	Making organic fertilizers	Making organic fertilizers	Usage of organic fertilizers instead of chemical	Making organic fertilizers
29	Supports from other organizations in training	The government, manufacturers, the pineapple grower group of Thailand	The government support in the financial	The government and the pineapple grower group of Thailand. The information from the government is not good.	The CPD of Thailand and cooperative department of the province.	The CPD of Thailand	The agricultural department of the province	The CPD conducted the conference, but the information is not good
30	Financial service	Members can buy inputs and fertilizers in credit	Money loan with the same rate as commercial bank. The dividend is given in the end of the year.	Members can buy inputs and fertilizers in credit	Money loan with lower rate than commercial bank.	Money loan with the same rate as commercial bank. The dividend is given in the end of the year.	Members can buy inputs and fertilizers in credit	Money loan with the same rate as commercial bank. The dividend is given in the end of the year.
31	Value adding activity	No	No	Fair trade pineapple	Paper from pineapple	Pesticide free pineapple and pineapple dessert	No	Pineapple dessert
32	Coordination with other actors	No coordination	No	With processing plant in producing fair trade pineapple, developing quality and negotiation of price	No	With processing plant in sustaining the price of pineapple	No	With processing plant in contract for the required amount with higher price.
33	Product oversupply	Collaboration with other actors in subsidizing the oversupply	Asking the government to support	Asking the government to support	Help members to find other processing method	Asking the government to support and Finding new market	Asking the government to support	Asking the government to support and Finding new market
34	Collaboration with other POs	No	In buying inputs with cheaper price	In buying inputs with cheaper price	Exchanging information between POs	Sharing the problems and exchanging information between POs	Exchanging market and technological information	To lobby the government for the support.

Table 11: Summary of answers for each PO

5.2 Data Analysis

5.2.1 The actual quality problems in the pineapple production

- **Problem in production**

Table 9 shows that marbling disease, mealy bug wilt disease, and Fusarium stem rot are the serious problems that are found in the pineapple production. All three serious problems occur in the production stages.

However, there are many problems in production that are considered as a normal problem. For example, nitrite problem is a normal problem with high score that tends to be the serious problem. Root rot, fruit collapse and internal browning are the normal problems while Butt rot, nematode, heart rot, yellow spot, Penicilium/ Fusarium fruit let core rot and parasitic disease are the normal diseases that have low score which tends to be not the disease.

The problems in pineapple production that are considered as minor problems in Thailand are black rot and pink disease.

The problem in production has been happened in Thai pineapple growing for long time. The solutions for these problems are not well applied to the farm or growing area. Lack of knowledge among farmers or even the producer organizations is one of the reasons why problems are not solved. The measure such as, Integrated pest management, management of pests and disease on seed material and management of hearth rot are not applied on the production farm. In some POs, the traditional knowledge is applied on the farm which is useful for fighting with the problem in production. The circulated growing of plants in the farm is done to avoid the ants and mealy bug, the vector animal for the mealy bug wilt.

- **Uniformity problem of the product**

The uniformity problem in quantity is an important problem in Thailand. The fluctuation of price is known as the main factor of this problem. Moreover, the knowledge of farmers and also producer organization is another important cause. They believe that the quantity of pineapple will be dropped gradually with the year of growing. Moreover, they also think that this problem cannot be solved.

On the other hand, the uniformity problem in product's quality is also classified as normal problem. This issue is the obstacle for selling product to the processing factory. The degree of ripeness is the only quality aspect that shows the problems in the uniformity.

- **Standard of the product**

Although unreached standard might not seem as the important quality problem in pineapple production in Thailand, some farmers, especially small farmers, are still facing this problem. From the answer of the question, it stated that the standard required by the manufacturer is the maturity, size and nitrite level of pineapple. The method or activities that support or make the product reaches the required standard are well conducted by POs. POs always give the suggestions for their members not to harvest the fruits that have not reached the required standard. Moreover, the suggestion on using the fertilizers that makes pineapple's nitrite level high is given to the members. On the other hand, the suggestion is given but there is no actual practice that controls the activity of the members. 4 of 7 POs let members directly deliver pineapple to the processing plant. The sorting and grading is done at the

factory. Therefore, the quality of the product is not able to be controlled to reach the required standard of the processing plant.

5.2.2 The actual functions and roles of POs

The role of producer organization in Thailand is mainly economic. It combines of production activity and marketing activity. The activity of producer organizations on the production is the main activity that has actually been done. Providing inputs is ranked first in the importance of the roles and functions that they are having. Developing and exchanging technological knowledge is also considered as important. On the real practice, the producer organizations do not have the good knowledge on helping members to solve the problem in production. The measure and method in solving problems in production which is effective and widely accepted is not applied on the member's farm. The producer organizations do not have knowledge about this stuff. The managements and measures that can be applied to solve the problem are not guided to the farm that got the problem. From the result of question 16 on solving the production problems, only two of seven POs applied the crop circulation which is one of the methods in the Integrated Pest Management (IPM). The rest of POs do not applied any measured on solving the production problems. Pineapple POs in Thailand help their members that cannot reach the required quality by taking a closer look into that member. The alternative ways of solving problems are searching in order to help. These members will be taken care seriously.

According to the function, activities of POs in economic roles can be divided into four main activities; increasing bargaining power, reducing information asymmetry, quality improvement, and new functions. The detail of each activity is;

Increasing bargaining power

- **Contract and price negotiation**

In contracting and price negotiation, the producer organizations collaborate with the government and the processing plants in negotiating the fair price. There is the summit conducted among these three parties on dealing with the price which is fair to both parties and quality required by the processing plants. Sometimes, the price is negotiated between the producer organizations and the processing plant. The higher than standard price is got by the POs that can feed the product to processing plant with the required amounts in the season that product is less available or the time that the processing plant increases the production.

- **Physically collecting of farm product**

Most of the pineapple producer organizations in Thailand (5 of 7) do not own the product when they delivery to the processing plant. POs do not buy it from members. They do collect and forward to the customer. Only two POs take the ownership of the product by buying from members before selling to the processing plants. The customer that almost all POs have is the processing plant. There is one producer organization that also sells their product to retailer (Tesco). All of the producer organizations directly sell product to processing plant without passing any middleman.

Assuring the homogeneous quality of products

○ Uniformity of product

On dealing with the problem in uniformity of product, pineapple producer organizations in Thailand give the advice and also plan for members on applying the flower forcing chemical. On the quantity of pineapple, the producer organizations make the plan for their members. When members come to buy the chemical at POs' office, they will get the information on the schedule for applying the chemical in order to avoid the oversupply of pineapple from members in the same time. Three of seven POs make the growing plan for their members. On the other hand, Two POs do not apply any measure on this problem. In the quality aspect, producer organizations only suggest their members to harvest the pineapple that are ripen as required from the processing plant. Sometimes, the processing plant is asked to help on planning of the production. There is the misunderstanding in one POs which stated that the problem in uniformity of production is not solvable because the production of pineapple will be less and worse quality every year. They understand that is normal to happen.

In order to make product more uniform, good coordination between producers and processors are needed. This includes the sharing of information in the marketing and production aspect and the coordination with actors in the supply chain.

○ Sorting and grading

One of the methods that can make product homogenous and uniform is sorting and grading (sizing). By doing this, the processing plant will get the product's size and type that they prefer. The farmers may get the better price and the POs may have better bargaining power on the price of the product. Sorting and grading is done by some of the POs (4 of 7) while the rest does not do. It is done by the processing plants that purchase the product.

Reducing information asymmetry

○ Provision of credit

The credit provided to members can be classified into two types which are the credit for buying the inputs and fertilizers and the credit as the cash for spending on developing the farm or in personal living. Three of seven POs provide credit to members in the form of inputs and fertilizers. Members do not have to pay directly when they buy. They can pay when their products are sold. On the other hand, the credit provision as cash is done in four POs. This can be divided into two groups; the same interest rate and lower interest rate than the commercial bank. Three of four prefer to lend members in the same interest rate as bank and pay the dividend to members in the end of the year.

○ Information transferring among farmers and other actors in the supply chain

The transfer of information among actors in the supply chain is done by helping of the producer organizations. POs play important role in transfer information between farmers and other parties. There are many means of transferring; regular meeting, urgent meeting and calling. Most of POs conduct meeting if the topic of the information is important and urgent. For the normal information, the phone call may be used or the information will be given to members when they come to the POs' place.

The transfer of information among actors in the supply chain is very important in making product more uniform. The information on demand of the pineapple required by the processing plants in the

particular time could be used in making the plan of production for members of POs. This is also able to apply on the uniformity in quality of product. The feedback from the processing plants can be used in adjusting the growing and harvesting of pineapple to reach required quality.

Quality improvement

- **Providing fertilizers and inputs**

In order to solve the problem and improve the quality in production, fertilizers and inputs are needed. POs play very important roles in providing these inputs by either selling with the low price or selling as the credit. Members that do not have enough money can pay when the product is sold in the harvesting season or when they have money. Most of POs (5 of 7) sell inputs and fertilizers in cheaper price while the rest two POs sell them in the same price as market but the dividend is divided in the end of the year. This activity makes profit to both POs and members. POs gain profit to operate the business while members get the inputs at low price and good quality.

- **Developing and exchanging technological knowledge**

The technological knowledge are developed in POs and exchanged among members. Pineapple POs in Thailand develop the organic fertilizers to use by their own. This knowledge is shared to members of the group and also other producer organization that is interested. The experts in the technical aspect are sometimes invited by the government to give the knowledge to the producer organizations on various topics about the production of pineapple. The technological knowledge can be classified into various topics;

- **Controlling of pesticide used**

The producer organizations did well in managing and control the pesticide used by members. POs sell only the pesticide that is working and safe for the pineapple, consumers, and growers. The expert on pesticide is invited to give the knowledge to users. Also, the producer organizations suggest the period of applying pesticide for their members in order to avoid the residue in the product. Three of seven POs give information and advice to members when they come to buy pesticides at POs office. On the other hand, other three POs promote the pesticide free among their groups by using other method that expels the pest and vector.

- **Help to reach the product criteria set by the processing plant**

When members always face the problem in being not able to reach the standard set by the processing plant, POs have some method on helping them. These measures are different for each producer organization. Some POs help farmers to find the real causes of the problems. For example, PO5 gave an advice to the member that faces the problem to reduce the growing area because they cannot afford for the fertilizers and inputs. It is better to pay a good attention on the smaller farm than loose attention on big farm. Some POs help members by giving an advice and pay more attention on that member. One PO stated that it asks the governmental organization to help on finding the cause and solving the problem.

- **Training**

The trainings that are provided by the producer organizations are mainly related to the usage and production of fertilizers. Four of seven POs provide the training on producing and usage of organic

fertilizer instead of chemical fertilizers. One producer organization trains the member on using the chemical fertilizers in the right way. On the other hand, there is no training conducted in two POs.

New functions: Vertical coordination

Applying quality assurance and traceability system

Most of the POs do not apply the quality assurance program on their members. Only two POs have the activities that record the processes done by farmers. This can help farmers to find the origin of problems that occur and make the customer sure about the quality of product they buy.

Coordination with other actors in the supply chain

The coordination with other actors in the supply chain helps producers to improve the quality of products. The transfer of information is one of the coordination with other actors that producer organizations have. By other means of coordination with the processing plants, the quality improvement can be applied by the support from them. Not only the information that is used in planning, but sometimes, the processing plant's experts also help on solving the quality problems and they help to plan the production for the producer.

Except from the coordination with other actors in the supply chain on product improvement and transfer of information, POs in Thailand have little coordination in other aspects. Three POs in Thailand have the coordination with the processing plants in making the special contract, sustaining the price, and develop quality and negotiation of price.

Collaboration with other POs

The collaboration with other POs is done in some POs. The main objective of collaboration is for exchanging the knowledge and helping each other on solving the problem that occurs. Two POs collaborate to buy inputs and fertilizers in big amount, so they can buy in cheaper price. Moreover, some POs collaborate to gain the power in order to ask the support from the governmental organizations. There is one PO that does not collaborate with other.

Value addition

There are many activities that have been done by the POs in order to add value to the product. They are both the application on the pineapple and the process of the production. The added value "Fair trade" pineapple is the product from one of the POs for the international market especially Europe. Moreover, the pesticide free pineapple is also done by some POs. Pineapple is also used in processing of the pineapple product such as the pineapple candy and the paper from the pineapple's residue. The rest (3) POs do not have any activity that add value to the product.

Support from the governmental organizations

Pineapple grower and producer organizations got the supports from the governmental organizations. In training, the governmental organization such as CPD, the provincial cooperative department and the provincial agricultural department give the hand on conducting and giving the technical information. The governmental organizations give the support on improving the quality of pineapple by providing the technical knowledge and inputs to farmers and producer organizations. They also help the grower by negotiating with the processing plant on setting up the fair selling price of the product. On the other hand, the support for growers in order to meet the required standard of the

customers is not given by the governmental organizations. The only standard that the governmental organizations give to farmers is the GAP. Six of seven POs stated that they have never got any support on improving the production in order to reach the standard.

5.2.3 The potential of POs

Development of POs

Development of POs	POs in Thailand	Level / Stage
Formality	Formal	Intermediate
Scope of organization	Local, first-level organization	Early
Activity	Bulking and marketing activity	Early
Marketing channel	Local market	Early
Value of product	Low value	Early

Table 12: The development of pineapple POs in Thailand

The information in Tables 12 and 13 is the comparison of the information in Tables 4 and 6 with the data gathered in the empirical study. Table 12 shows the information about the development of pineapple POs in Thailand. The POs in Thailand can be concluded to be in the early stage of development. Almost all conditions of the development among the pineapple POs in Thailand are in the early stage. Only one issue that is in the intermediate stage is formality of the organization. The producer organizations in Thailand are required to register with the governmental organization. Scope of organization is needed to be expanded perhaps by coordinating with other POs in the other districts or provinces. The activity of POs should be more variety in order to make the product difference from others. As the result of developing of the activity, the value of the product will be improved to have higher value. For example, the GAP or organic pineapple is another type of the diversified product which has higher value than the traditional pineapple that can be found over the country.

Business Development

Indicators for development	POs in Thailand	Level / stage
Profitability	Breakeven + profit	Intermediate + Advanced
Product, market and marketing channel	More than one	Intermediate
Market service	Able to access some independent market services	Intermediate

Influence on price of product	Able to influence some	Intermediate
Relationship with other actors in value chain	Some good	Intermediate
Capacity to influence the market environment	No	Early

Table 13: The business development of pineapple POs in Thailand

From the information shown in Table 13, the pineapple POs in Thailand can be expected to be in the intermediate stage organization. The business development stages are distributed in each parameter, but not in advanced stage. Some producer organizations are profit from operating, but some are just break even. No POs are found in getting lost on the operations.

There are three aspects that POs in Thailand are good at which are; 1) they have more than one marketing channel which are the processing plants and the fresh market, 2) they are able to influence some price setting, and 3) some of them have good relationship with other actors in the value chain.

By coordination between many POs in the province, the group of producer organizations has more power in bargaining the price with the processing industries. The group of POs does not have the full ability to negotiate the fair price by their own. Sometimes, the groups of POs ask or lobby the government to take part in negotiating the price and quality required of the product to be fair for both farmers and processing plants.

Not all POs have the good relationships with other actors in the value chain. Some have very good relationship with the manufacturers so that the manufacturers help to give the technical information or even the less intense regulation and quality of the product when PO's members deliver products to the processing plant. On the other hand, some POs do not have any good relationship with the actor in the value chain. The relationship is just the seller and buyer.

From the interviews and observation of the pineapple POs in Thailand, the pineapples POs do not have any capacity to influence the market environment. The market environment depends on the mechanism of the market. The POs cannot promote their members' interests to the market. It is depends on the customer and market mechanism.

Tables 12 and 13 show the development of pineapple POs in Thailand. These tables show capability and development stage of POs on doing business and helping their members can be seen. The development of pineapple POs in Thailand is not high. Almost all aspects of development fall in the early stage. The power and business development of Thai pineapple POs in the market is not too low that they are manipulated by the buyer. On the other hand, it is not so high that they can dominate the market or transaction. They are still able to negotiate for the fair condition and price in the market.

5.3 Conclusion

The research question D "What are POs in Thailand doing in solving the quality problems and improving the quality of tropical fruit in Thailand?" is answered in this chapter. The information from the empirical study shows that the POs in Thailand support the production activities, do the marketing activities for their members. The stage and development of POs in Thailand is shown in order to measure the capacity of POs on helping farmers.

Moreover, the quality problems of pineapple production in Thailand are stated. This information can be used in combination with the information from Chapter 2 to answer the research question A on the quality problems of pineapple in Thailand.

The quality problems of pineapple production in Thailand can be classified into three problems; production problems, uniformity problems, and unreached standard problems. In the production problems, the marbling disease, mealy but wilt, and Fusarium stem rot are considered as the big problems that often occur and cause the big damage on the pineapple production. Moreover, there are many problems in production that are considered as normal problems. The uniformity problem can be divided into a quantity and quality element. Both problems are considered as normal problem, but the uniformity problem in quantity tends to be the most serious problem. On the other hand, the problem of unreached standard of pineapple seems not to be a quality problem in pineapple production. This might be because the processing plants in Thailand do not require high standard of pineapple. The causes of these three main problems are shown in Chapter 2 and Table 7 in the conclusion section of Chapter 3.

Producer organizations in Thailand have several roles and functions that help their members in three kinds of activity, economic, social, and political. The main economical roles and function of pineapple POs in Thailand are about the production and marketing activities. Providing fertilizers and inputs develop and exchange technological knowledge, physically collect the farm products are examples of important economic roles in that POs in Thailand have. On the marketing activity, marketing and contract and price negotiation are the roles that POs in Thailand have, but they do not pay much attention like they do on the production activity. Another activity in the economical roles that POs in Thailand have is the provision of credit. This activity is the second most important activity that they are doing. Coordination with other actors in supply chain and collaboration with other POs is not normally found in the interviewed POs. The main aim for coordination is for exchanging the technical knowledge and better price for buying inputs and fertilizers.

The development of POs and business development are used to measure the power and capability of POs in Thailand on supporting their members. The development of pineapple POs in Thailand is considered as the early stage of development. Only the formality of the organization is considered as the intermediate stage. The scope of organization, activity, marketing channel, value of product are under the early stage. When looking at the business development of the organization, pineapples POs in Thailand are classified as intermediate stage. The business development stages are distributed in each parameter, but not in advanced stage.

Chapter6: Conclusion and recommendation

6.1 Introduction

This research project is about the role of producer organizations in Thailand on solving the quality problems of pineapple production. The objective of the research, as presented before, is to make recommendations for producer organizations in Thailand on solving quality problems that occur in the production of pineapple in order to improve the ability to export by making an analysis of the quality problems and the ideal roles of the producer organizations on solving the quality problems and improving the capability of producers in the supply chain. In order to achieve the objective of the research, the comparison between the problems that can happen in the pineapple production and the actual quality problems are done. Moreover, the actual roles that they are having are used to compare with the potential roles of POs on solving the quality problems.

The main research question, as derived from the objective, is “How can producer organizations help in solving the quality problems and improving the export of tropical fruit from Thailand?”

This chapter will present the conclusion both on the research objective and the research questions. The four research questions will be answered. First, the quality problems that occur in the tropical fruit chains for domestic and export market will be shown. After that, the solution on each problem is stated. The roles of POs that can help on solving the quality problems are reviewed. Lastly, the actual roles of POs in Thailand are found.

In Section 6.2, the answers to each research question, including sub questions are detailed. In the end of the section, the answer to the research question is stated. In Section 6.3, the recommendations for the pineapple producer organizations in Thailand are stated. Finally Section 6.4 is about the recommendations for the further research in the field of this report

6.2 Conclusion

6.2.1 Research question A

“What are the quality problems that occur in the tropical fruit supply chains for domestic and export market?”

In order to answer question A in efficient way, 3 questions related to the concept of the main research question are answered

A1) What are the quality problems that occur in the domestic and export market?

The approach that is done to answer this sub research question is; firstly, the literature review approach is used in order to get the information about the disease that can happen with pineapples. Second, the information from the literature review is used in the interview, so the empirical study gave the actual quality problems of pineapple in Thailand.

The quality problems in pineapple production of Thailand can be classified into three main problems, problem in production, uniformity problem of product, and unreached standard of product. The result of interview shows that the problem in production of pineapple is the most important problem in Thailand. The problem in production can be divided into three stages which are the growing stage, harvesting and post harvesting stages. Disease is the main problem in the growing stage. The most important diseases that are widely found in pineapple production are the marbling disease, mealy bug

wilt, and Fusarium stem rot. There are various diseases that happen to pineapple in harvest and post harvesting stages

For the uniformity problem of product, the uniformity problem in quantity is more important problem than the uniformity in the quality of product. From the result of interview, the uniformity in quantity of product is classified as the major problem while the uniformity of quality is classified as the normal problem in pineapple production.

The problem of unreached standard of the product is not a serious problem in the pineapple industry in Thailand. The standard that processing plant requires is the maturity, size and nitrite level.

A2) What are the causes in the quality problems?

A3) Where is the cause of quality problems in the supply chain?

In order to explain the causes of the quality problems of pineapple in Thailand in more effective way, the answers to sub research questions A2 and A3 are combined to be one answer. In these sub research questions, the literature review is done to figure out causes of quality problems.

Quality problems can be caused by many factors. In the problem of production, the causes come from the high infection of disease, lack of knowledge of producers, lack of capital to invest on farm, and low use of inputs and fertilizers.

Fluctuation of price which leads to the fluctuation of the production is the main cause for the uniformity problem of product. The lack of planning in production of pineapple is also another cause that makes the problem occur. Besides these two cause, information asymmetry, oversupply of the product and the small amount of product from various small farms are also causes of this problem.

In the problem of unreached standard of product, lack of knowledge and capital to invest in farm is the important cause of the problem. The uncertainty on when the standard is used by the processing plant makes producers confused whether the processing plant is serious on the standard required.

The major causes of quality problems in pineapple production occur with the producer. The problems in production happen as the producers' lack of knowledge in preventing and solving problems. Moreover, lack of knowledge among farmers also causes the problem in unreached standard. The lack of knowledge and capital to invest is the major cause that happens with the small producer in Thailand. The uniformity of product comes from the fluctuation of price and the lack of good planning. These causes of problems happen in the producer stage in the supply chain. The processor is also the part of actors in the supply chain that is the origin of problems. In the standard of pineapple, the uncertainty in standard required by the processor is another cause. In conclusion, the cause of quality problem mainly originates from the producer. It also happens with the processor.

6.2.2 Research question B

“What are the solutions for quality problems that occur in the tropical fruit supply chains?”

In order to give a clear answer to question B, two questions which relate to the main research questions need to be answered.

According to the causes of the quality problems, three types of solution are figured out by the combined methods of literature review and empirical study. The answers to sub questions B1 and B2 are combined in order to make clearer conclusion.

B1) Which types of solution are matched to the problems?

B2) In which stages of the supply chain can the solution be applied?

In order to solve the quality problems of pineapple production in Thailand, the solutions can be applied on three stages; Technical, organizational, and institutional. The solutions for every quality problems need these three stages in order to solve.

First, in the technical stage, the solutions applied in the production are various managements on production, harvesting, and the post harvest treatment. These solutions can solve the problems in production that are caused by diseases or infection. For example, integrated pest management can solve the diseases that result from the vector and pest. Chemical forcing on pineapple plant is another solution that can be used for making product uniform in quantity. Moreover, sorting and grading helps product to be more uniform.

Second, the solution in organizational stage is applied in the producer organizations for helping members to solve the quality problems. The capital and knowledge providing can help on solving the problem in production, uniformity of product and the unreached standard. In almost all problems, lack of capital and knowledge is the major cause. By providing access to credit and knowledge to farmers, they can apply the knowledge and money on their production. Moreover, the planning of the production is one of the knowledge that is useful for solving the quality problem in uniformity of products. POs need to make planning for their members on growing and harvesting in order that the product will not oversupply from members in the same time.

Third, the solution in institutional stage is also important for solving quality problems in pineapple production of Thailand. Only the farmers or POs themselves cannot solve some quality problems that occur such as the fluctuation of price, uncertainty in standard level of the manufacturer, or even the asymmetry of technical and market information. The collaboration between difference actors in the supply chain is needed. The support from the other organizations, processor and governmental organizations, is sometimes necessary to solve the problem. For example, the fluctuation of price is a problem that needs the coordination among three actors which is the producers, processor and the government in negotiation. Moreover, the required standard is another example that needs the coordination between the producer and processor. The clear standard should be set and regularly applied in practice so that all related parties have the same understanding. The collaboration within the supply chain can also be applied on solving the information asymmetry problem between producers and processors.

At last, all these three stages are needed to be applied in the solutions for quality problems of pineapples in Thailand.

6.2.3 Research question C

Quality problems	Suggested activities on problems solving	Actual activities of POs
Production, Uniformity, Unreached standard	1. Develop and exchange technological knowledge	1. Provide fertilizers and input
Production, Uniformity, Unreached standard	1. Coordinate the activities of supply chain actors	2. Provision of credit
Production, Uniformity	2. Apply quality assurance and traceability system	3. Develop and exchange technological knowledge
Production, Uniformity	2. Providing inputs and fertilizers	4. Physically collect the farm product
Production, Unreached standard	2. Provision of credit	5. Marketing of farm product
Unreached standard	3. Physically collecting of farm product	6. Contract (and price) negotiation
		7. Apply quality assurance and traceability system
		8. Assure the homogeneous quality of products
		9. Coordinate the activities of supply chain actors
		10. Add value to the product

Table 14: the comparison between the potential role on solving each quality problem and the actual role of POs. Remark: The activity is arranged in order of the importance and priority.

Table 14 shows the comparison between the potential roles of POs on solving the quality problems and the actual roles that pineapple POs in Thailand have. Six important roles of POs on solving the quality problems and ten actual roles that POs have are shown. This table is used in answering the questions C and D.

Research question C

“How can POs help to solve the quality problems?”

By making an analysis of the roles that POs could have on helping to solve problems in quality of pineapple production in Thailand, the result is shown as the main role of POs, which is useful in solving the quality problems, is the economic role. There are two activities in the economic role; production and marketing activities. Two sub research questions, related to these two activities, are stated in order to verify the roles of POs on solving the quality problems.

C1) How can POs help to solve the quality problems in the production level?

In table 14, the roles of POs in the production activities that help to solve the quality problems compose of providing inputs and fertilizers and developing and exchanging technological information. These activities directly relate to the solutions of the problems in production.

C2) How can POs help to solve the quality problems in the marketing level?

In the marketing level, the main goal of producer organizations on solving the quality problem is to reduce information asymmetry, and applying quality assurance and traceability program and increase the bargaining power. In order to get these two goals, various activities have to be done. Provision of

credit, physically collecting of products, and coordinating the activities of supply chain actors could be done.

6.2.4 Research question D

“What are POs in Thailand doing in solving the quality problems and improving the quality of the tropical fruit in Thailand?”

The empirical study is conducted to get the information from the interview in order to answer this research question. Although PO may also have social and political roles, economic role can be considered as the most important role for quality improvement. It combines production activity and marketing activity. From the data shown in table 14, the activity of producer organizations on the production is the main activity in practice. According to this function, activities of POs in economic roles can be divided into four main activities; increasing bargaining power, reducing information asymmetry, quality improvement, and new functions.

The activities in increasing the bargaining power that can improve the quality of product compose of physically collecting of farm product and assuring the homogeneous quality of products. By doing this, the quality of products will be improve since POs can applied sorting and grading when they gather product at their place before sending to processors. Moreover, assuring the homogeneous quality of products needs particular quality standard that farmers must achieve. These two aspects can solve the quality problems that occur.

In order to reduce information asymmetry, POs helps on transferring information among farmers and other actors in the supply chain. They also help farmers by providing credit by using the credit information from the financial institution that does not want to provide credit to a small farmer. The interest rate is sometimes lower than the one that commercial bank provides. Credit is also provided to members in the form of inputs and fertilizers.

In the activities of improving the quality, POs in Thailand pay much attention on them. Providing inputs is the most important role that they are having. Developing and exchanging technological knowledge is also considered as important. In practice, the producer organizations do not have the right knowledge on helping members to solve the problem in production. The measure and method in solving problems in production which is effective and widely accepted is not applied on the member's farm.

Other than three traditional functions of the producer organizations on solving the quality problems, some of new functions are done by some POs. Applying quality assurance and traceability is done in a few POs. Also, the coordination with other actors in the supply chain is hard to be found in the pineapple POs in Thailand. On the other hand, the collaboration with other POs is normally done by almost all POs. The main objective of collaboration is for exchanging the technical knowledge and helping each other on solving the quality problems that occur. The value addition of the product is done in many POs for the process of production and also on the processing of pineapple. The dessert from pineapple is made while the organic pineapple is another activity that is done in some POs

6.3 Recommendation on the roles of POs on solving the quality problems

The recommendation for the POs on solving the quality problems is made by comparing the activities that are useful to solve the quality problems that occur with the actual activities that POs in Thailand carry out.

In order to solve the quality problems in effective way, POs in Thailand need to adjust the intention in some activities;

Develop and exchange technological knowledge

This role is one of the three most important roles for solving the quality problems. Although it is considered as one of the most important roles that POs in Thailand are having, they could pay more intensive and attention on it as it can help on solving all quality problems that occur. The technological information could be updated in order to get more effective solution. By doing this, the expert in the technical field could be invited to help on the technical problem or improving the quality of product. The technological information could be up to date. For example, the effective measure on managing the production to deal with the disease of the pineapple, such as integrated pest management and other management on disease, could be applied. Moreover, the exchange of technological knowledge could be intensively conducted. The method of some POs is effective in solving some quality problems. For example, the crop circulation in pineapple farmer groups in Rayong province is effective in solving the problem caused by pests and insects. Another example is the organic fertilizer in pineapple farmer groups in Rayong province. This fertilizer gives a lot of profit to members of the group. This technological knowledge could be transferred to other pineapple producers in other producing areas.

Coordinate the activities of supply chain actors

By making the analysis on the potential roles of POs on solving the quality problems, this role is another most importance. When looking at the actual roles of POs in Thailand, the coordinating activity is neglected. In order to solve quality problems, POs need to pay more attention to this role because it could help on solving all quality problems that occur in pineapple production in Thailand. By having more coordination, the technical and market information can be transferred easier between the producer and processor. The producer could have better information on adjusting or planning of the production. Moreover, the producer could plan the production together with the support from the processor.

Beside the support from the processing company that POs could get, the support from the governmental organization is also important in solving some quality problems. Some cause of the quality problems needs the support from the governmental organization. For instance, the fluctuation of price needs the governmental organization to help in negotiating to set the fair price for both producer and processor.

Applying quality assurance and traceability system

Applying quality assurance and traceability system is another role that can help on solving all quality problems that occur. In the real practice, it is ranked as 7th important role that POs in Thailand have. POs in Thailand could pay more attention on applying quality assurance and traceability system in order to solve the quality problem and improve quality of the production which supports the future market requirement. The problems in production and uniformity of product could be solved as the causes of the problems are figured out by the record keeping. By applying this program, the method of production can be improved. Every step of production is recorded, so the origin of problems will be easily figured out. The reason why POs should apply this system is because they are in the interface position between the producer and the processor. It is the good position to set up the quality control system. By doing this, POs will also have more opportunity to do business with customers that require

particular standards. The method of applying the system can be observed and learned in the PO3 in Prachuap kiri khun province, applying fair trade program, and PO5 in Rayong province, applying the record keeping.

Providing fertilizers and inputs

The role in providing fertilizers and inputs is considered as the most important role for POs in Thailand. Every PO in Thailand pays much attention on it. For solving quality problems, this can be considered as important role because it helps to solve problems in production and the uniformity of products. It is good to perform this activity but the time and attention could be divided to other roles that are more important on solving the quality problems like three roles that are stated before.

Provision of credit

POs have provided credit for members for long times both in cash and credit for buying inputs and fertilizers. By performing this activity, it can help to solve the problems in production and unreached standard of product. This role is one of the most important roles that POs in Thailand have paid much attention. Lack of capital to invest is one of the important causes that lead to the quality problems. Therefore, by helping them with the credit, members will have more capital to invest in their farm and production. In the mean time, although this role is considered as important for them, the method of loaning should be more formal in order to avoid the problem that the debtors do not pay the POs back when the loaning period finish. The legal contract should be applied on the loan. The help from the governmental organization should be provided on this issue because it is over the capability of POs to deal with them.

Physically collecting of farm product

Physically collecting of farm product used to be the important role for POs in Thailand. In the present day, some farmers directly deliver product to processing plant without pooling at POs' site. By lacking of collecting of product, some measure that can improve the quality of pineapple is not done. POs in Thailand should pay more attention on this role. It does not only make more bargaining power, but the sorting and grading can also be done in order to make product more uniform. The product can be checked whether it reaches the standard before delivery to the processing plant. This method can also make more trust for the customer on the quality of the product. As the nature of delivery of farm product to processor changes, it is not feasible to POs to collect all products from their members. The POs should

1.4 Discussion

This research project composes of information about the quality problems of pineapple production and the roles of POs on helping members to solve the quality problems. The research is conducted in the perspective of producers not the processors. Various aspects of this research project will be discussed in the following sub topic.

Strong and weak point of research project

In the beginning, this research project aimed at the pineapple producer organizations in Thailand which includes the pineapple for fresh consuming and the pineapple for processing. In the stage of empirical study, it was found that the majority of producer organizations in Thailand do not do business in the pineapple for processing. Their main customers are the processing plants. The researcher needs to edit some content of the report to support the pineapple for processing.

On the other hand, the sample group of the research can cover the producer organizations in the pineapple industry of Thailand. Most of the pineapples POs in two largest producing areas are interviewed. These groups can represent the POs of pineapple in Thailand.

Recommendation for different approach

The research in the perspective of processors should be included in the project. As stated before, this research project based on the perspective of producers, so some problems that are considered as important by the producers may not be important for the processors. Being not important for the processors, that problem should not be considered because the product can be traded. . Not only the processors that should be included in the further research, the late actor in the supply chain such as the retailer in foreign countries or the customer are also useful to the research.

The condition of pineapple industry in this project is mainly based on the literature review which is 5 years old. Therefore, the information is not up to date. The condition of the industry may be changed. The interview with processing plant should be conducted to get clearer and more update view of the industry

Recommendation for further research

The further research that could extend the content of this topic is the one that focuses on the later actor in the supply chain such as the processor or exporter. Not only the actors in the supply chain that are interesting to focus on the research, the role of governmental organizations and NGOs on improving the quality of pineapple can also be a good topic for the further research.

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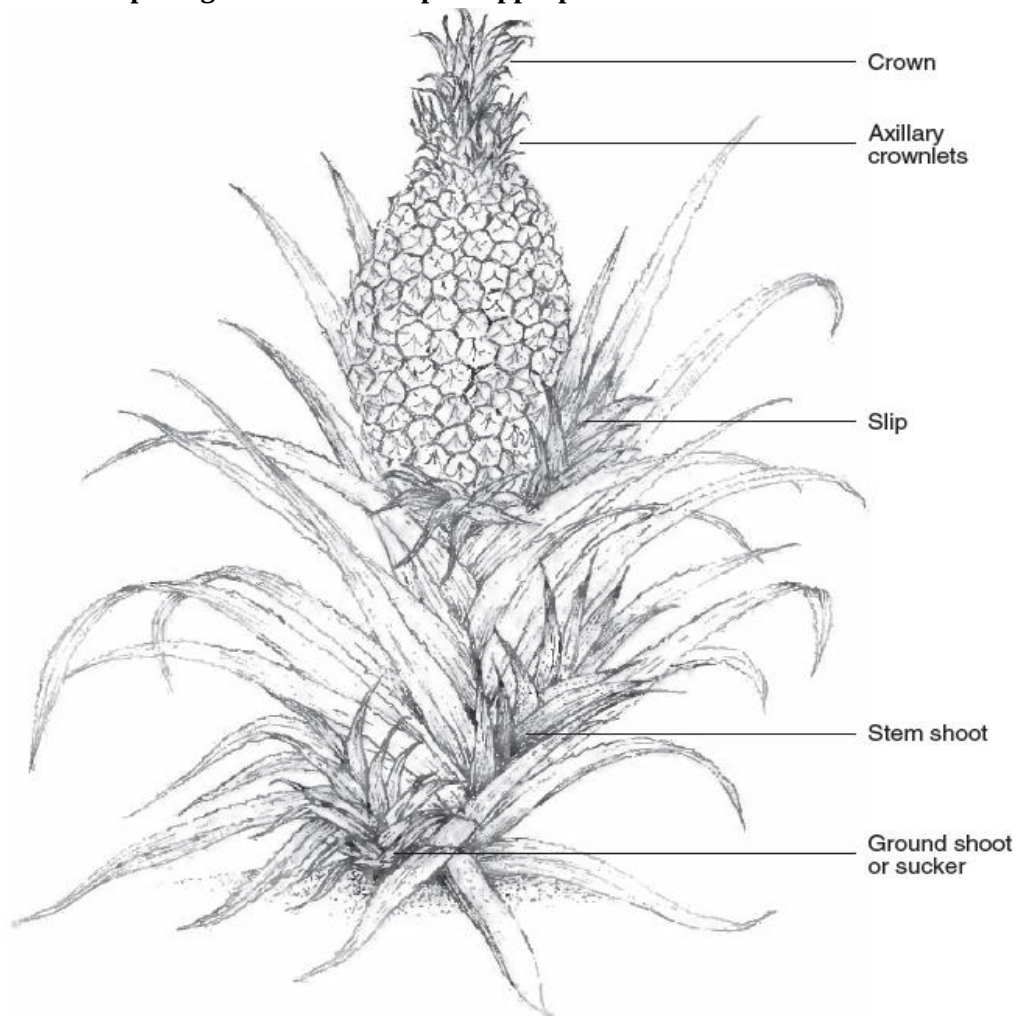
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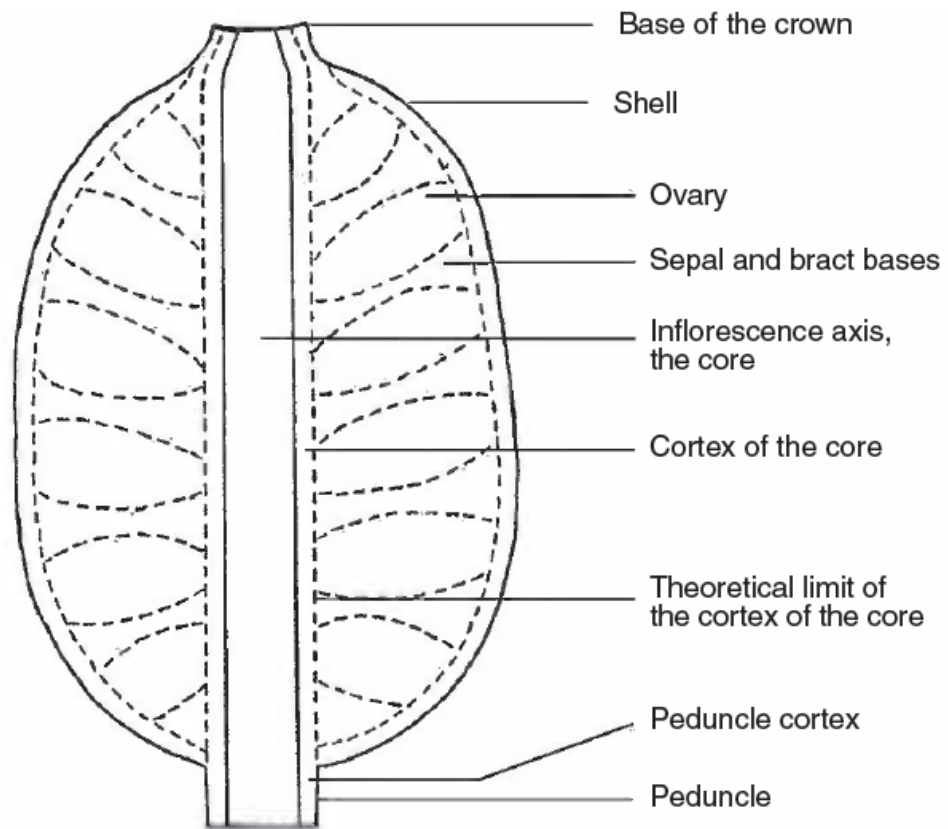
Annex

Annex 1: Morphological structure of pine apple plant



Source: Eeckenbrugge and Leal, 2003

Annex 2: The morphology of a 'Smooth Cayenne' pineapple fruit.



Source: Eeckenbrugge and Leal, 2003

Annex 3: CODEX STANDARD FOR PINEAPPLES (CODEX STAN 182-1993)

Source: <http://www.fao.org/docrep/meeting/005/w7169e/w7169e0n.htm>

1. DEFINITION OF PRODUCE

This Standard applies to commercial varieties of pineapples grown from *Ananas comosus* (L.) Merr., of the *Bromeliaceae* family, to be supplied fresh to the consumer, after preparation and packaging. Pineapples for industrial processing are excluded.

2. PROVISIONS CONCERNING QUALITY

2.1 MINIMUM REQUIREMENTS

In all classes, subject to the special provisions for each class and the tolerances allowed, the pineapples must be:

- Whole, with or without the crown;
- Sound, produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;
- Clean, practically free of any visible foreign matter;
- Practically free of damage caused by pests;
- Practically free of pests affecting the general appearance of the produce;
- Free of abnormal external moisture, excluding condensation following removal from cold storage;
- Free of any foreign smell and/or taste;
- Fresh in appearance, including the crown, when present, which should be free of dead or dried leaves;
- Free of damage caused by low and/or high temperatures;
- Free of internal browning;
- Free of pronounced blemishes.

When a peduncle is present, it shall be no longer than 2.0 cm, and the cut must be transversal, straight and clean. The fruit must be physiologically ripe, i.e., without evidence of unripeness (opaque, flavorless, exceedingly porous¹ flesh) or over ripeness (exceedingly translucent or fermented flesh).

2.1.1 The pineapples must have been carefully picked and have reached an appropriate degree of development and ripeness in accordance with criteria proper to the variety and/or commercial type and the area in which they are grown.

The development and condition of the pineapples must be such as to enable them:

- To withstand transport and handling; and
- To arrive in satisfactory condition at the place of destination.

2.1.2 Maturity Requirements

The total soluble solids content in the fruit flesh should be at least 12°Brix (twelve Brix degrees). For the determination of Brix degrees a representative sample of the juice of all the fruit shall be taken.

2.2 CLASSIFICATION

Pineapples are classified in three classes defined below:

1 Except in certain varieties such as those of the Queen Group.

2.2.1 “Extra” Class

Pineapples in this class must be of superior quality. They must be characteristic of the variety and/or

commercial type. They must be free of defects, with the exception of very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package. The crown, if present, shall be simple and straight with no sprouts, and shall be between 50 and 150% of the length of the fruit for pineapples with untrimmed² crowns.

2.2.2 Class I

Pineapples in this class must be of good quality. They must be characteristic of the variety and/or commercial type. The following slight defects, however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package:

- Slight defects in shape;
- Slight defects in colouring, including sun spots;
- Slight skin defects (i.e., scratches, scars, scrapes and blemishes) not exceeding 4% of the total surface area. The defects must not, in any case, affect the pulp of the fruit. The crown, if present, shall be simple and straight or slightly curved with no sprouts, and shall be between 50 and 150% of the length of the fruit for pineapples with trimmed or untrimmed³ crowns.

2.2.3 Class II

This class includes pineapples which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified in Section 2.1 above. The following defects, however, may be allowed, provided the pineapples retain their essential characteristics as regards the quality, the keeping quality and presentation:

- Defects in shape;
- Defects in colouring, including sun spots;
- Skin defects (i.e., scratches, scars, scrapes, bruises and blemishes), not exceeding 8% of the total surface area. The defects must not, in any case, affect the pulp of the fruit. The crown, if present, shall be simple or double and straight or slightly curved, with no sprouts.

3. PROVISIONS CONCERNING SIZING

Size is determined by the average weight of the fruit with a minimum weight of 700 g, except for small size varieties³, which can have a minimum weight of 250 g, in accordance with the following table:

- 1 Trimming consist in tearing some leaves off the top of the crown³ such as Victoria and Queen.

Size Code	Average Weight (+/-12%) (in grams)	
	with crown	without crown
A	2750	2280
B	2300	1910
C	1900	1580
D	1600	1330
E	1400	1160
F	1200	1000
G	1000	830
H	800	660

Significant volumes of pineapples in international trade are packaged and sold by count per box. Boxes are packed to minimum weight expectations e.g. 10 kg, 20 lbs, 40 lbs, appropriate for the various markets. Fruit are segregated for packaging by weights which approximate the above size codes, but may not consistently fall within a single size code, but would retain the uniformity required by the code.

4. PROVISIONS CONCERNING TOLERANCES

Tolerances in respect of quality and size shall be allowed in each inspection lot for produce not satisfying the requirements of the class indicated.

4.1 QUALITY TOLERANCES

4.1.1 “Extra” Class

Five percent by number or weight of pineapples not satisfying the requirements of the class, but meeting those of Class I or, exceptionally, coming within the tolerances of that class.

4.1.2 Class I

Ten percent by number or weight of pineapples not satisfying the requirements of the class, but meeting those of Class II or, exceptionally, coming within the tolerances of that class.

4.1.3 Class II

Ten percent by number or weight of pineapples satisfying neither the requirements of the class nor the minimum requirements, with the exception of produce affected by rotting or any other deterioration rendering it unfit for consumption.

4.2 SIZE TOLERANCES

For all classes, 10% by number or weight of pineapples corresponding to the size immediately above or below that indicated on the package.

5. PROVISIONS CONCERNING PRESENTATION

5.1 UNIFORMITY

The contents of each package must be uniform and contain only pineapples of the same origin, variety and/or commercial type, quality and size. For “Extra” Class, color and ripeness should be uniform. The visible part of the contents of the package must be representative of the entire contents.

5.2 PACKAGING

Pineapples must be packed in such a way as to protect the produce properly. The materials used inside the package must be new⁴, clean, and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labeling has been done with non-toxic ink or glue. Pineapples shall be packed in each container in compliance with the Recommended International Code of Practice for Packaging and Transport of Fresh Fruits and Vegetables (CAC/RCP 44-1995).

5.2.1 Description of Containers

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the pineapples. Packages must be free of all foreign matter and smell.

6. MARKING OR LABELLING

6.1 CONSUMER PACKAGES

In addition to the requirements of the Codex General Standard for the Labeling of Prepackaged Foods

6.1.1 Nature of Produce

If the produce is not visible from the outside, each package should be labeled as to the name of the produce and may be labeled as to name of the variety and/or commercial type. The absence of the crown should be indicated.

6.2 NON-RETAIL CONTAINERS

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside, or in the documents accompanying the shipment.

6.2.1 Identification

Name and address of exporter, packer and/or dispatcher. Identification code (optional)⁵.

6.2.2 Nature of Produce

Name of the produce if the contents are not visible from the outside. Name of the variety or commercial type (optional). The absence of the crown should be indicated.

6.2.3 Origin of Produce

Country of origin and, optionally, district where grown or national, regional or local place name.

6.2.4 Commercial Identification

- Class;
- Size (size code or average weight in grams);
- Number of units (optional);
- Net weight (optional).

6.2.5 Official Inspection Mark (optional)

7. CONTAMINANTS

7.1 The produce covered by this Standard shall comply with the maximum levels of the Codex General Standard for Contaminants and Toxins in Food and Feed (CODEX STAN 193-1995).

7.2 The produce covered by this Standard shall comply with the maximum residue limits for pesticides established by the Codex Alimentarius Commission.

8. HYGIENE

8.1 It is recommended that the produce covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of the Recommended International Code of Practice – General Principles of Food Hygiene (CAC/RCP 1-1969), Code of Hygienic Practice for Fresh Fruits and Vegetables (CAC/RCP 53-2003), and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

8.2 The produce should comply with any microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 21-1997).

Annex 4: GAP of pineapple in Thailand

Source: http://as.doa.go.th/plant/gap/gap_pineapple_1.html

1. Planted crops.

1.1 cultivated sources.

Choosing the planting should consider other factors as follows.

1.1.1 Background conditions

- The area is high above sea level not exceeding 600 meters.
- A small slope to prevent water constraint, but not exceeding 3%.
- Pineapple plants should be sent for sources near the plant cultivation.

1.1.2 Landform.

- A sand mold or mold soil which has good drainage.
- A soil has a proper amount of organic substance
- A soil has a slightly acid value of acid - alkaline (pH) of approximately 4.5 to 6.0.

1.2 Climate.

- Pineapple is drought resistant plants that can grow well in tropical rainfall are between 1000 to 1500 Mm per year.
- Fruits are distributed regularly and temperatures between 24 to 30 degrees Celsius.

1.3 Species.

- Pineapple cultivar Pattavia is the only breed that can be used in the processing factory and also good for fresh consuming. currently the only facility for delivery but can be used.
- Other cultivars (Phuket, Sawee, Nanglae) are suitable only for fresh consumption

Characteristics of good varieties Pattavia pineapple are;

- Application must have smooth edges or a spineless little prick.
- On the end of leaves, the eye is not a shallow groove
- The shape of pineapple fruit is cylindrical with only one crown
- When found the defect as an extremely thorny, deep eye, fruit is not cylindrical shape with many crowns, the plant must be destroyed. Don't leave them to further propagation.

1.4 Growing

1.4.1 Soil preparation

Plow roughly for the first time with 20-40 centimeters depth and tillage 1-2 times depending on the condition of soil. Collect the soil for analysis. For the new farm, take the big root out of the soil and make the farm a bit slope (1-3 percentages). Make the farm higher than the road for 6 inch to avoid flooding. Get rid of all hard and compact soil if it exists. Be aware of the anthill. Don't split the

soil from anthill over the farm. For the farm that used to grow pineapple, before tillage, the plant should be destroyed 2-3 months before.

1.4.2 Growing

1.4.2.1 Product distributing plan

- Make the production plan by setting the harvesting period before growing and use the proper seeds
- Avoid the period of natural flowering, especially winter
- Ask for advice from the processor about the quantity required.
- Planning with the other farmers

1.4.2.1 Seed

There are two types of seeds material, crown and sprout. In the sprout material, chemical forcing must be done when the plants is 8-12 months old while 10-14 months old plant grown from crown can be applied with chemical forcing. The important is the type and size of seed material should be the same in the same farm.

In order to avoid the oversupply of pineapple, especially in April to June, the seeding should be done in the rainy season. The sprout seeding can be done all year round except in the mid of rainy season because it is easy to get rot.

Size of sprout can be classified into three sizes

- Big sprout : 700 - 900 grams
- Normal sprout : 500 - 700 grams
- Small sprout : 300 - 500 grams

The weight of crown must exceed 180 grams

1.4.2.3 Density of farm

The proper density of farm is 8,000 – 12,000 plants per rai with the double line 25x50x100 cm. per plant will make 8,533 plants per rai. This can be adjusted to get more density. The ease of caring after seeding and the size of pineapple should be concerned

1.4.2.4 Seed treatment

The seed should be applied with the anti fungal chemical before planting. This can avoid the stem rot disease and the disease from the fungi that always happens in rainy season. (More detail in 3.1.1)

2. Caring

2.1 Fertilizing

2.1.1 Seeding fertilization

Tillage Fertilization: The recommended formula is 16 - 20 - 0, 15 grams per plant (1 table spoon). It can be applied at the side of plant. In the case of the organic compound in the soil is lower

than 1%, put the organic fertilizer with 50-100 kilograms phosphate rock into each row.

Stem shoot fertilization: The recommended formula is the fertilizers with ratio of 2:1:3 such as 12 - 6 - 15 or 13 - 13 - 21, amount 40 grams/plant (3 tablespoons) Fertilizers should be applied for 2-3 times. Firstly 1-3 months after growing and then every 2-3 months. Apply fertilizers on the stem shoot.

Leaf fertilization: If the plant is mal nutrition, the fertilizers formula 23 - 0 - 25, dissolve in water for 5 percents concentration. The amount is 75 milliliter/ times, 3 times. It can be done by spraying 5 days before flower forcing and 20 days after the forcing.

2.1.3 The nitrite residue prevention

- Strictly follow the 2.1 on using of fertilizers, don't exceed the recommended amount
- Do not destroy the crown
- Do not water 15-30 days before harvesting
- Do not use nitrogen fertilizers after flower forcing
- In the area that nitrite residue is over the limit, collect the pineapple leaf in the period of flower forcing to analyse the Molybdenum concentration value. If the value is lower than 1 in million, put the molybdenum substance (5 milligram per plant) by spraying onto leaves after the flower forcing or using Potassium Chloride (5 grams per plant) 75 days after flowering.

2.2 Watering

Although pineapple does not need much water, watering is the way to increase the production. The uniformity of size is more and reach the requirement of processor. If the pineapple after flower forcing does not get enough water, the size will be too small and the shape will be abnormal. The regular watering in summer period especially in the growth period of plant is very important to the size and quality of pineapple. The required amount of pineapple is 300 milliliter/ plant/day and stop watering 2-4 days before harvesting.

2.3 Flower forcing

Flower forcing can be done when the pineapple reaches 2.5 kilograms. Ethephol is used in forcing. 8 milliliter of Ethephol is mixed with 300 grams of urea dissolved in 20 liter of water. Drop it onto pineapple plant by 60-75 milliliter. Do it two times with the gap of 4-7 days. Another method of chemical forcing is the Calcium carbide applying. Apply half teaspoon of Calcium carbide on the top of the plant and follow by 50 milliliter of water.

Flower forcing should be done in the evening or at night. If it is raining within two hours after forcing, repeat the step in 2-3 days.

2.4 Sanitation and hygiene

- Destroy herbs around the farm(See the recommendation for herbicides in 3.2)
- Get rid of the container of fertilizers or herbicides by burying or burning
- Keep the chemical herbicides in the safe place with lock
- Clean equipments properly. If it is damage, repair it to be in good condition.

3. Pest Control

3.1 Important disease of pineapple

3.1.1 Stem rot

Phytophthora is the fungus that causes this problem. The high infection will occur in raining season. Soil with base condition is the source of the disease. Leaf, plant and fruit will be destroyed by this fungi.

Prevention

- Adjust the soil to have pH less than 5.5 by using the sulfur dioxide or the soil with acidic condition
- Organize a good drainage
- Spraying Metalacsil (20-40 gram/ 20 liters of water) or Eforcidealuminum (80-100 gram/ 20 liter of water) on the farm
- If the disease is found in farm, burn the infected plant and spray that area with the herbicide that stated before.

3.1.2 Marbling disease

The fungi Ervinea and the rapid change of environment is the cause of this disease. This disease will spread on the pineapple in 7-10 days before harvesting.

Prevention

- Increase the density of farm in order to sustain the temperature of pineapple.
- Increase the acidity of pineapple by applying Potassium chlorine 75 days after flower forcing

3.2 การควบคุมวัชพืชในไร่สับปะรด

3.2 Herb controlling

3.2.1 Controlling of herbs without using of chemical

Farmers should plow deeply and crowd for two times in order to get rid of herbs. After growing for 1-2 months, the herb will grow. It should be eliminated by physical removing that does not damage pineapple plant.

3.2.2 Controlling of herbs by chemical herbicides

This method is better than the physical removing but the herbicides must be carefully used. In the table below, the type and amount of herbicides is stated in order to use

Period of use	Herbicides	Amount / 1 Rai	Type of herb	Remark
Before growing	Glyphosate 48% SL	500-600 milliliter	Chanurd grass Nut grass	Spray in the soil preparation
	Paraquate 27.6% SL	300-600 milliliter	Herb that grow from the seed	Spray before growing of pineapple, when soil is wet
	Bromasil 80%WP+ Diyuron	500-600grams 500-600grams	Herbs with narrow leaves Herbs with wide	Spray when soil is wet, before herbs grow and just grow

	80%WP		leaves	
After growing	Bromasil80%WP + Ametrin80%WP	400-500grams	Herbs with narrow leaves, Herbs with wide leaves	Spray when soil is wet

Remark

1. spraying in 1 rai uses 60-80 liter of water
2. Don't directly spray on the crown of pineapple
3. After chemical forcing, all herbicides are prohibited

4. Post harvest technology

4.1 Harvesting and post harvesting

- Harvest the fruit that reach the maturity level (145-156 days after flower forcing)
- All chemical is prohibited to use
- Sorting all defect pineapple out.
- Immediately deliver pineapple to the customers

4.2 Transportation

- Arrange pineapple by putting the crown downsize
- Be aware of overheat during transportation
- Use clean and proper vehicle in transportation of pineapple

5. Record keeping

- Every activity on farm, farm gate price, epidemic of pineapple, fertilizers and chemical using should be recorded. The date of fertilizing, type of fertilizers must also be recorded in order to use in the forecasting the production of next year and improving the quality of pineapple.
- The weather must also be recorded
- Also, the result of soil analysis

Annex 5: standard of pineapple for processing plant

Source: http://contact.doae.go.th/cts/upload/810/812/836/174_มาตรฐานสับปะรดโรงงานของประเทศไทย.pdf

Minimum requirement

- The fruit must be the whole fruit without crown or peduncle
- The maturity must be in the proper level
- In good condition (No bruising, rotten, significant defect and marbling disease)
- No contamination such as sand or oil
- No strange aroma and taste
- No fungus at the core
- Free of pest or damage from pest, including the cut from knife or sharp object on the fruit

Pineapple must be harvested in proper method and the post harvest period must be in good condition.

1. Classification

The quality of pineapple is classified into 2 classes

- 1) Class I
- 2) Class II

The condition of the shell

In every class of pineapple, pineapple must have good condition according to the cultivar, free of pest. The fruit is free of major defect. The small defect can be occurred at the shell, but it must not affect the shape, quality, and keeping quality. The size must be in the range of standard level.

The condition of flesh

In every class of pineapple, the flesh must be normal and the maturity level must be more than 25 percent and not too matured (the flesh is clear yellow without the matured smell). The nitrite level must not exceed 25 milligram per kilogram.

2. Size Specification

Pineapple in each class must have the size as;

Class	Diameter ¹ (cm)	Length (cm)
Class I	10.5-15.5	More than diameter
Class II	9.0-10.4	More than diameter

¹ The diameter is measured at the biggest area of fruit.

3. Provisions concerning presentation

Packing and transportation

Pineapple must be well arranged and packed in the transported vehicle in order to avoid the physical damage which impacts the quality of pineapple. It must be free of strange particle and the contamination must be controlled so that it will not affect the quality during transportation.

4. Sales Document

- Seller's Identification
- Origin of Produce

5. Contaminants

The list of banned chemical from department of agriculture and cooperative must not be used or found in the product. Moreover, the chemical that makes pineapple matured is also prohibited without the recommendation from expert of DOA.

6. Hygiene

- Sampling practice

Small truck – Sampling must be conducted more than 2 times with 20 fruits per times.

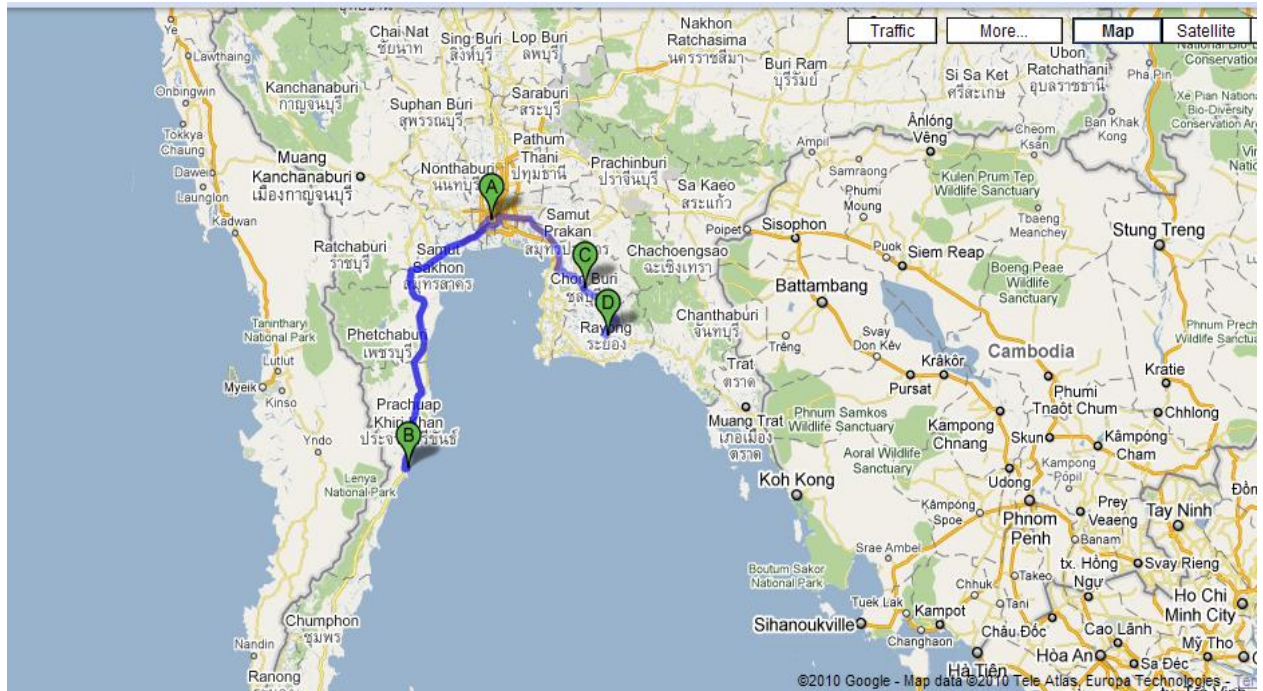
Big truck (6 wheels to 10 wheels) - Sampling must be conducted more than 3 times with 20 fruits per times

7. Sampling and Analysis procedures

Nitrite

Quick measure is conducted at the middle of fruit (2.5-3.75 centimeters depth from the peel). Nitrite strip is used and color is compared with the standard.

Annex 6 : Map of pineapple production in Thailand



B: Prachuap kiri khun (50% of all production)

C: Chonburi (2nd largest production area)

D: Rayong(3rd largest production area)

A: Bangkok (Capital city)

Source: Anupunt et al., 2000

Annex 7: Interview Question

General Information about the Producer organization

1. What are the main products of the cooperative?
Product 1 _____
Product 2 _____
Product3 _____
2. In what year was the cooperative established?
3. How many members in the cooperatives?
4. Do farmers have to meet the certain requirements to become a member?

Quantity_____
- Quality_____
5. What was the turnover in 2008?
6. What is the area of land used by the producers?
Average of all producers Rai
Largest producer Rai
Smallest producers Rai
(1 hectare = 6.25 rai)
7. Who are the main buyers of the product of cooperatives?
8. What is the form of your sales contracts:
Written contract or verbal agreement
9. Do members have the option for selling in the market instead of the cooperative?
10. What is the final market of the product?

Quality problems and management

11. What are the most important quality problems? Give Ranking;

How serious is this problem in your fruit supply chain?	No Problem	Small Problem	Serious Problem
<i>In production</i>			
1. Mealybug Wilt Disease			
2. Nematode			
3. Butt Rot			
4. Heart Rot			
5. Root Rot			
6. Yellow Spot			
7. Fusarium Stem Rot			
8. Black rot			
9. Penicilium/ Fusarium fruitlet core rot			
10. Fusariosis			
11. Pink disease			
12. Fruit collapse			
13. Marbling disease			
14. Internal browning			
<i>In harvesting</i>			
15. Fruit bruising			
<i>Post harvesting</i>			
16. Mechanical Injury			
17. Post harvest chilling injury			
18. Moisture Loss			
19. Flesh translucency			
20. Sunburn			
21. Malformations			

22. Deep eye			
23. Shell surface pitting			
24. Parasitic disease			
25. Lack of market demand			
<i>Problem in uniformity of quality and quantity</i>			
26. Uniformity of pineapple's quality			
27. Uniformity of pineapple's quantity			

12. What quality criteria are applied by cooperatives? (For example, maturity, size, and color)
13. What is the standard for the supermarket and export market? How does it difference from the fresh market?
14. What international standard is applied on members? (Ex. GAP, GLOBALGAP, CODEX, SPS)

Role of Cooperatives

15. What is the function that cooperatives have? Please give the ranking.

How Important are these activities within your PO?		Not important at all	Little important	Medium important	Very important	Of crucial importance
Enhancing bargaining power						
1.	Contract (and price) negotiation					
2.	Physically collecting the farm product					
3.	Assuring the homogeneous quality of products					
Reducing information asymmetries						
4.	Provision of credit					
5.	Marketing of farm product					
Improving quality of product						
6.	Provide inputs					
7.	Develop and exchanging technological knowledge					
8.	Apply quality assurance and traceability system					
9.	Coordinating the activities of supply chain actors					
10.	Adding value to the product					

Production

16. How do POs help members on solving the problems that occur? Any measure is applied on the farm such as Management of pest and disease on seed material, Integrated Pest Management, etc
17. What does the cooperative do to manage pesticide use by the members?
18. What does cooperative do on solving the uniformity problem?
19. Which sorting method is done in cooperative?
20. If members cannot produce the product that reaches the criteria, what does the cooperative do on the member?
21. What quality assurance program does cooperative apply on members? Is it working or not?
22. Does the cooperative get helps from the other organizations or the government on improving the quality of pineapple? And How?
23. What do other organizations or the government does to comply with the standard for supermarket and international market?
24. What inputs do cooperative supply to members? What are the advantages for doing so?

Marketing

25. When looking at marketing business, how does the cooperative do on the product of members?
 - c. The cooperative collects products from members and sell to the customer
 - d. The cooperative buys products from members and sell to the customer
26. Who does the cooperative sell the product (to whom, directly or via wholesaler)?
27. How does cooperative do on transferring the information from the downstream actors of the supply chain to members and the other way around?

Training

28. What training does cooperative provide to members?
29. Is the training supported by other organizations or the government?

Financial

30. How does cooperative help members on the financial service? Or is it supported by the government?

31. What processing activities does cooperative conduct in order to add value to the product?

32. How does cooperative coordinate with the other actors in the supply chain?

33. When the problems occur with the overall supply of product in the country (Oversupply and supply shortage), how does cooperative do to help members?

34. Does the cooperative collaborate with other cooperative? What is the advantage for doing so?

Annex 8: Interview result

Interview result with the cooperative officer of Prachuap kiri khun province

The officer of the cooperative is contacted because they can recommend the interviewer to the producer organizations in the province but there is some information about the current situation of the pineapple production in the province that they shared with the interviewer.

Q: How is the platform of the procurement of processing plants?

A: The procurement of the pineapple has changed from the past. 20 years ago, the manufacturers need to rely on the cooperatives to gather pineapple and deliver to the processing plants. Dole Thailand did the growing themselves. In the past 20 years, the procurement system has changed to the quota system. There are many quota controllers which cooperative is one of them. Cooperatives hold a large quota in providing pineapple to the processing plants. Therefore, the processing plant can be assured with the quantity that they required will not be missed.

Q: Why the fresh pineapple is exported in very low amount?

A: As the pineapple is the perishable product, the special method of transportation is required. This leads to the higher cost of the production. In Europe, Costa Rica is the main supplier of the fresh pineapple because of the close distance. On the other hand, Philippines export fresh pineapple to Japan. The distance between Thailand and Japan is two times longer than of Philippines. Another possible reason is the quality of pineapple grown in Thailand does not reach the required level from importing country.

The promotion of the government on growing the high quality fresh eating pineapple is not successful because farmers do not see the profit that they will get when they applied a lot of standard on their farm. If they continue to do farming on the old practice, they are still able to sell to the manufacturer. Moreover, they do not need to take risk of the lack of demand on the developed pineapple. There is no certain market channel that they can recognize. Although the government conducts the promotion campaign, they do not continuously support the farmers on assuring the better farm gate price that they will get and the certain market channel for this kind of pineapple.

Q: What is the condition of oversupply of pineapple in the present day?

A: The oversupply problem becomes less in the present day because the farming area is becoming less and less. The best growing area of the pineapple is the foothill or prone area. The farmer likes to grow the pineapple in the combination with Oil palm and rubber. After two to three years of growing the oil palm and rubber, pineapples cannot be grown because of the size of the other plants. They intercept the sunlight, so it does not reach the pineapple plant.

Q: What is the situation of applying GAP in the province?

A: GAP is promoted and supported by three governmental organizations which are 1) the cooperative promoting department, 2) Department of agricultural extension, and 3) Department of Agriculture. The first two departments provide the knowledge and technique

on applying GAP on the farm to farmers while the last department is the auditor of the GAP. In the theory, GAP is the standard that is required from the processing factory but the processing factory does not care about this requirement in the real situation. This also happened with the standard in the size and maturity of the pineapple. When the processing plant does not want a lot of pineapple, the standard is applied intensively. On the other hand, the season that pineapple is lack or the processing plants require large amount, the standard is not the issue for accepting the product. This makes farmers confused with the standard of the processing factory.

Interview result of the producer organizations

General Information about the Producer organization

1. What are the main products of the cooperative?

Product 1: All POs has pineapple as the 1st product

Product 2: Interviewee 3: Sugarcane, Interviewee 5-7: Casava

Product3: Interviewee 3, 5: rubber

2. In what year was the cooperative established?

The POs established in the year 1970-1989 are Interviewee 1-4 while Interviewee 5-7 are established in the 2000s.

3. How many members in the cooperatives?

Interviewee 1: 300

Interviewee 2: 489

Interviewee 3: 800

Interviewee 4: 709

Interviewee 5: 120

Interviewee 6: 206

Interviewee 7: 258

4. Do farmers have to meet the certain requirements to become a member?

There is no certain requirement both in quality and quantity to become the members of the group or cooperatives.

5. What was the turnover in 2008?

The range of turnover is wide. Some of interviewees do not want to disclose the turnover of their group because they feel uncomfortable.

6. What is the area of land used by the producers?

Average of all producers Rai

Largest producer Rai

Smallest producers Rai

(1 hectare = 6.25 rai)

7. Who are the main buyers of the product of cooperatives?

All of the interviewees claimed that the main buyers of the cooperatives are the **members** of the cooperative.

8. What is the form of your sales contracts:

Written contract or verbal agreement

Almost all of interviewees (except interviewee2) have the written contract without the length of the contract. The interviewee2 claimed that her cooperative do the verbal contract with the manufacturer.

9. Do members have the option for selling in the market instead of the cooperative?

Yes, members in all groups/cooperatives can sell the product directly to the manufacturer or the middle man for the fresh consuming market.

10. What is the final market of the product?

All interviewees claimed that the manufacturers that they feed pineapple to have the international market as the main distribution channel for them. This means that the final market of the product is international market.

11. What are the most important quality problems? Give ranking:

		IN 1	IN 2	IN 3	IN 4	IN 5	IN 6	IN 7	Summary	SD.
In production										
1	Mealybug Wilt Disease	3	3	3	3	2	3	2	19	0.49
2	Nematode	1	1	2	3	1	2	1	11	0.79
3	Butt Rot	2	1	1	3	1	1	3	12	0.95
4	Heart Rot	1	1	2	3	1	2	1	11	0.79
5	Root Rot	3	1	2	3	1	1	2	13	0.90
6	Yellow Spot	2	2	1	2	1	1	2	11	0.53
7	Fusarium Stem Rot	2	3	2	3	2	3	3	18	0.53
8	Black rot	1	1	2	3	1	1	1	10	0.79
9	Penicilium/ Fusarium fruitlet core rot	1	1	2	3	1	2	1	11	0.79
10	Pink disease	2	1	1	2	1	2	1	10	0.53
11	Fruit collapse	1	2	2	2	1	2	2	12	0.49
12	Marbling disease	3	3	3	3	3	2	3	20	0.38
13	Internal browning	2	1	2	3	1	1	2	12	0.76
In harvesting										
14	Fruit bruising	3	1	2	2	1	2	3	14	0.82
Post harvesting										
15	Mechanical Injury	3	1	2	1	1	1	3	12	0.95
16	Post harvest chilling injury	1	1	2	1	1	1	2	9	0.49
17	Moisture Loss	3	1	1	2	1	1	1	10	0.79
18	Flesh translucency	2	1	1	2	2	1	1	10	0.53
19	Sunburn	3	2	1	3	3	2	2	16	0.76
20	Malformations	3	2	2	3	2	2	2	16	0.49
21	Deep eye	2	1	2	3	1	1	2	12	0.76
22	Shell surface pitting	2	1	2	3	1	2	2	13	0.69
23	Parasitic disease	3	1	1	3	1	1	1	11	0.98
24	Lack of market demand	2	2	1	3	2	3	1	14	0.82
Problem in uniformity of quality and quantity										
25	Uniformity of pineapple's quality	3	1	2	3	1	1	1	12	0.95
26	Uniformity of pineapple's quantity	3	2	2	3	2	2	2	16	0.49
Other Problem		Nitrite	3	2	3	3	1	2	15	0.90

12. What quality criteria are applied by cooperatives? (For example, maturity, size, and color)

Interviewee 1: No quality criteria is applied by cooperatives

Interviewee 2: No quality criteria is applied by cooperatives

Interviewee 3: No quality criteria is applied by cooperatives

Interviewee 4: No quality criteria is applied by cooperatives

Interviewee 5: The group set the quality criteria (Size, maturity and nitrite level)

Interviewee 6: The group set the quality criteria (Size, maturity (color) and nitrite level)

Interviewee 7: The group set the quality criteria (Size, maturity (color) and nitrite level)

13. What are the quality criteria that the manufacturer requires? Where is the quality measurement conducted?

Interviewee 1: Size, nitrite level and maturity. The measurement is conducted at the manufacturer.

Interviewee 2: Size, nitrite level and maturity. The measurement is conducted at the manufacturer.

Interviewee 3: Size, nitrite level and maturity. The measurement is conducted at the manufacturer.

Interviewee 4: Size, nitrite level and maturity. The measurement is conducted at the manufacturer.

Interviewee 5: Size, nitrite level and maturity. The measurement is conducted at the group.

Interviewee 6: Size, nitrite level and maturity. The measurement is conducted at the group.

Interviewee 7: Size, nitrite level and maturity. The measurement is conducted at the group.

14. What international standard is applied on members? (Ex. GAP, GLOBALGAP, CODEX, SPS)

Interviewee 1: Thai GAP

Interviewee 2: No international standard applied on members

Interviewee 3: Fair trade and Thai GAP

Interviewee 4: No international standard applied on members

Interviewee 5: Thai GAP

Interviewee 6: Thai GAP

Interviewee 7: Thai GAP

15. What is the function that cooperatives have? Please give the ranking

The functions and roles that cooperatives have are ranked in the table below.

Functions and roles	I1	I2	I3	I4	I5	I6	I7	Sum	Mean	SD	Mode
Contract (and price) negotiation	2	2	2	3	3	4	4	20	2.86	0.90	2
Physically collecting the farm product	2	2	3	3	3	4	5	22	3.14	1.07	3
Assuring the homogeneous quality of products	2	1	2	2	2	3	4	16	2.29	0.95	2
Provision of credit	3	3	4	4	4	4	4	26	3.71	0.49	4
Marketing of farm product	2	1	3	3	4	4	4	21	3.00	1.15	4
Provide processing facilities and input	4	3	4	5	5	5	5	31	4.43	0.79	5
Develop and exchanging technological knowledge	2	2	3	3	4	5	5	24	3.43	1.27	2
Apply quality assurance and traceability system	2	1	2	2	2	3	4	16	2.29	0.95	2
Coordinating the activities of supply chain actors	1	1	2	2	3	3	3	15	2.14	0.90	3
Adding value to the product	1	1	1	2	2	3	4	14	2.00	1.15	1

Remark: I = Interviewee

16. How do POs help members on solving the problems that occur? Any measure is applied on the farm such as Management of pest and disease on seed material, Integrated Pest Management, etc

Interviewee 1: Gather as the group to buy the inputs and they apply the integrated pest management on the farm of members. The cooperative also arranges the meeting and event to teach members about this topic.

Interviewee 2: No action conducted on this topic

Interviewee 3: No action conducted on this topic

Interviewee 4: The cooperatives ask the expert for the recommendation, knowledge and the measure to solve the problem, but there is no stated measures applied on members

Interviewee 5: The farmers group will discuss and analyze problems with member. The measure that is applied on members is Integrated Pest Management. The circulation of crop is also applied in order to eliminate the animal that causes the disease.

Interviewee 6: No action conducted on this topic

Interviewee 7: The principle of integrated pest management is applied on members' farm. There is soil tillage before growing plant and the plant circulation is also applied on the farm.

17. What does the cooperative do to manage pesticide use by the members?

Interviewee 1: Following the GAP practice which is trained by the government and manufacturers.

Interviewee2: Give the knowledge when members buy the pesticide from cooperatives.

Interviewee3: Give the notice and arrange meeting for the members about using the pesticide properly.

Interviewee4: Give the knowledge when members buy the pesticide from cooperatives.

Interviewee 5: The pesticide is not used by their members in pineapple growing.

Interviewee 6: The pesticide is not used by their members in pineapple growing.

Interviewee 7: The pesticide is not used by their members in pineapple growing.

18. What does cooperative do on solving the uniformity problem?

Interviewee1: On the quantity aspect, the government helps to guarantee the price not to be lower than 4 baht per kilogram. This measure is to stop the farmers from moving to other crops when the price drops down. On the quality aspect, the cooperatives and government set up the minimum requirement for the quality of pineapple such as the ripeness, size, disease and insect.

Interviewee2: The problem of uniformity of production is over control in both quality and quantity aspect. The quality and quantity will drop down every year. The uniformity in ripeness of pineapple is also the hard problem to be solved. The degree of ripeness cannot be the same in all fruits. The only thing that can be done is to force the flowering with gas after 6 months of growing. The chemical that makes the pineapple ripen is banned from the factory, so the uniformity of ripeness is hard to control.

Interviewee3: The ripeness of pineapple. As the chemical that ripens pineapple is banned, the cooperative can only give the advice to members to harvest only the ripen pineapple in order to avoid the rejection from the factory.

Interviewee4: Teach members in applying the flowering gas. Not apply on all plants in the same time. Make the good planning, so the pineapple can be harvested all year long.

Interviewee 5: The group plans for members to apply the chemical in forcing plant to give flower. The information is given to members when they come to buy chemical or fertilizers.

Interviewee 6: The processing plant helps in this problem.

Interviewee 7: The planning is done in the group on forcing the flower which relies on the schedule that avoids the oversupply problem. The problem of uncertainty in quality is not the major problem of the group because the group has never faced the reject from the manufacturer.

19. Which sorting method is done in cooperative?

Interviewee1: The sizing and nitrite measuring is done at the manufacturing

Interviewee2: The sizing and nitrite measuring is done at the manufacturing

Interviewee3: The sizing and nitrite measuring is done at the manufacturing

Interviewee4: The sizing and nitrite measuring is done at the manufacturing

Interviewee 5: The sizing and nitrite measuring is done at the group.

Interviewee 6: The sizing and nitrite measuring is done at the group.

Interviewee 7: The sizing and nitrite measuring is done at the group.

20. If members cannot produce the product that reaches the criteria, what does the cooperative do on the member?

Interviewee1: The cooperatives will coordinate with the government to subsidize farmers in helping to buy the product.

Interviewee2: This problem has never occurred with the cooperative because the product sold in the quota of cooperatives is more respected than the product sold by individual farmers.

Interviewee3: The cooperative helps members in improving the product in more intensive manner.

Interviewee4: The cooperative give the advice to members in another way and encourage them to retry.

Interviewee 5: The poverty is the main factor for member in producing bad product because they cannot afford to buy the fertilizers and input. The group solves this problem by encouraging them to produce in smaller amount, so they can use more fertilizer and take better care of the plant. Therefore, pineapple that they produce will have better quality and accepted by the factory.

Interviewee 6: The cooperative give the advice to members in another way and encourage them to retry.

Interviewee 7: The group will help member on adjusting the growing method and using of fertilizer.

21. What quality assurance program does cooperative apply on members? Is it working or not?

Interviewee1: No quality assurance program applied on members.

Interviewee2: No quality assurance program applied on members.

Interviewee3: The cooperative are making the product under the fair-trade sign and this organization will audit the farm of members in the period of time that they set. The quality assurance program is also set by this organization.

Interviewee4: No quality assurance program applied on members.

Interviewee 5: The record keeping and tracking of the data is applied on members. Sizing and grading is done at the group which makes the manufacturer confidence in the product.

Interviewee 6: Only grading and sizing is done to make the manufacturers believe in the uniformity of pineapple.

Interviewee 7: The grading of pineapple is done at the group's place. Pineapple is divided in the size and they are delivered to the processing plant with the uniformity of size and acceptable nitrite level.

22. Does the cooperative get helps from the other organizations or the government on improving the quality of pineapple? And How?

Interviewee1: The government helps on providing inputs in cheaper price and also the technical knowledge.

Interviewee2: No support from the government at all.

Interviewee3: The government helps on negotiating with the factory on setting the buying price to be fair for farmers. Moreover the government provided cheap fertilizers and inputs. Sometimes they conduct the conference on the technical knowledge of pineapple production.

Interviewee4: No support from the government at all.

Interviewee 5: The government supports the group by conducting the fieldtrip to the other production area.

Interviewee 6: No support from the government at all.

Interviewee 7: The group gets less support by the government. The support is not directly on the group, but it is only the common conference on the topic of pineapple's quality.

23. What do other organizations or the government does to comply with the standard for supermarket and international market?

Interviewee1: NO

Interviewee2: NO

Interviewee3: NO

Interviewee4: NO

Interviewee 5: The government supports the group in applying GAP.

Interviewee 6: NO

Interviewee 7: NO

24. What inputs do cooperative supply to members? What are the advantages for doing so?

Interviewee1: The cooperatives sell the inputs and fertilization to members in the cheaper price than market price, so members can get the good quality inputs in the better price.

Interviewee2: The selling price of the inputs that the cooperative sells are equal to the market price but in the end of the year, member will get dividend from the profit that cooperative makes.

Interviewee3: The cooperative sells good inputs that are suitable for the production in cheaper price than market.

Interviewee4: The cooperative sells inputs to members in cheap price. This helps both members and cooperative. Members can buy inputs in cheaper price while the cooperative can spend profit from it on other functions.

Interviewee 5: Help members to reduce cost and members can get the good quality input in lower price. When one farmer uses bad fertilizer, he/she will tell other members not to use it.

Interviewee 6: The selling price of the inputs that the cooperative sells is equal to the market price but in the end of the year, member will get dividend from the profit that cooperative makes.

Interviewee 7: Members will get the good fertilizer which is work for the pineapple in the cheaper price. They do not have to take risk of cheating by the bad fertilizers company with more expensive price that is the popular news in Thailand now.

Marketing

25. When looking at marketing business, how does the cooperative do on the product of members?

- e. The cooperative collects products from members and sell to the customer
- f. The cooperative buys products from members and sell to the customer

Interviewee1: Collect: only when there is the problem on oversupply

Interviewee2: Collect

Interviewee3: Both Collect and buy.

Collect- from the medium and big farmer to the factory

Buy – from the small farmers in order to sell to the factory

Interviewee4: Collect

Interviewee 5: Buy

Interviewee 6: Collect

Interviewee 7: Buy

26. Who does the cooperative sell the product (to whom, directly or via wholesaler)?

Interviewee1: processing plant

Interviewee2: processing plant

Interviewee3: processing plant

Interviewee4: processing plant

Interviewee 5: Processing plant, retailer

Interviewee 6: Processing plant

Interviewee 7: Processing Plant

27. How does cooperative do on transferring the information from the downstream actors of the supply chain to members and the other way around?

Interviewee1: The meeting of farmers is conducted regularly. At least, 3-5 times a year for the village scale, 6 times a year for the district scales.

Interviewee2: The farmers get the information directly from the factory

Interviewee3: The information on the requirement from manufacturer is transferred to the cooperative and the cooperative conducts the meeting then call members to participate in.

Interviewee4: The cooperatives act as the middle man between manufacturer and farmer in transferring the information from each side another side.

Interviewee 5: If the topic is important and urgent, such as the epidemic disease or the government will make an artificial rain, the meeting will be urgently conduct. If the topic is not much urgent, the phone call will be made to the leader of each area to spread to their fellow.

Interviewee 6: The meeting is conducted when the information is urgent and important for members to know immediately. On the other hand, the information will be transferred to members when members come to the group if the information is not urgent.

Interviewee 7: The meeting is called if the topic is very important, but if it s not, members will get information when they come to buy inputs and fertilizers at the group. Sometimes, telephone call is done.

Training

28. What training does cooperative provide to members?

Interviewee1: No

Interviewee2: the usage of fertilizers and pesticides

Interviewee3: No

Interviewee4: The cooperative conducts the training on making organic fertilizers and professional of members.

Interviewee 5: This group aims on making the organic fertilizers to replace the common fertilizers. The training on this topic is always conducts at group's office.

Interviewee 6: The usage of organic fertilizer instead of chemical fertilizer.

Interviewee 7: The organic fertilizer making is conducted at the group to help farmers to reduce the cost of chemical fertilizer used.

29. Is the training supported by other organizations or the government?

Interviewee1: The government, manufacturers and the pineapple grower group of Thailand

Interviewee2: The government supports in the financial

Interviewee3: The pineapple grower association of Thailand and the support from the government. The knowledge from the government is the outdate information that is not useful to the present growing of pineapple.

Interviewee4: The cooperative promotion department of Thailand and the cooperative department of the province.

Interviewee 5: The Cooperative Promotion Department helps in the training about the market mechanism and the cost reduction in pineapple production.

Interviewee 6: The agricultural section of the province helps in conducting of training and fieldtrip to learn about the technology in growing pineapple.

Interviewee 7: The cooperative promotion department conducts the conference on the technology and how to solve disease of pineapple, but the technology that they provide is sometimes not work.

Financial

30. How does cooperative help members on the financial service? Or is it supported by the government?

Interviewee1: No financial service for members, but members can buy the inputs and fertilizers by credit. They can pay back when they get money from selling farm product.

Interviewee2: Members can loan money from the cooperative with the same interest rate as the bank but members will get dividend from the cooperative in the end of the year.

Interviewee3: The cooperative does not allow members to loan money but the members can buy the fertilizers or pesticide by credit. The member can pay the cooperatives back when they get money from selling products.

Interviewee4: Members can loan the cooperative with the lower interest rate than normal bank. This money is supported by the cooperative promotion department of Thailand.

Interviewee 5: The group lends members money. It is supported by the BACC. The BACC lends the groups 0.5% per year but the group has interest for members with 1% per year which is still lower than the rate of other bank. The profit that the group gets will be paid back to members as dividend in the end of fiscal year. If the member does not pay back to the group, that member will be disqualified from the group.

Interviewee 6: The cooperative does not allow members to loan money but the members can buy the fertilizers or pesticide by credit. The member can pay the cooperatives back when they get money from selling products. The support is done by the government in feeding money to the group to help members.

Interviewee 7: The group let members loan on the same interest rate as the other bank, but in the end of fiscal year, the dividend is paid back to the members.

31. What processing activities does cooperative conduct in order to add value to the product?

Interviewee1: No value adding activity

Interviewee2: No value adding activity

Interviewee3: Producing fair-trade pineapple

Interviewee4: Producing paper from the shell of pineapple

Interviewee 5: The used of pesticide is prohibited in this group and they get the certification from the Agricultural department of Thailand in the pesticide free pineapple. The pineapple that is not matched the quality criteria will be used to make the dessert from pineapple.

Interviewee 6: No value adding activity

Interviewee 7: The dessert from pineapple is made to add value of the pineapple. The group applies GAP to members which lead to the certification on GAP pineapple.

32. How does cooperative coordinate with the other actors in the supply chain?

Interviewee1: No coordination with other actors in the supply chain

Interviewee2: No coordination with other actors in the supply chain

Interviewee3: The processing factory in producing fair-trade pineapple and developing of quality and negotiating of selling price.

Interviewee4: No coordination with other actors in the supply chain

Interviewee 5: The coordination with the manufacturers in sustaining the price of the product.

Interviewee 6: No coordination with other actors in the supply chain

Interviewee 7: The price negotiation between the group and manufacturers. The manufacturer required for the certain amount of pineapple from the group. If the group can feed them with the required amount, the group will get better price

33. When the problems occur with the overall supply of product in the country (Oversupply and supply shortage), how does cooperative do to help members?

Interviewee1: The collaboration with other organization in subsidizing the oversupply of pineapple.

Interviewee2: The government supports the cooperative to buy the oversupplied pineapple to be the animal feed.

Interviewee3: The government supports the cooperative and they help in negotiation for the price of pineapple.

Interviewee4: The cooperative helps to find the alternative production of pineapple when the supply exceeds demand.

Interviewee 5: The group helps member to find the market channel and ask the government to subsidize their members.

Interviewee 6: The government helps in buying the oversupplied to feed animal. If the government does not help, farmers will not collect the fruit and left it rotten in the farm.

Interviewee 7: The group helps member to find the market channel and ask the government to subsidize their members.

34. Does the cooperative collaborate with other cooperative? What is the advantage for doing so?

Interviewee1: No collaboration with others.

Interviewee2: Yes. The cooperatives collaborate with other cooperatives in buying the inputs with cheaper price.

Interviewee3: Yes. The cooperatives collaborate with other cooperatives in buying the inputs with cheaper price.

Interviewee4: Yes. It helps on exchanging the information between cooperatives.

Interviewee 5: The problem of each group will be shared in collaboration with other group.

Interviewee 6: The information on technology of growing and the market information are exchanged between groups.

Interviewee 7: It is very important to lobby the government in helping the farmer when the oversupply of production occurs.