CHAPTER 2

Literature Review

2.1 Agricultural Economy of Thailand and Global Markets

2.1.1 Thailand Agro-economy

Vegetables and fruits are important agricultural economic goods of Thailand. They create the revenue for the country of multi-billion Baht. They are in fresh, chilled, and frozen forms. The exporting value in the fourth quarter is 22,472.87 million Baht (OAE, 2012). The overview of the exporting of this agricultural goods at the global level shows that the value of the exporting of vegetable and fruit goods in the fresh, chilled, and frozen forms had continuously expanded since 1990 but was reduced in 2006 and has continuously reduced. In June 2012, the reduction was at 21.5% compared with the same month in 2011. The exporting values in the important markets include USA, Indonesia, The Netherlands, Germany, and Canada (DITP, 2012). The important exporting market for the vegetables is Japan which has been the first rank since 1989.

When considering the present situation of the vegetable and fruit exporting, it is found that this kind of goods must face the measures and trade barriers of non-tariff type (Kennedy and Rosson, 2002) The measures and barriers are imposed by the organizations in Thailand and by the trade counterparts. The measures imposed by the internal organizations have the objectives of facilitating the exporting of vegetables and fruits. The measures by Thai government sectors are the measures related to the standards of agricultural goods and systems. The agricultural goods standards have the objectives of controlling and promoting agricultural goods (B.E. 2551) and are divided into 2 types. Those include the compulsory standards which are the standards imposed by the ministry so that the agricultural goods must follow the standards. The general standards which are the standards imposed to promote the agricultural goods to meet the standard levels.

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2.1.2 European Union (EU) Market

The situation and overview of the vegetables and fruits of Thailand are different in each country. EU is a large food market of Thailand and potentially imports fresh vegetables and fruits. The consumers have high buying powers. EU is thus the market that Thailand must maintain the market share because if the goods can be exported to any member country, the goods have the possibility to be delivered to other member countries without control and additional tax. However, the exporting to EU is not simple because EU has imposed Non-Tariff Measures and Non-Tariff Barriers (NTMs and NTBs) in various forms, especially in terms of hygiene and food safety (Ardakani et al., 2009). From the past, EU seriously examines the vegetable and fruit goods from Thailand. The examination focuses on the residual toxic agents and the microbial that can be harmful to humans. The plant diseases and plant pests that may come with the vegetables and fruits are also examined to prevent from their distribution in EU. EU focuses on every steps of production from seed, ingraining, labor, harvesting, post-harvest management, containers, logistics, to sale distributions to consumers. However, NTMs and NTBs which are imposed by EU are considered the trade protection measures to protect agricultural and producing sectors in EU. In addition, they protect lives and hygiene of the consumers.

One of the NTMs that EU introduces using the international agreement is the Sanitary and Phytosanitary Measures (SPS). EU is the region that employs SPS highest in the world and makes the exporters from the developing countries which cannot comply with this measure not able to export the goods to EU.

The application of SPS is to limit the importing of agricultural goods in order to protect and save lives and hygiene of humans, plants, animals, and products from the viewpoints of food contaminants, toxic agents, or microbial which is the disease carrier. The definition of safety level and examination standards for imported goods must comply with international standards and be based on reliable scientific approaches. The SPS of EU follows the criteria of WTO on the Sanitary and Phytosanitary Agreement – APSA after the 1994 Uruguay Round of Trade Negotiation. The measures are adjusted for different situations, which are known as SPS Plus. Such an application is in the case where the situation is not normal and creates risk against the hygiene of humans, animals, plants, and environments.

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The measures related to the plants will cover the phytosanitary including Plant Health and Plant Quarantine. The protection of the phytosanitary in EU is the important part in the SPS. EU issues the regulations to strictly control the importing of plants from other countries. Before the plants are allowed to enter EU, they must be under the examination steps and must have the phytosanitary certificate issued by the responsible organizations of exporting countries. The responsible unit in Thailand is the department of agriculture, ministry of agriculture and cooperatives. The examination must comply with the international plant protection convention and there must be the requirements about the sources without disease. There is a regulation of prohibited plants too. In addition, EU seriously monitors the use of pesticides. There are a number of announcements for the permission and abandonment of several pesticides. Based on the principles of Hared-based Regime, the maximum residue limits (MRLs) of some pesticides in respective plants are defined. The frequency of random examinations of residue chemicals in fresh vegetables and fruits at the importing ports is also defined. Generally, the examination will be randomly carried out 10% of a whole lot of goods. If the residuals higher than the allowable values are found many times and the exporters have been already informed but not made any improvement, EU will adjust the rate of random examination to be 50%. In 2009, EU performed the random examination at the rate of 50% with 3 types of vegetables including yard long bean, the tomato-family vegetables, and the cabbage-family vegetables.

EU also built a warning system to inform the member countries of the data of the goods that have the plant and animal origin not complying with the hygiene regulation of EU. The system is called Rapid Alert System for Food and Feed: RASFF. The countries that are in the information network RASFF include 27 member countries of the EU and the member countries of European Free Trade Association: EFTA like Ireland, Liechtenstein, Norway and Switzerland.

According to the RASFF, the member countries will randomly examine goods at the examination port. If the non-complying goods are found, they will be reported to the national RASFF contact point. RASFF gives the information as well as the management measures to the member countries and the third-party or the goods origin countries in order to have suitable corrective and preventive measures (European Commission, 2010). The informing of RASFF can be divided into 2 kinds, i.e. market notification and

border rejections, each of which is subdivided into 2 types, altogether 4 kinds of warning as follows:

1. An urgent warning.

This warning is released when there is a detection of food or animal food with high risk against human and animal safety, and the foods are already in markets. It is aimed for the members of RASFF to perform necessary measures of urgent withdrawal of goods from the markets.

2. The notification of warning.

This warning is done when there is a detection of food goods or animal foods with risk in the market. However, other member countries need not to perform urgent measures because the goods have not entered the markets yet or have already sold out of the markets or the hazards need no urgent measure.

3. Border rejection.

This warning is a notification warning when there is a random examination of food goods and animal foods that do not comply with the standard and are urgently risky to the hygiene. The member countries will reject the importing at every port of the EU.

4. RASFF NEWS.

It is the notification of food safety which is not the kind of warning but interesting information. The quality examination and control authorities of the RASFF member should recognize the information under the heading "News".

As a whole, there is highest rate of system warning for chemical risk. It is also found that the goods from Thailand have the highest number of warnings in the world although the exporting compared with the other countries is much less. The number of warning for the physical risk is found minimum. The physical risks include the lack of the hygiene certification system, the lack of labeling or the details in the labels not complete the control of the temperature in goods not as required, the tearing of container, or the leak to outside, etc.

However, the warning of the biological risk is in the second order from the chemical risk for the group of vegetable and fruit goods. It is the contamination of microbial which is dangerous against the hygiene like Salmonella and E.Coli. Therefore, the EU has issued the regulation of food safety for the goods entering the EU based on the Codex. The Codex specifies the Maximum Residue Limit – MRL which is the maximum amount of the acceptable residues. It also specifies that the materials in contact with the foods must be safe and do not disperse the hazardous materials from the containers to the foods with the amount beyond the specified amount.

Apart from the assignment of MRL, the EU also specifies the goods to be imported to the member countries such that the goods must be produced from the manufactures with GMP. The GMP is the standard which gives importance to personal hygiene, hygiene and appropriate location, pest and animal carrier control, tools, and machines for producing. The vegetables and fruits that will be used in the production must come from the farms with GAP from the department of agriculture, ministry of agriculture and cooperatives only. The GAP standard is the measure from the Thai government sector and is imposed to control the export quality and the vegetable and

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fruit standard at the farm level. The GAP uses 8 examination criteria including water source, farming site, use of agricultural hazardous materials, storage and transportation at the site, recording, production with safe and free of agricultural pest, production management for quality products, and harvesting/operation after harvesting.

The Global GAP standard is the farm management standard of the important volunteer type in EU. It is established by the Euro-Retailer Produce Working Group – EUREF in collaboration with supermarkets in EU in order to response to the worry of the consumers about the goods safety. The environment and labor standard of the Global GAP covers the whole production process from farming to consumers.   The Global GAP covers the goods of the vegetable, fruit, livestock, fishery, and feed type. The members of the Global GAP occupy the market share of 85% of the fresh goods market in the Western Europe.   There are more than 30 members in 12 countries like Tesco, Sainsbury's, Dellhaize, McDonalds and ASDA. The Global GAP consists of general regulations and general agricultural practices. The examination system is the check list which divides into 214 control points including 49 Major Must, 99 Minor Must and 66 Recommendations. The producers according to the standard must invest in buying equipment and systems according to the regulations which increase high costs for the producers.

The British Retail Consortium (BRC) standard belongs to the group of the retailers in UK.   They have developed and used the standard for their own goods since 1998. They have started evaluating producers whether they have followed the established standard or not. Afterwards, there are applications to other sectors of food industry. The regulation of BRC is divided into topics including Management Commitment and Continuous Improvement, Food Safety Plan (Hazard Analysis and Critical Control Points), Internal Audit, Corrective Action and Preventive Action, Traceability, Layout, Product Flow and Segregation, Housekeeping and Hygiene, Handling Recruitments for Specific Materials, Control of Operations and Training.

The International Food Standard (IFS) is the standard which was established in 2000 by The Central Association of the German Retail Trade and Federation Desentreprises du Commerce de la Distribution – FCD to establish the standard for the suppliers of these retailers. IFS is another standard and volunteer, without legal

consequence.   It is the requirement of the retailers in Germany, France, Italy and some other countries that require their suppliers to follow. The retailers in Germany which uses IFS include Lidl, Aldi and Spar whereas those in France include Carrefour, Archon, and Casino. The requirement of IFS is divided into several levels like basic level, advanced level, and the highest level called Best Praetors in the Food Industry. The IFS standard is similar to the BRC one with the same requirement up to 80%. However, the retailers in UK, Germany, and France still do not accept that they are the same standard.   Therefore, the burden falls to the exporters who want to sell their goods to these 2 groups, which incur higher costs.

Apart from the standard established by the retailer groups, there are standards which are established by Hyper Market in EU too like Tesco Nature's Choice standard. This standard is used with all fresh foods that are sold to Tesco.   There are 11,400 farms in 66 countries that are the member of this standard (UNTAD, 2007).   This standard is similar to the Global GAP Fruits and Vegetables.   However, it is more serious.   Another standard Marks & Sponsor's Field to Forte is concerned with the chemical amount used in the farming of fresh vegetables and fruits for the Mark & Sponsor's.   Carefour has developed the Frillier Quality standard which is applicable to every fresh food.

Although the EU market will have interesting power in buying, but at the same time it is the market that has intensive trade-barrier measures.

2.1.3 United States of America (USA) Market

USA is another interesting market for the exporter of Thai vegetables and fruits. The population of the US is 4-5 times higher than that of Thailand and has the per capita income 5 times higher.   Although the fresh fruits from Thailand are popular for the US citizens, only 6 kinds of fresh fruit are allowed to be imported into the US market.   The US department of agriculture has announce the Final Reels for the permission of importing the fresh fruits from Thailand under the radiation for 6 kinds of fruit, including mango, rambutan, longan, lychee, mangosteen, and pineapple.   The imported fresh fruits must pass the gamma ray to eliminate and prevent the spread of plant pests from Thailand to USA. From another viewpoint, it is the protection of the US

agricultural sector because the overall US market shows that there has been the increase of importing fresh fruits to 170 times base on the statistics (1996-2007). The data from the department of export promotion specifies that the mango and pineapple is in the interested list for the US market since February 2012. Thailand has exported the radiated fruits to the USA about 606 tons, worth more than 60 million baht. However, there are different limitations in exporting general fruits to other markets, for example, the exporting that needs the elimination of plant pest risk using the radiation.

The radiation treatment has the principles that are established by the agreement of Thai and US government. The detail includes the source of raw materials which are the fresh fruits to be treated, must come from the farms that are GAP registered with the agriculture department. The packaging plants for the exporting to the US market must be GMP certified and examined by the inspectors of APHIS/USDA (Animal and Plant Health Inspection Service) in Thailand. The radiation treatment plant must be certified by the officials from APHIS and the agriculture department too. It can be seen that the in-charge authorities for the exporting fruits to the US market are APHIS/USDA and the agriculture department. The APHIS/USDA will send their inspectors to base in Thailand with the condition that the necessary expenses of the inspectors will be taken care by the ACFS as the coordinator. The ACFS will provide a fund to cover all necessary expenses for supporting the operation of the APHIS officials including APHIS administrative costs, CPHST (Center for Plant Health Science and Technology) administrative, and the cost of certifying the treatment plant, the cost of certification, the cost of equipment and other services related to OWP (Operational Work Plan for the Exportation of Irradiated Fruit to the United States from Thailand). The ACFS was the responsible unit for the financial management instead of the private sector in the first year of operation. The financial report will be annually done by the APHIS and certified by the ACFS before the examination. All expenses must be paid in advance to the USDA (Office of Agricultural Affairs, 2008). The private sector has been the responsible unit in the later years. The exporting companies have established the group of Thai Private Cooperator which was later developed to become the Thai-USA coordinator centre for exporting fruits limited company. The main objective of the company is to collect the money and to establish a fund for the expense of exporting the radiated fruits to the USA. It also coordinates the mission of registration and informing

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data to concerned persons like USDA, the agriculture department, the radiation treatment plants, the packaging plants, the exporters, and other services (Office of Agricultural Affairs, 2008a).

Apart from carrying the burdens by the exporters in terms of the Trust fiend as mentioned, the processes in the radiation treatment is also complicate from selecting the raw materials of fresh fruits to the post-harvesting process. The fruits must be quality and suitably ripe for the radiation treatment. All of the processes are very crucial because the fruits must pass the radiation treatment with the minimum radiation of 400 Gray according to the standard of the US department of agriculture (Office of Agricultural Affairs, 2008a). The treatment makes the fruit management after the harvesting but before the exporting different from the process of exporting general fruits (Kennedy and Rosson, 2002). In addition, there is a detailed standard of the container size and the amount per a container for the containers for the radiated fruits. The configuration of container must be sent to the preclearance officers to consider and give permission that it is suitable for the use and has no effects on the radiation. When an appropriate and correct container is obtained, the exporter needs to make an appointment for the radiation treatment with the cooperator authority in advance. Each radiation treatment specifies minimum amount and cost per kilogram. In addition, the transportation from the packaging plant to the radiation treatment plant must be in a close condition and be separated from the other goods that are not under the radiation treatment. This is to prevent from the contamination and the treatment plant will provide the logistics within the plant. The cost is charged with the persons who bring the goods for the treatment. Before the treatment, the preclearance officers will randomly examine the fruits in those lots and if the plant pest is found in any lot, that lot will be rejected.

The risk of the exporters of fruits to the US also extends to the destinations when the goods arrive there after the fruits go beyond the preclearance officers. This is due to the short storage life of the permitted fruits. The appropriate transportation means is the air transportation. However, the exporters have already the cost of radiation treatment. When it is added up with the air transportation cost, the ability in increasing the prices of Thai fruits is thus reduced, compared with the same fruits from other countries. Besides the cost issue, the quality of the fruits when arriving at the US is also another

issue. The exporters realize the cost constraints and thus try to reduce the transportation cost by using the marine transportation instead. The amount of goods for the marine transportation must be large to economize the cost per unit as much as possible. Consequently, it is not possible to consistently control the quality of the raw materials so that the raw materials are suitable for the radiation treatment of the whole lot. The goods at the terminal ports then become damaged. In case of mangos, they will not be ripe and have a sour taste. If the age of those mangos is too short, the treatment will delay the internal development. On contrary, if the mangos are too ripe, there will be rotten mangos. Such damage must be agreed between the exporters and importers for the happening expenses and costs.

The foregoing issues are a trade obstacle for Thai fruits to the US market which requires the promotion and collaboration from the growers to the exporters to develop Thai goods so that they are competitive in the US market.

2.1.4 Australian Market

The Australian market is an interesting market for the fresh, chilled, or frozen vegetables and fruits including the canned fruits from Thailand. Although Australia is the country with a high rate of agriculture products and has important food production industries, Australia still needs to import several agriculture and food goods. The importing values 10.1 billion US dollars in 2009/2010, reducing 3.1% from 2008/2009. The increasing goods in the importing include vegetables and fruits, sugar, bakery goods, cereals, wine, and beer. The importing sources include New Zealand, USA, China, Thailand, and Ireland (DITP, 2012). However, Australia is an increasingly important trade counterpart. When looking at the magnitude of exporting goods from Thailand to Australia with the expansion rate of 15% per year during 2007-2012, Australia is the important trade counterpart with the eight rank and has the value of exporting from Thailand of 7.2 billion US dollars in the first 9 months of 2012 (EXIM Bank of Thailand, 2012). When compared with the economic situation in USA and the debt problem of several member countries in EU, these make the Australian and Asian people have their consuming cultures not much different from that of Thai. It is thus a good opportunity for Thai food goods.

Australian allows only 6 kinds of vegetables and fruits to be imported from Thailand. They include baby corn, asparagus, longan, lychee, mangosteen, and pineapple. Although there is an FTA agreement between Thailand and Australia, it is just the tax agreement. Thai exporters still face the NTB which is seriously imposed by the Australia for vegetables and fruits. They argue that their country is an island and thus needs to have a serious RSP measure in order to prevent the insects which may be with the agriculture goods. The measure starts from the registration of each goods exporter which the exporters need for exporting their products. Their farms must be GAP certified with the agriculture department. The packaging plants must be registered too. The packaging plants must be GMP certified. For the importers, Australia also requires registration for importing each type of goods. The importers must send the data of the import permit to the exporters for the issuance of the Phytosanitary Certificate. Before exporting, the exporters must make an appointment with the plant quarantine to randomly examine the goods in the lot of exporting at the packaging plant. The officers will examine for the plant pests and the cleanness. The packaging complying with the AQIS (Australian Quarantine and Inspection Service) standard must have correct labeling at the container and quality goods. If the goods comply with the requirements, the Phytosanitary Certificate will be issued in order to be used at the agriculture control at airports.

The steps above are the general steps for the exporting of fresh vegetables and fruits. AQIS also imposes detailed steps which are specific to each kind of goods. For examples, mangosteen must be packed in the container with insect-protecting net. The net must have the mesh size according to AQIS requirement. The mangosteen must have no damage traces and be clean without insects and ants. They must be cleaned for the whole fruit and sepal. In addition, the mangosteen must pass fumigation using the methyl bromide gas with the concentration of 32 gm³ for 2 hours at the temperature of 21°C or more (ICON, 2013). When the random examination complies with the requirements of AQIS, the officers will issue the certification of the examination in order to receive the phytosanitary certificate at airport.

The regulation for importing longan is different from that of mangosteen. AQIS specifies that the exported longan and lychee must pass the cold disinfestations treatment before exporting or during logistics or pass the vapor heat treatment. The

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exporter must select a method of treatment. Both the cool room and container must be examined by the officers from the department of agriculture whether they can maintain the temperature according to the required AQIS or not. The temperature probes already calibrated according to standard will be placed at the points required by AQIS to collect the data in the cool room and container. When passing the examination, longan can be put inside the room. Every step must be under the control for the officers. When the temperature complies with the requirement, i.e. between -3° and 3°C, the officers will randomly examine the longan bodies whether the temperature is in the specified range or not. If it is not, the whole process must be redone. The cold disinfestations during the transportation can be done only in the case of marine transportation because it is difficult in the case of the air transportation. This is because the containers of the airlines have no the temperature control and thus cannot control the temperature as required the AQIS. This difficulty is also true in case of the marine transportation because only few companies that the temperature recorders that can record and report the temperatures throughout the trip. When the longan arrives at a port in Australia, the PQ inspector will check the temperature of the longan whether it is within the range required by AQIS or not. If not, that lot of goods must be held for further processes of AQIS.

In case of lychee which requires the process of VHT to eliminate freest flies be exporting, the regulation is similar to the cold disinfestations treatment which must be controlled by the officers from the agriculture department. There must be the placement of the temperature measurements at the required locations. The fruit pulp temperature must be measured and printed out during the VHT process in order to check its compliance with the AQIS requirement.

In case of pineapple, the pineapples to be exported must be cut at their tops and leaves. Only the fruit itself that is allowed to be remained. AQIS eliminates the insects by using the methyl bromide gas which is the same as in the case of mangosteen. The exporters can selectively use the fumigation before exporting or do that when the goods arrive at Australia. The concentrations of the methyl bromide are assigned according to the temperatures outside and inside the fruits. The fumigation is not allowed if the internal temperature is lower than 10 °C. In case of fumigation before exporting, the concentration of the gas must be measured and recorded.

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Australia allows other fruits to be imported in form of chilled and frozen fruits, e.g. frozen durians. Interestingly, AQIS requires that pomelo be imported in form of chilled pulp. The exporters must comply with the requirements by AQIS in terms of production process and container used.

It can be seen that Australia is an interesting country for fresh fruits. However, there are conditions and standards that are very strict and become critical trade barriers for Thai vegetables and fruits.

2.1.5 Asian Market

Asian markets are considered new and high potential markets. As a whole, there are upper-level markets including Japan and South Korea. They want quality goods and have importing regulations. The measures for agriculture goods are rather strict. The middle-level markets are China, Hong Kong, and Middle-east countries. They do not impose much strict standards. The goods need not to be high quality. The lower-level markets are our neighbor countries like Vietnam and Lao. They do not have many requirements and measures. The goods are cheap and in a large quantity.

Japan can produce many kinds of fruits with quality. The amount of produced fruits is, however, not enough for the consumption. Japan thus needs to import fresh fruits. Most import fruits include banana, kiwi, and pineapple. Japan is the largest net food importing country with the exporting rate of about 4,000 million USD and importing rate of 5,000-6,000 million USD. In 2011, Japan exported foods 4,206 million USD but imported foods altogether 63,725 million USD, which was increased from 2010 by 23.20% (Foreign Trade Promotion Office in Tokyo, 2012). This is attributed by the phenomena of the earthquake and Tsunami on 11 March, 2011 as well as the nuclear power plant incident. The phenomena affects the production sources of agriculture foods and fisheries in the north-eastern region of Japan.

Thailand is at the 3 rank of the food importing countries, behind USA and China, respectively. The important goods from Thailand are processed chicken, sugar, seafood, processed seafood, rice, and fruit. Agricultural cooperatives will collect products and deliver to consumers or retailers if they are domestic products. The storage, packaging, and transportation are carefully done to preserve freshness and

quality of goods. There is the data of producers and production sources at every piece of goods for traceability.

For the fruits from abroad, the importing companies will select, coordinate with the exporters of producers, negotiate, examine the quality before delivery, and prepare relevant document. These are for the confidence in the standard of goods quality and food safety. Some importing companies have the network companies to be the exporters from the upstream. Most imported fruits are delivered to the distributors and supermarkets directly.

The JTEPA agreement (Japan – Thailand Economic Partnership Agreement) in 1997 abolished the importing tax for the tropical fruits except durian, papaya, mango, and mangosteen. This increasingly creates the opportunity of exporting tropical fruits to the Japan market. Presently, Japan allows importing 7 kinds of fruits from Thailand including 5 kinds of mangos, mangosteen, raw banana, young coconut, pineapple, durian, and sweet tamarind (OAE, 2013).

The vegetable market in Japan is considered a big vegetable market. Although producible in the country, the fresh, dried, and frozen vegetables need to be imported to Japan, especially in crisis period of the nuclear power plant. The consumers are worried about the food safety due to the radioactive contamination. This results in the increased order of vegetables from the domestic producers by the important retailers in order increase confidence to the consumers.

The prices of the vegetables in Japan are not fluctuating because the trade counterparts have the networks with the domestic producers and importers in order to maintain the stability of the goods amount for sale. The imported vegetables are about 41% fresh vegetables, 28% frozen vegetables, 4% temporarily preserved vegetables, and 27% dry vegetable, bean, tapioca and potato (DITP, 2011) Imported fresh vegetables with high values include onion, carrot, broccoli, asparagus, mushroom, lettuce, tomato, and pea, for examples.

Although the rate of population growth will be decelerated but the importing of vegetables has an increasing tendency because the production cost of the domestic vegetables become higher, the number of farmers reduces, and the farming areas are limited. In 2010, Japan imported vegetables of 2,153 million USD, increasing from

2009 26.1%. In 2010, Japan imported Thai vegetables of 100 million USD, increasing from 2009 14.7%. Japan imports vegetables from Thailand, 5% of the vegetable importing. Important goods include asparagus, onion, and frozen vegetables like chopped asparagus, okra, and baby corn, for examples.

Under the JTEPA agreement, Japan abolished the tax for importing some fresh, chilled, and frozen vegetables and will be gradually abolished within 5-10 years (OAE, 2013).

Since the tax measures for importing vegetables and fruits of Japan are not the obstacle against the importing, Japan instead uses the strict hygiene regulation. The laws that control the importing of vegetables and fruits are plant protection law which prohibits the importing of parts of plants, vegetables, fruits with soil or contamination of insects and plant pests, and food sanitary law which controls residual hazardous materials and food safety. Japan has the strict requirement of chemical standard which requires the Phytosanitary Certificate before exporting vegetables (fresh, chilled, frozen, or dry) by Thai agriculture department. There must be also the examination of residual poisonous materials for the issuance of health certificate before the exporting of every lot of some fruits including mangosteen, mangos of Nangklangwan, Pimsaendaeng, Rad, Namdokmai, and Mahachanok kinds. These fruits must pass the vapor treatment in order to eliminate the insects before exporting. This process must be under the control of the Japanese and Thai plant quarantine officers. All costs of Japanese officers will be charged on Thai side. The vapor treatment plant and equipment must be examined and certified by Thai and Japanese officers only. The paper boxes that are used for containing the fruits in the vapor treatment process are specified for their size and ventilation pores suitable for different air and marine transportation.

Although Japan has such regulations, the Thai ministry of agriculture and cooperatives also announces the requirement of examining residues in 29 vegetables and fruits before exporting to Japan. Every lot of goods must be randomly examined at the Japan quarantine and if there are problems like the plant pests are found with the goods, that lot of goods must be fumigated. This largely incurs the burdens of cost and time for the importing.

A new interesting market for Thai fresh fruits is South Korea Market. South Koreans have similar consumption test to the consumers in other Asian countries. They care for health. Teenagers like tropical fruits with sweet and sour taste in combination, especially the fruits with high nutrition values like banana, pineapple, and mango. The popular consumption will be even higher in the period of warm weather and summer. The processed, frozen, and canned fruits will be popular in the food industry, restaurant business, and hotels. Although there is limitation for general consumption, the South Koreans have increasing incomes and buying powers which increase the opportunity of market expansion.

Presently, South Korea does not allow to import fresh vegetables from Thailand but allows to import 7 kinds of Thai fruit including durian, banana, coconut, grape, pineapple, mango (Namdokmai, Nangklangwan, and Rad) and mangosteen. The distribution channel of Thai fruits is as follows. The fruits with high curing time and processed fruits which can be kept for a long time will be send by the marine transportation, e.g. banana, pineapple, and coconut. The fruits with high selling price and seasonally exported like durian, mango, and mangosteen will be mostly send by the air transportation. The fresh fruits from abroad will be sold via the importing companies and then distributed via various channels, e.g. cooperatives, supermarkets, department stores, hyper market, internet or online market to the consumer.

Although the obstacle in terms of tax is reduced due to the FTA between ASEAN and South Korea, South Korea still has other measures, e.g. the limitation of importing quota like rice, tapioca flour, and red bean; measures of Korean-language label for every kind of food; agriculture, livestock, and fishery foods with detailed labels according to the relevant law, and hygiene measure for agriculture goods to prevent from plant and insect diseases possible coming with the fruits and destroying local plants. The latter is done through the plant protection act which requires that the fruits to be imported needs to pass the risk assessment from the National Plant Quarantine Service: NPQS. The recent fruit that was allows to be imported to South Korea is the fresh mangosteen under the requirements as follows. The producing farm and packing house must be registered with the National Public Procurement Office: NPPO. NPPO will send the list of farms and packing houses qualified according to the imposed standard, i.e. the farms with the GAP registration at the agriculture department

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and the packing house with the GMP certification at the National Plant Quarantine Service of Korea each year. The exported mangosteen must pass the process of using Methyl Bromide according to the requirement. Afterwards, they will be randomly examined for their quality by the officers from the agriculture department and then obtained the certificate for exporting (Department of Trade Negotiations, 2012)

Apart from the above-mentioned markets for Thai vegetables and fruits, other interesting markets are China, India, Middle-east countries and neighbor countries. These markets have not much trade obstacles in terms of tax and NTB. Consequently, the exporting is not difficult. They do not emphasize safety or hygiene, which can be considered the exporting markets that can distribute goods during the seasons of high production and satisfactorily for the lower grade goods.

The China market is an important export market of Thailand. Thai fruits are very popular for Chinese consumers both in terms of fresh and processes fruits with the value of not less than 14,000 million Baht in 2011 (Naewna, 2013). Important exported fruits are durian, mangosteen, longan, lychee, mango, papaya, pineapple, and dragon fruit. In addition, there are popular processed fruits, for examples, dried longan, fried durian crisp, baked banana crisp, baked jack fruit crisp, and baked pineapple crisp, among others.

Presently, after the FTA between Thai and China, there was the reduction of importing tax to 0%, which has resulted in the expansion of trade of vegetables and fruits. There is also the initiation of new transportation route to China, namely R9 route from Mukdaharn Province via Lao, Vietnam, to Hoi-i-gwan port of Ping-Siang city in Kwansi Province of China, with the total distance of 1,200 km. The transportation takes 2-3 days. R9 route facilitates the distribution of goods, fruits, and other agricultural goods from Thailand to China with the increasing rate of 20-30% or about 1,000-1,500 million Baht (District Agriculture Office, 2009).

The problem and obstacle in trading with China is the NTB, more specifically the plant hygiene. The imported vegetables and fruits must have the certificate for plant and insect diseases and must pass the examination by the state officers at the plant quarantine, e.g. the importing of longan. If the random examination finds insect, the fruits must be treated by the methyl bromide. This incurs a cost and results in the quality

of goods. There must be also the certificate for the examination of residual chemicals from the agriculture department so that the residual sulfate dioxide will not over the limited value. The imported mangos and durians to China must come from the farms which are registered with the agriculture department only. Besides, although there is no importing tax and are higher numbers of trade channels, the transportation of imported vegetables and fruits from Thailand to China must be solely done under the logistic companies allowed by the Chinese government. Consequently, there is a monopoly that Thai exporters must carry the cost burden to operate according to the company requirements. The Chinese importers even specify that the eligible importers and exporters must be the licensed persons only (Ministry of Finance, 2013). These companies will distribute goods to wholesale and retail markets and will receive the commission fee from the consignment. When the goods are sold, the money will be transferred back to Thai exporters and creates the risk of delayed transfer. Thai exporters must also take the burdens of VAT 13% for fresh fruits and 17% for processed fruits, based on the evaluation prices by third-party companies every 3 weeks and being different from province to province. If the exporters do not take this burden, the importers will put the burden to the wholesaler and retailers, which makes Thai fruits cost higher than domestic fruits. Moreover, there is a problem of business management in China, which is lack of central in-depth data of China business in terms of law, regulation, trade culture in connection with Thai exporters, as well as the mainly use of Chinese in trade negotiation.

2.2 Food-relevant Standards

2.2.1 Backgrounds about Standards

In the era of globalization, the movement of information, people, and goods is very rapid. There are attempts to remove or reduce obstacles for the movement with high mobility and freedom. There is higher relocation of people to cities, which demand higher amount of food. The food price becomes higher and the demand of agricultural goods also rises in turn. The movement of people, animals, plants, and things is a cause of spreading diseases and plant pests. Therefore the establishment of measures to inhibit or reduce the risk of food safety and plant hygiene is taken into consideration in the

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global stage. There are many aspects of measures to reduce and protect such a treat. Since the equality is desired, the issued measures are made so that they are not considered as trade obstacles but they are standards. These standards are differently enforced in each part of supply chain which covers from raw materials in production, products, delivery, and management (Jaffee et al., 2008). On one hand, the standards become the trade barriers from importing countries that mainly are developed countries. From the viewpoint of exporting countries, the standards are considered the measures or standards as the trade barriers. They are the NTB measures. In addition, the standards may be assigned by the buyers to differentiate the products that they sell to create trade competitiveness. The pollution and global warming is raised as the barriers too. However, no matter what standards they are for, e.g. food safety, business or environmental responsibility, the standards try to show that they form the basis of a sustainable development of every entity in the food supply chain.
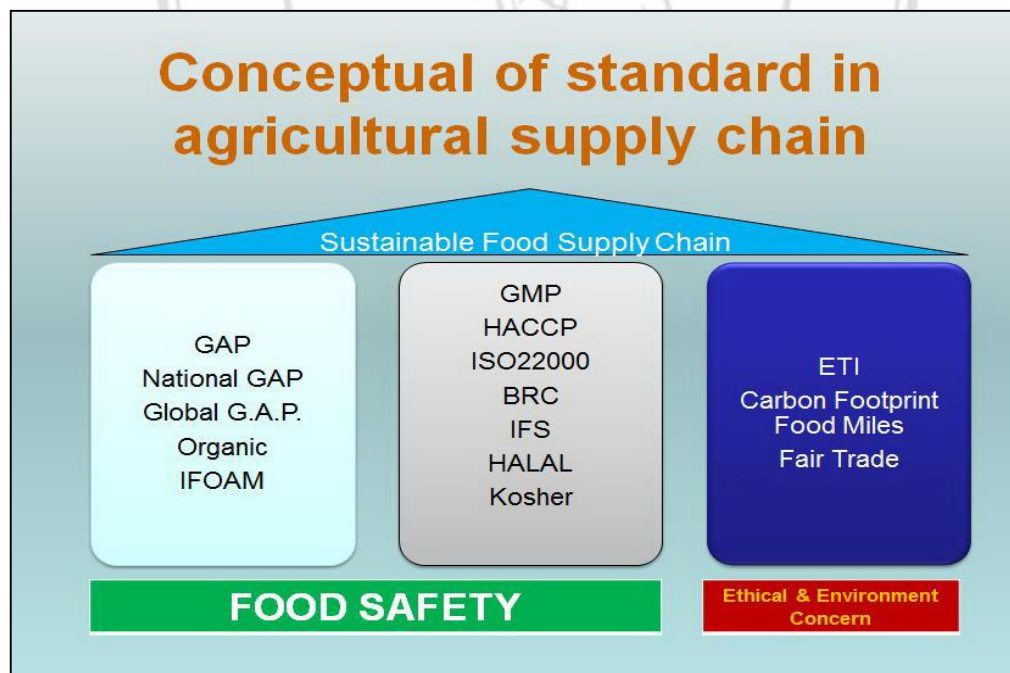
Figure 2.1 Conceptual of Standards in Agricultural Supply Chain

The standards can be generally divided into 3 groups:

1) The standards that are established and used for food production.

2) The standards that are established for the morals in working and the environmental responsibility. However, such standards are parts of several standards but they are the ones that are generally mentioned and widely implemented.

3) The production standards. The production standards will consider the hygiene of production workers as well as the hazards or risks that may occur from the production. The standards include GMP, HACCP, ISO22000, IFS, BRC and etc.

2.2.2 GMP (Good Manufacturing Practice)

GMP is the starting and familiar standard in the pharmaceutical and cosmetics industries. It is used also in the food industry. GMP is the criteria or fundamental requirements necessary for the production control to create the safety of products. GMP emphasizes the prevention and removal of risks that make goods or food poisonous or dangerously contaminating against consumers. GMP is divided into 2 parts (Deeprasertwong, 2011; 2011a; 2011b).

- It specifies the criteria of production that emphasizes the risk and safety under the productions inappropriate for consumption.

- It considers the contamination possibly due to the unhygienic packaging such that there is a contamination and harmful to hygiene (FDA, 2004).

There are 6 requirements for GMP:

1) Location and production buildings must be in the places that do not easily create contamination, are far from wastes or disease carriers, and are far from places with large amount of dust. The buildings must have rigidity, good drainage systems, methods of removal and protection from carrier animals. The buildings must be easily cleaned and maintained. There is a separation the production places from the residence areas. The insect protection and removal equipment must be provided. The things that are not used must be removed from the production lines. The production areas must be provided with enough lighting.

2) Facilities and containers used in the production must be made of materials that will not react with food such that there is no harm to consumers. Yet they must the size suitable for working, stainless, and able to clean easily. The design of facilities must take into account of contamination, hazard in buildings, ease of cleaning and maintenance, enough numbers for operation.

3) Production control must control complete process and comply with hygienic principles from raw material examination, ingredients or chemicals used in the production, production preparation, packaging, storage, and delivery. The raw materials in production must be clean and suitable quality for production. There is cleaning necessarily for reducing contamination. The raw materials must be stored in the conditions that prevent from contamination and degradation to the minimum level. There is an efficient inventory management. The containers for containing and transporting must be in the suitable condition, not creating contamination. Ice or vapor for the production must be of standard quality according to the local law. The production, storage, and transportation must be the process that prevent from contamination and quality degradation. There is the production control process in an appropriate manner. There is a production recording. The results from analyzes must be kept at least 2 years.

4) Hygiene: The water used in the production plants must be clean and able to be treated when needed. There is a provision of closets and cleaning sinks in front of the closets in accordance with the hygienic principles and with enough numbers for the workers. Such areas must not be opened directly to the production areas. There must be cleaning sinks in the production areas and enough hand-washing equipment. There are appropriate approaches of animal carrier prevention and removal. There must be suitable and enough number of garbage bins with covers. The drainages must be efficiently provided so that there is no contamination.

5) Maintenance and cleaning: The production buildings must be maintained in the uniformly clean and hygienic condition. This must be also for machines and equipment. The surface of facilities that are in contact with food must be regularly cleaned. They must be checked for the condition of immediate use.

Use of chemicals for cleaning must be under the conditions of safety and the chemicals must be kept in places and safe from incurring contamination.

6) Personnel and hygiene: The workers must not be infectious or free from dangerous diseases according to the law. There must be no wounds that may lead to contamination on products. Workers who directly contact the food must wear clean and appropriate dresses. Hands must be washed before and after work. Clean and not contaminating gloves must be used. No decoration is allowed during work. Nails must be taken care in the clean condition. Hats or head-nets must be used to prevent from contamination. There are trainings for workers in food production as appropriate (Codex Alimentarius International Food Standards, 2003).

2.2.3 Hazard Analysis and Critical Control Point (HACCP)

HACCP is the analysis of hazard and critical control point. It is a tool to identify, evaluate, and control possible biological, chemical, and physical hazard. It is the system that stresses control more than product final test (Codex Alimentarius International Food Standards, 2003a). HACCP is originally developed by Dr. W. E. Deming who proposed theories of quality management. HACCP can be used to improve the goods quality and reduce the costs. HACCP was revised in 1960 by Pillsbury in collaboration with the US Army and NASA. It is the collaborated food production for space projects that demand zero-defect error. This is aimed at the food safety for astronauts during their missions. Pillsbury employed HACCP and focused on the production processes to attain highest safety via the worker control and the continuous critical control point. The company proposed the concept to the US FDA to announce as the law for the can foods with low acid in the 80's. Later on, the US National Academy of Science introduced HACCP to ensure the confidence in food production. HACCP became then well-known (FAO, 1998).

The application of HACCP in the food chain is based on the assumptions that all operations comply with GMP and the Codex Alimentarius General Principles of Food Hygiene (CODEX). The ability in applying HACCP depends on the compliance with the systems and programs. HACCP consists of 7 principles:

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1) Conduct a hazard analysis.

2) Determine the critical control point.

3) Establish critical limit.

4) Establish a system to monitor control of the critical control point.

5) Establish the corrective action to be taken when monitoring indicated that particular CCP is not under control.

6) Assign validation to confirm the performance of HACCP.

7) Assign document relevant to operation and appropriately record data

Implementation of HACCP in Thailand

In 1991, EU issued the regulations for the producers of foods to EU members that the producers must determine critical points and controls in production. In 1997, USA issued the law stating that the sea food producers for the USA must employ HACCP in the production. Consequently, Thailand has to follow the law by producing foods under HACCP to comply with the regulations and requirements of trading countries. In 1997, Thai Ministry of Public Health issued the industrial standards of HACCP in food production and the use recommendation as TSI 7000-2540. In addition, the Office of Industrial Product Standards and the Food and Drug Administration are the certify authority for the entrepreneurs.

Benefits from using HACCP are:

- The consumers are more confident in quality and safety of products that are certified. The costs and resources of producers are lessened in long run because the resources are more efficiently allocated. Yet, the problems are prevented and solved timely when the deviation or problems likely occur. The time used for developing new products is also reduced.

- The government officers who are in charge of controlling food safety are facilitated because good and appropriate records from producers help in examination. Thus, the monitoring from the authority becomes convenient and efficient.

- Good relationship between producers and government sectors is promoted because they participate in planning HACCP.

- The certification of HACCP by appropriate authorities will help the examination of importing countries because the persons in charge are confident in quality and safety. The reputation and exportation of Thailand is thus promoted.

- Highest benefits belong to consumers because the food products that are safe will be more available (Food Network Solution, 2011).

2.2.4 ISO 22000:2005 Food Safety System Requirement

ISO22000 is the standard of quality and safety management in food industry and the industries relevant in food chain. ISO22000:2005 is designed to cover the production process throughout the food chain, both direct and indirect, to the consumers. In addition ISO22000:2005 also includes food safety system similar to GMP as well HACCP.

ISO22000:2005 is composed of 8 principles components:

1) Scope

The scope emphasizes on operation and control measures to ensure that the production processes response to customers and regulations of food safety. The nature and type of organizations which are involved, directly or indirectly, fall into these standards. The organization size is not important.

2) Normative Reference

The reference addresses the materials or terminologies used in the ISO documents.

3) Terms and Definitions

These are the terms and definitions that attempt to maintain the clarity according to the aims and spirits of the standards.

4) Food Safety Management Systems

The systems stress on the documentation of operation and maintenance for efficient food safety. This includes the necessary protocols which ensure that the development or improvement is safe and efficient. The sub-contract that is influential to the food safety is also included.

5) Management Responsibility

It is the bond between high executives and systems in implementing and maintaining the food safety systems. It is accomplished by assigning the responsibilities to teams. These include the issuance of strategy, objectives, emergency plans, responsibility and communication that are efficient in the organization and among customers. There are meetings to regularly correct mistakes and errors.

6) Resource Management

The management is aimed at managing the efficient food safety. The involved executives must prepare resources, budget, and staffs so that the systems are efficiently operated.

7) Planning and Realization of Safe Products

This is an integration of GMP and HACCP to efficiently manage. It includes training, cleanness, hygiene, validation, sales person evaluation, control of risk or regulation-violating points, and product recall.

8) Validation, Verification and Improvement of the food safety management system

This is an examination of equipment and apparatus including systems. There must be implementations of plans and may be parts of continuous development processes (Ministry of Foreign Affairs 2011; Deeprasertwong, 2007; 2011b; Surarungchai 2010; FSSC22000, 2010; Sansawat and Muliyil, 2012).

2.2.5 British Retail Consortium (BRC)

BRC is the food safety standard which arises from the integration of large-scale retailers like Tesco Sainsbury, Iceland Food, Safeway, Waitrose, The Co-operative Group and ASDA (Ministry of Industry, 2009; Pornchalearmpong and Ratanapanon, 2012).

In 1998 BRC responded the industrial need in development by issuing the BRC Food Technical Standard applicable to the evaluation of producers for retailers who have their own food production brands. The standard is designed to help the brand

owners consider safety and quality, and to help prevent from mistakes and errors which can be legally sued. In such cases the retailers and brand owners are legally liable to their product brands (British Retail Consortium, 2008).

BRC has 6 principal requirements.

1) System for analysis of hazard and critical points that need control in food production (HACCP).

2) Quality Management System

3) Factory Environmental Standards

4) Product Control

5) Process Control

6) Personal

BRC has the following benefits and drawbacks:

Benefits

1) It is the standard that is accepted by the UK retailer association.

2) It is the standard that is accepted by groups of suppliers and industrial plants.

3) It has the scope including quality, hygiene, and product safety.

4) It ensures that the producers and delivers follow the GHP.

Drawback

1) The certification of BRC standard does not include the trading or distributing producers, wholesalers, importers, as well as the distribution or storage outside the direct control to company (Uaa, 2009).

The food safety standards are the basic requirement of all supermarkets and hypermarkets while GMP, HACCP, ISO22000 and BRC are required by buyers or importers, especially supermarket chains in European countries. These standards are mainly involved in packing and processing step. In order to be certified all the fundamental requirements must be implemented. The traceability is one of key criteria of food safety standards. The raw material must be able to trace back to producer. Without suitable knowledge and communication between producers and buyers it will be difficult to achieve the goal of food safety. Therefore, the farmer or producer must have certain level of knowledge and understanding on meaning and criteria of food

safety. It would be better if the farmer will have some tools to support and elevate knowledge to improve their capability in all aspects to meet with food safety standards requirement.

2.3 Standards Involving Sectors of Agricultural Goods Production

2.3.1 Good Agricultural Practices (GAP)

The important principles of GAP are the control and management to reduce the contamination risk of products from grower/packer handlers. The contamination may be cause of consumer illness. The contamination may be of different types from physical, biological, to chemical contamination. However, principally GAP is a good management for growers to reduce the contamination risk of biological and chemical type. In fact the biological contamination is sensitive and highly risky such that inappropriate management can lead to the contamination. Vegetables and fruits are self-protecting against the contamination. It is a good nature in increasing the efficiency of contamination reduction by washing. However, it depends on the kind of plant whether it is possible to clean by washing or not.

Four main reasons of implementing GAP.
1) Epidemic that links the imported or domestic food.
2) The discovery of germs that are carried with agricultural goods both domestic and imported.
3) There are research and academic reports that the cleaning at the surface of agricultural products is not simple.
4) There are research reports that the germs may occur at the post-harvesting processes.

Due to those reasons, there were notions of management to reduce the contamination risk in agricultural goods. The principles of management for food safety in agricultural goods are as follows:
1) When there is contamination, the contamination removal or the sterilization of agricultural products becomes difficult.

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2) The protection of biological contamination in every steps from production to distribution becomes necessary in order to protect and remove the contamination.

3) Document and operation handbooks, prevention plan, training plan for all worker levels, and site environment are the main factors of the safety system of agricultural goods and food (University of California–Davis, 2013).

GAP imposes farming practices for the farmers to follow. The farming practices principally gather the management strategies from several disciplines in order to reduce and diminish the risks related to the safety of agricultural food and goods. The management principles include:

1) Soil Management

2) Water Management

3) Animal or Plant Production Health and Welfare

4) Health Care and Public Health

For correct and appropriate management of agriculture, farmers need to have knowledge, understanding, planning, measuring, monitoring, and recording in every step of processes (Ellis, et. al., 2004). It can be seen that the knowledge transfer to farmers and the knowledge accumulation of farmers are important and necessary matters.

2.3.1.1 Global GAP

Global GAP was originally known as EUREP GAP which had been established in 1997 from the group of European and UK retailers. The Global GAP is an independent organization which is established in order to be an examining, evaluating, and certifying body for agricultural goods. The Global GAP has the purpose of globally single standardization. The Global GAP standards cover the input to be used, the post-harvest management, the environment and the worker life quality.

The Global GAP standard is the inter-firm certification, i.e. no direct report to buyers. The Global GAP was changed from the EUREP GAP in 2007 (GLOBAL G.A.P, 2013). The Global GAP includes:

1) Global GAP General Regulations

2) Global GAP General Control Points and Compliance Criteria

3) Global GAP General Check List

Besides, the Global GAP can perform the benchmarking with the processes of other standards for the purpose of calibrating the Global GAP too. The standards of the Global GAP will be revised and developed every 3 years. The Global GAP gives importance to stakeholders and want to support them in the certification of respective country standards on the ground of "think global, act local". Therefore, the Global GAP gathers experts from many countries of which the legislations and conditions are different. This leads to the establishment of National Technical Working Group (NTWG) whose roles is to develop and translate document, consider and correct issues of difference for the application of the standard in each country (GLOBAL G.A.P, 2013a).

The standards of the Global GAP cover the farm management which is known as the "Integrated Farm Assurance (IFA)" and consists of

1) Global GAP Reissue Assessment on social practice

2) Plant Propagation Material

3) Animal Transportation

4) Compound Feed Manufacturing

IFA is the standard that integrates the standards of several product groups, see Figure 2.2.

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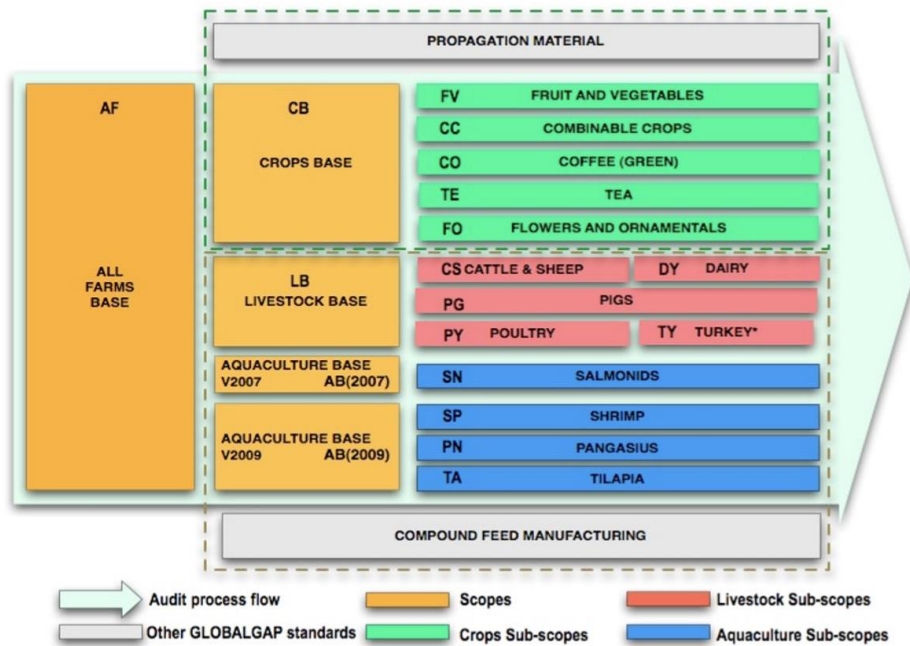
Figure 2.2: Integrated Farm Assurance (IFA) Standard
(GLOBAL G.A.P., 2009).

Figure 2.2 shows that the implementation of the Global GAP standards to vegetables and fruits need to consider 3 major scopes including Crop Base Module, All Farm Base Module and Fruits and Vegetable which is under the Crop Base Module. For certifying the farming standard, farmers need to follow or show the compliances to all related regulations. However, each control point will have levels of compliance. The level of compliance is defined as follows:

1) Major Must
2) Minor Must
3) Recommendations

At the beginning of establishing the Global GAP in Thailand, there were difficulties due to lack of experts who really understand the system. The document is in English, which is not suitable for Thai farmers. The certifying cost is also high. Thai farmers are mostly small entrepreneurs and thus cannot afford for such high costs. The costs and the support of knowledge transfer come from export companies or buyers. Consequently, the number of farms that pass the Global GAP certification for each company is thus limited.

Presently, experts and academicians try to establish Thai GAP standards equivalent to the Global GAP. The established Thai GAP standard is successfully equivalent to the Global GAP and accepted that the Thai GAP is qualified to the Global GAP (GLOBAL G.A.P., 2013b).

However, it requires efforts and supports from government and private sectors in making farmers, buyers, and exporting companies to foster the Thai GAP. To make the exporting companies use the Thai GAP instead of the Global GAP, the exporting companies must be confirmed by the buyers abroad that they accept the Thai GAP. Although there is an acceptance from the Global GAP, the Thai GAP needs continuous supports to make the buyers abroad accept it. The benefits from such action will be with farmers and exporters when using the Thai GAP instead of the Global GAP.

2.3.1.2 National GAP (Thailand)

National GAP in Thailand is motivated by the Department of Agriculture, Ministry of Agriculture and Cooperatives (Wannamolee, 2008). There have been establishments of steering committees which are comprised of experienced persons in developing quality system of agricultural products. The system was enforced in September 25, 2002 and the government announced the year 2004 as the year of food safety in order to make the people realize the food safety.

GAP in Thailand has been developed to become the quality management system which was developed from GMP, GAP, HACCP, SPS, QA, and ISO Standards. Thai GAP has the same purposes as GAP, i.e. preventing, removing, and reducing risks of hazardously physical, chemical, and biological contaminations. Thai GAP considers 8 main factors of quality control system.

    1) Water

    2) Field and Land History

    3) Pesticide Issues

    4) On-Farm Stocking and Transporting of Produce

    5) Crop Protection

    6) Production Process

    7) Post-Harvest Handling

    8) Records

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he handbooks for plants has been prepared thereafter in order to set up the guidelines in following GAP for 14 kinds of plants which include 8 major fruits, rice, etc. There are examinations of system. The conformance is divided into 3 levels:

1) The first level is safe.

2) The second level is safe and without insects.

3) The third level is safe from insects and has quality (Salakpetch, 2007).

2.3.2 Organic Farming and IFOAM

Organic farming is a form of agriculture, which combines many techniques for farming. This includes crop rotation, fresh fertilizer, compost, and pest control using natural approaches to preserve environment and control agriculture pests in farms. The organic farming is safe for workers and consumers and is considered a sustainable agriculture (Rigby and CaÂ ceres, 2000; Paull, 2006).

The organic farming gives importance to the use of chemicals, pesticides, herbicides, antifungal agents, and hormones. The genetic modification is not accepted by the organic farming too.

The organic farming is set up from 2 international standards:

1) Codex Alimentarius (Codex Alimentarius International Food Standards, 2007)

2) International Federation of Organic Agriculture Movement (IFOAM) (United Nations, 2008; The Council of the European Union, 2007; Paull, 2010).

However, the certification of organic farming will be under the system of IFOAM. There are several developments of organic farming systems, depending on the countries of standard establishment. Those standards are similar in natures, i.e. referring to Codex and IFOAM. The organic agriculture according to IFOAM is based on the following principles:

1) The Principle of Health

2) The Principle of Ecology

3) The Principle of Fairness

4) The Principle of Care

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These 4 principles come from the morale principles and are the motivation for practices (IFOAM, 2013). There is an increasingly preference of organic products in Thailand. However, only some groups of consumers can afford for the organic products that have higher prices than general agricultural products. In addition, the promotion of Thai farmers to do the organic farming still faces problems and obstacles. For examples, the added prices are not satisfactory for farmers or not motivating them enough. Besides, there are difficulties in controlling weeds, plant diseases, and pest diseases because farmers are lack of knowledge in controlling with biological system. The farmers feel that the organic farming is not worthwhile if there is no support from buyers. Some plants can be done in the organic system but some are not appropriate in Thailand because the agriculture in Thailand is of open nature and consequently the control of pest spreading and plant pathology is difficult. On the contrary, the investment for close systems is costly and may not be worth for the investment.

The standards involving sectors of agricultural have been issued to be as guideline for farmer to implement for goods production. Most of the standards try to support by offering the best practices. However, the best practice are evaluated by auditors and it seems that the audit process of all standards are likely to find mistake or noncompliant with criteria, which have been indicated in the standards. The farmer may try to pass the standards without clearly understanding, this might lead to wrong actions or avoid noncompliant standards in improper ways. This problem can be solved when the farmers realize benefit of standard, so they can implement it with their voluntary base.

2.4 Environment-related Standard

2.4.1 Carbon Foot Print

The global climate is fluctuating and significantly changed due to human. The human recognizes the risk due to the climate change which is due to the greenhouse effects. The greenhouse effects occur from the emission of gases that destroy the atmospheric layers. Scientists have studied and developed mechanisms to help reduce the emission of such gases. There are target values in reduction of gas emission including methods of measurement.

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Gases that induce the greenhouse effects start from the transportation, land preparation, production, food consumption, fuel, goods production, raw materials, constructions, as well as service. These activities create carbon dioxide and other gases which lead to the greenhouse effects. There has been international conferences which lead to the "Kyoto Protocol". There is then a standard to compute "GHG Inventory" (GHG, Green House Gas). GHG is used in determining the emission of gases in ISO14064 (series 5-7) (Wright et al., 2011).

The principle of carbon footprint comes from the ecological footprint. Each country or organization can calculate the gas emission using GHG Emission Assessment. When the amount of gas is known, it is possible to plan for the reduction of gas emission. However, the gas emission is mainly caused by the increase in population, the expansion of economy, the use of more energy. Academicians suggest the way of reducing gas emission which is the reduction in energy consumption.

However, several companies try to be carbon-footprint certified in order to present good image to buyers. It creates reputation for organization and response to the desire of conservative customers. It is also a kind of organization PR and stimulates the organization workers (UK Carbon Trust, 2008). There are also labels that are related to the reduction of greenhouse gases by using similar principles, e.g. Foot-miles.

2.5 Trade Norms and Regulations

2.5.1 Ethical Trade Initiative (ETI)

ETI has been mentioned for the first time in 1995 by Welford. After that, there is a raise of the ethical issue as the western strategy. Later on, UK uses it for referring the production sources of products. It ensures that employees are treated according to labor standards. This ETI comes from another reputable standard, namely "Fair Trade". Fair Trade is the standard which is more specific than the objective of the development of employee life quality in order to be a sustainable development.

ETI (UK) does not mention about the environment standard. However, many companies have followed the environment issues which are done by our suppliers as well (Blowfied, 1999). ETI is supported by several retailers in UK. There are requested

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for the suppliers to supply the foods from the producers who are good and ready to conform to the labor law. Production companies must follow the local laws and some laws that are imposed in consistent with ETI (Schaller, 2007). If the country of producer has standards, the producer must follow the labor law of the country. However, if there is no any specification, the company must follow the ETI standard.

The practice according to the ETI standard is difficult and complicate for the business that is expanding at the present. The standard or labor law is still a challenging issue. In poor countries, wages are still problematic issue. For examples, what are appropriate wages, how to deal with child labor forces. The seriousness with the problem of child labor forces may result in conflicts and worse living of those children. ETI has gathered the organizations and members voluntarily to solve the complicate problems that cannot be solved by sole company (ETI, 2013).

2.5.2 Fair Trade

Fair Trade has been initially introduced to trade approximately between 1940-1950 by religious and NGO groups. The fair trade was then developed in the supply chain in the developing countries (World Fair Trade Organization, 2009). At the present, the fair trade is developed in terms of certificate issuance by the Fair Trade Labeling Organizations International. It is the integration of the stakeholders in international trades for the purpose of sustainable development and benefit protection. It is what the producers earn to have, especially in the developing countries. Fair Trade Organization is supported by consumers.

Fair Trade has the following principles:
1) Market access for marginalized producers which helps the producers find the opportunity in selling products and reduce the size of supply chain, which then creates more revenues from the goods.
2) Sustainable and Equitable Trading Relationships which are certified by Fair Trade. This helps reduce cost, both direct and indirect, in long-term business development negotiation. Fair Trade is the deal in being business partners, fosters cooperation, information exchange, and common planning.

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3) Capability Building & Empowerment. Fair Trade helps producers understand conditions and requirements of markets, develop knowledge and skills necessary in business undertaken.

4) Consumer Awareness Raising & Advocacy which connects producers and consumers so that the consumers understand and make decision in supporting the producers, which is a provision of opportunity to producers.

5) Fair Trade as "Social Contract". It is the social contract of buyers and consumers. They agree to pay or buy goods with fair prices. There are supports in terms of finance and facility. On the other hand, the producers use Fair Trade as a tool in developing economic and social quality of life.

Fair Trade is still a standard that supports producers by producers and consumers (World Fair Trade Organization, 2009).

Environmental and ethical standards are considered as one of the tools to improve ethical in doing business. A few years ago, one of competitiveness of agricultural business in Thailand is labor cost but nowadays, Thailand almost lost this competitive advantage because of higher labor cost, increasing of welfare. Hence, the farmer should try to find the way to maintain their competitiveness by implement knowledge and technologies.

2.6 Maturity Model (MM)

2.6.1 General

Maturity model is the structure at the level describing characteristics, processes, and guidelines in the organizational operation. The maturity model can be used for the comparison to help understand the differences of capabilities, behaviors, processes, and guidelines in the organizational operation for its sustainable development.

The maturity model, indeed, is originated from Capability Maturity Model (CMM) which is the trademark of Carnegie Mellon University (CMU). CMM developed CMM to solve the delay problem in collecting the organizational data of the U.S. Department of Defense and the owner of the job. CMM is the origin of the fund for establishing Software Engineering Institute (SEI) of CMU. The developed model

for the step of the process development starts from AD-HOC to optimization. CMM is originally a tool for evaluating the capabilities of the organizations that contact with the U.S. government. These organizations are the counterparts with the U.S. government in the software projects. The framework of CMM was published in 1988 and in the book "Managing the Software Process by Watts Humphrey" in 1989. The book has been continuously published. Later the idea has been presented in the form of CMM which specifies practice frameworks and processes of each maturity level. This was published in 1995 (Paulk, et al., 1995; Paulk 1998; Curtis, et al., 1994; 2001)

There are 5 levels of software process maturity, which are the basis of the continuous development process. The level of maturity facilitates the prioritization of the organizational development. In each level, there is a set of goals which lead to the success as well as the process components. When the goals are accomplished, the maturity level will be moved to the higher level as shown in Figure 2.3.
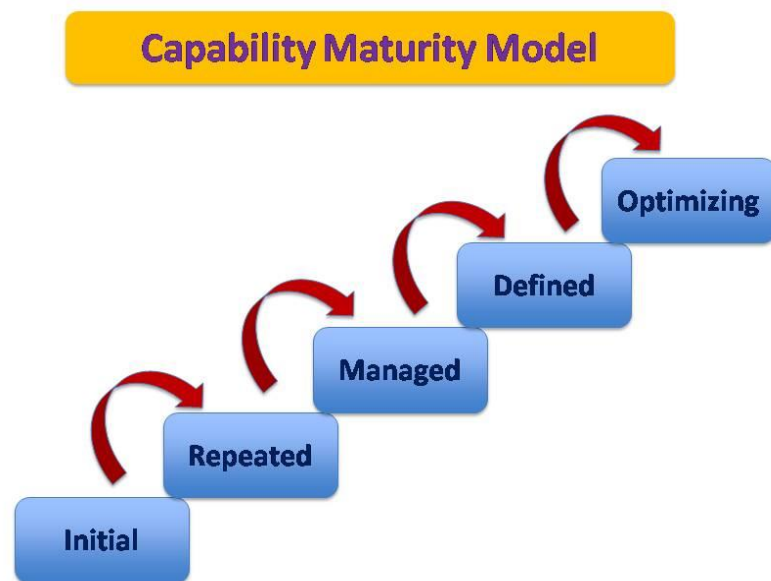
Figure 2.3 The Five Level of software Process Maturity

2.6.2 Five Levels of Software Process Maturity

5 levels of CMM have the following descriptions:

1) Initial:

Software process solves ad-hoc problems and can solve the problems from time to time, depending on the effort and capability of workers.

2) Repelled

The level is the basis of the project management. There are processes in managing cost and work plan. It can be successful if the project has been done before or is similar to previous projects.

3) Defined

The process is managed in terms of document. There are standards and systematic development. There is the use of standards in the development process.

4) Managed

There are control and analysis in quality and process as well as the improvement.

5) Optimizing

There is a continuous development of system by evaluating the outputs for further development. There is application of innovation and technology.

2.6.3 Behavioral Characterization of Maturity Levels

2.6.3.1 Level 1: The Initial Level

At the initial level, the organization does not provide the environment leading to the development. The success of organization depends on the capability of worker and situation. When there is change in workers, the efficiency of work will drop because the capability in operation is the individual and personal capability. Cost and time cannot be controlled in most operations. As such the success in this level depends on the individual capability in the organization. The success cannot be repeated if it is the same persons who have accomplished the works. Therefore, it is the level for the capability of person not the organization.

2.6.3.2 Level 2: The Repeatable Level

This level implements the policy to practice. There are planning and new project management based on the experiences from similar projects. The process of problem solving is applied. There is the organization of work system in terms of document. There is development by training. There are monitoring and enforcement as well as fundamental development.

The organization employs basic programs for control and management at this level. There are new projects developed from surveying the past and present projects. The project manager can monitor cost and project progress. Workers have responsibilities in control. There is an establishment of project standard. There is cooperation with sub-contractors, if necessary for responding customers or trade counterparts for good relationships.

The processes can be different in the organization projects at this 2 level. The successful organizations have planning which will create appropriate management of process.

In conclusion, at the level 2, the organizations follow orders and disciplines because the project managers can plan and follow the past successes and repeat them. The project is under the quality control and follows the work planning.

2.6.3.3 Level 3: The Defined Level

At the defined level, the standards in the process of software development and maintenance will be kept in the forms of document and there is a connection to the whole document.

The process at the level 3 utilizes the changes for appropriateness to facilitate the manager and workers in efficiently working. There is a widespread of trainings and they are used to make sure that the manager and workers are knowledgeable and skillful enough for their operations.

There are specific projects for developing software process, which are identities of fundamental projects. These projects are referred in CMM. The establishment of good process will be an indicator of the readiness in operation and

examination because the clearly defined criteria and processes mean a good internal management of project.

At level 3, the organization can summarize works to be standards because the management and workers can consistently manage and repeat the activities. There is a production planning with respect to cost, plans, and duties under capability control. The duties, missions, and responsibilities in work processes are understood.

2.6.3.4 Level 4: The Managed Level

At the managed level, organizations will set qualitative and quantitative goals for products. The productivity and quality improvement processes will be used as key performance indices of organizational activities. The organizations will collect and analyze the project data. There are quantitative measurements and evaluations as criteria in project evaluation.

The success of projects in terms of products and processes come from the variation reduction in the process to the acceptable interval. The relevant risks are carefully and appropriately handled.

At this level 4, it can be concluded that the organization can predict situations because there are the monitoring and following-up of the process. When there is a tendency that the quality and process will deviate than the established criteria, there will be responses for the situation to solve the problems and to lead to the productivity improvement at the end.

2.6.3.5 Level 5: The Optimizing Level

At the optimizing level, the organization focuses on the continuous process development. There is a SWOT analysis and progressive activities to achieve the set goals. The protection of damage will be set up. Efficient data will be used in the cost and benefit management. There is study of new technology and adjustment of internal processes. The innovation is applied to the work in order to increase efficiency and transfer to the organization.

Organization teams will analyze the damage causes including the evaluation of the processes leading to damage and use them as lesson learned for other projects.

There is a continuous learning in the organization at this level 5 because continuous learning and development is the capability enhancement of processes and projects. The development comes from both the increase and application of the existing things using innovation and new technology or new processes.

2.6.4 Skipping Maturity Levels

The maturity level in CMM describes the natures of organization in each level of maturity. Each level is the construction of foundation of success which becomes higher via an efficient and effective process development. The organization has the benefits from the application of processes in higher levels. The processes can be self-performed at the levels 1 and 2. Graphs and comparative result analysis of data is done at the level 3 using the data at the level 4. The technology is introduced to create benefits at the level 5 after knowing the level and the development direction of the organization. In general, it is recommended that there is an establishment of study group to study the processes required for moving to the level 3. The evaluation at the level 4 includes some parts of the lower levels.

The development process cannot be successful if there is no serious implementation. The obvious point of the level is that it is not mostly possible to solve problems and to plan project management when they are found.

Skipping levels in maturity is the deterioration of efficiency increase because there are detailed and important processes in each level, which are the basis in elevating capability level. The processes lacking fundamental developments are always not successful in the development due to lack of foundation for future development.

2.6.5 Internal Structure of Maturity Model

Each level in maturity model classifies factors into parts, except the level 1. In such a classification, there is a summary of essential operations as shown in Figure 2.4. In each capability level, there will be the definition of key process areas which will be divided into 5 steps according to maturity model. In each scope of process area, there are general practices as requirements of guideline in operation. The explanation of key practices can be the natures of activities to be done.

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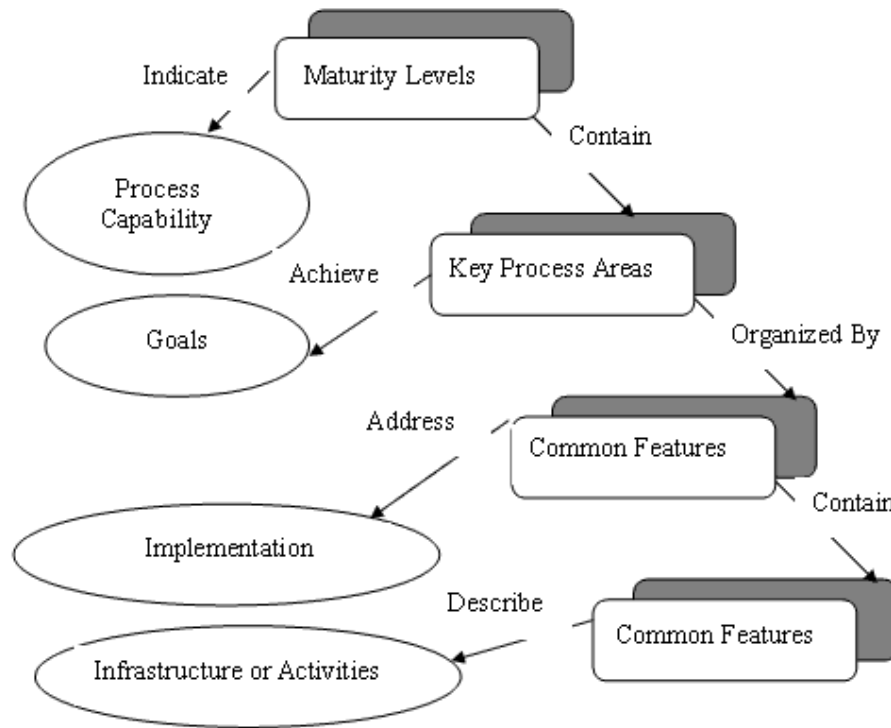
**Figure 2.4 The CMM Structure (Source from CMU/SEI)**

2.6.5.1 Maturity Model

A maturity model is clearly defined and can show the development towards higher levels. There is a specification of the capability level of operation processes in each level as shown in Figure 2.4. The level 2 is due to the success in the level 1 and is self-developed to the level 2.

2.6.5.2 Key Process Areas

In each maturity model level, there is a classification of key process areas into items which are the scope of interest and importance for organizations. The key process areas are for the development the organizational process and define things to be accomplished in each level.

Each key process areas will combine the relevant activities that make the goal achievement possible regarding capability. Key process areas will be defined specifically for each maturity level as shown in Figure 2.5. Means leading to goals of each key process area can be different, depending on the environment of project and its type. However, the goals of key process areas need to be achieved to step to higher levels.

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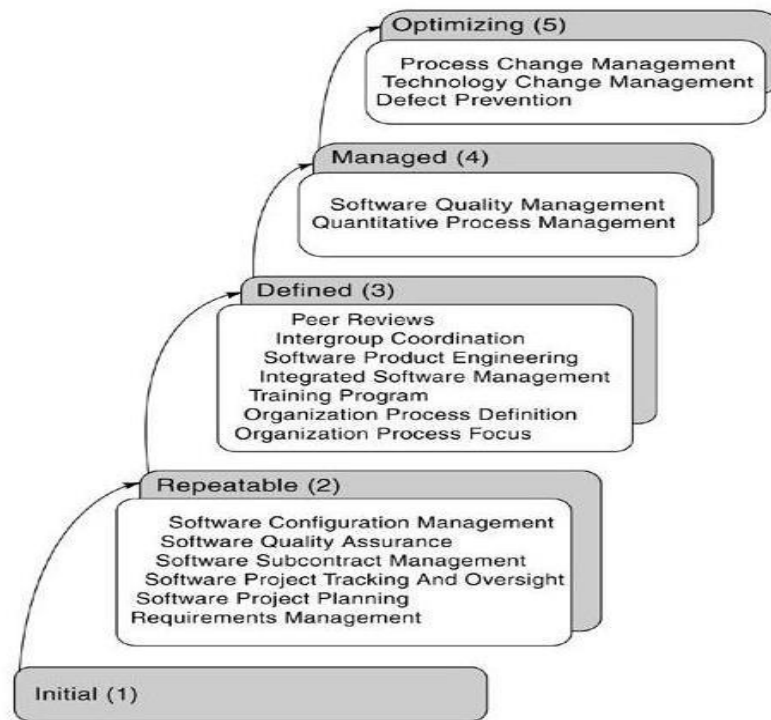
SEI CMM Key Process Areas by Maturity Level

Figure 2.5 The Key Process Areas by Maturity Level

(Source from SEI CMM, CMU)

CMM does not specify the process areas to be key areas. Indeed, key process areas are the important issue for the efficient development of processes as shown in Figure 2.5. The key process areas of each maturity level in software process capability are shown in Figure 2.5 too. Goals are the summary of the key practices of key process areas and indicate the success of operation.   Goals are the framework of effort of key process areas.

2.6.5.3 Common Features

The Common Features are Attribute that indicate whether the implementation and institutionalization of a key process area is effective, repeatable, and lasting

The Five Common Features are as follow:

1) Commitment to perform

2) Ability to perform

3) Activities to perform

4) Measurement and analysis

5) Verifying implementations

2.6.5.4 Key Practices

Each key practice explains way of achieving goals, which explains about the structures and activities to be done. Each key practice is a single sentence and followed by the explanation and possibly examples including the references to higher levels.

Key practices explains "what" like what should be done, but not in interrogative sentence like how should it be done to be successful or to achieve goals.

2.6.6 Application of CMM

Since CMM has been continuously improved and developed. There are applications of CMM in several industries nowadays. CMM may witness the success in software development, it does not mean to be successful in other applications, not even in the software industry. There are several firms that are successful with using CMM development model.

The application of CMM should consider its suitability and nature to fit with the organization. Indeed, after CMM had been developed, there was the development towards People Capability Maturity Model (PCMM) and later Capability Maturity Model Integration (CMMI). Presently, there are more than 1 CMMI, i.e. CMMI for Acquisition, CMMI for Development, and CMMI for Services CMMI. All 3 models have some common practices because they are applicable to every business. However, in each model there exists some different practices due to specific nature of business, which lead to different foci as follows (Phillips and Shrum, 2011).

1) CMMI for acquisition is the model for the business of production and service delivery. It enhances the efficiency in dealing with suppliers, requirement collections of customers, monitoring suppliers of progress and activities that affect the customer desires. The process area is the agreement type between customer and producer as well as correctness examination

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2) CMMI for development is the transformation from the customer requirements to the development of products. It is the creativity of products or services to response the desires of users.

3) CMMI for service is the model constructed for focusing on service and delivery management. The model emphasizes the planning and management of service to increase the efficiency in dealing with the complaints and problems from the customers. It also plans for solving problems related to personnel, process, and or equipment.

It can be concluded from the literature review that CMM is the model of process development which is created initially for solving problems and obstacles in the delay delivery of software projects under the U.S. Department of Defense. The development is from CMU and is continuous to suit the situations and foci. CMM was then developed to be PMM and presently to be CMMI. CMMI is composed of several models, depending on the nature of business and problems to be solved. CMMI has been introduced to many industries which integrate existing systems. Consequently, it integrates best practices to be a new practice guideline.

CMMI has been employed in small and large businesses to increase efficiency in validation and leads to continuous development. It is a well-known and widely accepted model.

The CMMI can be used as a tools to help the farmers to improve their capability by taking them on the step of maturity level in order to clarify their level of knowledge and process improvement model which is suitable in each level of maturity.

2.7 Knowledge Management (KM) and Knowledge Engineering (KE)

2.7.1 General

High competition in trade and economy exists in the present world and the driving factors for resource, economy and society power struggling. The crucial factor the create value and capability to human beings and thus differentiate them is knowledge. Most people want to educate the family as much as possible because they realize that no any asset is comparable to knowledge. All kinds of asset can be used up and cannot be taken by the other, except knowledge.

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Learning can be done in various respects, for examples, learning from the age development via surrounding environments. Learning is different in each person, depending on the capability in learning. Knowledge when skillfully performed becomes skill. Both knowledge and skill exist in many people. Sometimes people do not understand that they have knowledge or skill more than the other.

Knowledge and skill inside the human beings are the resource that cannot be evaluated. The knowledge in the workers and executives are momentous in an organization. Without knowledge transfer, the knowledge can disappear. This is also the case of the worker retirement, quitting, or decease. Therefore, the organization must invest in creating knowledge for the new workers from grounds. The new comers may have knowledge but not comparable to the leaving persons in terms of specific knowledge and skill, which is accumulated from their experiences. The investment in terms of training to the new comers is the waste of resource and time. Consequently, many organizations try to preserve knowledge and skill as the organization asset. The organization can pick it up to transfer or create benefits. This is accomplished by knowledge capturing from the knowledge workers to be explicit knowledge and manageable by using KM as widely done at the present.

KM is the knowledge capturing to be manageable knowledge. When the knowledge is in the manageable state, no matter document, data, it can be preserved and disseminated or transferred. In transferring or managing knowledge, knowledge will create value for the organization and it is a sustainable development of the organization.

KM needs the process of KE to facilitate the structuring of knowledge from knowledge collecting, capturing, analysis, synthesis, and validating to knowledge construction.

2.7.2 Fundamentals of KM and Its Extensions

2.7.2.1 Knowledge Creation

The theory of knowledge creation is introduced by Ikujiru Nonaka and Hirotak Takeuchi. It is the theory that increases knowledge creation towards innovation (Nonaka and Takeuchi, 1995). The innovation is the factors of success (Nonaka, 2007). In Japan, innovation is the key success factor of many businesses. Innovation has been

created daily. It brings success to many Japanese companies such as Honda, Mitsubishi, Panasonic, Asahi, etc.

The knowledge has two dimensions. One is knowledge type and the second dimension is knowledge level. The knowledge type also has two types which are as follows:

1) Tacit knowledge, it is the personal knowledge or experience. It could be a belief perspective and value systems.

2) Explicit knowledge, it is the information or data supporting. Explicit knowledge can be readily transmitted or stored in database.

Knowledge level could be classified into four levels which are from individual, group, organization to inter-organization.
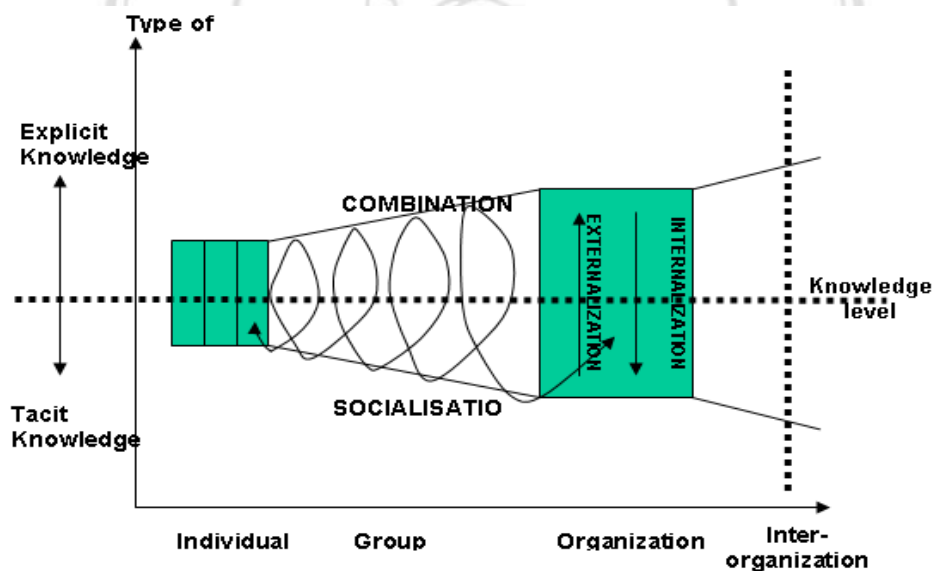

Figure 2.6 Knowledge Creating Company by Nonaka, (1995)

The process of knowledge development is from individual to group. Then the explicit knowledge would be developed and shared among group. The organization has to arrange the process of knowledge by combining and bring individual knowledge to accumulate for creating new knowledge (Nonaka and Toyama, 2003).

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To share tacit knowledge in individual to organization, the organization has to arrange the activities, i.e. socialization to exchange or share the knowledge and experience. It created new experience in the group.

The organization has to change the tacit knowledge to be explicit knowledge then shred the explicit knowledge once again. In this process it is called Externalization. The knowledge is from individual to organization.

The organization has to motivate individuals to use and learn from explicit knowledge. Individuals have to practice and do their works or learn by doing. Once they get more experience and skills they would have new knowledge. The knowledge could be learned and memorized, which is called Internalization. Then, it could be moved to next round to created Socialization again and again.

Figure 2.7 Knowledge creation SECI Model (Nonaka & Takeuchi)

The knowledge workers according to the knowledge creation in the problem of interest are the growers. The concept of learning process is employed to acquire the tacit knowledge and then try to arrange environment to support the learning process as the above-mentioned theory.

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2.7.2.2 Learning in Action

In KM, the theory of learning in action by David Gavin is one of the most appropriate for Thai fresh producers or growers. It will help Thai growers to develop their learning skill. Learning in action is suitable for Thai growers. Since learning in action does not require knowledge workers to leave their duties to do knowledge management, it is not necessary to be trained by professional. It can help avoid a risk of worker to leave from their important work. David Gavin gave the concept to change action to be learning opportunity (Garvin, 2000). Furthermore, learning model could be classified into 4 types of learning as follows:

1) **Intelligent Learning**

The intelligent learning is to acquire data and information. It could be from competitors or from surrounding situations. To acquire data and information, it can be done by searching, inquiry, and observation.

- Searching

The information can be from newspaper, magazine, internet or other organization.

It could be secondary survey.

- Inquiry

The inquiry will be from the expert, who has direct experience and has insight information. The information that we will get could be special technique, business information in depth. However, the quality and quantity of information will depend on the number of surveyor and experience of person who give the information.

- Observation

The competitor or and others player in the chain shall be observed. We may have information on working process, solution, decision and special technique. Moreover, we may know about the result and reflex of action that had been done by the others.

2) Experiential Learning

Experiential learning can be described by the learning curve. In many industry, where cost, time, consumption of resources, or lead time of problem solving can be reduced will create value and more competitive advantage for their organization.

The following price of model T 1990-1923 (Figure 2.8) can be described about cost reduction in average of every 10 log of cumulate unit produce price will drop down 15 percent (Garvin, 1993).
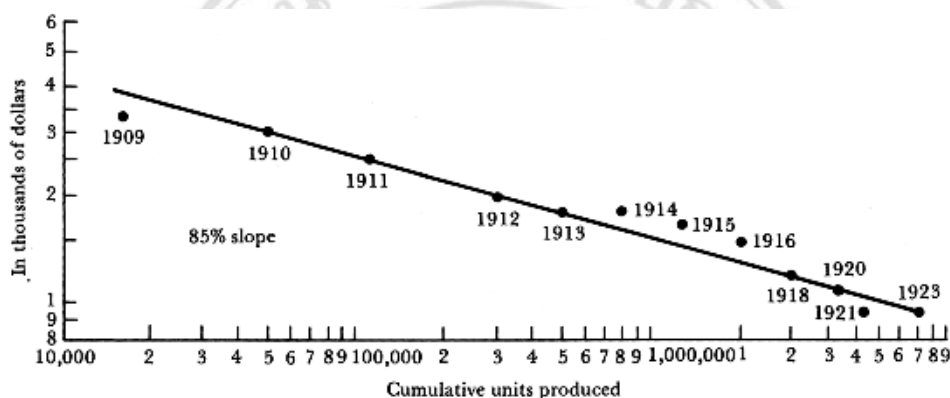
Figure 2.8 Price of Ford Model T 1909 - 1923 (in constant 1958 US$) versus cumulative units produced (learning or experience curve). On average, for each doubling of cumulative production, prices dropped by 15 percent. Source: W.J. Abernathy and K.Wayne. Limits of the learning curve. Harvard Business Review, September - October 1974

From the learning curve, it can be concluded that

1. Learning is very important to develop industry and services.
2. Learning rate has uniform straight line in every product, process, organization and industry.
3. Learning curve is stable for certain period of log scale.
4. Knowledge which has been received from experience is more memorable and transferable.

5. The organization which has learning curve lower than the average of industry. That organization will lost their competitiveness. In the other hand the organization, which has learning curve higher than the average of industry will have more competitiveness.

The experiential learning will consider on reflex and reviews of actions.

Reflex is to analyze the future or continuous impact after the action has been done. It might effect in term of economic, social, environment, safety, lifestyle, culture, health and, and morality.

Review is to consider on cause and result in every working step. Organizations must have reviewing board to analyze the cause and result in the past. It will be used for improving or changing working behavior and process.

Furthermore, the organization should have after action review after work. It is to exchange knowledge immediately after finishing their tasks. Since it is still up to date situation and not forgotten, it is similar to training, information and experience sharing. It is aimed at learning from the result and improving the works in the future and continuously.

3) Experimental Learning

Experimental Learning is to do some experiment and find the causes of results or stimulate the causes and results by imposing hypothesize for new created knowledge. Experimental learning may have 2 categories.

1) Experiment which cannot expect the result and is not able to set up hypothesis.

- Learning from Auditing (Probe - Learn Process)

  Learning from auditing is to learn from relation of causes and results. Try to understand and start from the causes or results. However, we have to consider from the causes and results for next process. Try to audit small processes which have effected to the next process.

- Demonstrate Project

2) Experiment from hypothesis.   This is to try to find cause and result (Hypothesis and Test). Try to set up hypothesis as much as possible and test those hypotheses. Try to prove the relation of causes and results. It will help learning and new knowledge, which could be useful for working

.

4) Leading Learning

In all activities of organization learning (Intelligent Learning, Experiential Learning, Experimental Learning), the manager of the organization must lead in all activities. The leadership in learning skill can be practiced as follows.

1) Try to offer learning opportunity to staff.

- Discuss problems and lead the discussion to be more interested.
- Assign staff to discovery new story. Share duties, experiences and skills.
- Exchange experiences and let staff share their experiences and questions.

2) Create environment of learning together.

- Challenge the staff to learn and motivate them to analyze the cause and solution on problem solving.
- Always support the staff once the wrong decision or mistake occurs. Have to realize that trial and mistake is better than do nothing.
- Lesson and respect to comment of staff. Event manager has more experience but in some situation and environment the manager experience may out of date already. Then the manager has to be ready to learn as well.

3) To be leading in discussion

- The question has to be creative for learning such as (How and Why).
- Lesson to all ideas. Some bad idea might be suitable for some problem.
- Try to have discussion which has clear and reasonable information, and along with some evidence.

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Furthermore, the manager has to be open-minded and accept different ideas, information, technology, and new knowledge from staff or colleagues. The manager should not solely trust or believe on any old experience.

The guideline of learning improvement for individual to organization is as follows:-

1) Seek and open new points of view or differences. In order to improve learning, we need to seek new concepts or points of view to lead development.

2) Accept information by considering that individuals trust their own experiences and knowledge. Sometime, the knowledge is belief. To change belief, human beings must face real situations and prove that their beliefs are not true.

3) Open and accept information from the source without any filter will be better. To have the truth, the raw information should not be accessed, analyzed, or modified.

4) The manager has to design and is ready to learn. The person who is not ready to learn will lose the learning opportunity because the one who has better knowledge and information may hesitate to inform or teach that person.

2.7.3 Knowledge Engineering (KE)

KE tries to capture the knowledge in the form of document and data, tangible and intangible, to be in the manageable state. That is to be possible to collect the knowledge, to classify it, to improve it, to utilize it when desired, or to build the new knowledge. Moreover, KE makes the knowledge transfer possible or the knowledge beneficially usable.

Knowledge can be divided into 2 types, i.e. explicit and tacit.

- Explicit knowledge is the knowledge that is recorded and visible, e.g. production document, basic data, standards, or patents.

- Tacit knowledge is the knowledge in human beings. More specifically, it is the experiences accumulated to be expertise and skills.

Organizations that are interested in KM view the tacit knowledge as the valuable asset of the organizations. It has been said that a company greatest assets may not lie in the products they make but the knowledge of the people who produce those product (Dayan & Evans 2006).

Therefore, to preserve the valuable asset of the organizations or the knowledge in the brains of the workers, it is necessary to transform the individual knowledge into the explicit knowledge. Several methods of such a transformation exist. However, one the widely accepted method is the so-called SECI model by Ikujiro Nonaka.

2.7.4 Common KADS

2.7.4.1 Overview

It is accepted that knowledge is itself an asset. There are surveys and conclusions that knowledge is the most valuable asset in the organization. The knowledge will lead organizations to success. In the present society, learning is the supported matter and is raised for its importance. Knowledge is considered to be a science (Gobin and Subramanian, 2010).

Common KADS is originated from KADS (Knowledge Acquisition and Documentation Structuring) and is developed to be knowledge base system by University of Amsterdam.

Common KADS becomes a tool in supporting KM and has been developed and recognized by various institutions, no matter academic institutions like leading universities and companies. It is nowadays a European standard for knowledge analysis for further development. Common KADS is recognized not only in Europe but also USA and Japan.

Common KADS increases the opportunity and finds out the obstacles against knowledge development. In addition, it can inform of knowledge analysis. The process in KADS does not focus solely on brain bank or knowledge from experts. It also focuses on the structure building according to the human beings viewpoint. The internal knowledge is a model which comes from initial study and data collection and later is developed for level increasing (Schreiber et al., 1994)

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2.7.4.2 Common KADS Model Components

Common KADS include main models as follows: Knowledge Model Task Knowledge and Domain Knowledge Communication model, Knowledge model, and Design model (Figure 2.9).
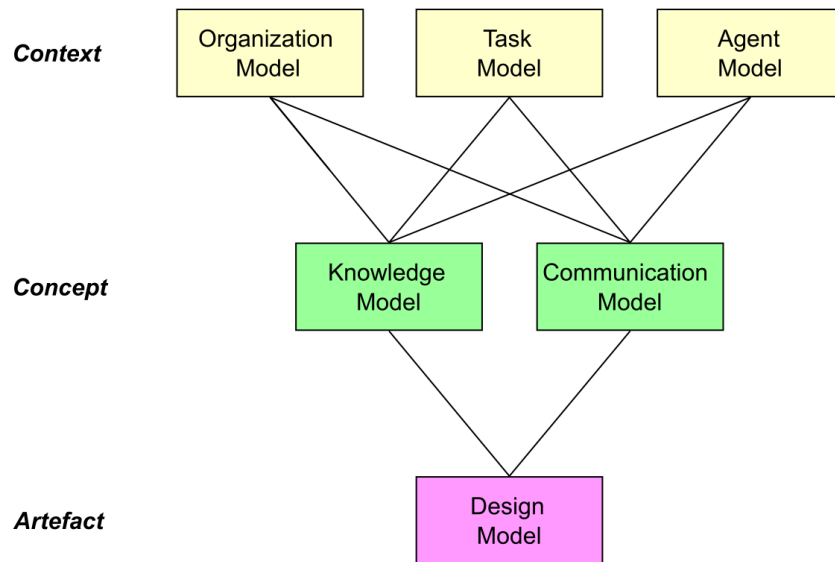
Figure 2.9 Common KAD Model Set

   - Organization Model represents the format of organization.   It is used to support and analyze the organization to determine problems, opportunities, and effects from developing Knowledge Base System (KBS)

   - Task Model explains the tasks undertaken or in organizations.

   - Agent Model explains the capabilities, norms, expectations of workers.

   - Knowledge Model explains the knowledge bodies used in working.

   - Communication Model explains the communication among workers.

   - Design Model explains the structure and system necessarily to be constructed and established.

2.7.4.3 Knowledge Model

Accordingly, the knowledge model explains the knowledge bodies used in working.   It is a tool to specify the knowledge relevant to specific works, which are

the data from the expert or practitioner communication. Those knowledge bodies can be reused. It can be said that knowledge model is the process in applying knowledge for working and problem solving or decision making with real sent data and possible output display. Common KADs addresses 3 main knowledge bodies including Task Knowledge, Inference Knowledge, และ Domain Knowledge.

- Task Knowledge is the ledge model of tasks or works that serve main and minor objectives.

- Inference Knowledge is the knowledge model of thought. It is the knowledge in reasoning to achieve minor objectives like desires and results.

- Domain Knowledge is the knowledge model of specific problem principles. It is the specific knowledge in problem solving or decision making to fulfill missions (Schreiber et al., 2000).

Three types of knowledge can be concluded as shown in Figure 2.10.
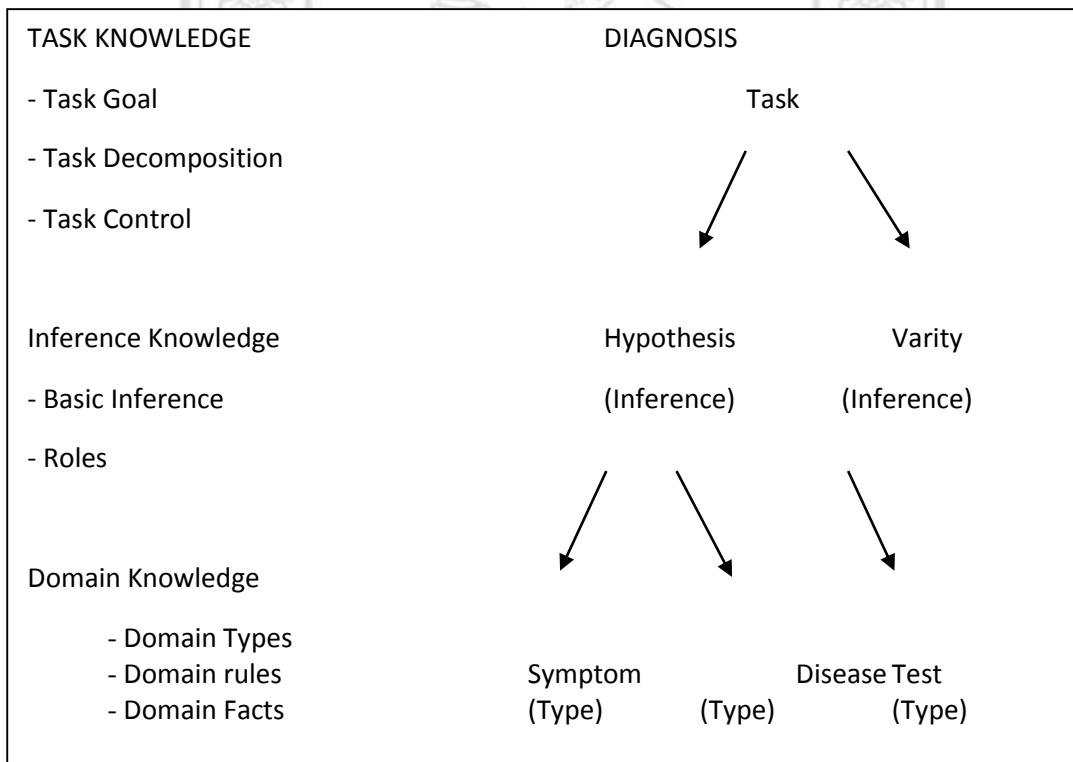
Figure 2.10 Common KADS, Overviews of Knowledge Categories in the Knowledge Model

2.7.5 Knowledge Management Maturity Model (KMMM)

Siemens AG/Corporate Technology Knowledge Management & Business combines Knowledge Management (KM) and Maturity Model (MM) together because KM plays an important role in identifying the present status of organization as to the basics of sustainable future organization development.

Competence Center of KM at Siemens AG is the developer of Knowledge Management Maturity Model (KMMM) and employs successfully in the knowledge management of organization. The model development consists of 3 steps, starting from analysis model and auditing model (Ehms and Langen, 2002).

The first step in developing the model is to identify the knowledge body and the knowledge level of organization, including activities and conditions in the organization. It is not an easy task to identify the knowledge body and the knowledge level of the organization by itself. This may lead to time and investment lost for the analysis of problems in order to solve them and develop the organization. Therefore, to identify the present capability of organization, it is necessary to design the questions for capturing the knowledge of organization workers. It is thus necessary to design tools to support and to be guideline in learning of personnel. The qualification of tools should be as follows:

- They are the tools which allow organizations learning and have the scope of comprehensive knowledge management of organizations.
- They have steps in appropriately initializing the development suitable for the present KM.
- They support the organization development using KM or KM projects.
- When modeled, they must yield quality results. The quality can be different in view of KM practitioners.
- They are possible, i.e. able to be implemented for developing knowledge and capability of organization.

KMMM is rooted to CMM of Software Engineering at Carnegie Mellow University. However, the application of KMMM in the area of KM is still at its fancy. It is new in the sense of interpreting knowledge in terms of maturity levels, which is composed of 5 steps of KM as shown in Figure 2.11.

**Figure 2.11 KMM The Five Maturity Levels of Knowledge Management
(source from KMMM by Siemens AG).**

Maturity Level "Initial": At this level, the operation is not stable and does not recognize the control of success.   Success seems to be the matter of luck or incident. It is not from the knowledge application to reach the target or organization plan.

Maturity Level "Repeatable": At this level, organizations see and recognize the importance of knowledge management activities. The activities are explained in lines of KM. Success and failure are raised up in the organizations.   If the is the atmospheres or factors that support any personnel, it may result in a holistic development.

Maturity Level "Defined": There is a consistency in activities.   The activities are efficient and support KM of organization workers.   The overview of personnel in terms of KM is clearly specified.

Maturity Level "Managed": There is a further application of the guidelines that solve the problem in Level 3 to include the whole organization.   The improvement of such guidelines is also carried out to create robustness to KM supporting activities.

Maturity Level "Optimizing": At this level, the organization will develop its capability and flexibility to accommodate and comply with new standards or regulations of the KM in organizations without regressing to lower maturity levels.

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However, it is not allowed to cross over the maturity levels because it is aimed to create sustainable capability and knowledge. Works at each level will be focused and developed to foster the capability for accommodating the development to higher levels.

KMMM consists of 8 edges of KM where all 8 edges are adopted from EFQM (European Foundation For Quality Management) (EFQM, 2011). KMMM is applicable to the KM aspect in the analysis step of 64 topics. KM is comprehensively explained to support the operation of the organizations in learning. The scopes of the 8 edges are shown in Figure 2.12.
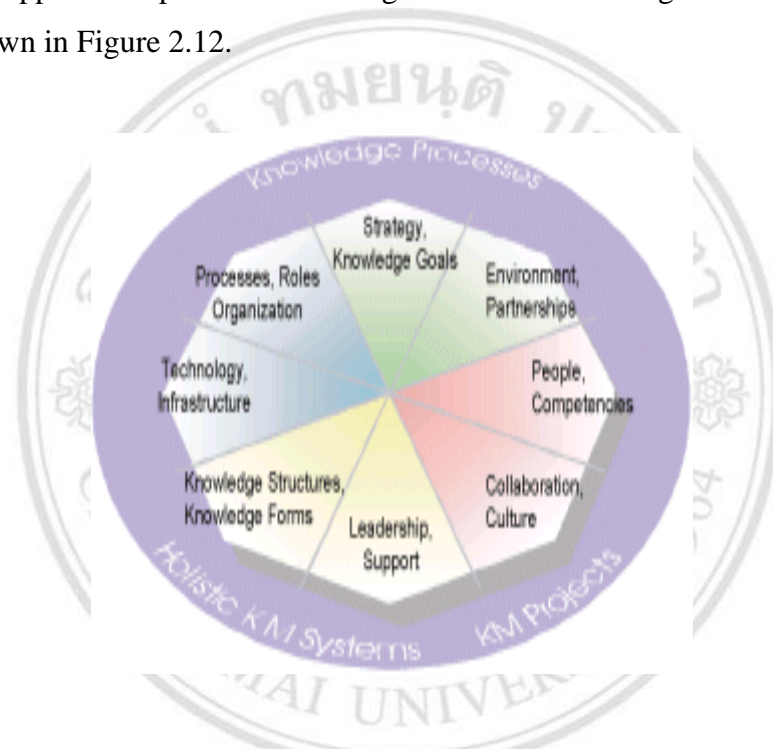

Figure 2.12: The Eight Key Areas of Knowledge Management (Source from KMMM by Siemens AG).

1) Strategy, Knowledge Goals: This edge looks at the visions and goals of the organizations, which are established for KM as well as the nature of executives, expenditures, and policies.

2) Environment, Partnerships: This edge deals with the interaction of organization workers, outsiders including customers and stakeholders.

3) Peoples, Competencies: It is the knowledge management of individuals including personnel selection, development promotion, self-responsibility and management.

4) Collaboration, Culture: The edge focuses on cultural organization, the communication, and structure of team or network.

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5) Leadership, Support: The edge looks at the leadership, e.g. the management format, goals, and agreements due to managers.

6) Knowledge Structures, Knowledge Forms: This edge focuses on the work content, document, and formats.

7) Technology, Infrastructure: Data management is the topic of this edge, including IT systems and their connection to KM.

8) Process, Roles, Organization: The edge is about the structure of organization and the work assignment of KM with the emphasis on practical guidelines.

KM process is divided into 6 steps, which shows the policy. The stakeholders must be motivated to perform activities in KMMM Project, confer Figure 2.13.
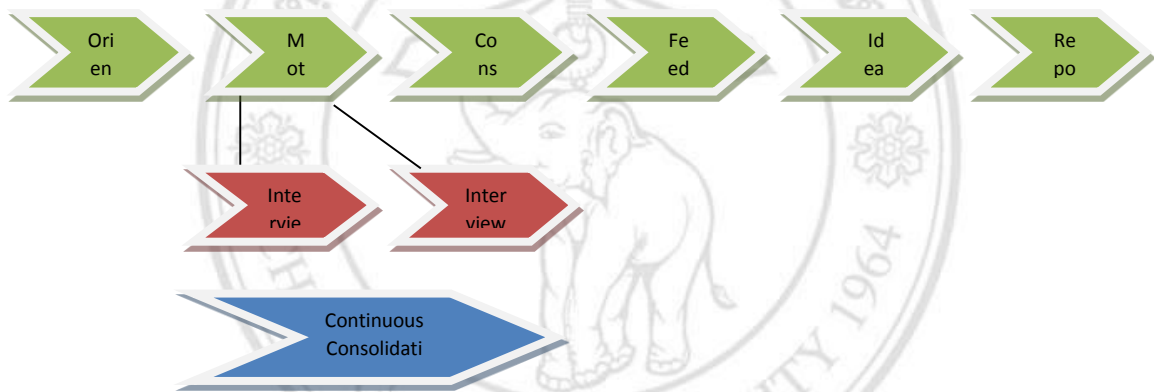
Figure 2.13: Process of The KMMM Assessment
(Source from KMMM Siemens AG)

Data collection can be from interviewing experts, talking, or work planning. When the data is completely collected, the data will be transformed into the format of maturity level to access the responsibility and capability of individuals. The results are then ready to be presented and for feed-back.

The results from KMMM are the capability increase in communication so that there is increase in understanding and common problem solving among differences in perception of KM. The results are qualitative and quantitative, i.e. measurable. The results from KMMM can be used for the development of knowledge and capability of growers.

KM in Agriculture

KM plays more roles in nowadays agricultural industry. There is the use of data about geography, climate, plant pathology, insect pathology, and various analyses to support the decisions of the stakeholders in agricultural business. Each country attempts to develop KM in various forms to store and transfer knowledge to growers. The growers in developing countries have limited knowledge and capability. The access of information is also limited. Therefore, knowledge transfer to the growers in developing countries is thus challenging. For promoters, this is just the one side of knowledge transfer to growers. The knowledge in agriculture consists of different aspects, e.g. the knowledge from experts or practitioners, knowledge from ages to ages, and skill development. These kinds of knowledge are not of explicit type but of tacit one. The knowledge capture from growers requires tools in knowledge capture and synthesis in form of explicit knowledge. The tools are useful in transferring knowledge to new growers who do not have experience and expertise. It can be seen that KM add value and life quality to growers with the reduction of risk in self -experiments and in damaging due to unawareness.

Most KM in agriculture is the use of technology in supporting the decision of growers. There is use of Decision Support System (DSS). It is based on the so-called system approach where several kinds of knowledge are used to build the tool including technical matter, situation modeling, expert system, data-base system, and GIS (Kropff, et al., 2001). Other supporting tools are:

1) Geographical Information System (GIS) is the management selection. The system analyzes and present data related to geographical data. It helps growers in planning and increase capability as well as reduced limitation for basic utility of growers. GIS mainly collects the data of altitude above sea level, slope, soil quality, soil composition, nutrition, temperature, and drainage (Yule, et al., 1996).

2) Smart farming employs technology to help management of farm. This is similar to the system approach but is differently called. However, the smart farming always deals with the study of farm management with the emphasis on plant requirement and facilitates more growers. There is analysis using holistic knowledge, e.g. analysis of water, soil moister, light intensity, and

light desired by plants.   It may provide facilitating systems to help reduce workers. The smart farming thus employs explicit knowledge for farm management than captures personal knowledge for development and transfer.   It is obvious that the technology used is the matter of using existing knowledge for management than capturing knowledge for utility.

3) Contract Management System is an open system.   The system uses general information and multi-media in KM.   Different applications of this technology include:

- National Agricultural Research Information System (NARIS) as found in Egypt (Rafea, 2009).

- Data System for facilitating researchers to screen knowledge bodies important the development of agricultural business.   The system will store data for new generation of growers and thus preventing data from losing due to new technology replacement.

- Modern ICT is the use of internet and web-technology.   It focuses on the data level, i.e. whether local or global.   There are attempts to use the internet in transferring data to people and growers.   ICT is another approach of fast access to data and there is effort to develop the data into a language with easy understanding.

- Text Mining which consists of 2 kinds used in Central Laboratory for Agricultural Expert System (CLAES) in Egypt.

- Intelligent search engine is the tool that facilitates searching of agricultural data which requires the development of ontology to support the search engine.

- Mining Grower's Problem DATA Base is the collection of smart or expert-typed problem solving.   The data is from problem solving of specific experts (Rafea, 2009).

Knowledge in agriculture may be data, information, skills, or experiences accumulated from probing in organizations, societies, or wisdoms.   The agricultural knowledge also includes the culture in operation, new agricultural technology, diagnosis of plant pathology, insect pathology, and other relevant matters, market data, market

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demand, requirements, legislations, and public policy. All of these is collectively called knowledge or KM. KM in the past is focused on the development of explicit knowledge.   However, the development and transfer of individual knowledge is gaining higher interest (Malekmohammadi, 2009).

The growers in developing countries are not interested in the technology that facilitates or systematizes working. The growers rather look for the knowledge that improves productivity or living. The promotion from the government thus tries to add the required knowledge but the growers do not still confide the promotion unless the growers have satisfactorily examined the information.

The strategy in developing and promoting KM for innovation emphasizes the learning of organizations, which considers the following factors.
1. The creation of clear goals in innovation creation.
2. The analysis of available knowledge and the identification of the best practice knowledge.
3. The promotion of using tacit knowledge.
4. The exchange of the relevant knowledge through networking.
5. The provision of tools in access knowledge.
6. The dissemination of new knowledge for learning.

Since the innovation belongs to a small number of persons in developing countries, it is necessary to develop the capability of growers including the learning process.   The application of innovation by growers is mostly limited by the access to innovation and technology or the support from organizations, government or private sectors. The support is of specific manners, e.g. genetic improvement, water management, or investment provision.   These things do not promote learning.   In addition, the places with highly populated growers, there are more use of innovation or higher innovation than those in remote areas or without communication (Hartwich et al., 2007).

2.7.6.1 Agricultural Knowledge Management in India

KM in promoting agricultural business or growers is raised as an issue in India.   National Seminar on Agriculture Extension mentions about the system that

promotes the role of communication and information provision, mass media, business partnership, growers, and market promotion.

The growers need the information about price, market, post-harvesting management, goods quality, and safety standards.   Some farms search for the data by themselves. Minor growers have difficulty in access of information.   The dissemination of information is largely at major growers.   Therefore, there is an idea of employing technology to support the transfer of knowledge to growers with the information search and assumption that M Agriculture /e Agriculture telephone can improve productivity to growers. It can increase incomes of growers. When there is good and timely information, growers can trust experts or recommenders. There is the trial of using telephones in the Indian agricultural business.   However, the study is on the basis that there has been already the development of content, appropriate informing networks, and ability to access financial service and market, and growers have knowledge.   There is a study that supports such hypothesis (Ferroni and Zhou, 2012).

1. Growers trust that telephones are reliable information resources.

2. Growers will study the following information in an order: Seeds, prices, fertilizer, chemicals in preventing insects and plant enemies, harvesting and markets, and tools and equipment.

3. Growers recognize of its convenience and cost economy. However, the application and worthiness is a matter of consideration in each town of India.

4. Telephone is a sensitive matter for buyers.

5. The information from telephone helps the growers in bargaining and sale decisions when they have satisfactory prices.

However, the applications on mobile phones are the information provision and communication with growers.   The communication among growers is new thing and can create connection to market demand.

The promotion from business or private sectors has a growth rate and is important in informing growers.

In minor growers, the goods from them should realize the food safety. Their goods will have quality and standards according to customers if they receive the right service and information, and they can follow market situation.

About 40% of growers in India can access information. The rise of cost and food price necessitates growers to employ technology.

There are questions in India about how the government inspire or motivate growers. It seems that the authorities that promote technology to growers show good signs and there is a trend of serious development for growers by introducing technology as a tool in transferring knowledge to growers.

2.7.6.2 Agricultural Knowledge Management in Ghana

There were experiments in Ghana to apply KM to promote agriculture in order to develop a sustainable agriculture in the country. The objectives in the application of KM to agriculture promotion are to create connection among promotion authorities or experts in different specializations with growers and to induce the development and knowledge transfer in agricultural field efficiently. However, the culture of the workers in the organizations of promoters and of growers is much different such that there is a gap in between. This results in lack of communication. If there is more communication, it is believed that there will be knowledge development of growers. Therefore, there is the development of Knowledge Management Model for agricultural extension practices in Ghana, which employs KM in persons and explicit knowledge to knowledge exchange according to widely accepted theory of KM. In addition the Knowledge Conversion Model of Nonaka and Takeuchi (1995), which explains Knowledge Creation, transformation of Tacit Knowledge to Explicit Knowledge, the creation of the atmosphere of knowledge exchange in organization, and the learning with external organizations to result in new knowledge, is also applied. This is called SECI Model, i.e. Socialization, Externalization, Combination, and Internalization.

As mentioned above, lack of connection or communication among extension experts and growers is the obstacle in developing knowledge. It is doubtless that knowledge and practice search for grower is necessary because there is appropriate

uses of farm and harmful to environment from incorrect and inappropriate operation from farm owners. Promotion experts need to employ the learning format in helping growers make decision on technology development or new approaches of agriculture in order to result in new knowledge both tacit and explicit. Growers will be motivated to apply technology from agricultural experts when they realize that they participate in design and development of those technologies (Boateng, 2006).

2.7.6.3 Agricultural Knowledge Management in Bolivia

Bolivia introduces KM for the innovation of agriculture which is composed of many small farms which lack of knowledge and technology to support farming although there is support of research, agricultural promoting projects, adding values to agricultural goods. Therefore, there are research works on KM for creating agricultural innovation in Bolivia. KM is the matter related to knowledge exchange between knowledge developers and users. Lack of knowledge exchange is the main reason of no agricultural development (Hartwich, 2007).

2.8 Closure towards Proposed Methodology

The literature review above has shown the potential of CMM and knowledge management as a solution methodology for the problem as described in Chapter 1. The details of the proposed methodology will be described in the next chapter.