

Development and Constraints of Food Industries in Thailand

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Abstract

Thailand is one of the world's five and Asia's only consistent net exporter of food but it still needs a concerted effort by business and government to develop the food industry. Recently, a survey to investigate the role of academic institutions has been carried out to identify their capacity to serve the food industry. Each has been clearly identified in terms of competence in specialized fields of expertise based on the location. They agreed to have a coordinating agency to oversee food industry needs for training and education, research and development, academic services, analysis and inspection of food products, technology transfer and construction of databases on food science and technology. However, various obstacles in the link of the cooperation between the public and private sectors should be removed to acquire up-to-date information about trends in the global food industry and to identify higher value-added goods with market potential along with upgrading employee skills.

Introduction

Food-processing industry has increasingly become an important sector in the economical development of Thailand. The exports of major agricultural products such as rice, maize, poultry and processed foods remained steady during the economy struggle in 1997. Agricultural production is still a strong base for the production of foods for the nation's population and of raw materials for the food-processing industry presently and is expected to remain high in the future. Thailand has earned foreign currency from processed foods exported since 1970. Thereafter, agriculture diversified into higher value products including horticulture, livestock and fisheries. At present, Thailand is the leading exporter of several commodities including rice and rice products, sugar, frozen chicken and seafood, canned tuna, canned seafood and canned fruits and vegetables.

The total amount of annual export earnings reached approximately around Baht 280, 940 million (or US\$ 7,000 million at 1 US\$=40 THB conversion rate) in 1997 (Chayovan, 1997).

As Thailand became one of the world's five and Asia's only consistent net exporter of food, and remains the world's largest exporter of rice, natural rubber and tapioca, manufactured products now account for over 70% of its total exports. The country can improve its already solid position as one of the world's top food exporters. Thai food-processing industry recorded a significant growth during the past 10 years in increasing the value of production and growth of exports. Attention has been paid to measures specifically designed to encourage technology

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upgrading, acquisition and diffusion, including the application of better organizational, production and informational technology and to ensure the existence of an appropriate legal and regulatory framework which should be conducive to food processors and their business development. Industry's structure needs to create linkages between large, medium and small enterprises, linkages with multi-national corporations, and linkages in the global commodity chain. Within the national macro-and micro-policy framework, an institutional support infrastructure has been developed, including trade promotion, establishment of technical and research institutes, productivity centers and the role of sectoral associations of industry and commerce has been expanded.

In 1997, a survey to investigate the role of academic institutions was carried out to identify their capacity to serve the food industry. Thirteen universities from different regions of the country where degree programs in food science and technology are offered with a budget from the government, gave their views. Each university can be clearly identified in terms of its competence in specialized fields of expertise based on the location. They agreed to act as a coordinating agency to direct food industry needs for training and education, research and development, academic services, analysis and inspection of food products, technology transfer and database on food science and technology. Based on the studies, it was concluded that each individual region has a potential to develop coordination and support to the respective universities as a center of academic excellence for specialization in food science and technology (Maneepun, 1997).

Although Thailand's food industry benefits from substantial indigenous supplies of raw materials and low reliance on imports, still various constraints remain in terms of profitability and long-term growth. Among them, there is the high cost of raw materials which must be imported when local supply runs short due to changes in weather and other factors. Also the cost of land for raising livestock or planting crops is relatively high compared with other countries in the region. The confusing system at the government level needs to reduce duplication among several agencies from ministries of Commerce, Industry, Public Health and Science, Technology and Environment. More consistent government promotion of Thai food products, as well as assistance in ensuring reliable supplies of raw materials is also needed. In addition, the industry requires a stronger government role in international trade talks, since food exports are faced with various trade barriers. Thai food industry needs to focus on the sustainability and enhancement of competitiveness in the globalizing markets.

High growth potential of Thailand's food industry

Presently, there are about 7,000 food manufacturing firms in Thailand which mainly consist of small-to medium- scale enterprises and very few large-scale ones. Size is mainly determined by the total investment and the amount of the product output. Thailand's food industry is divided into 4 major categories, including primary agricultural products, livestock and poultry, fisheries and processed foods which offer the highest added value.

1 Primary agricultural products

Domestic production of major crops in Thailand which are used for national economic

indicators includes rice, maize, sugarcane and tapioca. Since these key farm crops are produced for both domestic and export markets they have also become a source of export earnings for the country. Since the production of each crop involves a large number of farmers, when the crop is affected by changes in the weather conditions or other factors causing damage, the government has to assist these farmers, including the stabilization of the price and restructuring of farm products. The primary agricultural products exported from Thailand from 1987-1996 in terms of both quantity and value are shown in Table 1 (Office of Agricultural Economics, 1997). Prospects for the agricultural sector could be much brighter if the volume of exports of value-added products, which had been somewhat small could be further increased. Although 60% of the population is engaged in agriculture and related industries, low priority has been given to the development of the sector.

Table 1 Export of primary agricultural products from 1987--1996 in terms of both quantity and value

Quantity, Million Tons : Value, Million Baht

| Year | Rice | | Maize | | Tapioca products | | Sugarcane | |
|------------|----------|-------|----------|--------|------------------|-------|-----------|------------------|
| | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value (baht/Ton) |
| 1987 | 4.443 | 22.70 | 2.920 | 6.25 | 6.203 | 20.29 | 2.026 | 3,610 |
| 1988 | 5.089 | 34.68 | 0.810 | 2.10 | 8.155 | 22.29 | 1.855 | 4,190 |
| 1989 | 6.140 | 45.46 | 1.573 | 5.14 | 9.935 | 25.00 | 2.961 | 5,120 |
| 1990 | 4.017 | 27.77 | 1.226 | 4.29 | 8.191 | 24.37 | 3.370 | 6,420 |
| 1991 | 4.333 | 30.52 | 1.215 | 3.81 | 7.080 | 24.81 | 2.900 | 7,190 |
| 1992 | 5.151 | 36.21 | 0.849 | 2.75 | 9.094 | 29.53 | 3.757 | 4,930 |
| 1993 | 4.989 | 32.96 | 0.179 | 0.58 | 7.330 | 21.66 | 2.294 | 5,570 |
| 1994 | 4.858 | 39.19 | 0.125 | 0.45 | 5.657 | 18.75 | 2.605 | 6,430 |
| 1995 | 6.198 | 48.63 | 0.117 | 0.44 | 4.070 | 18.25 | 3.730 | 7,390 |
| 1996 | 5.460 | 50.73 | 0.090 | 0.42 | 4.623 | 20.57 | 4.378 | 6,690 |
| % Increase | 1.765 | 5.96 | -32.01 | -27.81 | -6.11 | -1.74 | - | 6.16 |

Source : Office of Agricultural Economics, 1997.

2 Livestock and poultry

It remains difficult to develop an export market for beef and pork meat due to the outbreaks of foot-and-mouth disease and cholera and the low standards of hygiene of abattoirs which do not meet international requirements. Due to the possibility of disease transmission to human, pork meat could not be exported to the Japanese and Singaporean markets (Office of Agricultural Economics, 1995). In 1994, processed pork products were developed and up to 666 tons were exported with a value of Baht 92 million. Since then, value-added processed pork products have been developed for ready-to-eat foods, including frozen processed pork meat and canned meat for specific markets in Singapore, Korea and Japan. As a result, the export quantity and value have significantly increased as shown in Table 2.

Table 2 Export of fresh pork and processed pork products, frozen chicken and chicken eggs from 1987–1996 in terms of both quantity and value

Quantity, Tons : Value, Million Baht

| Year | Fresh pork meat | | Processed pork products | | Frozen chicken | | chicken eggs | |
|------------|-----------------|-------|-------------------------|--------|----------------|-----------|--------------|-------------------|
| | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value baht/Ton |
| 1987 | 21 | 0.66 | 14 | 1.41 | 81,905 | 4,019.92 | 7,964 | 144.78 |
| 1988 | 36 | 1.53 | 40 | 7.65 | 95,784 | 4,869.91 | 4,109 | 78.75 |
| 1989 | 195 | 9.31 | 46 | 9.24 | 107,983 | 5,875.83 | 3,269 | 69.87 |
| 1990 | 1,438 | 71.61 | 71 | 13.57 | 138,859 | 7,586.03 | 5,338 | 129.92 |
| 1991 | 1,337 | 66.29 | 103 | 14.32 | 164,176 | 10,275.73 | 6,401 | 148.73 |
| 1992 | 288 | 15.53 | 272 | 34.41 | 174,829 | 10,399.29 | 2,610 | 51.89 |
| 1993 | 289 | 14.47 | 667 | 79.85 | 157,081 | 8,885.70 | 727 | 13.14 |
| 1994 | 205 | 11.53 | 666 | 92.48 | 153,043 | 9,854.38 | 1,069 | 35.97 |
| 1995 | 585 | 40.55 | 1,823 | 214.48 | 149,935 | 9,661.77 | 1,510 | 30.67 |
| 1996 | 142 | 10.57 | 1,279 | 141.30 | 137,214 | 9,085.02 | 4,035 | 98.34 |
| % Increase | 20.39 | 29.61 | 70.90 | 64.99 | 6.22 | 9.65 | -14.37 | -12.13 |

Source : Office of Agricultural Economics, 1997.

Frozen chicken has been developed for both domestic and export markets. Japanese market accounted for more than half of Thailand's total annual exports of frozen chicken, amounting to 137,214 tons in 1996. Presently, the Thai Broiler Processing Exporter Association of Thailand attributes the incompetitive pricing of Thai products to rising production cost caused by tariff and import quotas on the raw materials used to produce animal feed (Keeratipipatpong, 1997). The association had asked the government to act to reduce exporters' production cost before the chicken industry lost even more ground to its competitors. At the same time, association members must attempt to expand the domestic market for their goods to produce more value-added chicken products. There is also room to improve production efficiency at most operation levels. Total local production was forecast at 15 million chicks/week up from 14 million chicks/week in 1997. However, domestic consumption is still low and per capita consumption is only 11kg compared with 29kg in Malaysia and 32kg in Singapore. There is therefore room to expand sales locally. The export of frozen chicken meat experiences remarkable fluctuations due to the strong competition in the world market, and in the case of chicken eggs, exports and value are gradually decreasing as shown in Table 2.

3 Fishery products

The first container of frozen squid was shipped to overseas markets more than 30 years ago. In 1995, Thailand had become the world's first exporter of seafood and producer of cultured black tiger shrimps. Presently, most of the marine products of high quality find their

way to many modern processing facilities conveniently located along the fishing harbors or farm areas (Thai Frozen Foods Association, 1996). The finished products are shipped overseas to supply consumers with fresh and tasty products with a high nutritive value. The growth of the industry is the result of the joint effort of the private and government sectors which are determined to drive the industry to international recognition and acceptance. The exports of frozen fishery products are shown in Table 3 (Office of Agriculture Economics, 1995/96).

Table 3 Export of fishery products and frozen products from 1991–1995 in terms of both quantity and value

| Products | Quantity(Q), Tons : Value(V), Million Baht | | | | | | | | | |
|---|--|-------|---------|-------|---------|-------|-----------|--------|-----------|--------|
| | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | |
| | Q | V | Q | V | Q | V | Q | V | Q | V |
| Fishery Products | 903,515 | 73.96 | 940,327 | 78.19 | 969,147 | 86.19 | 1,072,353 | 105.38 | 1,017,217 | 110.93 |
| Frozen fish fresh | 236,896 | 8.11 | 291,838 | 8.06 | 281,572 | 8.20 | 286,383 | 8.45 | 309,739 | 9.85 |
| Frozen fish fresh, fillets | 86,020 | 6.24 | 86,235 | 5.56 | 85,697 | 5.72 | 87,203 | 5.44 | 96,126 | 6.41 |
| Shrimps, prawns, lobsters, fresh chilled frozen | 121,240 | 26.68 | 130,516 | 31.70 | 148,886 | 37.84 | 199,476 | 49.16 | 175,091 | 50.30 |
| Crabs, crabmeat, fresh chilled frozen | 380 | 0.38 | 1,036 | 0.11 | 1,113 | 0.90 | 2,005 | 0.18 | 1,907 | 0.26 |

Source: Office of Agricultural Economics, 1995/96.

Innovative packers have successfully introduced a wide range of convenient products to international markets. Battered and breaded fish and shellfish, products suitable for microwave ovens and ready-to-cook meals are some of the products processed with technology transfer through joint ventures. Research and development to tackle environmental problems as well as processing and marketing aspects require investment that should include transfer of technology. Government policy has given priority to the increase of exports of high value fishery products and market promotion. The fishery industry has received both technical assistance and credit facilities through various governmental and international agencies. Also several universities are offering research and training facilities at the undergraduate and post-graduate levels.

4 Processed foods

Processed foods that offer the greatest added value can be divided into 4 groups.

- 1) Canned seafood: tuna, sardines, shrimps and crabs
- 2) Canned fruit products: pineapple and juice
- 3) Canned vegetables: baby corn and bamboo shoots
- 4) Canned pet feeds for dogs and cats

The exports of processed foods from 1993-1997 are shown in Table 4 in terms of both

quantity and value.

Table 4 Export of processed food products from 1993-1997 in terms of both quantity and value
Quantity(Q), Tons Value(V), Million Baht

| Products | 1993 | | 1994 | | 1995 | | 1996 | | 1997 | |
|---------------------------------------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|
| | Q | V | Q | V | Q | V | Q | V | Q | V |
| Canned seafood products | 111,944 | 12.60 | 132,976 | 16.38 | 132,973 | 19.67 | 129,603 | 21.86 | 131,341 | 29.92 |
| Canned tuna | 229,901 | 13.06 | 283,215 | 15.56 | 221,245 | 13.63 | 188,464 | 12.39 | 202,660 | 16.60 |
| Canned animal feeds for dogs and cats | 149,681 | 4.31 | 152,070 | 4.29 | 144,905 | 5.01 | 146,724 | 5.62 | 136,179 | 6.66 |
| Canned pineapple | 499,005 | 7.51 | 485,125 | 7.06 | 390,550 | 6.18 | 371,907 | 7.13 | 324,415 | 7.38 |
| Pineapple concentrate | 85,168 | 1.45 | 101,044 | 1.63 | 89,059 | 2.09 | 85,272 | 3.20 | 71,890 | 2.96 |
| Canned fruits | 130,526 | 2.32 | 114,428 | 2.49 | 123,963 | 3.05 | 124,343 | 3.47 | 130,191 | 3.25 |
| Canned vegetables | 130,069 | 2.67 | 163,571 | 3.05 | 210,256 | 4.66 | 204,068 | 5.13 | 209,956 | 5.69 |
| Total | 1,309,294 | 43.91 | 1,432,249 | 50.46 | 1,312,951 | 54.26 | 1,250,381 | 58.79 | 1,206,632 | 72.46 |

Source ; Center for Commercial Statistics

1) Canned seafood: tuna, sardines, shrimps and crabs

The quantity of tuna catches in Thailand has increased yearly but it is still insufficient for the tuna processing industry. The imports of tuna in fresh, chilled and frozen forms amount to about 400,000 tons annually. Presently, since tuna has been subjected to over-fishing, the processing industry is facing a shortage of tuna. There are about 58 large processing factories which meet international standards. The total production of canned tuna is about 326,400 tons which accounts for 35% of the total production of canned seafood products amounting to 922,546 tons. In 1995, Japan accounted for about 36.2% of the export markets of canned tuna, USA for 31.8%, Israel for 15.4%, Australia for 3.8% and other countries for 0.49% (Department of Agricultural Economics, 1996).

Canned sardines in tomato sauce or vegetable oil have been processed for both domestic and export markets. Presently, the processing industry is facing a shortage of raw materials resulting in the discontinuation of the production since 1996. The quality of imported raw materials usually deteriorates before they reach the factory. The high wages of employees which factories can not afford led to the move of the canned sardine business to other countries where raw materials are available and wages of employees are lower.

The production of canned shrimps has increased very rapidly. The production which amounted to 14,444 tons in 1986, increased to 58,755 tons in 1995. Since 1995, the raw materials which have been imported from ASEAN countries (Indonesia, Malaysia, Philippines and Singapore) account for about 93% of the total production. Cooked and peeled fresh shrimps were collected by middlemen for delivery to processing factories. Control and inspection were implemented at the factory level before processing. In 1994, factories for shrimp canning

numbered about 17 in the country. These factories also process other fishery products such as canned tuna, crab and baby clam. The total production of canned shrimps was almost completely aimed at exports and the average export quantity increased by about 13.4% during the period 1986-1995. The main export market of canned shrimps was USA with a quantity of 5,245 tons in 1986 which increased to 24,564 tons in 1995. Among the EU countries, United Kingdom and France, have imported canned shrimps from Thailand with a steady increase but this tendency is likely to decline in the future. Since these two countries prefer frozen and ready-to-cook seafood products, market expansion looks very difficult in the future.

Export of canned crab meat has decreased yearly since 1990. The export quantity which amounted to 10,001 tons in 1990 decreased to 6,903 tons in 1994. The product control and inspection by importing countries have become very strict, especially in the EU countries. During 1990-1994, 27% of the products were imported by France, 20% by the USA, 10% by Canada and 13% by Japan. Presently, the production is decreasing due to the shortage of raw materials, high cost of raw materials and technical barriers in international markets especially in advanced countries.

2) Canned fruit products: pineapple and juice

Two varieties of pineapple are grown in Thailand, Smooth Cayenne and Queen. Smooth Cayenne which is grown over about 95% of the total plantation areas, is suitable for processing, while Queen is predominantly used for fresh consumption. The major growing areas are the eastern and southern regions where sandy soil and moderate rainfall offer suitable conditions. The production basically runs for 9 months in a year from October-July with 2 peaks of cool season cropping in November-December and summer season in May-June. Canned pineapple production has developed extensively based on a management system involving growers and factories, processing technology, and market management. The quantity of exports of canned pineapple was 398,352 tons in 1990 and it increased to 707,260 tons in 1994. In 1994, canned pineapple exports to USA faced anti-dumping legislation in the US market, resulting in the payment by pineapple canning factories of an import tax up to 30-40%. In 1995, the amount of exports to USA decreased to 96,521 tons. During the 1990-1994 period, 38% of total canned pineapple was exported to USA, 13% to Germany, 7% to Japan and 4% each to Canada and the Netherlands. In the Asian market canned pineapple started to be imported by Korea and Taiwan. Presently, the processors are promoting a domestic market which is gradually increasing, accounting for about 7% of total production.

In 1993, there were 30 pineapple canning factories, with only 25 factories in operation with a production capacity of about 864,057 tons/year. Due to the reduction of the pineapple price in 1993, a few factories had to discontinue their operation. At present, only 21 pineapple canning factories have been in operation with a total production capacity of 600,000 tons.

The production capacity of pineapple juice concentrate peaked in 1994 with a volume of over 100,000 tons. There are presently 15 processors in Thailand producing both frozen and aseptic concentrate. Unfortunately, the production and export volume have decreased due to the shortage of raw materials. In 1998, the exports are estimated at only 68,000 tons (Tantipipatpong, 1998).

Pineapple juice concentrate is produced as a by-product of canned pineapple in which core and eradicated meat are extracted for juice. Occasionally, whole fruits are used in production.

Juice is then centrifuged and pasteurized prior to evaporation by steam. The finished product is then filled and stored in cold storage as frozen concentrate, or under goes UHT process for sterilization and is packed in aseptic bags.

About 90% of pineapple juice is exported. The export quantity was 73,680 tons in 1990 and it increased to 102,367 tons in 1995 with 41% of the export directed to USA and 32% to EU countries (Netherlands, Spain and Belgium).

3) Canned vegetables: baby corn and bamboo shoots

Canned baby corn has been developed for both domestic and export markets. Hybrid corn varieties have been developed. Export markets of canned baby corn are USA, EU, Japan, Canada and Australia. In 1994, the export quantity of canned baby corn was about 46,187 tons of which 38% was exported to the US market and 22% to EU countries.

Canned bamboo shoots have been introduced in both domestic and export markets. Bamboo shoot production needs to develop to meet the canning industry requirements in both quantity and quality. The export quantity was 42,638 tons in 1990 and it increased to 71,199 tons in 1994, but decreased to 62,362 tons in 1995. The export markets of canned bamboo shoots are Japan, USA, EU, Canada, Australia and Korea.

4) Canned pet feeds for dogs and cats

Canned pet feeds for dogs and cats have been developed from by-products of the fish canning industry. Wet feed was processed in can containers. Formulated feeds include mixture with cereals, grains, by-products from chicken and beef processing industries, vitamins and minerals. The export markets cover Asian countries, North America (US and Canada), Australia and New Zealand and EU.

In 1995, the export quantity was 82,726 tons and the production capacity has increased since then.

Role of academic institutions supporting food industry development

The survey conducted to investigate the role of academic institutions identified their capacity to serve the food industry in 1997. Among the academic institutions consisting of government and private universities, government universities have played a prominent role in the development of the food science and technology curriculum. Geographic representation has been classified into central, northern, southern and northeastern regions. The survey studied university policy with responsibilities in teaching and research and development for the food industry. The findings strengthened the role and responsibility of these institutions (Maneepun, 1997).

Thirteen universities established at different times academic food science courses and developed knowledge-based resources. The potential services can be classified into 4 categories;

1) Services provided for the analysis and inspection of food products

Most universities give priority to teaching, research and academic services in training and education for specific communities.

Two universities are recognized as food research institutions: Institute of Food Research and Product Development (IFRPD), Kasetsart University and Institute of Nutrition, Mahidol

University. They analyze and inspect food products for food industries when required, including those for exports. However, they still need to develop laboratory capabilities, especially equipment for analytical examinations which are required by the importing countries.

2) Faculty members and researchers undertaking research and development activities

Several faculty members and researchers from participating academic institutions are able to develop projects and publish their research results in both local and foreign journals. Regional development may identify directions based on available agricultural commodities in each region. The regional activities are as follows:

- (1) Southern region: in the case of seafood products, research activities, training and services for seafood industries have been developed. A center was established at the university campus to promote exports of seafood products
- (2) Northern region: fruits and vegetables are commonly grown in the region, especially temperate commodities. The university has a potential to develop research, training and services for fruit and vegetables industries.
- (3) Northeastern region: in the case of meat products, research activities, training and services for meat industries can be developed. Animal production requires organization input to develop facilities and identify locations for each animal type, since the northeastern region has large land areas where water resources need to be developed. Animal production in the central region will have to be relocated in the near future due to the expansion of residential areas. The universities in the region may play a role in assisting meat industries as needed.
- (4) Central region : in the case of cereals, grains and root crop products, research activities, training and services have been developed in many universities. Collaborative research has been developed with all the region as well as overseas universities.

3) Training at multiple levels and education

Several training courses are being organized based on specialized fields. The training courses are as follows : traditional processed food products, processed food products for income generation , etc. Human resources development for personnel in the food industry has also be promoted, including food safety, food processing and technology transfer , food quality control, etc.

4) Specialized fields in food science and technology need to strengthen the capacities to provide services to the food industries

Twelve areas have been proposed from participating universities such as food-processing engineering, meat products, food microbiology and fermentation technology, product development, dairy products, starch and cereal products, fishery products, fruits and vegetables, postharvest technology, fat and oil, food packaging and nutrition.

To meet the food industry needs, recommendations include the establishment of laboratory information management systems, planning for training programs and technology transfer to the private sector, development of a center of networking for specific developed technologies, establishment of National Food Industry Development Plan and supply of database services on food standards, regulations, law, etc. which are required by international food trade.

Constraints of Thai food-processing industry

There are several constraints which the Thai food industry needs to address immediately. During the period 1997-1998, Thailand had to tackle problems associated with the economic crisis due to currency depreciation. Problems of the food-processing industry have become major issues for the government, for example how to promote the increase of Thai food exports and create a demand for Thai products worldwide (Phacharintanakul, 1998). The constraints which are expected to be overcome in the near future are as follows:

1 Agricultural production

- 1) Problems associated with both low quantity and quality of raw materials should be addressed by the government to promote the production of raw materials with a higher yield. For the livestock industry, quality and disease control should be improved.
- 2) Challenges to upgrade primary processing industry to international standards such as GMP, HACCP and ISO 9000.
- 3) High production cost of processed food products especially seafood products, chicken and seafood processing.
- 4) Tight cash flow, high interest rates and difficulty in obtaining loans prevent companies from continuing business.
- 5) Cyclical problems that affect agricultural production, i.e. flood, drought, disease outbreaks, insufficient irrigation, etc. require advanced planning by industry and government immediately to switch to alternative crops as well as markets.

2 Lack of public facilities, services and complicated systems at government levels

- 1) Lack of public facilities such as insufficient development of water resources, communication system, transportation including land, water and air. The development of efficient public facilities may enable to reduce the production cost of agricultural products.
- 2) Lack of up-to-date information relating to trends in the global food industry makes it difficult to plan or improve the production.
- 3) Systems involving officials from concerned ministries that promulgate laws, regulations and legislation which require time to implement should be simplified. A system is needed to restructure these agencies to reduce the administration cost in order to enhance the competitiveness of the products in international markets.

3 Lack of defined quality standards and increase of technical barriers from importing countries

- 1) Inadequate quality standards of some processed food products in relation to pesticide residues, hormones and drug residues, and contaminations.
- 2) Technical barriers from importing countries which require high tariff, high standards with complicated regulations in food production, packaging and labeling, have affected export products in international market.

4 Insufficient knowledge of market promotion

- 1) Thai food processors still depend on custom-made orders for exporters which should create and promote their own brands for worldwide recognition.
- 2) Lack of cooperation between the public and private sectors to pool resources and identify higher value-added products with market potential along with upgrading employee skills.
- 3) Inadequate research and development to utilize value-added by-products from food-processing industry for market potential.

Conclusion

Agricultural production in Thailand is still a strong base for the production of foods for the nation's population and of raw materials for the food-processing industry presently and is expected to remain high in the future. High growth potential of Thailand's food industry can be divided into 4 major categories; primary agricultural products, livestock and poultry, fisheries and processed foods. The total amount of annual export earnings reached approximately US\$ 7,000 million. Role of academic institutions has been investigated in relation to the possibility to support food industry development. The constraints of the Thai food-processing industry presently, include the shortage of raw materials, high wages, high production cost, inadequate public facilities and insufficient knowledge of market promotion which are expected to be resolved in the near future. Economic crisis has enhanced the cooperation between the public and private sectors to identify higher value-added products with market potential along with upgrading employee skills.

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