

Situation of Agricultural Engineering in Thailand

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ABSTRACT

Thailand is one of the world suppliers in agricultural production. Approximate 41% of the total area (210,377 km²) of the country is under agriculture; of which about 105,020 km² are paddy lands. The total population is about 61 million and approximate 60.4% live in the rural areas and most of their earning by farming. Mechanization plays more important roles in the present Thai agricultural production system. Thai government has enhanced the mechanization development plan which had firstly been included in the Seventh National Economic and Social Development Plan (1992-1996). In the Eighth (1997-2001) and the Ninth (2002-2006) National Economic and Social Development Plan, the mechanization policy is not explicitly stated like in the previous two Plans. The general objective of developing the agricultural sector was to improve capacity to complete in agricultural production by promoting the replacement of human labour by agricultural machinery. At present Thailand is under the Tenth Plan. No mechanization development plan or programme clearly state in the policy. Nonetheless, several policy issues need support from agricultural engineering and machinery technologies. Agricultural engineering and machinery technology on post harvest and food processing have a quite importance role to play in the implementation of the strategies project "Local Community Product" which mostly dealing with the processing of agricultural produces.

Research and Development on agricultural engineering are conducted by the Department of Agriculture and universities in corporation with local manufacturers. Thai government has established some policy to promote research and development in industry by joint corporation with researchers in universities and National Science and Technology Development Agency. The extension of agricultural machinery is conducted by the Department of Agricultural Extension whereas, the Department of Agriculture corporate with local manufacturers.

1. INTRODUCTION

The survey conducted by Office of Agricultural Economics in 1995 to 1999 indicated that average farm size declined from 4.2 to 3.71 hectare/household. The farmers in the Central plain region had the highest farm size, followed by farmers in the Northeast, the South, and the North. Farmers in the Northeast have the highest owner operated holding area per farm, followed by farmers in the Central Plain, the South, and the North. Farmers in the Central Plain have the highest rented holding area per farm. Thus, the problems facing each region are different. Problems of land rent mostly occur in the Central Plain. Most farmers in the Northeast have their owned land, but, they face problems of poor soil conditions and high risks from climatic variations. Two crops a year is a common practice in rice cultivation in the area under irrigation. Some area in the central plain utilized under ground water can accomplish five crops in 2 years. In the past time water buffalo and cow were draft animals popularly used in cultivation system for land preparation. Nowadays they are found very few and only in the remote rural area. Almost of cultivation system is under mechanized. Various kinds of tillage implements are used differently in land preparation depending upon crop,

tilling purpose and area. For paddy field in the irrigated area, disk plow equipped to two-wheel tractor or small four-wheel tractor is generally used at present and followed by rotary tiller. Moldboard plow is also used but in a declining number. For field crop, disk plow, disc harrow, spring-loaded cultivator, and rotary tiller are used, commonly equipped to big tractor. There are several methods of rice planting depending upon area and labor condition. Transplanting methods is a major practice for seasonal crop. While broadcasting and direct seeding are general practices in high land or rain-fed area. Every method is most done manually.

From the Agricultural Engineering Research Institute (AERI), Department of Agriculture survey in crop year 1999-2000, it shows that paddy was harvested by manual using sickle 57.2%, by combine harvester 35.2% and by reaper 7.6%. Threshing is mostly done by using power thresher about 88.3%. After harvest, farmers usually sell their product immediately at high moisture content. Sun drying is still a prevailing method for paddy drying. However, as an increasing number of combine harvester in a past few year, it burdens large amount of high moisture paddy to market at peak in a short period especially in the second crop. This leads to an increasing number of dryer to solve the problem.

2. STATUS AND TRENDS OF AGRICULTURAL MACHINERY IN THAILAND

Farm machineries in Thailand are essential in land preparation. For dry land soil preparation mainly large four-wheel tractors with disc tillers are used while locally made power tillers (8-12hp) are popularly used for the wetland cultivation. In some area, farmers have changed their planting practice from transplanting method direct seeding method by using rolling injection planters or seedling transplanted essentially in maize and soybean land. In the harvesting process of rice, the adoption of local rice combine harvesters has been rapidly expanding during last decade. In addition, sugarcane harvesters and corn combine harvester were used in custom service since 1995.

In 2000, The distribution of selected farm machinery which are power tiller, the small four-wheel drive tractor, the large four-wheel drive tractor, irrigation pump, power thresher, power sprayer and rice combine harvester, approximately 1.75 million units, 150,383 units, 183,704 units, 2.32 million units, 12,400,187 units, 76,386 units, 3,000 units respectively (OAE,2000)

Over the past two decade the agricultural machinery manufacturing industry in Thailand has become relatively modernized. Starting with the production of non-mechanical animal-drawn equipment, local manufacturers have developed the capability to supply the growing demand for new types of power-intensive machines, such as two-wheeled tractors (power tillers), threshers, agricultural sprayers and water pumps. Such machines are now produced on a relatively large scale along with other machines such as farm trucks. Prompted by new demands for further productivity, the manufacturing of more sophisticated, control-intensive machines has recently been taken up by some companies. At present, the majority of farm machines used are locally produced. Only the large tractors, 75% of engine powered sprayers and 30-40% of irrigation pumps are imported (Kiatiwat, 1996). The local production for the last two items trends to increase every year. The 217 manufacturers surveyed by the Agricultural Engineering Research Institute (former Agricultural Engineering Division), Department of agriculture, and the Thailand Institute of Science and Technology Research in 1987 were grouped into the following three categories with reference to the number of workers employed:

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|-----------|---------------------------------------|---------------------------|
| 1. Small | - up to 10 employees | -100 manufactures or 46% |
| 2. Medium | - more than 10 and up to 30 employees | -74 manufactures or 34% |
| 3. Large | - more than 30 employees | -73 manufacturers of 20 % |

These are located in different regions but mostly in central plain around capital, Bangkok. Presently local agricultural machinery industry is capable in producing machines to fulfill the needs of farmers. The annual turn over of this industry is about US\$ 240 million, This includes the production of three joint venture Thai-Japanese small diesel engine manufacturers (Kiatiwat, 1996)

Therdteppitak reported in 1998, during the past decade, the agricultural machinery industry in Thailand has grown rapidly both in production volume and product development. Due to the impacts of low crop price and economic stagnation in recent years, there is a big drop in sales of agricultural machinery in Thailand. Anyway the recovery is expecting to come very soon. Approximate annual production in 2001-2002 of some major agricultural machinery and equipment in Thailand is given by the following:

1. Small diesel engine	100,000	units
2. Small gasoline engine	400,000	units
3. Two wheel tractor	80,000	units
4. Disc plow for two wheel tractor	150,000	units
5. Disc plow for farm tractor	5,000	units
6. Water pumps	50,000	units
7. Rice-harvester combines	600	units

The importation of agricultural machinery is still the important player to satisfy the farmers and agro industry sector for more sophisticated advanced and high technology machinery and equipment. Four-wheel tractors are the major import item with the quantity about 5,000 units, in which 70% is used tractor. Used tractors below 40 HP are imported from Japan and higher power tractor from UK. The brand-new tractors are imported from UK, Japan, China, Italy etc. Others import machinery are as follow:

1. Pre-harvest machinery such as irrigation system, power sprayer, weeder etc.
2. Post-harvest machinery such as sugarcane harvester forage cutter and baler,
3. Agro industry machinery such as poultry, cattle and dairy machinery etc.

Trend and future of agricultural machinery in Thailand, Due to the present socio-economic condition of the country, farm labor shortage has become a critical problem in most agricultural operations. Undoubtedly demand for agricultural machinery and equipments will be in increasing but the expansion rate will differ from region to region, particular agricultural operations and machinery types. Other important factors on crop price and government policy must be taken into consideration.

There will be a growing market for four wheel tractor of less than 40HP with rotary implements which will replace two wheel tractors for rice cultivation in the central plain region and the lower part of the northern region. Due to labor shortage during harvesting season, especially for paddy rice and sugarcane, most farm owners or farmers are looking forward to an appropriate and high efficient harvester. It is quite obvious that agricultural mechanization in Thailand is at the turning point from labor intensive machines towards control intensive machines such as planting machines, irrigation system machines, powered sprayers, combine harvesters, dryers using biomass fuel, silo and storage handling, advanced and high quality rice mill machines etc. Eventually these machines will be rapidly adopted by farmers or proprietors. However, much effort should be taken to develop modification and adjustment to suit the local condition.

3. GOVERNMENT POLICIES

Thailand started its first Economic and Social Development Plan in 1961. By the end of the 2nd plan, 1971 the development in terms of basic necessities, namely irrigation, electricity and transportation resulted in increased production. However, although there was an increase in the GDP, a study on the income of population revealed an increased gap of

among population of different occupation and areas within the country. Thus in the 3rd Plan (1972-1976), the Government concentrated on income generation and social equality including emphasis decrease population growth rate, improving agricultural institution and price guarantees of agricultural produce. Due to unsuccessful outcome during the past 14 years, the 4th Plan (1976-1980) was set to solve basic and urgent problems facing the nation. The strategies among others included.

1. increase in agricultural production potential,
2. improvement in the industrial structure to export oriented industries, thus promoting income generation as well as increase rural employment,
3. decrease the population growth rate, and
4. enhance science and technology development rate.

As for the attempt to reduce the population growth rate, the government had succeeded appreciably. It should also be observed that working population had increase, particularly in the last decade though the active population had not increased. In addition, the population engaged in industry increase to a considerable extent in the last two decades.

Throughout the First to Third plan (1961-1976), the goals for increasing agricultural production were achieved by increase of agricultural use area. But during the fourth and Fifth (1981-1986) plans, the strategy was to increase agricultural production by the development and use appropriate technology e.g. increased production per unit of land, improving cropping system, livestock improvement etc.

During the Sixth National Economic and Social Development Plan (1987-1991), the national agricultural mechanization policy was included with the general objective of developing the agricultural sector to increase productivity. In accordance with the general objective, the activities involved were expected to achieve the following.

1. Farmers will have machines for their production at low cost.
2. Agricultural machinery must be good quality in terms of price and maintenance cost.
3. Agricultural machinery must be appropriate for use under various conditions in the rural areas.

During the Seventh National Economic and Social Development Plan (1992-1996) mechanization plays an important role in agricultural production. Labour shortage and the necessity to reduce production cost have obviously shown off. However, it was the first time that agricultural machinery was named as one of necessary inputs for the agricultural production system of the country. Two immediate objectives concerning mechanization as follows:

1. Improvement of the productivities of local manufacture:
 - 1.1 Promote and support research and development of agricultural machinery to suit various farming condition.
 - 1.2 Render technical assistance to private manufacture and promote the collaboration between concerning public and private agencies.
 - 1.3 Promote standardization and quality control of agricultural machinery by mean of testing, evaluation and certification services.
2. Strengthening of research and extension of appropriate agricultural machinery to farmer in order to increase agricultural productivity and farmer's income:
 - 2.1 Promote training on selection, operation, maintenance and repair of agricultural machinery to extension officials and farmers.
 - 2.2 Promote long term credit loan to small manufacturers to improve their productivity and farmers in purchasing appropriate machinery.
 - 2.3 Promote agricultural machinery custom hiring services.

2.4 Support farmers and private sector in invention of small appropriate agricultural machinery.

In the Eighth (1997-2001) and the Ninth (2002-2006) National Economic and Social Development Plan, the mechanization policy is not explicitly stated like in the previous two Plans. The general objective of developing the agricultural sector is to improve capacity to compete in agricultural production by promoting the replacement of human labour by agricultural machinery.

The current plan is the Tenth Plan which will be implemented at a time of great economic volatility, rising oil prices, rising inflation, political uncertainty and higher expectation and demands for state services. The Plan will focus on 'human' as center of development efforts. Three main elements are accentuated: sufficiency economic, sustainable development, long-term planning vision spanning the next 20 years to provide 'change management'.

One of the policy statement of the council of Ministers delivered by General Surayud Chulanont, Prime Minister of the Kingdom of Thailand to the National Legislative Assembly on Friday, 3 November 2006 on economic policy as follows:

The Government's economic policy will be based on the philosophy of "Sufficiency Economy." Among other things, this means making use of moral principles to lead economic development under the free market system. This so as to drive the grassroots economy, which can be likened to the taproot of the nation, the market economy and the overall economy so that all sectors contribute to economic expansion in an adequate and sustainable manner. The emphasis will be on the leading role of the private sector and the latter's synergy with the public and civil sectors

The Government policies and strategies relate to agricultural engineering are as follows:

Promote agricultural development based on the "New Theory" as an important alternative for small farmers; at the same time, expand opportunities for product development and improve product quality through the use of technology, management and access to markets;

Local Community Products will be supported so that they are recognized by consumers as quality products in line with their market potential, whether at the regional, national or export levels; this can be accomplished through the establishment of an integrated project management system that will improve technology and management as well as provide market support;

Small and Medium Enterprises (SMEs): make use of the public-private sector alliance to increase the effectiveness of, and thereby strengthen, all SMEs through science and technology and management; in addition, special importance will be given to those SMEs that make use of intellectual property;

Promote energy efficiency, energy saving, the development and use of alternative energy, the survey and development of domestic and international sources of energy- including the joint development areas with neighboring countries- the use of clean energy, and appropriate price structure for energy and restructuring of the management of energy affairs by ensuring that there is a clear division between energy policy-making and regulation, and promoting long-term competition in the energy business as well as research and development of alternative energy.

4) FUTURE PLAN FOR AGRICULTURAL DEVELOPMENT

According to the prediction result, agricultural areas will continuously decrease, which can cause reduction in total productivity unless the yield per area is improved.

Additionally, due to the increase in the numbers of farm household, average farm size is reduced, which will make the amount agricultural production per household decrease in the future. Furthermore, the increasing labour demand in non-agricultural sector will make the total number of agricultural population decrease in future. In order to cope with increased productivity both the land-saving technologies and labour saving technologies should be developed and applied.

Land-saving technologies are referred to technologies that can increase the production per unit area or yield/area. Most of these technologies involve genetic, fertilizer, weed and pest control and water resource management.

Labour-saving technologies are referred to technologies that can increase the production per unit labour or yield/man-hour. Most of these technologies involve any means that can help farmer to work faster, in other word, help the farmer to manage wider area within the same time.

5. GOVERNMENT ORGANIZATIONS

The government organizations involved in Agricultural Engineering, Food Chain Management and Agro-base enterprise development are:

1. Agricultural Engineering Research Institute (AERI), Department of Agriculture, Ministry of Agriculture and Cooperatives is responsible for research and development on agricultural machinery, agricultural process and providing technologies as well as services to government and private agencies involves.

2. Post-harvest and Products Processing Research and Development Office, Department of Agriculture, Ministry of Agriculture and Cooperatives is responsible for conduct research, study and develop technology on post-harvest, processing, extraction of natural substances, and packaging and analysis, test and inspection of agricultural produce and products.

3. The National Bureau of Agricultural Commodity and Food Standards (ACFS), Ministry of Agriculture and Cooperatives was established on October 9, 2002. This is to designate the National Bureau of Agricultural Commodity and Food Standards (ACFS) as a focal organization to control agricultural products, food, and processed agricultural products by certifying and enforcing standards from food producers to consumers, to negotiate with international partners in order to reduce technical barrier to trade (TBT) and to improve and enhance competitiveness of Thai agricultural and food standards.

In June 17, 2003, the government cabinet approved the Ministry of Agricultural and Cooperatives to found Food had resolution to found the Laboratory Center for Food and Agricultural Co., Ltd. ("LCFA") for the purpose of centralized laboratory facilities service and export reference lab service and information support for agricultural & food product exporter. LCFA operates under direct supervision of the Ministry of Agriculture and Cooperatives and signed MOU with Department of Livestock Development, Department of Fisheries and Department of Agriculture to provide lab services, complement and cooperate with competent authorities to issue "Health Certificate" under "One Stop Service" concept . In addition, LCFA also signs an MOU with Central Sciences Lab (UK), a central lab of the UK government for information and staff exchange and project work.

LCFA provides service with world class standard approach to lab test in each specific product requirement to comply with export market destination. In addition, LCFA also provides lab service for monitoring and general lab services according to customers' requirement and for import clearance with Thai FDA. Our seasoned scientists in each various specialized lab; chemistry, biology, and physical product testing lab, coupled with our advanced equipments, can provide timely service with reasonable price to assist customer in various areas.

LCFA established to be a focal point of reference lab information for Thai exporter to search for export requirement and get update on market trend for exporter. LCFA is proud to be one of the mechanisms to support exporter from six branches around Thailand.

4. Office of Agricultural Economics, Ministry of Agriculture and Cooperatives is responsible for collect data of agriculture and agricultural economic. Then, analyze data and report to government and public.

In the year 2005 Bureau of Agricultural Development Policy and Planning, Office of Agricultural Economics (OAE), has set for Agro Economic Zone plan which is set up as "Area Approach". Implementation of the plan has applied to all country, plus more than 6.8 thousand Tombon (sub-districts) level, in each particular area provinces through Thailand. According to the plan of Area Approach will respond to Thai Government Strategy that would be helping to increase ability in agricultural competitive capability. The extension on cultivation will educate to farmers how to choose the suitable plants to accompany with the resources in the area. Aiming for better field crop production, harvesting and activities of management of the farming in each area that would bring about to reduce cost and also increase more income to all farmers. Therefore, the capacity of competition has spread to agriculture sector and industry sector. Besides, the Area Approach plan is classified to 12 important agricultural products to Tombon (sub-districts) level throughout Thailand.

5. Farm Mechanization Sub-Division, Department of Agricultural Extension is undertaking about extension activities.

6. Thai Industrial Standard Institute (TISI), Ministry of Industry is responsible for standardization of agricultural machinery.

7. Thai International Cooperation Program (TICP), Ministry of Foreign Affairs

Since 1963, TICP, formerly DTEC, has been responsible for the technical cooperation which Thailand provides to other developing countries, as well as mutual assistance programs organized among developing countries. Many of these activities are funded entirely by the Thai government. However, some are paid for by foreign governments. At present, Thailand provides technical cooperation to other developing countries under the scheme entitled "The Thai International Cooperation Program" (TICP).

Activities performed under the TICP banner include development projects, missions, awarding of fellowships and other forms of training, and the dispatch of experts and equipment. Projects focus mainly on priority sectors (agriculture, education and public health), which have been identified by Thailand's cooperating partners, and are designed to help Thailand's partners reach their development goals.

8. Bank of Agriculture and Agricultural Cooperatives, Ministry of Finance is responsible for loan extension to agricultural cooperatives and farmer.

9. Universities, Colleges of Agriculture and other technical institutes are undertaking research and development on agricultural machinery.

6. REFERENCES

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