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Agricultural Mechanization in Thailand

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ABSTRACT

Thailand is one of the world suppliers of agricultural produce. Approximately 21 million ha or 40.9% of the total area is used for agricultural production. About 49.8% of the agricultural land is used for growing rice, 21.5% for field crops, 21.2% for fruit or horticultural crops and 7.5% for others. Agriculture is an important sector and the largest source of employment of rural population of the country. About 46.6% of the total population is engaged in this sector. Mechanization plays a vital role in the present Thai agricultural production system. Labor shortage and necessity to reduce production cost have become pressing. This paper presents an overview of agricultural mechanization in Thailand, the status of agricultural machinery industry, the distribution/supply chain of agricultural machinery, agricultural mechanization policies, challenges and constraints of a sustainable agricultural machinery sector and the potential role of the agricultural mechanization associations in Thailand.

I. Overview of agriculture and mechanization status

Thailand is an agricultural country. Approximately 21 million ha or 40.9% of the total area is used for agricultural production. About 49.8% of the agricultural land is used for growing rice, 21.5% for field crops, 21.2% for fruit or horticultural crops and 7.5% for others. Agriculture is an important sector and the largest source of employment of rural population of the country. About 46.6% of the total population is engaged in this sector. Although, the importance of agriculture has declined a bit due to the expansion of other sectors but its contribution was still about 8.4% of total GNP in 2012. Crop production is the most important sub-sector of agriculture. In 2010, it contributed approximately 61.8% of gross agricultural output of Thailand, followed by livestock (15.6%), fisheries (22.4%), forestry (0.02%) and others (0.18%). The five most important crops in terms of cultivated area and value of production in Thailand are rice, maize, sugarcane, cassava and soybean with the area of 10.75, 1.11, 1.14, 1.03 and 0.16 million ha respectively. Rice, maize and sugarcane are important domestic food commodities as well as foreign exchange earners. Thailand has other important crops such as rubber, cassava, oil palm etc.

Traditionally, Thai farmers used simple tools, animal-drawn implements and water wheels. Mechanization with power technology began in 1891 when the government imported

steam power tractor and rotary hoes that were found to be unsuitable for paddy conditions and also quite expensive (Sukharumana, 1982).

In the early 1920s, agricultural machines were imported for trial operation at the Rangsit Rice Station in the Central plain region. During this period, the research and development in agricultural mechanization, however, did not progress much due to lack of well trained local personnel. Also, the onset of World War II disrupted all R&D in the country (Mongkoltanatus, 1993).

In 1947, a single axle tractor with rotary hoes powered by 4.4 kW gasoline engine was imported, but its low chassis was unsuitable for swampy fields (Rijk, 1989). In the early 1950's, the government's Rice Experiment Station promoted the use of 4-wheeled tractors by introducing contracting services. This project was unsuccessful.

In 1955, 262 tractors were imported from various countries but the most popular were the Japanese 2-wheeled tractors or power tillers.

During 1956-1957, the number of imported tractors increased significantly, which stimulated local workshops to simplify the design of imported tractors to reduce cost and also make them suitable for local conditions.

In 1957, the Agricultural Engineering Division (AED) of the Ministry of Agriculture and Co-operative released the design of an axial flow pump, namely "Debaridhi water pump" for local manufacture. This pump was subsequently commercially produced and widely adopted (Mongkoltanatus, 1991; Kaewprakaisaengkul, 1996).

In 1958, the Division released the design of a 4-wheeled tractor powered by a 25 hp engine, named "Iron Buffalo", to two private firms for commercial production (Chakkaphak, 1984). Due to the high cost of this tractor, it could not compete with imported tractors, so the firms stopped producing it. In the same year, the first prototype of a rice combine harvester was designed. The cutting and threshing units were connected to the tractor (25 hp) and driven by a PTO shaft. This prototype was not commercially produced (Mongkoltanatus, 1991; Kaewprakaisaengkul, 1996). In 1960 and 1964, two firms, namely Ford and Massey Ferguson, established assembly lines for four wheeled tractors (Singh, 1983).

In 1964-1965, workshops around the Bangkok area began to modify the design of imported 2-wheeled tractors by trial and error method. Only one workshop succeeded in simplifying the gearbox and other parts of the tractor to suite local paddy field conditions. In 1966, a few firms began producing 2-wheeled tractors. The lower price of these tractors relative to the imported tractors and their suitability to local conditions made them popular, and their adoption spread to all parts of the Central plain. The high demand for these tractors resulted in establishment of many farm machinery firms in this region.

In 1967-1969, a firm producing 2-wheeled tractors in Ayudhaya province began manufacturing a simple 4-wheeled tractor that was developed from a 2-wheeled tractor gearbox by adding two more wheels and a seat. It was powered by a 15 hp single piston diesel engine (Singh, 1983).

In 1975, the AED constructed the prototype for an axial flow rice thresher, which received its blueprint from the International Rice Research Institute (IRRI), then released it to a selected firms in Chachoengsao province for commercial production. Ten units were immediately sold, but it still was not successful as expected. Later in 1975, a new blueprint was released to three firms for commercial production, and subsequently it was widely adopted.

In 1977, a blueprint of a portable rice thresher was sent by IRRI and one firm produced it, but it was not widely used due to its low capacity. In the same year, the Japanese combine harvesters (head feed type) were demonstrated to Thai farmers but the farmers were reluctant to accept them.

In 1978, a rice transplanter (12 rows and power operated) was imported from China by a local firm that also produced it, but they could not be sold in significant numbers. At the same time, the AED tested a Japanese reaper.

During 1981 and 1982, approximately 1,000 units of Chinese reapers were imported and sold. The long stem rice varieties were not suitable for reaping and the farmers had to collect and bind harvested rice similar to manual harvesting and it required more labor. Moreover, heavy weight machines were also a major problem during field operations. These reapers were finally abandoned.

In 1985-1987, local firms around Bangkok started to fabricate a Thai-made rice combine harvester (Kalsirisilkp, 1993). Around the early 1990s, these firms successfully developed Thai-made rice combine harvesters. It was accepted for use by farmers and popularly used in hiring services, especially in the Central plain and then its use spread in other regions of the country (Krishnasreni and Kiattiwat, 1998). Thai combines have a capacity range from 0.42 to 0.9 hectares per hour (Kalsirisilkp, 1993; Krishnasreni and Kiattiwat, 1998). In 1997, there were about 2,000 units used mainly in the Central rice area of Thailand (Chamsing and Singh, 2000). Although, still much design and development was needed to improve its performance, the Thai rice farming industry was satisfied with the combine performance (Krishnasreni and Thongsawatwong, 2004). Currently, they are being used across the country with high competition in hiring systems especially in the Central region. Hiring rate for harvesting rice in the Central region had decreased while in the other regions it is still high.

II. The status of agricultural machinery industry

At present, most of the agricultural equipment used in Thailand is locally produced such as tractors, power tillers, disc ploughs, disk harrows, water pumps, sprayers, threshing machine, reapers, combine harvesters, cleaning equipment, dryers, rice milling machines, and processing equipment etc. However local machines produced from small manufacturers, are not standardized in quality, efficiency and durability. Some agricultural machines are imported from overseas by companies for Thai agricultural productions.

There is 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 appropriate and high efficiency harvesters. 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.

The information in Table 1 was obtained from survey of the top 70 agricultural machinery factories in Thailand in year 2001.

Table1. Major products of local manufacturers in Thailand

Machine	Production in unit per year
Two wheel walking tractors	80,000
Large tillage implements	3,000
Small tillage implement	90,000
Threshing machines	2,000
Combine harvesters	600
Sprayers with hand operated	60,000
Irrigation pumps	55,000

Source: The Agricultural Engineering Research Institute

In 2012, 4-wheel tractors and rice combine harvesters produced in Thailand was estimated about 40,000 and 3,000 units annually.

According to the Department of Industrial Works, it was reported that there were 2,809 industries which produced and repaired agricultural machinery in 2009, as shown in Table 2.

Table 2 Number of agricultural machinery industry

Type of Machines	No. of Industry
Walking tractor	275
Tillage equipment	329
Planter	16
Sprayer	447
Harvesting machine	386
Others	164
Repair and maintenance	1,192

Source: Department of Industrial Works

III. The distribution/supply chain of agricultural machinery

Specifications of agricultural machinery commonly used

At present agricultural machinery is wildly used among Thai farmers. There are many companies that do research themselves and import farm machinery from overseas such as China, Japan, Korea and Europe. Farmers have tendencies to use agricultural mechanization in their works due to lack of farm labor. The list of agricultural machinery in Thailand in the Year 2008 especially for rice production is shown in Table 3.

Table3. Specification of agricultural machinery for rice production in Thailand (Year 2008)

Items	Quantity (Unit)	Price (baht/unit)	Value (Million baht)
Tractor	287,226	302,557	86,902.237
Power Tiller	2,644,982	30,256	80,026.575
Irrigation Pump	1,430,984	4,500	6,439.428
Combine harvester	41,143	1,411,932	58,091.118

Source: Office of Agricultural Economics (2008)

Extension situation, utilization, machinery holding by farmers

Mechanization will play a very important role in the present agricultural production of Thailand. Labor shortage and the necessity to reduce production cost will further drive agricultural mechanization. Undoubtedly, the demand for agricultural machinery will remarkably increase during next ten years. However, need of machines will differ from different regions. Sophisticated control-intensive machines such as harvesters, transplanters, planters and powered sprayers will be highly needed by farmers in more progressive regions such as the central plain and the lower part of the North. At the same time, labor intensive machines such as single axle two-wheel tractors, water pumps and manual operated sprayers will keep expanding in the North and Northeast. Regional distribution of farm machinery is shown in Table 4.

Table 4. Regional distribution of farm machinery in year 2001

Item	Region								Whole Kingdom (Total, Unit)
	Northern		North - eastern		Central Plain		Southern		
	Unit	%	Unit	%	Unit	%	Unit	%	
Power tiller	818,028	47	243,321	14	413,643	23	2,78,376	16	**1,753,368**
4 Wheel tractor	47,471	26	20,032	11	111,278	60	4,923	3	**183,704**
Irrigation pump	566,129	25	355,846	15	1,281,849	55	113,568	5	**2,317,392**
Engine powered sprayer	65,316	15	25,483	6	332,888	77	9,080	2	**432,767**
Hand operated sprayer	4,519,791	37	3,330,606	27	2,794,099	22	1,755,691	14	**12,400,187**
Thresher	**7,002**	**9**	**25,745**	**34**	**4,0497**	**53**	**3,142**	**4**	**76,386**

Source: Office of Agricultural Economics (2001)

At present there are two forms of utilizing agricultural machinery as machine owner and/or machine hiring service. The ratio of machine owner to machine hiring service depends on size, type and price of machine or equipment. Most farmers own the small and inexpensive machine such as two-wheel tractors, water pumps and chemical sprayers etc. For four-wheel tractors and power threshers, only 6.4% and 6% of total machines were possessed by farmers. However, there still are a number of small farmers who have small holding area or in the remote rural area, they are unable not only to possess farm machinery and also can not call for the hiring service because their production is too small.

IV. Agricultural mechanization policies

There is no declared policy on farm mechanization by the government in Thailand. After determining the role which agricultural machinery has played in agricultural development in many other developing countries, and realizing its responsibilities, the government started showing increasing interest. These include formulation of policies; determining priority needs; selection of suitable agricultural machines; research and development; dissemination of information and extension services; provision of credit; coordination of activities; training of farmers, extension agents, and manufactures; assistance for manufacturing and on the farm use of mechanization inputs.

Policy and strategies for agricultural mechanization are not usually explicitly stated in the National Development Plan as they are part of the overall agricultural development policies. In the sixth National Economic Development Plan (1978-1991), the basic national policy for agricultural mechanization development was to increase agricultural production efficiency and to decrease production costs of agricultural commodities in order to be competitive in foreign markets. The general national objectives for agricultural mechanization policies are as follows:

a) Appropriate agricultural machinery available to farmers at a reasonable price;

b) Agricultural machinery and agricultural labor saving machines of reasonably good quality, commensurate with their prices and maintenance cost; and

c) Agricultural machinery suitable for operation under varied local terrains and soil conditions of rural Thailand.

Further to the basic national policy, the government also endorsed a series of policies and strategies dealing with various aspects of agricultural mechanization development, classified as immediate, short and long-term priorities. Research and development, local manufacture, agricultural credit and extension of agricultural machinery are focused in immediate policy. The institution development, operation efficiency development, standardization of product quality and training are focused in short-term policy. In the case of long-term policies, the following policies are focused:

a) Market distribution and pricing of farm machinery and equipment.

b) Prices of farm machinery and equipment.

c) Management of farm utilization.

d) Management of farm machinery utilization.

e) Custom hired service.

f) Machinery maintenance and repair.

g) Land development and irrigation.

h) Long term institutional development.

In the seventh plan (1992-1996), the policy added some specific objectives such as the R&D in agricultural machines considering the physical characteristics of farmers, improved production quality and development of new machines suitable for farm conditions in Thailand.

In the eighth and the ninth plans (1997-2006), the mechanization policy was not explicitly stated as it was in the previous two plans. It was included in the general objective of developing the agricultural sector aimed to improve capacity to compete in agricultural production by promoting the replacement of human labor by agricultural machinery.

In the Tenth Plan (2007 – 2011) The Plan focused on 'human' as center of development efforts. Three main elements were accentuated: sufficiency economic, sustainable development, long-term planning vision spanning the next 20 years to provide 'change management'.

The current plan is the Eleventh Plan (2012 – 2016) Strengthening of the agricultural sector and security of food and energy are stated in the plan. Development guidelines include:

- Reinforce natural resources as the foundation of the agricultural production base. Productive arable lands should be conserved and small farmers should be supported and assured of the right to own farmland. Land should be redistributed equitably, and tax policies should be used to increase the efficiency of land utilization. Further, land management mechanisms should be improved. Natural resources for agricultural production should be restored while good agricultural norms and practices should be promoted so as to support sustainable farming.

- Increase agricultural productivity. Research and development should be emphasized while agricultural production should be modified according to socio geographical conditions. Controls on imported chemical fertilizers and pesticides should be considered and their use on farms should be inspected to assure that they meet standards. Agricultural practices that preserve biodiversity and are suitable for the climate and the environment should be encouraged, while basic services for agricultural production should be improved. Development of science and technology for agriculture is essential, including support for technologies for production whose utilizing is friendly to the environment.

- Increase the value of agricultural commodities along supply chains. Local products and services in agricultural products, food and energy should be supported to create added value. Local educational institutes and the private sector should collaborate on research and development while farmers and firms should apply knowledge, technologies and innovations that are environmentally sound. Food quality and standards for farm products relative to production systems should be upgraded to meet international standards. Present and future markets for agricultural commodities should be strengthened and the private sector, community organizations and agricultural institutes should participate in managing the food and commodity system. In addition, the efficiency of logistic management in the agricultural sector should be improved.

- Create job and income security for farmers. An income insurance system, together with crop insurance, should be developed to cover all farmers. Fairness for farmers and stakeholders in the contract farming system should be encouraged. Farmers should have a better quality of life while the new generations and skilled labor should be induced to make their careers in agriculture. Agricultural institutes and community enterprises should be major mechanisms for supporting self-reliance. At the same time, small farmers adversely affected by free trade agreements should be strengthened in order to maintain their living conditions.

- Enhance food security and develop bio-energy at household and community levels. Communities and their citizens should plant trees in around their homes and in public areas. Farmers should utilize sustainable agriculture following the Philosophy of Sufficiency Economy. Information regarding agriculture and food production should be widely and continuously disseminated. Appropriate consumption behavior at individual and community levels, and creation of production and consumption networks among nearby communities should be promoted. Application of the zero waste approach in agriculture should be encouraged by utilizing farm residues to produce renewable energy at the community level. Infrastructure should be developed to systematically enhance food security for farmers and communities.

- Establish bio-energy security to strengthen the agricultural sector and support national development. Management systems for food and energy crops should be established. Research and development to increase the productivity of bio-energy crop production should be promoted. Bio-energy production and utilization related to the manufacturing and service sectors should increase efficiency. A mechanism to regulate the price structure of bio-energy should be created. Raise public awareness of the benefits of efficient energy use.

- Improve public management to enhance food and energy security. Farmers, local scholars, the private sector and local communities should participate in agricultural development planning. Actions by government agencies at the central and local levels should be streamlined and integrated. Food and energy databases should be developed that span production and marketing through consumption. Amendments to laws and regulations that affect agricultural development should be considered. International cooperation at bilateral and multilateral levels, particularly in the ASEAN community, should be encouraged in order to make food and energy secure.

Development guidelines for managing natural resources and the environment toward sustainability are:

- Conserve and create security for natural resource and environmental bases by safeguarding and restoring forest and conservation areas. A database system to organize information should be developed to serve as a tool for planning and management. Meanwhile, the management system governing land ownership and marine and coastal resources should undergo reform. Integrated water resource management should be urgently pursued. In addition, efforts should be made to restore and improve water resources to increase the water supply. It is essential to promote more efficient use of water. This requires a master plan of water infrastructure to systematically manage water consumption. Encouragement should be given to conservation and to sustainable utilization of biodiversity.

- Shift the development paradigm and redirect the country to a low carbon and environmentally friendly economy. The country's production and consumption behavior should be restructured to prepare for a transition toward a low carbon and environmentally healthy economy. To this end, energy efficiency in the transportation and logistic sectors should be enhanced in order to reduce greenhouse gas emissions. Eco-cities should be developed that emphasize urban planning and integration of cultural, social and ecological factors.

- Upgrade the ability to adapt to climate change. This should be achieved by enhancing knowledge and management tools to handle and respond to challenges from climate change. Community capacity and preparedness to cope with climate changes should be improved.

- Ensure preparedness to respond to natural disasters. Maps and priority lists of risk areas should be prepared at the national, regional and provincial levels. Disaster management efficiency should be improved while database systems and telecommunication networks should be developed. Support is also needed to provide for the development of science and technology in disaster management. The national volunteer work system should be improved to meet international standards. Moreover, the private sector, enterprises, schools and local authorities should be well prepared with action plans for disaster response.

- Foster resilience toward trade measures associated with environmental conditions and climate change impacts. Efforts should be made for surveillance and monitoring measures that are related to environmental conservation and that may have effects on international trade and investment. Planning should be introduced to deal with the anticipated effects from trade measures and international agreements on environment and climate change. It is essential to conduct research on the effects of these threats and develop strategic plans together with alleviating measures for relevant products and businesses. Firms should consider the carbon footprint for export goods, together with provisions for incentives for new industries that will create an environment for sustainable development.

- Enhance the role of the country in international arenas as it relates to environmental framework agreements and international commitments. There is a need to study these agreements in detail to ensure that they are thoroughly understood and to monitor the status of negotiations and the positions of other countries. It is also important that government officials be equipped with negotiation skills and techniques. Moreover, cooperation within ASEAN and with major trading partners should be enhanced. The implementation of international agreements and commitments on natural resources and environment should be supported.

- Control and reduce pollution. It is necessary to reduce air pollutants. The efficiency of solid waste disposal and community waste water treatment should be improved. In addition, a management system for hazardous, electronic and infected wastes should be established. Development of warning systems and responses for toxic accidents are needed.

- Enhance the natural resource and environmental management system to be more efficient, transparent and equitable. Support should be given to empower communities and to advocate their rights to gain access to and utilize natural resources. Amendments to legislation are needed to address inequality among communities regarding access to and utilization of natural resources. Changes in government investment policies to facilitate conservation and restoration are also needed. An environmental tax should be collected to provide incentives for efficient use of natural resources and pollution reduction. Ways and means to generate revenue from biodiversity should be explored. Databases, monitoring and evaluation systems should be developed. Research should be supported to establish an efficient management system for natural resources and the environment.

Provision of agriculture credit

As in most developing countries, it used to be difficult and expensive for Thai farmers to access credit. Market failures demanded both public investments and institutional development. From 1975, the Bank of Thailand instructed all banks to allocate a growing share (up to 14% in the 1980s) of all commercial loans to agriculture, at an interest rate lower than the market rate. Penalties on banks that could not meet targets contributed towards funding the Bank for Agriculture and Agricultural Cooperatives (BAAC), whose development was supported also by public and international funding. BAAC has subsequently expanded provision of agricultural credit, reaching 90% of farm households and all farm cooperatives, using a group liability guarantee that enables small farmers to access short-term credit without land titles as collateral. The BAAC is now almost entirely self-financed, achieved by attracting savings accounts, thanks to a wide network, competitive rates and a positive image.

The Thailand Board of Investment (BOI) plays a major role in development of the country's machinery industry. By offering tax breaks and other incentives, the BOI helps to attract new projects from domestic and foreign manufacturers, bolstering local capability and enriching Thailand as a production hub. Expanding the machinery arena also improves other manufacturing sectors of the country by giving them better machines for moving up market. Moreover, such growth contributes to the technical skills enhancement of Thai workers in machinery and metalworking.

V. Challenges and constraints of a sustainable agricultural machinery sector:

- Lack of appropriate technology at farm level;

- Small land holding, labor shortage and lack of financial support;

- Lack of collaboration among government institutions in support schemes;

- Rainfall during harvesting;

- Lack of appropriate technology of rice combine harvesters and drying and storage machinery;

- Small plot size for crop production especially for rice production in the North and the Northeast, which decreases field capacity of agricultural machinery and increases energy consumption per unit area especially for big machinery;

- Average family members active in farm for all crop production across regions in Thailand are small (2.0-2.6 persons/family or only about 45% of total family members), resulting in labor shortage for farms as some family members are old or women. Therefore, custom service is observed for many or all farm activities.

- Problems pertaining to land holding: size of planted area, land holding status and high rental rate of land;

- Size of planted areas for irrigated rice, rain-fed rice, cassava and soybean (both wet and dry season soybean) production in the North and the Northeast was smaller compared to that in the Central Thailand. Irrigation availability and socio-economic status of the region influence farm income, potential to improve crop production efficiency, chance to successfully access loaned money and holding of machinery;

- Farm operations of crop production in some regions are competitive for custom service of machinery, resulting in high hiring wage rate and low quality of work;

- Under-utilization of some agricultural machinery: Problems of unnecessary ownership of machinery and finance for machinery acquisition are observed. Some farmers own unnecessary machines which do not match with their farm work requirement or they do not offer custom service work. Therefore, low utilization rate of machines has resulted in high fixed cost of machine and consequently increased cost of production. These problems are faced especially in rain-fed rice production in all regions, and sugarcane production in the Northeast;

- Some parts of agricultural machinery are imported. Imported parts are similar to that of other machinery or vehicles. Therefore, import tax is charged at the same rate which is high for agricultural machinery. This results in high price of some agricultural machinery;

- Production technology for agricultural machinery of Thailand is still under development;

- Machinery for some farm operations and crops are still missing;

- Government support for the development and the promotion of farm mechanization are still inadequate, and fail to meet the requirements of users and producers;
- Irrigated area is limited and not equally spread throughout the country;

- Irrigation system is still in development phase that restricts growing more crops per season. Inadequate water supply in dry season and lack of drainage system especially for irrigated rice production;

- Landless farmers and small holding farmers cannot reach low interest loan from financial institutes. They still have to seek loan from other sources with high interest rate.

VI. Potential roles of the agricultural mechanization associations

Agricultural mechanization associations/institutions in Thailand

The THAI MACHINERY ASSOCIATION or TMA was established on November 13, 2001 by operators in the machinery industry who reckoned that Thais should have an opportunity to take part in the development of the country's manufacturing sector, which uses machinery as its principal means of production. They also wanted to promote Thai-made machines as tools that can drive economic development, with the objective of putting more of the business in the hands of Thais.

However, there are still many obstacles to reaching that goal, especially a lack of acceptance by the manufacturing sector, support from the public sector and involved agencies, and understanding and cooperation among machinery makers themselves. These are all the heavy barriers that the Thai Machinery Association must break down as it moves forward into the future. Nevertheless, with existing total 250 members, there is one thing which convinces the association that all these problems will be solved: that is the trend of increasing cooperation and unity among related parties.

Objectives of TMA:

1. To be a center for buyers and sellers and a business coordinator for exchanging expert knowledge and disseminating machinery information.
2. To promote and develop export knowledge and working skills for SME lathing plants.

3. To support and develop instructional and training programs for the machinery industry.

4. To research and develop new technology for developing higher capacity of the machines.

5. To coordinate with the membership of associations of clubs concerned with machinery and metal technology.

Activities for members:

1. To hold machinery training, seminars, and workshops for members and the public.

2. To arrange and distribute a machinery enterprise directory.

3. To collect information on machinery technology and news and to provide consulting services for members.

4. To contact and ask for help from research institutes and the public sector in order to develop machinery technology for members.

5. To coordinate with members who need equipment and tools for assembling all types of machines.

6. To participate in machinery technology exhibitions.

7. To publish the association's journal and distribute it to members, stakeholders in the public and private sectors and the general public.

8. To hold a meeting for members to exchange opinions and experience and to help develop the association so it can reach its objectives.

9. To hold overseas seminars.

10. To coordinate with agencies and institutions such as the Thai-German Institute, Federation of Thai Industries, NSTDA, Ministry of Science and Technology of Thailand, Department of Industrial Promotion, Ministry of Industry, Thai Subcontracting Promotion Association, in addition to financial institutions for SMEs, and banks.

Agricultural Machinery Manufactures Industry Club is under the Federation of Thai Industries and was established in 1980. It was formed with a view to supporting members' efficient conduct of their businesses through their alliances. Today, the total membership is 60 consisting of 51 ordinary members, 7 associate juristic members and 2 individuals. The objectives are to serve as the centre for all members and to act as the representative in the co-ordination of policies and forming the linkage with the government sector with a view to promoting and supporting the Thai manufacturers' products in its expansion of market territory both domestically and aboard.

Thai Society of Agricultural Engineer (TSAE) was established on February 19, 1976 by a group of engineers, consisting of academics, engineers, scientists, industrialist and others interested in the field of agricultural engineering. It sees it as essential to have a central knowledge of those in the field of Agricultural Engineers in Thailand. TSAE's objectives include:

1. To promote the study and dissemination of science in agricultural engineering and bioengineering.

2. To promote fellowship, honor and welfare of its members.

3. To promote the charity, sports and entertainment.

4. To promote the dignity of the profession in Agricultural Engineering.

5. To coordinate among the various institutions both internal and international.

Even though the trade balance is lopsided in the direction of imports, Thailand's exports of machinery are indeed growing. Sales are particularly strong regionally to member states of the Association of Southeast Asian Nations (ASEAN). Thailand's overall machinery exports have soared by 90% since 2004, and this is largely due to the economic, agricultural, industrial, and infrastructure development taking place in neighboring ASEAN countries. Exports to customers in the region are led by tractors and equipment for cleaning, sorting and grading seed and grain. ASEAN currently absorbs almost 30% of Thailand's machinery and parts exports. In coming years, the region will become an even more substantial market for Thai suppliers with trade barriers crumbling under the ASEAN Free Trade Agreement (AFTA) and the planned creation by 2015 of a massive single market called the ASEAN Economic Community (AEC). Contributing to the local industry's expansion, more world-class machinery manufacturers are setting up production facilities in Thailand due to its many advantages for profitable business. Role of manufacturers of agricultural mechanization equipment is to establish the mechanization supply chains and dealer franchise networks across the region through the coordination of chambers of commerce and business associations.

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Towards a more resilient, inclusive and sustainable Asia and the Pacific

CSAM, Centre for Sustainable Agricultural Mechanization, is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), based in Beijing, China. CSAM started operations in 2004, built on the achievements of the Regional Network for Agricultural Machinery (RNAM) established in 1977 with support of UNDP, FAO and UNIDO, and the United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (UNAPCAEM). CSAM serves the 62 members and associate members of UNESCAP.

The vision of CSAM is to achieve production gains, improved rural livelihood and poverty alleviation through sustainable agricultural mechanization for a more resilient, inclusive and sustainable Asia and the Pacific.

CSAM's objectives are to enhance technical cooperation among the members and associate members of UNESCAP as well as other interested member States of the United Nations, through extensive exchange of information and sharing of knowledge, and promotion of research and development and agro-business development in the area of sustainable agricultural mechanization and technology transfer for the attainment of the internationally agreed development goals including the Millennium Development Goals in the Asia-Pacific region.

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific
CSAM

United Nations
Centre for Sustainable Agricultural Mechanization

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