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INDIGENOUS MANUFACTURE OF FARM MACHINERY IN THAILAND

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A LOOK AT SOME ASPECTS OF

THE FARM MACHINERY INDUSTRY

by

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1. Introduction

As Thailand entered the 1980s under the Fifth National Economic and Social Development Plan, there has been a lot of excitement among policy makers that by the end of the plan period in 1986 the country would emerge as a semi-industrialized economy with gross domestic product from manufacturing being as great as that from agriculture. The past few years therefore saw a great deal of interest shown towards industrial development. Although most of the attention and publicity were on large scale industrial projects mainly concentrated in the Eastern Seaboard area, there has also been increasing attention paid to some smaller scale industries. One of these happened to be the farm machinery industry.

The interest in the farm machinery industry is witnessed by the increasing number of research and literature in this area. Both the Bank of Thailand and the National Economic and Social Development Board have undertaken separate studies on the industry. Furthermore, international organizations such as the International Labour Organization (ILO), the World Bank (IBRD), the International Rice Research Institute and the ^{local} academic community have also been actively involved in studying the industry.

One major reason for the interest shown towards this industry no doubt lies in its relationship to the agricultural sector which is usually the most important sector in LDCs and Thailand is no exception. Another reason is that the development of such a basic home grown industry could help to provide an impetus for further developments.

of more sophisticated local industries through the use of appropriate indigenous technology.

This paper attempts to outline some of the main features and development of the farm machinery industry.^{1/} It also hopes to look into the prospects of the industry and the potential impact on the agricultural sector and the industry of governmental policy related to this industry. Since this paper was written on short notice, no attempt will be made to go into details. Readers who may feel inadequate from reading this paper are referred to previous work listed in the reference.

2. The Role of the Local Industry in Promoting Farm Machinery Utilization

Farm machinery has had a long history in Thailand. It dates as far back as the late nineteenth century.^{2/} However, it was not until after the Second World War that farm machinery became better known to Thai farmers. The widespread acceptance of farm machinery started to take place rapidly in the sixties and seventies. Among ASEAN countries, Thailand is now known for being the country which utilize more farm machinery than the other countries.

^{1/} The main focus of the paper is on two wheel and four-wheel power tillers.

^{2/} David Feeny, "Technical and Institutional Change in Thai Agriculture, 1880-1940," unpublished Ph.D. dissertation, University of Wisconsin (Madison:1976), p.115.

Nevertheless, the acceptance of farm machinery did not take place overnight. There were many factors which gradually worked to influence the use of farm machinery. Some of the major factors include:^{3/}

- (a) The introduction of irrigation systems and double cropping
- (b) The introduction of high yielding varieties (HYV) of seeds
- (c) The net economic benefit from machinery use
- (d) The increase in the buying power of farmers.
- (e) The market for contractor service in farm machinery
- (f) The natural environment
- (g) The demonstration effect and the learning process
- (h) Other non-economic factors

In addition to the above factors, the local farm machinery industry has also been cited as a major factor contributing to the acceptance and utilization of farm machinery.^{4/} Local producers of farm machinery were able to modify their machinery to suit local tastes. Machines were designed to be less complicated than the imported ones. The simple design does not require a high level of domestic technical

^{3/}
Chesada Loohawenchit and Renu Pathnopas, "Evolution and Role of Farm Machinery in Thailand," Thammasat University Journal, September 1981.
(in Thai)

^{4/}
Chesada Loohawenchit, "The Farm Machinery Industry: A Case Study of a Small Home-Grown Industry in Thailand" a research paper prepared for the Seminar on ASEAN Comparative Study of the Development of Labor Intensive Industry, 28-31 October 1980, Pattaya, Thailand.

know-how and, in addition, the reduction of unnecessary costs makes it more affordable to farmers both in terms of purchasing and maintaining. The uncomplicated structure of the machinery also makes it easier to handle and service. In fact, for some types of repair job, farmers are able to do it themselves. Since engines are not installed on the power tillers, customers have the choice of choosing their engines. The design also makes it easier for farmers to use the engines of their power ^{tillers} for other purposes such as pumping water.

It seems that most successful firms in the industry relied on the availability of and nearness to potential markets. This was necessary not only because of the advantages to the selling effort but also because it made interaction with farmers possible and facilitated the introduction of modifications and improvements to the product to suit the local environment and taste of farmers. These firms generally started from a small local base. Only after having acquired a reputation locally did they turn to other markets. When they did they operated through dealerships.

3. Local Production Capacity

Initially, all of the early farm machinery in Thailand were imported. But in the 1950s, the government through the Division of Agricultural Engineering began to experiment and produce prototypes of local machinery. The first documented machine to be built locally was the Tebariddhi water pump. This was followed by the Iron Buffalo (a locally built power tiller) and a small four-wheel tractor.

However, production of farm machinery on a commercial scale did not take place until the mid-1960s. Since then, local production capacity has expanded rapidly as shown by figures in Table 1. In the late 1970s and early 1980s the growth of production capacity may have levelled off with very few new firms coming into existence. Given the fact that factories have generally been found to be underutilized in most recent studies even in good years, that imported products are again competing aggressively in the last couple of years, and that a number of firms have gone out of business, the present production capacity is probably not ^{/much} different from the 1978 estimate made by the Bank of Thailand.

From Table 2, it can be seen that the total production capacity of the industry in 1978 was approximately 67,000 units with 57,000 units of two wheel power tillers, 7,000 units of four wheel power tillers and 3,000 units of tractors. Actual production of the three machinery were 39,568 , 3,808 and 2,158 units, respectively. This shows that production capacity had not been utilized fully in the industry.^{5/}

Of the 64,000 units of output, about 18.8 percent were from firms of small sizes while 25.0 per cent were from medium size firms.

^{5/} The production capacity as estimated by the Industrial Service Division is larger. It was 87,000 units for two wheel tillers and 7,300 units for four wheel tillers in 1979.

More than half of all production units were from large firms.

In terms of production value, the industry generated about 780 million baht for tractors, four wheel powers tillers and two wheel power tillers. The major share of 64.1 per cent came from tractor production with the remaining 26.9 and 9 per cent coming from the two and four wheel power tiller production, respectively. A crude estimate made by the BOT study found that the three products generated about 135.8 million baht of value added.

4. Factor Intensity and Factor Productivity

Statistics obtained from a study in 1980 revealed that the amount of fixed assets per worker was approximately 90,300 baht.^{6/} This was lower than the fixed assets per worker of the machinery industry as a whole of 114,700 baht as found by another study in 1978.^{7/} Given that total price inflation between 1978-1980 was about 36% it seems that the farm machinery industry was probably less capital intensive than the other machinery industries. Furthermore, utilizing

^{6/} Loohawenchit, op.cit.

^{7/} Somsak Tambunlertchai, "Emploment Effects of Small-and Medium-Scale Industries in Thailand, Faculty of Economics Research Report Number 9, Thammasat University, November 1978.

the fixed asset to labor ratio for the manufacturing sector as a whole of 112,500 baht from the same study, it seems the farm machinery industry was also more labor intensive in general.

When classified according to three different groups based on firm size, the average capital-labour ratio were found to be 69.7 , 71.3 and 109.3 thousand baht for small, medium and large size firms, respectively. (see Table 3) This confirms that larger firms tend to be more capital intensive. However, within each of the three different size groups, large differences of the capital-labour ratio were also found. This seems to indicate there is a wide range of substitution possibilities between labour and capital in the industry.

The higher capital-labour ratio in the larger size firms translated into a higher labour productivity in the larger firms. The value added per worker for small, medium and large firms were 24.9 , 65.6 and 104.6 thousand baht. respectively. However , the figures show that the increase in labour productivity was much larger (163%) than the increase in the capital-labour ratio (2%) as one moves from the small size firm group to the medium size firm group. Although this could be because of the inclusion of nonproduction capital such as land and buildings used for residential purposes into the measure of capital thus making the difference in fixed asset per worker between the two groups insignificant, the very large increase in labour productivity makes it seems likely that medium size firms are more efficient than the small ones.

As for large size firms, the higher labour productivity as compared to medium size firms seemed to be more or less in line with the higher capital intensity.

5. Source of Technology and Design

Almost all factories obtained their machine design through copying and modifying from machines that were available in the market.^{8/} The domestic design which was found to have the most profound and widespread influence on local producers appeared to be the Prapadaeng model.^{9/} For foreign design, Japanese models were most widely mentioned. Although almost all producers copied their designs from others, they also introduced modifications to suit local terrain and farmer's tastes. The present design and technology of power tillers seem to have stabilized with no more significant changes taking place. Existing factories are reluctant to change their design and technology since they feel their products are now generally accepted by farmers. In addition, the cost of innovation may be high especially when the market in the past few

^{8/} Pathom Taenkam, The Small Tractor Industry, an M.A. Thesis, Faculty of Economic, Thammasat University. June 1980.

^{9/} For a discussion of various domestic models, see Pathom Taenkam, The Small Tractor Industry, an M.A. thesis. Faculty of Economics, Thammasat University, June 1980 and the Bank of Thailand, "The Power Tiller Industry" an unpublished report, 1978.

years has been adversely affected by bad weather.

Quite a number of factories obtained their designs and production technology when they started their operations directly from those factories already in operation. Some obtained their know-how through the pirating of skilled and able workers from existing factories. Others obtained theirs from their own experience or from relatives and workers who used to work in factories producing farm machinery or related products.

For institutional sources of design and technological knowledge, most of the factories relied on the Agricultural Engineering Division (AEG), the local office of the International Rice Research Institute (IRRI) and the Industrial Service Division (ISD). So far, the assistance received has been mainly in the form of information. Factories in general did not feel they have obtained much help in the area of power tillers, but for newer products such as rice threshers and transplanters, factories which have heard of these machinery attribute them to the AEG and the IRRI. A number has, in fact, been quite enthusiastic about obtaining such information from the AEG and the IRRI and would like to be getting more help in this area.

6. Public Policy Towards the Farm Machinery Industry

Prior to 1982, there was not much attention paid by the government to the farm machinery industry. Except for the large

tractor firms no promotional privileges or financial help was provided to firms in the industry by the government. For power tiller producers not only was assistance not provided to any degree, but a number of firms, in fact, felt that the government had not treated them fairly in terms of taxes and tariffs.

Imports were subjected to a duty of 5 per cent of the import (C.I.F.) price; a business tax of 3 per cent of the retail price; a standard profit tax of 11 per cent of the retail price; and a local tax of 10 per cent of the business tax. Domestic products were also subjected to such taxes except the import duty although this exception is more than made up for by the duty on their imported inputs. An imported engine has an import duty of 15 per cent which is three times higher than the import duty on an imported power tiller. Ball bearing and iron chains which are also important inputs entail a duty of 15 and 30 per cent, respectively.

In 1982, due to the increasing pressure from imported machinery, producers of power tillers lobbied intensively for increased protection through the Association for Thai Industries. The government in response raised the tariff rates for imported machinery and imported engines to 33% of the C.I.F. value in both cases. In addition to raising and equalizing the tariff rates for both farm machinery and engines, the Ministry of Commerce (MOC) was also given the power to control the number of imported machines

through licensing. The quotas established by the MOC amounted to 5,337 units for two-wheel power tillers and 705 units for four-wheel power tillers. As can be seen by figures in Table 4, this was quite a drastic action since the import of power tillers and tractors amounted to as much as 15,480 units in 1981 which is almost three times the combined quota level.

The examples in Tables 5-6 presents the amount of taxes paid for an imported machine and a locally produced machine both before and after the tariff adjustment. The calculation was based on the assumption that the cost of locally produced machine was the same as the C.I.F. price of an imported machine \$0 as to make comparisons possible. Marketing margins were also excluded since it is probably similar for both imported and locally produced machinery and its inclusion is not expected to change the conclusion of this study.

The results confirm that local producers pay a larger amount of taxes prior to the tariff adjustment in 1982. The amount paid was 24.14% of the cost of production as compared to 20.32% of the C.I.F. price for imported machinery. However, after the tariff adjustment in 1982, imported machines were made to pay total taxes of about 52.4% of the C.I.F. price as compared to 35.6% of the cost of production for locally produced machines.

In short, the farm machinery industry was not protected prior to 1982. Since then, the government has changed its policy by providing

both tariff and non-tariff barriers against foreign competition. The amount of protection is in fact much greater than the difference in the tax rates on imported and locally produced machines. This can be observed by the low level of import quotas set by the MOC.

Although the import tariff adjustment and the import quotas in 1982 would no doubt help protect local producers from foreign competition, it is doubtful that such a policy would benefit the economy and industry in the longer term. The rapid growth of the farm machinery industry in the past has brought with it many inefficient factories, and it may have reached the stage that these firms should be weeded out. The protectionism provided by the government would make such an adjustment all the more slower. Local producers would be less inclined to innovate and cut their cost of production to compete with foreign imports.

In the end, farmers will end up paying much higher prices for their machines. This would not only hinder agricultural development but would work to limit the market for farm machines, since it may not be as worthwhile to utilize machinery in agriculture. However, the most distasteful aspect of the policy is that once again we see the government protecting an industry at the expense of farmers who are the poorer majority of the country. Farmers are made to pay for the inefficiency of local firms.

7. Summary, Conclusions And Recommendations

The farm machinery industry started in the latter half of the 1960s and grew quite rapidly in the 1970s. The prospects of the industry in the eighties, however, do not seem to be as bright especially for the two and four wheel power tillers since the diffusion of farm machinery has been so rapid in the past that the market limit may be reached in a few years. (see Table 7) This is not to say that most farmers in Thailand either own or utilize a power tiller or a tractor. It is still true that the majority of farmers do not own or utilize these machines. But due to the lack of farmers' buying power, the inability to double crop, low productivity, inadequate transport routes, lack of markets, and other constraints, the expansion of the machinery market to the under-developed agricultural areas would be a difficult task.

Most of the problems in the agricultural sector could be solved if more and better irrigation facilities were established. As it is, the adoption and acceptance of new agricultural inputs including machinery are confined mainly to well irrigated ^{areas.} It therefore seems likely that in the long-run the growth rate of the industry would depend to a large extent on the pace of agricultural development.

One possible way for the industry to sustain its growth in the eighties is for factories to shift their production to newer and more promising machines such as rice threshers, transplanters, etc. This would open up a whole new market area for the manufacturers. To do

this, the industry needs help in the form of information on new machines. This is where the government can be most effective. The provision of machine blueprints or models and other technical information would help local producers in initiating the production of machinery. Once this is done, the adaptation and modification of the machinery to local conditions and tastes of customers can be left to these firms. The government can then proceed to provide more sophisticated technical advice on more difficult problems.

After a decade of high growth, the farm machinery industry should be slowly reaching the stage of maturity. Technological factors which are usually more important during the initial stages of developing a product for the market must now give way to the emphasis on marketing strategy and production efficiency. The large influx of imported machinery from the People's Republic of China shows very clearly that there has not been much significant changes in local innovation in recent years which would help make local producers maintain one step ahead of foreign competition. Imported farm machinery, after experiencing setbacks from domestic competition in the late 1970s, have fought back and seems to have caught up with the local producers by providing cheap and better suited machines than in the past.

Instead of letting the local farm machinery industry readjust itself to be more efficient and innovative for the task of competing against these imports, the government instead has chosen to protect

the local producers. It should be pointed out that the strong performance of local producers in the past no doubt came about through indigenous innovation in the face of strong foreign competition.

However, they were more than able to compete with these foreign ^{/imports} despite negative protection. There is no reason why the industry cannot again gear itself to compete with imports. The government policy of protecting local producers would only take away the pressure and incentive of producers to try to innovate and compete. This could gradually bring about a decay of the local industry.

Furthermore, it should also be said that even without foreign competition, many of the less efficient industries would go out of business anyway. The industry has reached a stage that the smaller and less efficient firms would have to be weeded out. The stronger and larger firms would take over a bigger share of the market. This may lead to greater economics of scale in production and marketing and better quality control.

Under a protected local industry, the diffusion and use of farm machinery may be somewhat constrained. The price of machines may be higher due to less pressure to cut production costs. Furthermore, new innovations may take place at a much slower pace. Despite the so far short experience of the tariff adjustments and import quotas since 1982, it should now be about time to review such governmental policy. It is also about time for someone to stand up for the farmers.

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TABLE 1
YEAR OPERATION STARTED

(no. of respondents)

Year	Loohawenchit (1980)	1981 Survey
Prior to 1966	1	10
1966-1970	8	11
1971-1975	21	20
1976-1979	5	18
1980-1981	n.a	3
Total	35	62

SOURCE: (1) Chesada Loohawenchit, "The Farm Machinery Industry: A Case Study of a Small Home Grown Industry in Thailand", a research paper presented at the Seminar on "Asean Comparative Study of the Development of Labour Intensive Industry" organized by ARTEP, ILO, 28-31 October 1980, Pattaya, Thailand.

(2) A survey conducted in 1981 by Renu Pathnopus

TABLE 2
CAPACITY UTILIZATION AND PRODUCTION VALUE
1978

	Type of Product			Total
	2 w. tiller.	4 w. tiller	Tractor	
Production capacity (units/year)	57,000	7,000	3,000	67,000
Production (units)	39,568	3,808	2,158	45,534
Capacity utilization (percent)	69.4	54.4	71.9	-
Value of production (million B)	210 (26.9)	70 (9.0)	500 (64.1)	780 (100)
Average domestic price (baht/unit)	5,307	18,382	231,696	-

Figures in parentheses are percentages.

Source: Bank of Thailand.

TABLE 3
CAPITAL, LABOR, OUTPUT AND VALUE ADDED

Item	Small	Medium	Large	Total
Number of firms	8	14	4	26
Fixed assets (million ₪)	2.72	22.95	40.00	65.67
Employees (persons)	39	322	366	727
Output value (millions ₪)	1.96	59.85	99.05	161.54
Value added (million ₪)	0.97	21.12	38.30	62.41
Output value/worker (thousand ₪)	50.3	186.9	270.6	222.2
Output value/fixed assets (thousand ₪)	0.72	2.61	2.48	2.50
Fixed assets/worker (thousand ₪)	69.7	71.3	109.3	90.3
Value added/worker (thousand ₪)	24.9	65.6	104.6	85.8
Value added/fixed assets	0.36	0.92	0.96	0.95

TABLE 4
 PRODUCTION AND IMPORT OF POWER
 TILLERS AND TRACTORS

Year	Local production				Import	
	2 wheel (1) (unit)	4 wheel (2) (unit)	tractor (3) (unit)	Total (4) = (1)+(2) (unit)	Total (5) (unit)	Market Share (6) = (5)/(4)x100 (%)
1970	-	-	-	-	688	-
1971	-	-	-	-	1,367	-
1972	-	-	-	-	109	-
1973	-	-	-	-	274	-
1974	24,808	2,324	-	27,132	1,112	4.1
1975	27,860	2,582	2,426	30,442	4,231	13.9
1976	31,766	2,914	2,332	34,680	5,257	15.2
1977	35,465	3,258	2,380	38,723	6,167	15.9
1978	39,568	3,808	2,158	43,376	4,298	9.9
1979	38,756	4,142	-	42,898	3,348	7.8
1980	50,075	6,853	-	56,928	3,892	6.8
1981	60,000	7,000	-	67,000	15,840	23.6
1982	-	-	-	-	3,820*	-

* Jan-Feb, only

SOURCE: Bank of Thailand and Department of Customs

TABLE 5

A HYPOTHETICAL EXAMPLE COMPARING TAXES PAID
ON AN IMPORTED MACHINE AND A LOCALLY PRODUCED
MACHINE BEFORE THE IMPORT TARIFF ADJUSTMENT IN 1982

1. Imported machine	unit:baht
(1) C.I.F. price	18,000
(2) Import tariff @ 5% of (1)	900
(3) Standard profit tax @ 11% of (1)+(2)	2,079
(4) Business tax (net)	
(a) 3% of (1)+(2)+(3)	629.37
(b) a reduction of 2% of (a)	-12.59
	616.78
(5) Local tax @ 10% of (4)	61.68
(6) Total taxes paid	3,657.15
(7) C.I.F. price + total taxes	21,657.15
(8) Overall tax rate $\frac{(6)}{(1)} \times 100$	20.52%
2. Locally produced machine	
(1) Cost of production (net of import on engine)	18,000
(2) Import tariff on engine	
@ 15% of 10,000 baht/engine	1,500
(3) Standard profit tax @ 11% of (1)+(2)	2,145
(4) Business tax (net)	
(a) 3% of (1)+(2)+(3)	649.35
(b) a reduction of 2% of (a)	-12.99
	636.36
(5) Local tax @ 10% of (4)	63.64
(6) Total taxes paid	4,345
(7) Cost of production + total taxes	22,345
(8) Overall tax rate $\frac{(6)}{(1)} \times 100$	24.14%

TABLE 6
 A HYPOTHETICAL EXAMPLE COMPARING TAXES PAID
 ON AN IMPORTED MACHINE AND A LOCALLY PRODUCED
 MACHINE AFTER THE IMPORT TARIFF ADJUSTMENT IN 1982

		unit:baht
1. Imported machine		
(1) C.I.F. price		18,000
(2) Import tariff @ 33% of (1)	5,940	
(3) Standard profit tax @ 11% of (1)+(2)	2,633.40	
(4) Business tax (net)		
(a) 3% of (1)+(2)+(3)	797.20	781.26
(b) a reduction of 2% of (a)	-15.94	
(5) Local tax @ 10% of (4)		78.13
(6) Total taxes paid		9,432.79
(7) C.I.F. price + total taxes		27,432.79
(8) Overall tax rate $\frac{(6)}{(1)} \times 100$		52.40%
2. Locally produced machine		
(1) Cost of production (net of import tariff on engine)		18,000
(2) Import tariff on engine		
@ 33% of 10,000 baht/engine	3,300	
(3) Standard profit tax @ 11% of (1)+(2)	2,343	
(4) Business tax (net)		
(a) 3% of (1)+(2)+(3)	709.29	695.10
(b) a reduction of 2% of (a)	-14.19	
(5) Local tax @ 10% of (4)		69.51
(6) Total taxes paid		6,407.61
(7) Cost of production + total taxes		24,407.61
(8) Overall tax rate $\frac{(6)}{(1)} \times 100$		35.60%

TABLE 7
STOCK AND INCREASE OF FARM
MACHINES IN THAILAND, 1975/76 - 1981/1982

(unit)

Type of machine	Crop Year						
	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82
<u>1. Tractor (> 45 hp)</u>							
-stock in use	13,338	17,569	22,826	28,987	33,285	37,177	50,044
-net increase	-	4,231	5,257	6,161	4,298	3,892	12,867
<u>2. Tractor (< 45 hp)</u>							
-stock in use	14,575	16,427	23,942	26,984	31,158	36,158	39,158
-net increase	-	1,852	7,515	3,042	4,174	5,000	3,000
<u>3. Two-wheel tractor</u>							
-stock in use	90,001	113,286	151,504	192,004	230,591	280,591	284,351
-net increase	-	23,285	38,218	40,500	38,687	50,000	3,760
<u>4. Water pump</u>							
-stock in use	251,288	277,084	317,328	359,308	473,975	517,975	603,548
-net increase	-	25,796	40,244	41,980	114,667	44,000	85,573
<u>5. Water wheel</u>							
-stock in use	56,891	68,219	81,923	87,775	107,730	125,811	146,927
-net increase	-	11,328	13,704	7,852	17,955	18,081	21,116
<u>6. Rice thresher</u>							
-stock in use	3,955	4,430	4,962	5,557	6,224	18,934	20,601
-net increase	-	475	532	595	667	12,170	2,207
<u>7. Winnowing</u>							
-stock in use	42,342	47,423	53,114	59,488	66,806	74,782	83,801
-net increase	-	5,081	5,691	6,374	7,318	7,976	9,019

SOURCE : Division of Agricultural Economic Research, Office of Agricultural Statistics. Ministry of Agriculture and Cooperatives.