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COUNTRY STUDY REPORT

on the

STATUS OF AGRICULTURAL MACHINERY INDUSTRY

in

REPUBLIC OF CHINA (Taiwan)

Information compiled
during
a fact finding survey.

UNIDO, Vienna
January 1969

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* Note: The opinions expressed in this document do not necessarily reflect the views of the Secretariat of ECAFE or that of UNIDO.

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Summary and conclusions - Taiwan

I. Agricultural Pattern

Taiwan has only 1,000 ha of arable land of which 900 thousands are cultivated for 654,000 holdings. Population pressure is very high: 14 persons per ha cultivated. In spite of these facts self-sufficiency in food is ensured due to high productivity and high technical level of agriculture. Good irrigation is generalized likewise multicropping, use of improved seeds and fertilizers. Main crop is paddy, but sweet potato, peanut, sugar cane, vegetable and fruit are also significant. A very successful land reform has resulted in a good repartition of land between farmers who are mainly owners. Average size of holding is about 1 ha, with 61% in number below 1 ha (402,000) and 6.6% above 3 ha (56,000) - none above 5 ha. Although income per farm family is rather high in average, the extreme division of land will be opposed in the future to an increased mechanization.

II. Farm Mechanization Pattern

Power mechanization has taken a significant start in the last years with 20,500 power tillers in use at the end of 1968 (Japan 1958, 3,300) and a population of more than 45,000 engines mostly diesel for irrigation pumps. Power tillers are almost entirely private owned and the trend is toward high horsepower (above 11 Hp). Demand could be around 7,000 for 1970 and 20,000 for 1975.

The number of draft animal is decreasing although about 360,000 are yet used with matched implements.

The use of other simple implements for rice cultivation is almost generalized. They are: paddy threshers operated by pedal, engine or power tiller, hand sprayers and now knapsack power sprayer-dusters, small rice hullers, and also improved hand tools like seeders and weeders. No subsidy is given by the government

/for purchase

for purchase of farm machinery but loans are provided to the farmers by Land Bank of Taiwan at special rates. Technical research and testing of farm machinery, training of farmers and extension service teaching of technicians and agricultural engineers are successfully carried out by Research Institute, Agricultural Improvement Station, Agricultural Colleges of National and Provincial University.

III. Manufacturing of farm machinery

Two manufacturing plants for power tillers operating under joint venture with Japanese companies have capacity for matching the actual demand. They can also in the future match the future requirement of the market and improve their actual percentage of local contents (75% about) and even export.

For engines the actual manufacturing capacity is limited and must be improved and also the quality. Production of threshers actually made by small and unorganized manufacturers will be improved and directed towards more developed. The market for hand sprayers is almost saturated and the local manufacturers had to stop their activity and a new power sprayer plant is being made and production capacity must be increased.

Limited facilities exist for ancillary industries and for availability of technical personnal, but the industry of Taiwan have proved in other sectors to be competitive upon the world market.

IV. Conclusion

Taiwan appears to be able to match its own requirements in farm machinery and particularly in power tillers.

New facilities must be provided for diesel engines, power improved paddy threshers, knapsacks sprayers.

Technical assistance to other countries could be given in the field of improved tools (seeders, weeders, threshers) and also of organization of testing, training and extension works.

Part I. [illegible]

I. Land Utilization

The total land area of Taiwan province is 3,596 thousand hectares of which about 48% is forest, 22% hilly land and only 30% arable land. The total cultivated area in 1966 was 896.3 thousand ha constituting 24.7% of total land. Out of the total cultivated area, 358.9 thousand ha are uplands and 537.4 thousand ha are paddy fields constituting 40% and 60% respectively. The gross crop area was 1,65[illegible] thousand ha, indicating a cropping index of 183.5. Thus it is seen that each unit of cultivated area produces 1.83 crops a year. The intensity of crops per year has shown a steady increase from 1945. The cropping index was 111 in 1945 and 170 in 1955.

Thus it can be concluded that the intensity of agriculture with reference to crops per hectare per year has reached a very significant level in Taiwan.

a) Land Utilization by Nature

Table 1.1 Pattern of Land Utilization by Nature - (1966)

(Million Ha)

Total land area		3.6
forest area	1.74	
Hill and waste lands	0.78	
Cultivated area	0.90	
Potentially arable additional area	0.18	

b) Land Distribution by Crops and Agricultural Production

There has been a very significant increase in the total value of agricultural production. Taking 1951 as the base, the production index in 1966 for agricultural crops has increased to 218 and total value of agricultural crops increased to 180. This is due to higher yield per ha and stable price as shown in the following table as of 1966-67:

/Table 1.2

Table 1.2 Crop area, yield and value in Taiwan (1967)

No.	Crop	Harvested area	Yield	Value/ 1,000 T$ c/	No.	Crop	Harvested area	Yield	Val 1,0
1.	Paddy a/	7[illegible] c/	3,067	133.0	9.	Tobacco	10	1,775	[illegible]
2.	S. Potato	236	15,734	20.5	10.	Jute	8	1,[illegible]77	2,[illegible]
3.	Wheat	12	2,007	98.5	11.	Cotton	2	1,137	[illegible]
4.	Peanut	93	1,359	137	12.	Banana	44	14,746	[illegible]
5.	Soyabean	52	1,439	165	13.	Pineapple	12	24,904	[illegible]
6.	Corn	24	2,669	83	14.	Citrus	18	8,772	10[illegible]
7.	Tea	37	707	460	15.	Veg	115	-	-
8.	S. cane (crush)	90	74,739	5.5	15a.	Onion	1	37,717	[illegible]

Note: a/ [illegible]rown rill; b/ 000 ha; c/ 1st crop 340,000, 2nd crop 448,000; d/ kg/ha; e/ [illegible]36.

c) Land distribution by size of holding

As of 1967, out of 854 thousand total farm households, the following is the number and sizes of farm households:

Farm size	No. of Farm Households	% Distribution
Under 1 ha	492.5 thousand	62.0
1 - 3	261.1 "	33.4
3 - 5	53.9 "	6.6
Above 5 ha	Nil	---

From the above table it is seen that although the majority of number of farm households is less than 1 ha, the farm holding size of 1-5 ha is significant.

d) Population and land reform

i) Out of the total population of 12,993 thousand, total agricultural population is 5,340 thousand constituting 45%. Total working population is 4,063 thousand and total agricultural working population is 1,616 thousand, which is 40% of total working population. The total unemployment among total working population was 1.71% only.

/The total

The total population has increased 72% from 1950 to 1966, resulting in an increase of population per hectare from 8.68 in 1950 to 14.5 in 1966 - an increase of 67%. However, the higher cropping index pattern coupled with improved management technique has resulted in increase in production value per hectare, has increased by 192% during the same period.

The above factors indicate that there is an agricultural prosperity in Taiwan inspite of population pressure on land.

ii) Due to successful implementation of land reform programme, out of the total of 854 thousand farm households in 1966, 67.1% constitute owner cultivators, 20.6% part owners and only 12.3% tenants. This is a direct result of 37.5% land rental ceiling programme introduced in 1949, sale of public land programme in 1951 and land to be tiller programme in 1953.

This indicates that private ownership incentives due to land reform laws has been one of the causes for higher productivity. Although population pressure on land is 14.50 persons per hectare of total cultivated area, the total agricultural working population is 1,616 thousand or only 1.05 persons per hectare of total cropped area. The trend towards shifting to industry, recently introduced 9 year school programme for children and rapidly declining draft animal population has resulted in manpower shortage during critical farm operation periods.

2. Cattle Population

The total draft animals in 1966 was 98.7 thousand cattle and 261.6 thousand buffaloes. It is seen that cattle population is declining at the rate of 10,000 per year since 1961.

3. Farm Income

Although table 1.2 gives the agricultural production and prices of crops,

reliable data of farm income with respect to crops and farm size holdings are reflected in the report on farm record keeping project conducted in 1966 with 430 farm families.

Average farm income per family of 5.48 persons was US$1,000 and per hectare $700 per year. The farm income by farm size is given below:

Table 1.3 Farm Income by Farm Size
(Unit US$ Nos.) - Survey Results

Farm Average	Per Farm Family	Per Hectare
Total	1,000	700
Less 0.5 ha	419	1,073
0.5 - 1.0 ha	665	863
1.0 - 1.5 ha	904	724
1.5 - 2.0 ha	1,253	723
Above 2.0 ha	1,881	573

The above facts show that agricultural income per family is very significant and the farmer has a potential purchase capacity.

4. Farming Practices

In general, there is widespread utilization of farm machinery in Taiwan. Hand tools, power tillers, hand sprayers, hand pumps, power pumps, and pedal operated and power threshers and trailers are widely used. However, transplanting, weeding, harvesting, winnowing are mostly done manually. Considering agricultural practices, Taiwan has maximum cropping index as compared to any other country. Double cropping is normal practice in all paddy areas and other dry lands where irrigation facilities are available.

The first rice crop period is from March to Middle of July, and second rice crop is from August to November. However, due to unique farm operation technique of planting summer and winter crops in between rice crop a month before harvest, mers in Taiwan able to grow even four crops on the land per year as detailed in Table 1.6.

/Table 1.4

Table 1.4 Farm Operation Techniques in Taiwan

Month	Rice I	Summer Crop	Rice II	Winter Crop
March	Transplant			
April	Top Dressing, Spraying			
May	Heading	Planting		
June	Harvesting, Threshing	-		
July		Irrigation		
August		Harvest	Transplant	
September			Top Dressing & Spraying	
October			Heading	Planting
November			Harvesting, Threshing	-
December				Harvest
January				Irrigati
February				Harvest

In order to accomplish this pattern, summer and winter crops are sown in nurse beds early enough and transplanted into the paddy fields. Sowing and transplanting time depends upon the crop period and time available between the two major rice crops for optimum growth rate as detailed in Table 1.5.

Table 1.5 Farm Operation Techniques of Summer and Winter Crops

	Crop	Transplanting	Harvest
Summer Crop	Jute	Late April	Early August
	Melon	Late May	Early August
	Soyabean	Late June	Late July
	Luttuice	June	July
	Sweet Potato	Early May	Early August
	Water Melon, etc.	Late May	Early August
Winter Crops	Tobacco	Late September	Early Febr.
	Corn	Mid October	Early Febr
	Soyabean	Mid October	Mid Februa
	Peas	Late October	Late Febru
	Sweet Potato	Late September	Late Febru
	Vegetable Wheat	Mid October Late October	Mid Febru Late Febr

SECTION II. FARM MECHANIZATION

1. Farm Machinery Population (1966-67)

Category	Item		Model	Numbers	
I	Animal Drawn	1. Plows	Total	-	613,[illegible]
			1. Improved	414,826	
			2. Conventional	137,684	
			3. Kia Kong (weeder)	40,428	
			4. Lister	20,571	
		2. Harrows	Total	-	652,[illegible]
			1. Knife Tooth	325,541	
			2. Comb type	327,169	
		3. Puddlers	Total	-	137,[illegible]
			1. Puddling rotor	100,797	
			2. Cultivative type	36,9[illegible]	
		4. Wheel Marker (spacing gauge)	-	127,410	
		5. Bullock Carts	-	192,654	
		6. Bicycle Trailer	-	27,684	
II	Hand Operated	1. Weeder	-	34,920	
		2. Duster	-	21,846	
		3. Mist Blower	-	6,123	
		4. a) Sprayers (includes portable sprayer	-	180,730	
		b) Power sprayer and duster	-	9,734	
		5. Threshers (includes Power Thresher)	-	204,337	
		6. Winnowers (includes Power Winnower)	-	158,176	
		7. Potato Slicers (includes Power Operated)	-	67,970	
		8. Pumps (includes Power operated)	-	42,330	
		9. Hydraulic Ram	-	100	
III	Crawler Tractors		Total	-	467
		1. Less 40 Hp	-	379	
		2. More than 40 Hp	-	88	

Category	Item	Model	Numbers
IV	Wheel Tractors Above 25 Hp	-	87
V	Power Tillers	Total	- 14,2[illegible]
	1. Less 5 Hp	-	2,039
	2. 5-8 Hp	-	7,045
	3. Above 8 Hp	-	5,168
VI	Others 1. Trailers	-	3,000
VII	Engine -	All Hp up 15	40,[illegible]
	1. Diesel	-	19,306
	2. Kerosine	-	3,334
	3. Gasoline	-	17,840

2. Background Information regarding Introduction of farm machinery

i) Tractors: Crawler: These were introduced only for land development and for sugarcane cultivation and sugar mills. However, during the past three years, no crawler tractors have been imported. No manufacturing programs exists at the present.

ii) Tractors: Riding Wheel Type: The Hp range of 25 to 35 and above 35 were introduced from the past few years from abroad for sugar cane fields and mills. Plans are finalised to import another 40 sets of 35 Hp tractors from Japan. The manufacturers of power tillers appear to be aware of the potential market for such tractors in the future and one has imported a 25 Hp tractor for usage, demonstration and study. No plans exist for the present for manufacture.

iii) Power Tillers: The introduction of power tillers to Taiwan was by Joint Commission on Rural Reconstruction. In 1954, seven garden tractors were imported from United States and the following year, two power tillers were purchased from Japan. As a result of this, up to 1959, a total of 22 small manufacturers came into being and began producing locally made power tillers. In the meantime, the number of imported power tillers increased

/to 16

to 16 brands. However, by 1960 due to lack of funds technical know-how quality control, 19 manufacturers become bankrupt and the remaining 3 turned out only a small number of power tillers with imported engines. In 1961, two groups of Taiwan industrialists in cooperation with two of Japanese agricultural machinery companies set up two factories to produce power tillers.

Thus, there are two well-established manufacturers of power tillers and three small scale manufacturers of power tillers in Taiwan with a total production of 3,300 power tillers in 1967.

iv) Diesel engines: The introduction of power tillers and autocycles and recent introduction of engine driven pumps, threshers and other farm equipment has created a significant demand for engines. Diesel engines used for power tillers, big pumps, generators, threshers, while gasoline engines are used for small pumps, tricycles, etc.

Regarding gasoline engines, there are about 20 manufacturers of which 4-5 are with respectable size of operation. The total production capacity of all 20 may be about 1,000 a year.

Regarding diesel engines, there are about 12-14 manufacturers out of which 4 have a significant level of operation. Two are also manufacturing power tillers. Another two are manufacturing engines alone and the rest are small scale manufacturers.

v) Pumps: Mostly hand operated pumps were produced up to recent years. However, with introduction of small engines, power operated pumps have become popular. There may be about 30 manufacturers of all types of pumps out of which 3-4 are with significant level of operation, out of which a couple making submersible pumps.

vi) Plant Protection Equipment: Up to recent years, only hand operated sprayers and dusters were manufactured. Power operated equipment has

/introduced a

introduced a couple of years back on a limited scale. No effective manufacturin programme exists for power plant protection equipment.

vii) Threshers: There are many small scale manufacturers manufacturing man operated paddy threshers with the availability of small engines, these engines are being mounted on the existing design of threshers. No power operated efficient thresher is under manufacturing programme.

viii) Newly Introduced Equipment: Items like rice transplanter, seed cleaner, tractor, grain driers have been recently introduced in the field. No effective manufacturing programme is underway. Regarding rice hullars, a couple of manufacturers are manufacturing on a limited scale.

3. Growth Pattern of Agricultural Machinery Machinery Population

Table 2.2 Growth Pattern of Agricultural Machinery Population

Year	Tractor (Wheel and track)	Power Tiller	Diesel E. (includes power tiller)x/	All type Pumps	Power Sprayer and Duster	Hand Sprayer	Hand Duster	Pedal cart and Trailers	Thresher (Including [illegible])
1954	410	7	Not known						
1955	"	9		"		"		"	
1956	"	60		"		"		"	
1957	"	150		"		"		"	
1958	"	600		"		"		"	
1959	"	2,262		"		"		"	
1960	"	3,703	7,200	17,113 (estd)		"		"	
1961	"	5,313	8,200	1[illegible],677		"		"	
1962	"	7,504	10,700	26,757	804	125,899	9,517	26,066	124,[illegible]
1963	"	9,079	12,500	35,683	1,028	139,439	12,764	27,287	19[illegible]
1964	"	10,310	13,500	39,136	2,949	147,954	15,822	28,833	203,[illegible]
1965	424	12,203	16,000	42,330	4,489	161,506	13,558	28,872	205,[illegible]
1966	554	14,162	19,206	42,330	6,123	166,817	16,788	27,084	194,[illegible]
1967	-	17,130	25,206	47,330	9,734	180,780	21,886	30,278	204,[illegible]

Note: x/ Estimated.

/Considering th

Considering the growth pattern, manufacturing programme and usage, the following machinery needs further investigation:

1. Power Tiller
2. Diesel Engine
3. Power Pumps
4. Power Sprayer and Duster
5. Power Threshers

4. Five Major Power Machinery Produced during 1962-67

Table 2.3 Details of Manufacture of Five Major Power Machinery

(1962 - 1967)

No.	Item	1962	1963	1964	1965	1966	1967
1	Power Tiller	1,326	1,205	1,231	1,693	2,424	3,611
2	Diesel Engines x/	1,500	1,800	2,000	2,500	5,200	6,000
3	Sprayer and Duster	185	224	1,921	1,540	2,754	3,611
4	Pumps	1,564	8,050	8,926	3,453	3,194	7,029
5	Threshers	-	11,523	9,557	2,465	11,537	10,000

x/ Estimated

Thus, it is seen that there is a gradual increase in the number of power machinery produced in Taiwan.

a) Import and Locally Made Numbers of Power Tiller (1955-1967)

/Table 2.4

Table 2.4 Import and Local Production of Power Tiller

(Nos)

Year	Power Tiller		
	Imported	Locally Made	Total
1958	271	148	419
1959	582	1,080	1,662
1960	1,025	421	1,446
1961	1,136	469	1,605
1962	865	1,326	2,191
1963	370	1,205	1,575
1964	15	1,231	1,246
1965	119	1,893	2,012
1966	-	2,424	2,424
1967	-	3,611	3,611
Total	4,373	13,808	18,187

Thus, for the past 10 years, the total import of power tillers to the total put on the farms is about 24%.

b) Production Progress of Power Tillers and Diesel Engines (1961-1967)

Table 2.5 Production Progress of Power Tillers and Diesel Engines

(1961 - 1967)

Year	Power Tillers				Diesel E (inclu Power T
	Establishments 1/		Small Scale Manufacturers 2/	Total	
	A	B			
1967	2,043	1,268	300	3,611	6,0
1966	1,023	996	225	2,424	3,2
1965	702	876	315	1,893	2,5
1964	490	741	NA	1,231	2,0
1963	604	373	228	1,205	1,8
1962	673	618	35	1,326	1,5
1961	229	79	161	469	1,0
Total	5,764	4,951	1,264	11,979	17,0

Note: 1/ A/ China Agricultural Machinery Co. Ltd., Taipei.

B/ Hsin Taiwan Agricultural Machinery Co., Kaohsiung.

/2/

2/ Three manufacturers

a/ Hsin Nan Farm Machinery Co., Taichung.

b/ Ta Tien Agricultural Machinery Co., Taichung.

c/ Not visited.

The production figures estimated for small manufacturers based on limited available data.

3/ Estimated.

4/ Domestic consumption No. 1959 power tiller reported in 1966.

5/ Domestic consumption No. 2368 power tiller reported in 1967. Balance may be for export.

From the above table it is seen that 9.4% of total power tillers produced is in the small scale sector.

c) Capacity, Production and Local Content

Table 2.6 Estimated Capacity, Production and Local Content of Farm Machinery

Item	Power Tiller	Diesel Engine	Pumps
Existing capacity/yr	4,800	12,000	8,000-10,000
Established	4,400	10,000	4,000
Small Scale	400	2,000	2,000
Production in 1968-69	4,600	11,000	7,000- 8,000
Established	4,200	9,000	-
Small Scale	400	2,000	-
Local Content 1968	About 70%	About 85%	About 95%
Probable Expansion Program by established industry by 1975	8,500	16,000-18,000	about 12,000-15,000

1/ Includes Diesel engines for Power Tiller.

Thus it is seen that the existing production capacity has almost reached the installed capacity especially in the 'established sector' and hence any expansion programme will have to be analysed from the point of view of overall plant layout, balancing equipment, imports, technical personnel and financial ability.

/d)

d) Existing Ranges of Products Manufactured by Major Industries

Item	Range
1. Power Tiller	Hp3.5, 6.0, 8.0, 9.0, 10.5, 13.5, 15.0
2. Diesel Engines	3.5, 6.0, 8.0, 9.0, 10.5, 13.5, 15.0
3a. Power Sprayer	Gas Engine 35 cc, 73 cc.
3b. Mist Blower and Dusters	Gas Engine 1.6, 2 and 3.0 Hp
4. Power Centrifugal Pumps	Outlet dia 2, 2½, 3, 4, 5, 6, 8 inches.

5. Popularity in Design and Hp of Farm Machinery Used

I. Power Tillers

(i) 1966

Considering the total population of 14,272 power tillers in 196[illegible], 2,039 were under Hp (14.28%), 7,045 were 5-8 Hp (49.37%) and 5,188 were above 8.0 Hp (36.35%). Thus, it is seen that about 85% of power tillers are above 5.0 Hp.

(ii) 1967-68

About 13 Hp tractors were introduced in 1967 and during 1967-68, [illegible]ly 65% of total sales were in the range of 12-13 Hp. Thus, there is a trend towards high Hp power tiller.

(iii) 1968-70

In 1968-69, 15 Hp power tillers are being introduced. It is ex[illegible] that nearly 80% of sales will be of power tillers in the range of 15 [illegible].

II. Engines - Gasoline

1.5 to 2.0 Hp lightweight (10-15 kg) two stroke air cooled gasoline engines are becoming popular for knapsack mist blower, sprayer and duster. Higher Hp gasoline engines are not very popular for agricultural usage.

III. Engines - Diesel

Apart for usage on power tiller, diesel engine is mainly used on other equipment as follows:

/a)

a) Pumping Set:

Size:	2"	2½"	3"	4"	5"	6"
approximate kg	18	24	28	40	58	90
Hp of engine	3.5	3.5	6	8	10.5	13.5
RPM	2000	2000	2000	1800	1600	1000

It appears 3" to 5" pumps are most popular and hence engines of 6-8 Hp. 10-12 Hp are needed.

b) Threshers, rice pullers, Sillers Cutter, etc.

Maximum Hp requirement is about 3 Hp.

c) Processing (huller, mills, rice polisher, etc.)

Normal Hp requirement is about 6-8 Hp.

Thus there is need for 4 specific ranges of diesel engines

1. 2-3 Hp - for threshers, rice hullers, etc.
2. 6-8 Hp - for pumping sets of 3-4" and for processing machines.
3. 10-12 Hp- for pumping sets of 5-6" and for power tillers.
4. 15 Hp - for power tillers.

IV. Pumping Sets

The requirement is for a) 3-4" and b) 5-6" pumping sets.

V. Crop Protection equipment

Knapsack Type: 1.5 Hp to 2 Hp lightweight design.

VI. Threshers

3 Hp engine driven thresher.

6. Future Trend in Demand and Usage (1970-1980)

Table 2.6 gives anticipated trend in demand and usage of farm machinery in future.

/Table 2.6

Table 2.6 Future Trend in Demand and Usage for Farm Machinery (1970-1980)

Item	Present 1967-1968	Immediate 1968-1970	Next Five Years 1.70-75	1976-80
1 Crawler Tractor	Used for land development and sugarcane fields and mills only. Population about 500	As the demand is limited, any requirement may be met by import and feasibility of replacement with higher Hp wheel type tractor may be examined.		
2 Riding Wheel tractor	Only a limited number are in usage. Many models, makes and horsepower. Population about 90	Manufacturers are interested in introducing 20-30 Hp tractors on a limited experimental basis	Appears to be the beginning of the transitional stage. Interest by farmers in 20-30 Hp is to be created. Expected requirement in 1975 about 300 tractors	There will be a definate interest and preference by a class of farmers, for 20-30 Hp tractor. Expected requirement in 1980 about 500 only
3 Power Tiller	60% of sales were in 13 Hp range. Demand for higher Hp increasing. Total demand about 5,000 units a year. Total power tiller population about 17,000. Total manufacture in 1967 about 3,611 numbers	80% demand to be for 15 Hp tillers, and 20% for 8-10 Hp. Total demand of power tiller in 1970 to be about 7,000 units	The demand for 8-10 Hp power tiller will increase to 50% and demand for 15 Hp power tiller will be 50%. Total demand for power tiller in 1975 estimated about 20,000 per year	Static or declining demand for 50% 8-10 Hp power tiller and 50% 13-15 Hp power tiller. Total demand for power tillers in 1980 expected to be about 40,000 and introduction of 20-30 Hp riding tractor
4 Engine-gas	1-3 Hp lightweight. No effective manufacturing program. Total gas engine population about 3,500. Total manufacture in 1967 not known	Requirement by 1970 about 5,000/yr.	Demand to increase to 8,000-10,000/yr in 1975	Demand to increase to 10,000-15,000 per year in 1980
5 Diesel Engine	3-5 Hp 6-8 Hp 10-12 Hp 15 Hp Total diesel engine population about 20,000. Total manufacture in 1967 about 6,000	5,000/yr in 1970 5,000 sets 4,000 sets 7,000 sets	7,000-8,000/yr in 1975 12,000 sets 15,000 sets 10,000 sets	15,000-20,000/yr in 1980 15,000-20,000 sets 15,000-20,000 sets 10,000-12,000 sets
6 Plant Protection Equipment	Knapsack type duster, sprayer, etc. Just introduced. Total population about, including [illegible]	4,500 sets of knapsack type under 1-3 Hp lightweight gas engine in 1970	Introduction and usage of high speed duster and sprayers. About [illegible]	Introduction of tractor mounted sprayer and duster or high [illegible]

Item	Present 1967-68	Immediate 1968-1970	Next Five Years 1970-1975	1975-1980
7 Power Threshers	2-3 Hp threshers not very efficient. Present population about 75,000 units. Total manufacture in 1967 about 10,000	Necessity for high efficiency threshers. Demand about 12,000/yr with about 3-6 Hp engine	Demand about 12-15 thousand in 1975	Demand about 15-25 thousand by 1980
8 Power Pumps	3-4") more popular 5-6") Total existing population about 35,000. Total manufacture in 1967 about 7,000 units	Pumps with 6-8 and 10-12 Hp diesel engine. Estimated demand about 10,000/yr	Estimated demand about 15,000/- by 1975	Estimated demand about 15,000-20,000 by 1980
9 Other hand operated machines	For farmers in the range of 0-1 ha and especially those in the range of 0-0.5 ha will be requiring hand operated sprayers, dusters, foot operated threshers, etc. in a significant number.			

7. Necessity of Introduction of New Machinery

i) Riding Tractors: The general opinion is that although the demand for tiller will increase during 1970-75 period, there will be an awareness on the farmers' part of the usage of riding tractors and a limited de... will be created. However, during 1975-80, the demand for power tiller... may remain static, and there will be a demand for riding tractors in t... range of 20-35 Hp. Although this demand may be moderate, it is felt t... it may be necessary, during the next few years, riding tractors are introduced and experimentations carried out with respect to utility, ... of special implements for rice cultivation, usage for other purposes such as puddling, transplanting, crop protection, irrigation, threshin... and transport.

ii) Transplanter: Man operated transplanters have been introduced recently and a modest manufacturing programme has been undertaken. However, it is necessary that further field trials and tests are carried out and effici... multi-row transplanter is developed.

iii) Crop Protection Equipment: Although knapsack sprayers and dusters with ... Hp, lightweight gas engine will be popular durin... next few years, there a necessity to introduce high volume sprayers by 1975 and development ... research work to start in 1974-75 so as to introduce tractor mounted cr... protection equipment during later part of 1979-80.

iv) Power Threshers: The present threshers used are only foot operated old ... sign threshers with an engine as the prime mover. The efficiency of t... threshers are low and hence there is a necessity to develop, introduce and market an efficient integrated power thresher.

v) Grain Drier: There is a necessity to do further development work on grain drying technique and design and develop a more efficient machin...

/vi)

vi) Harvesting Machinery: Imported combine harvesters are being tested at Taichung Agricultural Experiment Station. There is a necessity to carry out extension and demonstration work after the tests are completed.

SECTION III

Manufacturing Industries and ancillary facilities

1. Farm Machinery Manufacturers

It is estimated that there are about 150 manufacturers of agricultural equipment in Taiwan of which only about 15 have manoperation of significant level.

Table 3.1 Estimated Number of Manufacturers by Product Range[x/]

	Medium Scale	Small Scale
Power Tiller	2	3
Diesel Engine	4-5 (including 2 of power tillers)	10
Gas engine	2-4	20-25
Pumps (power)	4-5	10-15
Pumps (hand)	---	15-20
Deep well pumps	1-2	---
Threshers (power and hand)	2-3	20-30
Other hand and animal drawn equipment	---	20-30
Estimated total	15-19	98-120

Note: x/ It is felt that most of the "factories" in small scale are only small fabrication shops.

However, it is to be pointed out that out of about 15 medium scale industri... only about 3-4 may have the facilities to produce quality products Two power tiller factories visited have good facilities. Regarding the balance of manufacturers, the size is too small and the technical ability is too poor and unstable to produce farm implements of good quality. No data is available regarding manufacturing facilities and numbers manufactured by all small scale industries sector. The details of the industries visited are given in table 3.2.

/Table 3.2

Table 3.2 Details of Agricultural Machinery Industry visited

Item	Shin Taiwan Agri. Mac. Co., Kaohsiung	China Agri. Mac. Co., Taipei	Ming Ming Mac. Works, Taichung	Hsin Nan Farm Mac. Co., Taichung	Ta-Tien Agri. Mac. Co., Taiwan	Ta-Yu Farm Mac. Co., Taiwan
1 Capital	NT$ 27 million	NT$ 60 million	NA	NA	NA	NA
2 Investment on fixed capital	NT$ 15 million	NT$ 25 million	"	"	"	"
3 Estd. Date	20 Dec. 61	In 1961	"	"	"	"
4 Investors	1) Japan 68% a) Kubota Iron Works NT$9.24 (34.2%) b) Mitsui & Co. NT$9.13 (33.8%) 2) Local 32% a) Taiwan Provincial Co. - Bank b) Yuen Foong Co. c) Taipei Section Mutual Loan Saving Co.	1) Japan 30% a) Iseki b) Yanmar 2) Local a) Land Bank of Taiwan 40% b) Local and Overseas individual investors 30%	Partnership No foreign participation Engine similar to Yanmar	Individual No foreign participation Buys Briggs & Stratton gas engine (6 hp) and fabricates tiller	Individual No foreign participation Buys Yanmar engine 14 Hp diesel from China Agri. Mac. Co.	Individual No foreign participation
4 Main Products	1) Kubota diesel engine, 5 models 2) Kubota tiller, 4 models 3) Other equipment	1) Agrimo Diesel Engine (Yanmar), 5 models 2) Agrimo tiller (Iseki) 6 models 3) NSU motor cycle (W. Germany) 4) Other agri. equipment	a) Ming Ming Diesel engines 2-20 Hp, 13 models b) Pumps, 4 models c) Hand Pumps	Local Power Tiller with Briggs & Stratton gas engine	Local Power Tiller with bought out locally made Yanmar engine	Threshers, etc.
5 Personnal a Total	326	400	about 95-100	15	35	-
b Managers & clerks	80	70	-	-	-	-

Item	Shin Taiwan Agri. Mac. Co., Kaohsiung	China Agri. Mac. Co., Taipei	Eing Hing Mac. Works, Taichung	Hsin Nun Farm Mac. Co., Taichung	Ta-Tien Agri. Mac. Co., Taiwan	Ta-Yu Farm Mac. Co., Taiwan
c Engineers & technicians	65	30	-	-	-	-
d Operators	181	300	-	-	-	-
6 Total area	1.33 acres		-	-	-	-
7 Building area	0.33 acres		-	-	-	-
8 Volume of Sales						
1965	-	NT$ 65 million	-	-	-	-
1966	NT$ 60 million	85 million	-	-	-	-
1967	-	136 million	-	-	-	-
1968	100 million	155 million	-	-	-	-
9 Installed Capacity	2,000 units of power tiller & 500 engines	2,400 units of power tiller & engines	200 engines/yr	about 200/yr	120/yr	Claims 10,000/yr
10 Manufacture in						
1966	996	1,023 power tillers	-	-	-	-
1967	1,268	2,043 power tillers	-	-	-	-
1968	1,800	2,400 power tillers & 3,500 engines	2,400 engines	about 120/yr	120/yr	-
11 Value of Import	30% (engine components)	30% (engine components)	15% (engine components)	30% (total engines)	Locally made engine with imported components	None
12 Items exported to	Viet-Nam & African nations	Viet-Nam & African nations	Viet-Nam, Philiprines, Ma- [illegible]	local sale only	Local Sale	Sale to other manufacturers

Item	Shin Taiwan Agri. Mac. Co., Kaohsiung	China Agri. Mac. Co., Taipei	Ling Hing Mac. Works, Taichung	Hsin Hun Farm Mac. Co., Taichung	Ta-Tien Agri. Mac. Co., Tainan	Ta-Yu Farm Mac. Co., Taiwan
13 Expansion planned	Additional land bought 2.1 acres for expansion of power tillers	To increase production of power tillers, diesel engines and small gas engines	To move into new industrial zone to make 400 diesel engines per month. To manufacture hand pumps	-	-	-
14 Machine tools used			Local and a few imported. Quality fair	All old machines imported. Quality poor	Local and imported machines	Old machines
15 Quality Control	Quality good	Quality good	Quality fair may be improved	Selective assembly, quality very poor	Quality may be improved	Poor
16 Sales & Service	Distribution and sales system exists	Distribution and Sales system exists	Limited Sales & Service set up	No organization	No organization	No organization

Hence it can be concluded that only about 3 or 4 medium scale manufacturers are producing quality equipment. The balance of more than 100-150 small scale manufacturers, although may be producing an appreciable quantity of equipment, the quality is extremely questionable.

It is also seen that no new industries are being planned and the expansion programme of existing medium scale established industries appears to be moderate. Hence it is felt that the demand of farm equipment by 1975 and also by 1980 in quantities, qualities and specifications desired will not be met by the existing two power tiller industries unless a long-term expansion programme be worked out by the existing ones. The contribution by small scale manufacturers is very questionable because of lack of technical know-how, finances and management skill.

The following are a few highlights of two major power tiller manufacturers:

a) Factory Produced Items

Crank shaft, pistons in some cases, cylinder, shafts, forgings, certain sheet metal parts, other machined components are produced in the factory. Heat treatment facilities are also available.

b) Major Imported Items

Engine components such as cylinder head, pistons, cylinder, fuel injection system, oil pumps, radiator, high-tensile hardware, piston rings, valve guider, springs, and any other components which require special steel. Electrical items such as generator, starter, certain special gears for gasoline and diesel, engines, and spare plugs, ignition system, magneto etc. for gasoline engine are being imported.

c) Import and Local Content of Major Items

Item	Import	Local	Local factory made	Local purch
Power Tiller	30%	70%	50% of local	20% of lo

Although local content has increased, the following trend has been

indicated with respect to local content

1968	70%
1973	80%
1978	95%

d) Cost Structure of Power Tillers

Considering sales price as the unit, the net factory price is 65%, sales expenditure about 12%, dealer margin 8%, general administration 8% and profit 7%. The commission for selling power tiller to farmers is 8% to main dealer (maximum), 6% to sub-dealer or 4% to service dealer depending upon the outlet source. It appears that local power tillers are competitive in price with imported Japanese tillers. The price difference between ex-factory and retail selling price is about 15%. However, the price of power tillers by small manufacturers is relatively low as detailed below.

Price of Power Tillers by Small Manufacturers

8 Hp Tiller x/	NT$13,000
14 Hp Tiller y/	NT$59,000

x/ Briggs & Stratton gas engine includes rake, plow, wheel, etc.
Purchase price: Engine NT$6,000, Tyre 2 Nos. 400 x 8 = NT$750.

y/ Yanmar 14 Hp diesel engine.
Purchase price: Engine NT$23,000, Tyre 2 Nos. 600 x 12 = NT$1,600.

e) Custom Duties and Other Charges

There is regulation on the percentage and value of imported components for local assembly. Overall custom duty is 15%. There is no sales tax on sale of agricultural machinery.

2. Other Engineering Industries

In Taiwan, there are a few plants producing machinery of following types:

Item	Nos. produced in 1967
Motor cycle	117,317 sets
Prime motors	12,937 units
Machine tools	9,790 units
Automobiles	4,808 units

Normally certain critical items - about 30% are imported and castings, forgings, tools and dies, sheet metal press work, machinery operations are done in local plants.

a) Availability of Machine Tools

Only simple bench and radial drills, lathes, shaper, grinders, etc. are available from the local sources. All other complicated and special purpose machines has to be imported.

3. Ancillary Industries and Raw Materials

i) Supporting Industries

a) Castings There are about 118 foundries with an average monthly output of 3,090 tons of castings, 8 electric arc furnaces for large castings, blast cupola for machinery castings, moulding machines and sand treating equipment. The quality of casting from foundries with good production techniques is reliable. Limited facilities for steel casting, aluminium casting is available. However, it is to be pointed out that with respect to quality castings for agricultural machines, such as, gear box, clutch housing engine block, etc. only a limited ancillary industry facilities are available. However, for simple castings there are many small foundries, although the quality may not be up to the desirable level. Cost of quality casting is about US$150/ton.

b) Forgings According to a report, two 2-ton steam and pneumatic hammers, less than 1 ton pneumatic hammer and drop hammer is available. Normally simple forgings are available from ancillary industry. However, for complicated forgings, it is not known if the existing manufacturers with the above-mentioned equipment has spare capacity.

c) Sheet Metal Press Work Most of the existing manufacturers obtain

sheet metal components from outside ancillary industry who use either mild steel or deep drawing steel. The existing requirement for simple sheet metal parts, the present ancillary industry may be able to supply. However, for a larger volume of production and for complicated press parts, existing machine capacity may be inadequate.

d) Machine Shop Most of the components of power tillers, engines, parts etc. are machined at the plant. It is to be pointed out that only a small number of established manufacturers have the engineering know-how with respect to design of jigs and fixture and correct manufacturing techniques. There appears to be no ancillary workshop - except that owned by government factories and Defence Department Workshops - for vending out components for machining. Although big workshops have heavy duty lathes, milling machines, planners, shapers gear cutting machines, grinders, etc. the spare capacity is not known.

e) Tools and Dies Copying lathes, shapers, die sinking machines, jig borers, grinders, electro-discharge machines and optical comparators are available with certain established industries, government and defence workshop. Availability of spare capacity is not known.

ii) Raw Materials - Primary Iron and Steel Products

1. Casting A total of 84,811 tons of pig iron were produced in Taiwan in 1967. The unit price is a little higher than that in Japan or United States.

Super class pig iron	US$102.5/ton
First class pig iron	95.0/ton
Second class pig iron	87.5/ton
Casting products	150.0/ton

Taiwan produced 443,251 tons of steel slabs, rods, bars and light shape structural iron in 1967. Most of them are of mild steel or

carbon steel with an average unit price of US$130/ton.

2. Steel About one-fifth of the steel is made from ores; the remain 80% from imported scraps by using electric arc furnaces. Due to of heavy size rolling mills and alloy, steel plates, steel sheets, strips and stainless steel are imported. Thus, all special steels such as deep drawing spring steels, equivalent steels for EN-1A, EN-3, EN-8, EN-9, EN-42, EN-45, EN-16, EN-18, SAE 5140, EN-43, EN-34, SAE 5620, etc. are imported wherever necessary.

iii) Proprietary Items Available Locally

a) Tyres and tubes for power tillers, motor cycle and cars are made locally. (Example tyres 4.00 x 8 (2 Nos.) US$19, 6.00 x 12 (2Nos.) US$400).

b) Electrical system items such as wiring, bulbs, horn, etc. are available locally, magnets are started being manufactured.

c) Battery is available from local sources.

d) Certain press components may be obtained through ancillary industries such as brake drums, power tiller wheels, head lamp pressing, radiators, rims are available.

e) From imported raw material, items such as gaskets, brake lining and cluth linings, rubber parts are available. Filter elements are available on a limited scale.

f) Certain sizes of pistons, piston pins are available from local sources. They are for mostly power tiller and diesel engines.

g) Paint is available from local sources.

4. Availability of Technical Personnel

There appears to be a significant shortage of technical personnel available in the field of managerial skill, industrial and tool engineering, design and development, and production engineering including metallurgy, heat treatment and

quality control and inspection. The usual wage structure in established industry is as follows:

a)	Junior high school passed	US$15 p.m.
b)	Junior high school	23 "
c)	Senior high school with two years military training	28 "
d)	Junior technical college	50 "
e)	University graduate	60 "

It has been stated that there is a significant "brain drain" to western countries abroad. The firms have a 2-3 year training programme for operators and training programme in the collaborating firm abroad for technicians and engineers.

SECTION IV

Policy Towards Farm Mechanization

1. Incentives by the Government

a) i) No priority has been given to the manufacturing industries for agricultural machinery in the current national development plan.

ii) Since all of the farm machinery manufacturers are privately owned, no budget allocation is given to this industrial sector during the Plan period.

b) Policy and measures for promoting manufacturing industries for agricultural Machinery:

i) Government-owned banks or financial agencies are providing funds for credit financing to farm owners. The interest rate is usually lower than other credit loans.

ii) The Government is supporting township farmers' associations to establish mechanization promotion centres for selected townships. The main functions of the centre are:

(1) To set up a farm machinery service station in each centre for maintaining farm machines owned by individual farmers.

(2) To fully utilize the power machines owned by individual farmers by helping those farmers who cannot afford to buy farm machines but need outside help in doing the farm work.

(3) To help those farmers who are willing to buy farm machines by assisting them in completing loan procedures.

(4) To help those research institutions which undertake the task of field-testings and demonstrations of newly developed farm machines.

(5) To carry out the farmers training programme, through which various courses on maintenance and repair of farm machinery will be offered.

iii) No government floor and subsidy prices for most of the crops. The market prices normally control farm price as follows:

Rice	NT$ 7	per kg.
Sweet potato	1.41	"
Wheat	6.58	"
Corn	4.93	"
Soybean	7.38	"
Peanut (shelled)	19	"
Sugar	11.47	"
Tea (crude)	17.8	"

The price of gasoline is NT$5.80/litre and diesel NT$4.25/litre.

iv) Towards foreign participation no special measures in this field has been taken; however, the investment by national or foreign companies in productive enterprises is encouraged by the government.

v) The agricultural policies of the government is to encourage farmers to increase agricultural production through developing and introducing modern farming techniques.

vi) In 1967, a total of 987,000 metric tons of fertilizers were allocated for crops which amounts to almost to 1 metric ton per hectare per year. Usage of hybrid seeds and cultural management techniques are of high standard.

2. Rural Development

Taiwan has excellent integrated programmes for rural development. Taiwan provides a good example of a rural development programme where there is effective and meaningful interrelation among education, research, development, manufacture, extension and overall planning.

By 1967, agricultural output was up by 140% and industrial output by 567% compared to 1952. Average annual growth rates for agriculture and for industry were 6.0% and 13.5% respectively. In 1967, agriculture accounted for 24.4% of the net domestic product and for industry 28.4% and other 47.2%.

The yield per hectare has steadily increased from 1952 for all the major crops. For example, in Taoyuan area, between 1948 and 1967, per hectare yi-

of paddy rice increased from 3,094 kg to 7,826 kg, and the farmers share climbed from 47% to 77%. Taiwan produced 2.4 million metric tons of rice in 1967, showing an increase from virtually the same acreage of more than 54% over 1952. Taiwan is one of the world's leading exporter of canned mushrooms, pineapple and asparagus. Government has given priority for hog and fish production. The number of hogs slaughtered from 1.26 million heads in 1952 to 3.42 million in 1967.

I) Agricultural Credit

a) Land Bank of Taiwan: Extends long-term credit to farmers and fishermen.

b) Cooperative Bank of Taiwan: Provides working capital for farmers and serves as a central bank to credit cooperatives and credit departments of farmers' associations.

c) Credit Department of Farmers' Associations: There are 297 members providing base for agricultural credit. They receive deposits from and extend loans to members of farmers associations. They also serve as agents for the land bank, the cooperative bank and government agencies in the extension of farm credit.

II) Specialized Credit Institutions

a) Credit Cooperatives 82 members engaged in commercial banking for their members.

b) Mutual Savings and Loan Associations: with 96 branches, accepting deposits and extends loans.

The current rates of interest range from 3.6% to 8.4% per annum for time deposits and for loans other than exports, interest rates range from 1.02% to 1.1%.

The Land Bank of Taiwan is one of the largest agricultural banks in Taiwan. It has a significant share in the agricultural machinery manufacturing industry in Taiwan. The Land Bank of Taiwan, Taiwan Cooperative Bank and other loan agencies give loans to farmers for power tiller on the basis of 7 year payback period and 10% interest. The interest charged by other agencies is about 12-15%. The Land

Bank of Taiwan also gives loans to other agricultural implements on 1-3 years pay back period. It is reported that the credit collection is very good.

3. Research, Testing and Educational Institutions

There are approximately 1,000 scientists and technicians in more than 20 agricultural institutions and stations engaged in research, testing and development, educational and extension work as shown below:

Organization	Functions
1. Taiwan Agricultural Research Institute (TARI) and its six branches	Fundamental and applied research
2. Seven District Agricultural Improvement Stations	Experimentation, extension and training
3. Taiwan Seed Service (TSS)	Experiment in seed production, processing and storage
4. Agricultural Colleges of National Taiwan University (NTU) and Provincial Chung Hsing University (PCHU)	Teaching and training
5. Provincial Junior College of Agriculture (PJCA)	" "
6. Botany Institute, Academia Sinica	Basic research
7. Taiwan Sugar Experiment Station (TSES)	Experimentation and research in sugar cane
8. Taiwan Tobacco Research Institute (TTRI)	Experimentation and research in tobacco
9. China Agricultural Machinery Company (private)	Farm machinery improvement
10. Hsin Taiwan Agricultural Machinery Co. (private)	" "
11. Taiwan Potash Research Foundation (private)	Fertilizer experimentation

The District Agricultural Improvement Stations are actively involved with various government and provincial agencies regarding extension work.

4. Training and Extension Service

a) Training Programme by Government Agencies

During the first stages of power tiller introduction, the sales promotion of farm machineries, particularly power tiller, the government agricultural agencies in collaboration with agricultural colleges and farmers associations conducted many training courses. In the first five years of power tiller extension 943 participants attended the training course on salesmanship and maintenance. Also 731 farmers were trained in the technique of operating, maintenance and repairs. However, with establishment of two power tiller factories, training and sales promotion is taken care by the manufacturers. However, local governments still hold shortterm training courses to the farmers.

b) Service Facilities by Manufacturers

One power tiller manufacturer has total points of sales and service 100 numbers. There are 20 main dealers, 20 sub-dealers and 60 service centres of sub-dealers. The other manufacturer also has a sales and service setup a similar pattern.

c) Standards and Testing Procedure

During the early part of power tiller extension programme, the government drew up a temporary power tiller standard and the college of agriculture, National Taiwan University was strengthened to conduct inspection work. The manufacturers are required to send in samples of new models for inspection.

SECTION V

Policy towards Industrialization

1. General Trend of Economy

By 1952, due to the emphasis on the economic development, both agricultural and industrial production had regained prewar levels. In 1967, the third year of the current 4th plan, real national income and real per capita income were 206% and 91% respectively higher than that in 1952. Their average annual growth compounded over the 15 years were respectively 7.6% and 4.4% and at current price 1967 national income stood at US$2.9 billion and per capita income, US$309. The target for the four-year plan ending in 1968 are annual growth rate of 6.8% for real national income and 4.1% for real per capita income.

During postwar rehabilitation period, priorities were given to fertilizer manufacture, petrol refining, aluminium pressing, coal mining and production of industrial chemicals and their light industries.

Following is the output of principal industrial products:

Item	Unit	1952	1962
Electric power	M. kwh	1,420	8,412
Steel bars	1,000 mt	18	443
Household refrigerators	Nos.	-	66,385
Automobile tyres	Nos.	-	230,425
Chemical fertilizer (standard)	100 mt	148	1,118

Private enterprise has contributed a great extent and of 1967 industrial production 70.3% came from private sector. For the four-year period from 1965 to 1968, the annual industrial growth rate in 1965, 1966 and 1967 were 16.6%, 13.7% and 17.5% respectively, whereas the average annual growth target was 11%.

2. Incentives for Investment

The tax and other benefits for investment is favourable. The China Development Corporation, a private institution specializes in medium and long-term loan to private industry. The Taiwan Land Development Company finances land reclamation,

construction of industrial estates, and development of eastern Taiwan.

3. International Cooperation

Since 1954, Republic of China is sharing its technical and developmental experiences with an increasing number of countries in a variety of experiences. Since 1954, about 5,000 technicians from 50 countries have received technical training in Taiwan and more than 1,000 chinese specialists and technicians have been sent out to assist some 30 countries in Africa, Middle East, Southeast Asia and Latin America.

Also since 1954, the government has conducted 18 industrial and agricultural seminars, with about 672 participants from Africa, Southeast Asia. In the field of agriculture, farming teams totalling about 600 persons since 1959 have been sent to 24 countries in Africa, middle East, Southeast Asia and Latin America. Africa alone 18 farming teams constituting of 516 specialists in the field of agriculture were sent.

The kinds of agricultural machinery which have been brought by the teams were power tillers (attachment, floating wheels for wet fields, air pumps for tires, engine-driven duster-sprayers, automatic sprayers, hand dusters, paddy field weed threshers (engine-driven, pedal-driven), winnowers, corn shellers, peanut shellers, straw-rope makers, slicers for fodder, shovels, hoes, sickles, sieves for grains, carpenter's tools, hand tools for iron works and spare parts thereof.

TAIWAN

SECTION VI

Conclusions

a) The agriculture of Taiwan is mainly devoted to intensive rice farming with highly developed cultivation methods.

b) The extreme division of land and the high density of population result in the same type of farm mechanization that is observed in Japan 10 or 20 years ago and the future evolution could be expected to be same.

c) Power Tillers are being popular and their market will increase substantially in the next years. The two existing factories are assumed to be able to meet the demand if expansion programmes are worked out effectively. They have also to improve the percentage of use of local content.

d) Regarding engines, the demand is expected to be more important for diesel : about 15,000 in 1970 (3-10 Hp), to compare with an actual production of below 6,000 in 1968 by several small manufacturers. It appears necessary to set up almost one plant for medium scale manufacturing diesel engines on a real industrial basis emphasizing upon quality control.

Demand for gasoline engines from 2-5 Hp is more limited; below 2,000 for 1970 the problem of local manufacturing does not appear to be in need of consideration at present. Likewise, manufacturing of micro-engins may be considered only with export possibilities.

e) Demand for 4 wheel tractors is very small. It could be increased significantly only with a light "paddy tractor" if such a type could be produced at low price.

f) Pumps are being produced in good quantity. The existing production in 1968 is 7,000 units and demand is expected to be 10,000 in 1970. Technical assistance could be provided for improved quality and manufacturing methods.

g) Paddy threshers - pedal and power operated - are also manufactured in appreciable numbers (about 10,000 units/year), with outdated facilities. A more developed model could be introduced for real industrial manufacturing.

h) The market for hand sprayers is almost saturated and local manufacturers have stopped their production. The demand for power sprayers will increase substantially and the local production can meet the demand with imported engines.

i) Production of hand tools like spades, seeders, weeders, etc. is produced in large volume by small scale manufacturers. Export are made to many countries could be expanded if production is rationalized and directed towards improved implements like paddy transplanter. This implies an emphasis on design and testing in conjunction with the governmental research centres And will be profitable to all rice growing developing countries of Asia.

j) Agricultural Research, extension service and agricultural and engineering education appear to be very well organized and has proved to be very effective for development of new agricultural techniques. Efforts have to be increased in the field of farm mechanization. Maintenance and service of power implements by private and governmental organizations are also to be substantially improved

Appendix A

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Appendix B

Organizations and Persons visited

I. Manufacturers

1. Shin Taiwan Agricultural Machinery Co. Ltd., 282 Su-chiven, 2nd Road, Kaohsiung, Taiwan, China (Tel. 2014-8); Taipei (53671)
   a) Mr. S. Uchida - Executive Managing Director
   b) Mr. Junichi Arakawa - Director
   c) Mr. Cheng-J. Lin - asst. Manager of Production Department
   d) Mr. Kikuo-Higushi - Auditor

2. China Agricultural Machinery Co. Ltd., 1 Tun Hua Road, S. Taipei, Taiwan, Republic of China (Tel. 779779)
   a) Mr. Wellington Tu - General Manager
   b) Mr. Y.T. Wang - Plant Manager
   c) Mr. Wei-chain Woo - Factory Deputy Manager
   d) Mr. Tony T.H. Hu - Chief, Farm Implements and Export Section.

3. King-Hing Machinery Works, Co. Ltd., 275, Jen-Ai Road, Chiayi City, Tai[illegible] (Tel. 7171)
   a) Mr. David C.F. Lee - Owner

II. Manufacturers (Small-Scale)

1. Hsin Nun Farm Machinery Co. Ltd., Taichung Taiwan.
   a) Mr. K.T. Chang - Owner

2. Ta-Yu Farm Equipment Factory, Taichung, Taiwan

3. Ta-Tien Agricultural Machinery Co. Ltd., Taichung, Taiwan.

III. Joint Commission on Rural Reconstruction, 37 Nan Hai Road, Taipei, Taiwan.

a) Mr. H.S. Chang - Secretary General (Tel. 29175)

b) Mr. Peng Tien-song - Specialist, Plant Industry Division and Associate professor, National Taiwan University and Counterpart to ECAFE study team.

IV. Taichung District Agricultural Improvement Station, Taichung, Taiwan

a) Mr. Wang Tzu Tao - Director

V. Agricultural Exhibit Hall, College of Agriculture, National Taiwan University, P.O. Box 6054, Taipei, Taiwan.

a) Mr. James Y.C. Lee - Agricultural Exhibit Hall-in-Charge.

VI. Metal Industries Development Centre, Taipei (Tel. 38376)

a) Mr. Schih-tschang Hu - Manager, Taipei office and Secretary-in-Charge, Machinery Manufacturing Industry Development Advisory Group, Ministry of Economic Affairs, Taipei (Tel. 31375)

VII. Mr. Yang Chia-ling - Political Vice-Minister, Ministry of Economic Affairs Taipei, Taiwan, Republic of China

VIII. United Nations

a) Mr. W. Roy Lucas - Resident Representative, UN Development Programme, No. 39 Chi-Nan Road, Sec-3, Taipei (Tel. 773176).

IX. Others

a) Mr. David S.M. Hsia - Manager, Engineering Department, Jardine, Matheson & Co. Ltd., 36, Kwei Teh Street, Taipei, Taiwan (543521) - M.F. dealer.

b) Mr. Calvin C. Chang - Chairman, Mayfoong & Co. Ltd., 198 Nanking E Road, Sect. 2, Taipei (Tel. 49368) - I.H. dealer.

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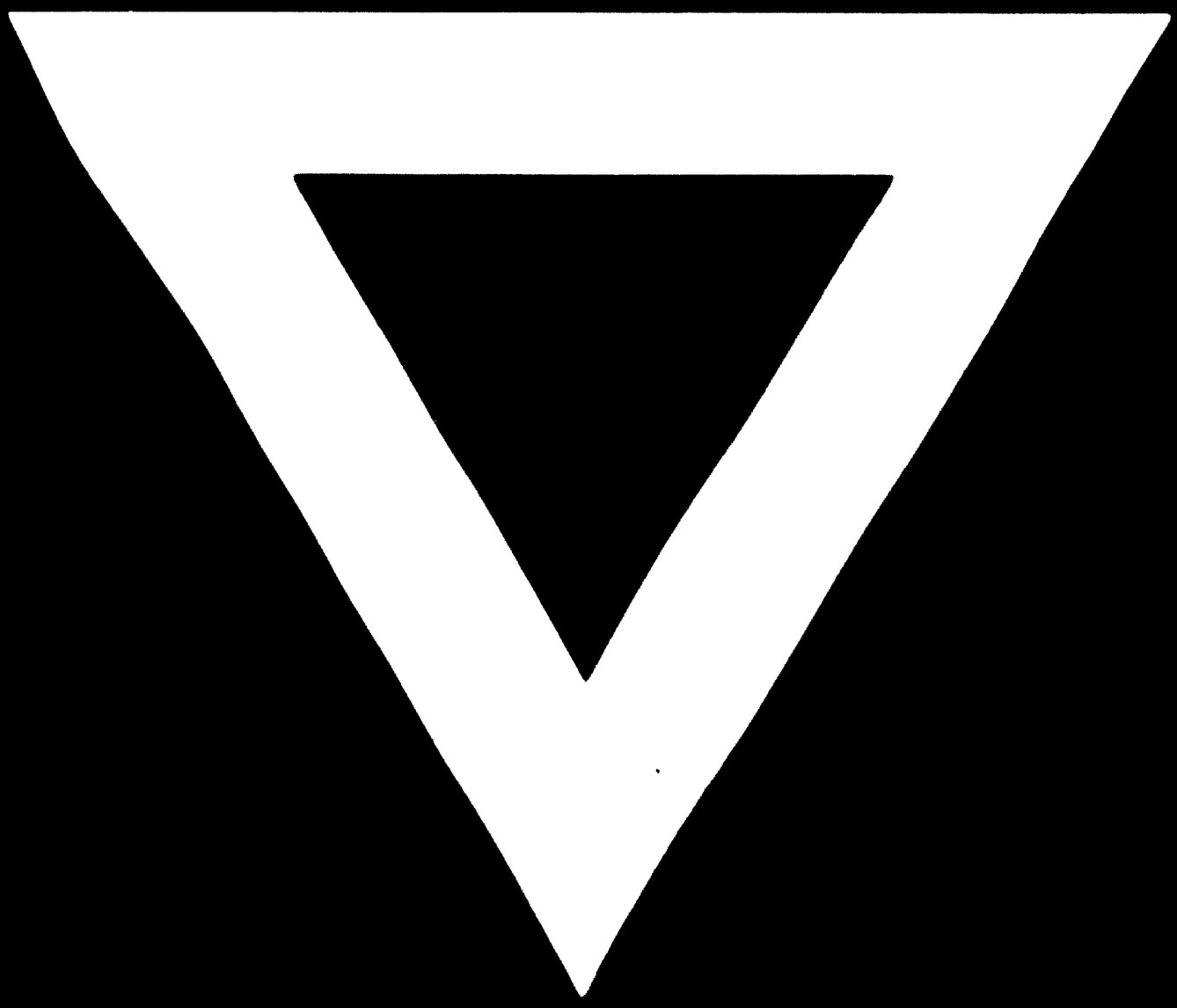

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