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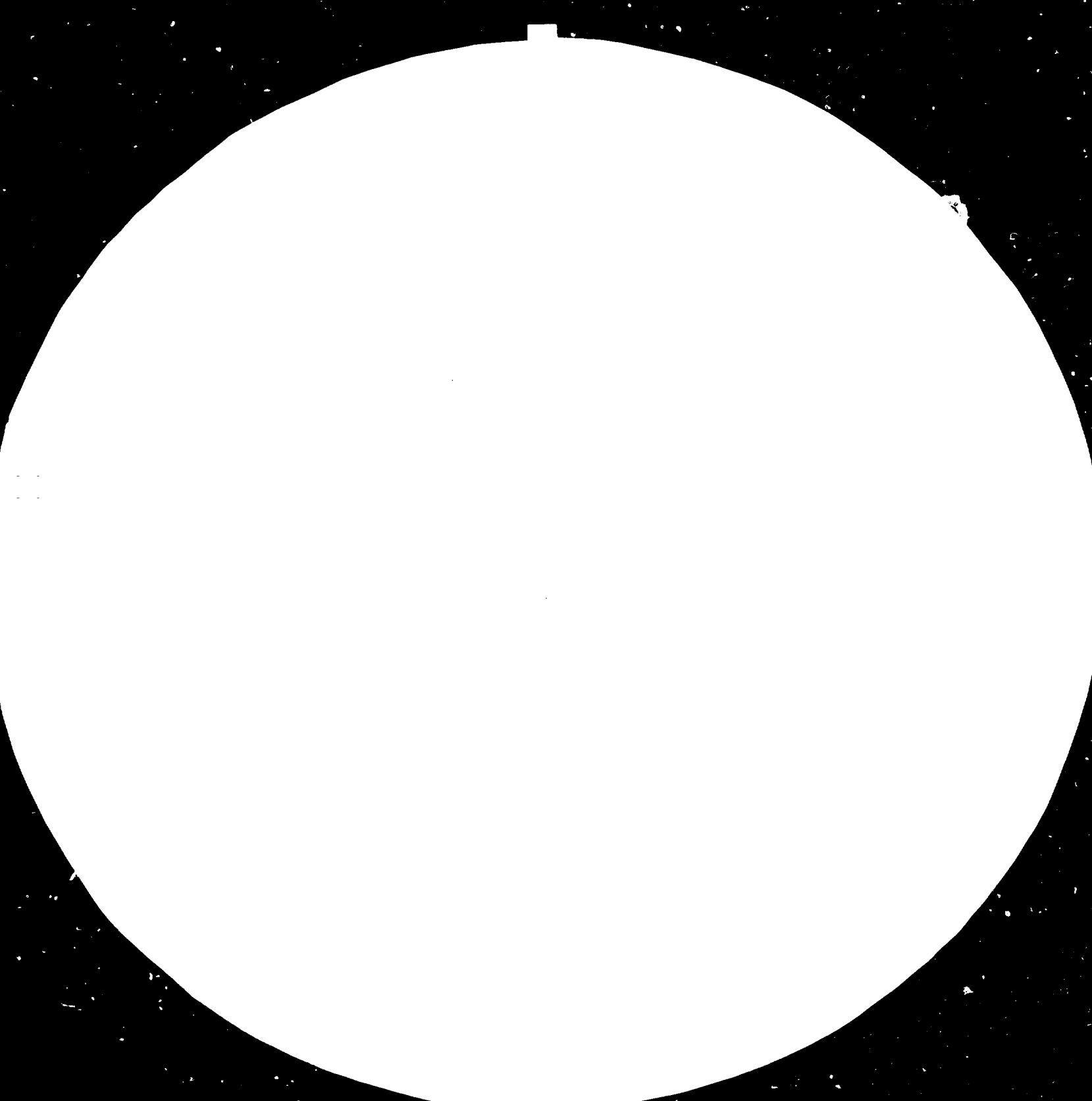

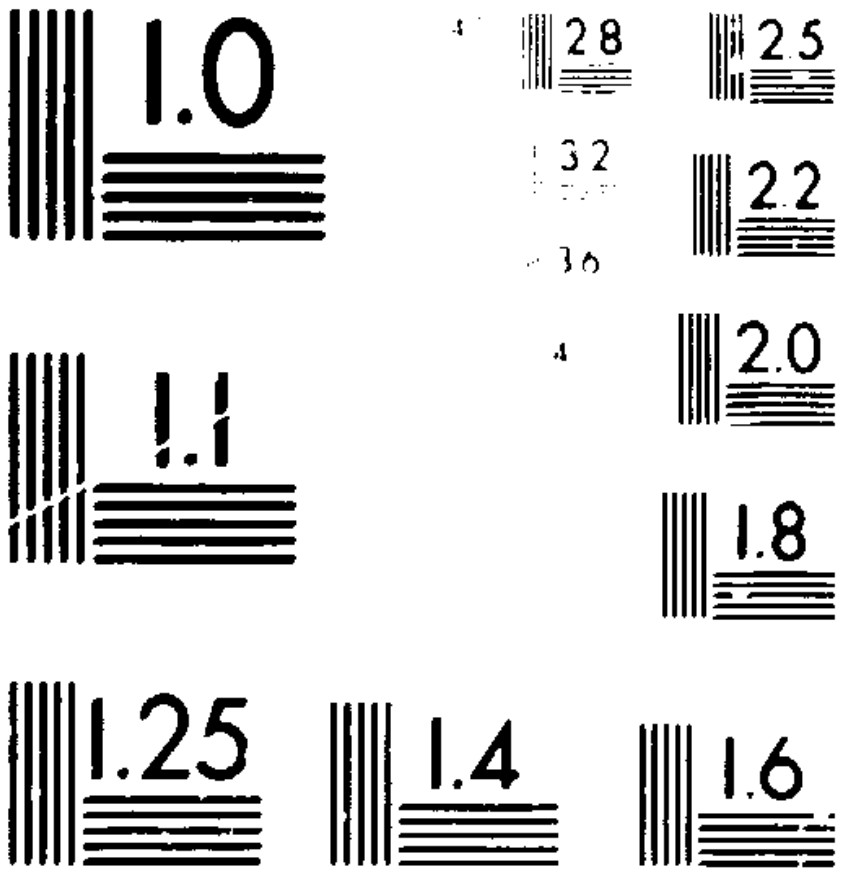

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AGRICULTURAL MACHINERY INDUSTRY IN THE PHILIPPINES*

by

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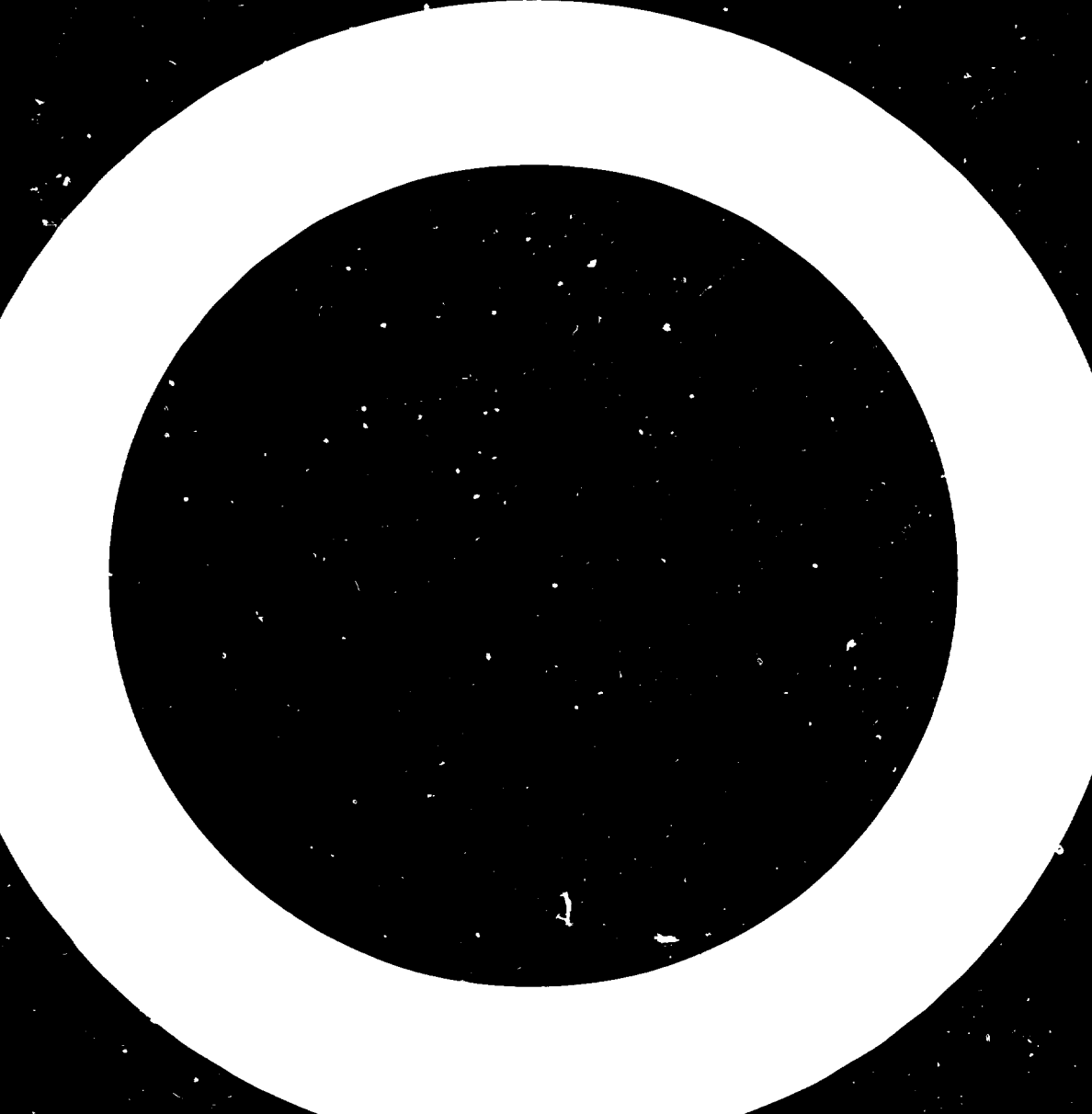

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I. INTRODUCTION

The Philippines is basically an agricultural country, although its national economic goal is to achieve a balance agro-industrial development. It has a total land area of 30 million hectares. Of the 8,217,510 hectares planted to food crops, rice accounts for 3,503,050 hectares and corn for 3,318,670 hectares. The rest are planted to root crops and vegetables. Commercial crops are planted in 3,905,890 hectares, of which 3,145,260 are planted to coconut and 424,620 hectares to sugarcane.

Farms are rather small, averaging about 2.0 hectares per landholding.

Agricultural machinery and equipment as discussed in this paper consist of the following:

1. Agricultural and horticultural machinery for soil preparation or cultivation. These include plows, seeders, planters and transplanters, fertilizer distributors, and manure soreaders; scarifiers, cultivators, weeders, hoes, and harrows; lawn and sport ground rollers; and these machine parts.
2. Harvesting and threshing machinery; straw and fooder presses; hay and grass movers; winnoving and similar machines for seed, grain or leguminous vegetablesand egg grading and other grading machines.
3. Tractors
4. Machinery used in the bread grain milling industry and other machinery for the working of cereals or dried leguminous vegetables, such as rice hullers and conetype rice mills.

2. AGRICULTURAL MECHANIZATION SITUATION

A. DEGREE OF MECHANIZATION

The degree of mechanization which can best be expressed in terms of power input to Philippine farms is only 0.2Hp per hectare, compared to Japan's 3.0Hp/ha. and U.S. of 1.0Hp/ha., Sugarcane employs the highest degree of mechanization, while coconut farming is barely mechanized.

It is estimated that there are about 5.0 million work animals which will ultimately have to be replaced by mechanical power.

B. IMPORTS

The industry imported US$ 37 million worth of agricultural machinery and equipment in 1979, US$ 25 million worth in 1980, and US$ 28 million worth in 1981. (See Table 1).

Table 1
Importation of Agricultural Machinery and Tolls
(CIF $ 000)

Machines/Tools	1979	1980	1981
Tractors	4,564	5,389	3,086
Power Tillers	1,384	376	458
Implements (Plows, Harrows, etc)	2,448	1,392	2,032
Planting/Weeding Equipment	129	161	705
Engines	17,184	5,888	8,353
Pumps	2,656	2,098	3,156
Harvesting Equipment	541	-	254
Pest-Harvest Equipment (threshers, rice mills, etc.)	6,693	7,492	8,598
Sprayers	2,269	1,865	1,238
Total	37,328	24,660	27,881

Sources: AMMDA, National Census and Statistics Office.

Due to a declining market, importations for 1982 and 1983 have further decreased.

C. EXPORTS

Very limited exports are being undertaken. This are principally in intermediate technology agricultural equipment such as power tillers, threshers, batch dryers, rice reapers, etc. which are exported to neighboring Asian countries and Africa.

D. MECHANIZATION TRENDS

1. Trends in Developed Countries

Farming practices in developed countries have undergone rapid changes due to industrialization. For example, in U.S. only 3% of the population work in agriculture and yet its production can support its population and export its surplus, whereas in many developing countries, like the Philippines, more than 50% of its population are in agriculture.

While tractor horsepower has been increasing over the past decades, tractor and fuel prices have stabilized tractor sizes to an average of 102.4Hp. Smaller tractors are also increasing to number.

The following changes are now taking place:

1. Reduced tillage inorder to reduce soil and water erosion
2. Use of more agricultural chemicals, although pollution effects are now being considered.
3. Increase in the use of lower horsepower tractors.
4. Electronic controls and sensors for engines and transmissions which is expected to match engines and speed to the load and permit more precise control over implements.
5. More refined transmissions, use of front wheel drive and 4-wheel drive to improve efficiency.
6. Use of diesel engines with improved designs on fuel economy.
7. Increased serviceability of tractors and equipment reducing daily maintenance.
8. Greater sophistication of tractors and equipment.

2. Trends in Asia

Agricultural mechanization in Asia has developed from the

manual to animal-draft power stage to intermediate technology stage. Such development has been affected by the following factors:

1. Farmers have very low purchasing power, hence, find difficultry in buying machinery.
2. Land is very fragmented, 1 to 2 hectares average, and cooperatives are not very strong except in Korea and socialist countries
3. Manufacturing is limited to intermediate technology like:
   a) implements
   b) sprayers
   c) threshers
   d) batch dryers
   e) low head pumps
   f) simple power tillers; and
   g. others
4. Complicated machinery like tractors, combines, and others are imported from developed countries like the United States, Japan and Europe.

The following changes have been experienced:

1. Transformation from manual to work animals to low technology equipments, like the use of simple power tillers and threshers, specifically those designed by the International Rice Research Institute (IRRI).
2. In many developing countries, recent demand for agricultural machinery had diminished in volume due to high energy cost and high cost of the machinery itself.
3. In many cases, the average horsepower had been reduced due to high cost of the machinery and the fragmented lands due to government land reform programs.

3. GOVERNMENT POLICIES AND PROGRAMS

A. NEDA POLICY

In line with its policies and strategies for a balanced

agro-industrial economic development, the National Economic Development Authority (NEDA), in its 5-year Development Program indicates that mechanization will be applied on a selective basis and will be adopted to local conditions and available resources.

This policy follows the "Appropriate Agricultural Machinery" Concept pursued by many developing countries with abundant labor, but scarse capital.

Determined efforts are being undertaken by government to develop the Engineering and Metalworking Industry Sector, of which agricultural machinery is a part. Several measures designed to provide encouragement of new industries in the agricultural machinery sector are being implemented or being considered.

B. BOI INCENTIVES

The government's Board of Investments (BOI) has listed Agricultural Machinery Manufacturing in its Investment Priorities Plan (IPP). Enterprises registered with the BOI are granted several incentives, such as tax credit on the basis of compliance with export or local content performance. Deductions of tariff duty and compensating tax for equipment that are purchased are applied against this performance credit.

The Board of Investments also encourages BOI-registered firms applying for permission to import agricultural machinery under tariff duty and tax incentives to buy from local manufacturers, provided the local manufacturers can meet the demand, price and specifications.

C. IMPORTATION POLICIES

Prior to Octobe 1983, there were no import restrictions for agricultural machinery, except that Monetary Board Circular No.37 lists some locally manufactured products under close monitoring of Central Bank. All these measures are being done inorder to reduce the country's balance of trade gap. Importations are generally covered by Letters of Credit and Draft Acceptances. Upon opening Letters of Credit, marginal deposits are imposed by commercial banks.

The present foreign exchange crisis that the country is facing resulted in the temporary freezing of all imports, except those indicated in the Central Bank's priorities.

A 10-50% tariff duty advalorem and an advance sales tax of 10% based on 125% of landed cost of imported agricultural machinery and equipment, is imposed. There is no distinction between knocked down (KD) and built-up (BU) equipment, except for a few equipment.

In line with the government restructuring program, tariff duties of finished products will be increased progressively, while duties for raw materials will be reduced.

Starting January 1983, duties for all imports have increased by 3% plus another 2% starting November 1983. In addition all duties will have to be paid in advance, upon opening of Letters of Credit.

D. FINANCE AND CREDIT

The upward trend in sales of agricultural machinery and equipment from 1965 to 1976 was due largely to the availability of three (3) CB-IBRD loans.

Apart from the Rural Credit Program (CB-IBRD), the following government institutions provide credit for farm machinery and equipment: Development Bank of the Philippines, Farm Systems and Development Corporation, and Philippine National Bank. Private banks are also required by Central Bank Circular No. 473 to allocate 25% of their loanable portfolio to agriculture.

E. MA-IRRI PROGRAM

The Ministry of Agriculture (MA) and International Rice Research Institute (IRRI) Industrial Extension Program conducts periodic workshops on small agricultural equipment. Enterprises are encouraged to manufacture agricultural equipment designed by the MA and IRRI.

F. MIRDC

A Metals Industry Research and Development Center operated by the government is equipped with modern metallurgical research

and scientific equipment. Local and foreign experts assist domestic industries in their technology problems.

G. AMTEC

A National Agricultural Machinery Testing Center has recently been set up at the University of the Philippines (Los Baños) to evaluate and test agricultural machinery.

H. PICAM

Only in November 1983, the Permanent Inter-Agency Committee for Agricultural Mechanization was created as a coordinating body for agricultural mechanization. This Committee is chaired by the Minister of Agriculture and co-chaired by the Director General of the National Economic Development Authority. Various ministries and private sector organizations involved in agricultural mechanization are members of this Committee.

The Committee has the following sub-committees:

1. Research and Development
2. Manufacturing
3. Marketing and Financing
4. Education and Extension

Policies, strategies and programs and now being finalized.

4. MANUFACTURING SITUATION

A. PRODUCTS MANUFACTURED

Records of the National Census and Statistics Office show that there were 30 manufacturers and assemblers of agricultural machinery and equipment. Fifteen (15) of these were classified as large firms. The industry employed about 6,000 people. The firms produced about ₱205 million worth of agricultural machinery and equipment.

The following agricultural machinery are now being manufactured in the Philippines in commercial quantities:

1. Power tillers, single axle type
2. Tractor implements, such as plows, harrows, furrowers, etc.
3. Pumps: low head centrifugal, line shaft turbines, propeller and hand (piston) pumps
4. Hand sprayers

5. Harvesting equipment: rice reapers
6. Post harvest equipment: rice mills, threshers, driers, hammermills, feedmixers, etc.
7. Hand tools
8. Animal drawn implements

In addition, there is a manufacturer of small diesel engines with very limited production.

1. Power Tillers

In the early 70's International Rice Research Institute (IRRI) designed a low-cost single axle power tiller that would be utilized by small farmers where landholdings are small: This was principally for rice using the wet farming practices. In the Philippines alone, some 50 manufacturers embarked into the manufacturing of this product and accounted for about 90% of the power tiller market of 12,000 units in 1975.

This single product achieved the following:

1. It made possible low cost mechanization for rice farming, replacing part of the work animals used.
2. It created manufacturing activity for small and medium-sized corporations.

Unfortunately, however, a rational manufacturing program was not developed such that each manufacturer were allowed to manufacture each component required, such as the gear box, pulleys, etc. Many companies suffered from poor quality problems, compounded by depressed market demand starting in 1976, only a limited number have survived.

Meanwhile, the product has been manufactured also in other Asian countries.

Many technological innovations have been made, such as steering mechanisms, higher capacity and a "floating" power tiller for use in water-logged areas.

2. Rice Threshers

The second product that has created an impact like that of power tillers is the rice thresher. It's impact is felt both by rice farmers and manufacturers.

Where before, hand threshing was being practiced, it was no longer possible because of the Masagan '79 Rice Program which increased rice yields substantially. The introduction of the IRRI rice thresher prevented grain losses due to timely threshing.

Small and medium-sized manufacturers are currently producing the thresher in almost all parts of the country.

B. BASIC FACILITIES

Basic facilities, such as foundry, forging, metal forming, machining and welding are available. There is, however, need to upgrade quality and introduce low cost and better production techniques. Component manufacturing and heat treatment facilities are required. The government's car manufacturing program has resulted in the mass production of gasoline engines, transmissions, and body stampings for both the domestic and export market. Given the opportunity, these facilities can be utilized for agricultural machinery manufacture.

C. SUBCONTRACTING ARRANGEMENT

Subcontracting does not figure greatly in the agricultural machinery industry. The Engineering and Metalworking Sector, to which the industry belongs, envisions a future industrial estate where an engineering center can supply all the basic requirements of small manufacturers. Thus, these manufacturers will not have to put up their own facilities because they can avail themselves of the center's facilities. This scheme will be economical for the industry, and the benefits to the farmers will be in the form of affordable standardized machinery of acceptable quality.

D. STANDARDIZATION AND QUALITY CONTROL

The government has begun setting minimum standards for farm machinery and equipment such as threshers, rice mills, grain driers, and corn shellers. Manufacturers are required to comply with the minimum standards before they can sell to the public. For example, the National Food Authority conducts tests on threshers, driers, and rice mills offered for sale. A certification of compliance with set standards is issued only after a successful test run.

The Agricultural Machinery Distributors Accreditation Committee (AMDAC), a government body which accredits agricultural machinery distributors and manufacturers for them to avail of government financing, sets minimum standards for each product.

An Agricultural Machinery Testing Center has been set up at The University of the Philippines, Los Baños, to assist in this function.

E. MANUFACTURING PROBLEMS

In addition to problems of lack of basic facilities, standardization and quality control, the manufacturers face other probelsm such as:

1. Inadequacy of good quality raw materials and components
2. High production costs due to high input cost
3. Inadequate financing
4. Poor productivity
5. Inadequate volumes of production

5. MARKETING AND DISTRIBUTION

Sales figures for 1979 to 1981 were provided by the Agricultural Machinery Manufacturers and Distributors Association, Inc. (AMMDA). Table 2 shows local production and importation values during the period and their shares of the total sales of agricultural machinery and equipment

Table 2

Sales of Agricultural Machinery and Equipment
(In Thousand Pesos)

	PRODUCTION		IMPORTATION		TOTAL SALES	
	Value	%Share	Value	%Share	VAlue	%Increase (Decrease)
1979	79,481	13	512,499	87	591,980	- -
1980	59,272	18	273,438	82	322,710	(44)
1981	74,591	15	412,252	85	486,843	46

Table 3

Sales of Selected Agricultural Machinery 1978-1982
(In Number of Units)

Farm Machinery/Eqpt.	1978	1979	1980	1981	1982
Standard Four-Wheel Tractor	971	836	494	566	522
Compact Four-Wheel Tractor	295	388	161	162	131-
Power Tiller	6,301	5,379	2,993	2,901	1,157
Engine	40,526	47,388	33,312	35,731	28,247
Irrigation Pumps	4,331	4,106	2,155	1,753	1,506
Farm Processing Equipment	3,169	3,916	3,652	2,957	908

Increased production and importation were made possible by the farm mechanization program with financial aid from CB-IBRD. But from 1976 to 1978, consumption and production declined substantially because the CB-IBRD loan had been exhausted.

Manufacturers and distributors operate through mixed channels of distribution: dealers and company-owned outlets.

6. RESEARCH AND DEVELOPMENT

A. TECHNOLOGY POLICY

The development of Science and Technology in the Philippines is being coordinated by the National Science & Technology Authority (NSTA), which has recently been reorganized. Under NSTA are four (4) councils, most prominent of which is the Philippine Council for Agriculture and Resources Research and Development (PCARRD) which has been in existence for some time. Most of the agricultural machinery research and development activities are coordinated by PCARRD. The Philippine Council for Industry and Energy Research and Development (PCIERD), is a newly established council and will involve itself also in agricultural machinery.

Research and Development in the field of agricultural machinery has been strong in the country due to the efforts of the International Rice Research Institute (IRRI), which has developed intermediate technology equipment such as single axle power tillers,

threshers, reapers, pumps, driers, fertilizer applicators, etc. Government agencies, like the Bureau of Plant Industry, University of the Philippines at Los Baños, National Food Authority, etc, also do R&D work.

B. PCARRD PRIORITIES

The long term program of PCARRD is to develop research and development in various areas, according to the following priorities:

I. Research and Development of appropriate technology for production and post-production operations and systems for commodities as produced by small farmers.

In line with this, the priorities according to crop and operations are as follows:

1. Rice - land preparation, crop establishment (sowing and transplanting), crop care (irrigation, fertilizer application and crop protection), harvesting, threshing, in-farm and farm-to-market transport, drying, storage and milling
2. Cassava - planting/fertilizer application, harvesting
3. Corn - planting/fertilizer application, harvesting, shelling, drying and storage
4. Coconut - harvesting, husking, splitting, drying
5. Field Legumes - Harvesting and threshing, drying and storage
6. Sugarcane - Planting, fertilizer application
7. Fruits and VEgetables - Land preparation, harvesting, storage transporting

II. Research and Development for utilization of energy resources for agricultural production operations and utilization by rural communities, such as the following:

1. Design and development of devices, tools and equipment and appropriate systems for utilizing indigenous energy resources.
2. Testing, evaluation and modification for local manufacturing and adoption of alternative energy equipment introduced from abroad.

3. Pilot studies on the transfer and adoption of energy technology packages to the end-users.

III. Research for systems studies, such as the following:

1. Standardization of machinery components, quality control studies, introduction of basic facilities and rural workshop.
2. Policy studies for agricultural mechanization
3. Socio-economic impact of agricultural mechanization
4. Strategies for transfer of agricultural engineering technology to end-users.
5. Operations research and paper studies by multi-disciplinary teams
6. Use of manpower "displaced" by mechanization
7. Packaging of agricultural engineering technology

C. IRRI PROGRAM

The International Rice Research Institute (IRRI) Program seeks to develop machines that satisfy two major conditions. First, the designs must be compatible with the technical and economic needs of the small farmers who will use them. Second, the manufacture and servicing of these machines must be within the technical capabilities of indigenous small-and medium-scale machine shops. Drawings, design, information, and limited technical support are given free to manufacturers who want to commercially produce IRRI designs when they agree to the conditions of a Memorandum of Agreement and provide information of their manufacturing facilities and marketing plans. IRRI retains worldwide distribution and patent rights for all designs developed at IRRI and does not grant exclusive manufacturing rights and license. This policy ensures for all interested manufacturers equal access to IRRI designs and creates a competitive climate that encourages the production of quality machines, product innovation, and fair pricing.

D. RNAM

The UN-Escap Regional Network for Agricultural Machinery greatly assists local institutions in the agricultural mechanization efforts, principally research and development and manufacturing. Developments in other countries are monitored and promoted in the Philippines. It also conducts workshops, exchanges of experts, and prototypes, etc.

E. OTHER R&D ACTIVITIES

There are many other government agencies undertaking research and development such as the University of the Philippines at Los Baños, Bureau of Plant Industry, Philippine Sugar Commission, National Post Harvest Institute of Research and many state college and universities all over the country.

7. FUTURE DEVELOPMENTS

It has been noted that agricultural machinery in developed countries is becoming more and more sophisticated. In developing countries, such sophistication is not available because of so many factors not present in developed countries. Manufacturing for agricultural machinery tend to be sophisticated also in developed countries utilizing mass production techniques. There is, therefore, a need to increase capabilities for accelerating agricultural mechanization in developing countries, as agricultural mechanization increases crop yields.

The following specific areas have to be considered inorder to increase production and productivity:

1. Tillage, including proper cultivation of the soil
2. Proper planting techniques
3. Seed quality, through the use of appropriate and high yielding varieties
4. Fertilization, through application of organic or chemical fertilizers
5. Crop protection through proper control application of insecticides
6. Harvesting technology, through the use of agricultural equipment

7. Proper storage and preservation
8. Transportation, through effective and appropriate transport

A. MANUFACTURING PLANS

A workshop conducted by the government represented by the Board of Investments, Ministry of Trade & Industry, Ministry of Agriculture and other agencies, and agricultural machinery manufacturers, proposed the development of manufacturing programs for various products and components. For inclusion in the Investment Priorities Plan (IPP) as pioneer projects, the following have been suggested:

1. Mini Tractors
2. Hydraulic Cylinders
3. Gearboxes
4. Blades and Tynes
5. Control Valves
6. Hand Tools

Hand in hand with inclusion of the above products in the IPP, a manufacturing program has been proposed inorder to save or earn foreign exchange and create manufacturing activities. This program, if implemented, will require progressive increases in local content. Products proposed are as follows:

1. Power Tillers
   - 1.1 Multi-speed tillers
   - 1.2 Single axle
2. Primary Tillage Equipment
   - 2.1 Disc plows
   - 2.2 Moldboard Plows
   - 2.3 Chisel Plows
   - 2.4 Ripper/subsoilers/furrower
   - 2.5 Rotary Tillers
3. Animal Drawn Implement
4. Secondary Tillage Equipment
   - 4.1 Disc Harrows
5. Cultivating and Weeding Equipment
   - 5.1 High Clearance Cultivators

5.2 Multi Weeders
5.3 Cut Aways
5.4 Chipper Cultivators
5.5 Trash Rake
5.6 Root Rake
5.7 Disc Cultivators
5.8 Disc Ratooners
5.9 Rice and Corn Weeders
5.10 Stubble Shavers
5.11 Rotary Slashers

6. Planting Equipment
   6.1 Sugar Cane and Cassava Planter
   6.2 Rice Transplanter
7. Pest Control Equipment
   7.1 Knapsack Sprayers
8. Harvesting Equipment
   8.1 Rice Reaper
9. Post Harvest Equipment
   9.1 Multi Crop Threshers
   9.2 Dryers:
       Batch Type
       Continuous Flow
   9.3 Feedmill Plants
       Feedmixers
       Hammermills, Grinders
   9.4 Rice and Corn Mills
   9.5 Corn Shellers
10. Material Handling Equipment (agricultural tractor driven)
   10.1 Trailers
   10.2 Loaders
   10.3 Graders
   10.4 Dozers
11. Irrigation Equipment
   11.1 Sprinkler Irrigation System
   11.2 Pumps
       Volute (low head, centrifugal
       Deepwell Turbine Pumps
       Hand Pumps

8. COOPERATION IN AGRICULTURAL MACHINERY

A. ASEAN COOPERATION

For their mutual benefit, developing countries, especially within a region, most cooperate among themselves in the agricultural machinery industry inorder to accelerate its development.

As example of such type of subregional cooperation is ASEAN (Association of South East Asian Nations) which aims to achieve economic cooperation among the five Asean countries. Cooperation is being developed in all areas of economic activity - industry, trade, agriculture, transport and communications, tourism, finance, etc. In the field of agricultural machinery, the UN-ESCAP Regional Network for Agricultural Machinery has initiated information exchange among countries of Asia. It is also pushing for the creation of a National Communities for Agricultural Mechanization in each country.

In addition to the large potential domestic market for agricultural machinery, there are opportunities for an expanded market due to export and Asean Cooperation. The Asean Agricultural Machinery Federation (AAMAF) organized 4 years ago has embarked on various programs aimed at increasing intra-Asean trade, such as:

1. Preferential trading arrangements in the form of margins of preference on tariff duties now being implemented for a few products with further moves to expand preferences to a wider range of agricultural machinery.
2. Mini-Tractor Program, wherein an opportunity study has been conducted by UNIDO starting February 1983 and completed in September 1983. The report is now being evaluated by the Asean Agricultural Machinery Federation. It is envisioned that the Mini-Tractor gearbox will be a joint venture project located in an Asean country and the rest of the components to be part of an industrial complementation scheme.

B. ENTERPRISE COOPERATION

Cooperation with small and medium-sized agricultural machinery firms maybe more ideal for the developing countries rather than with large firms, as such large firms employ different management,

marketing and manufacturing concepts which are difficult to implement in developing countries.

Small firms, through their trade or industry associations or government agencies, should be encouraged to cooperate with their counterparts in developing countries as their techniques and methods are more flexible.

Even among firms in devloping countries, cooperation can be encouraged. Exchanges in information especially in research and development and manufacturing will be beneficial to parties concerned.