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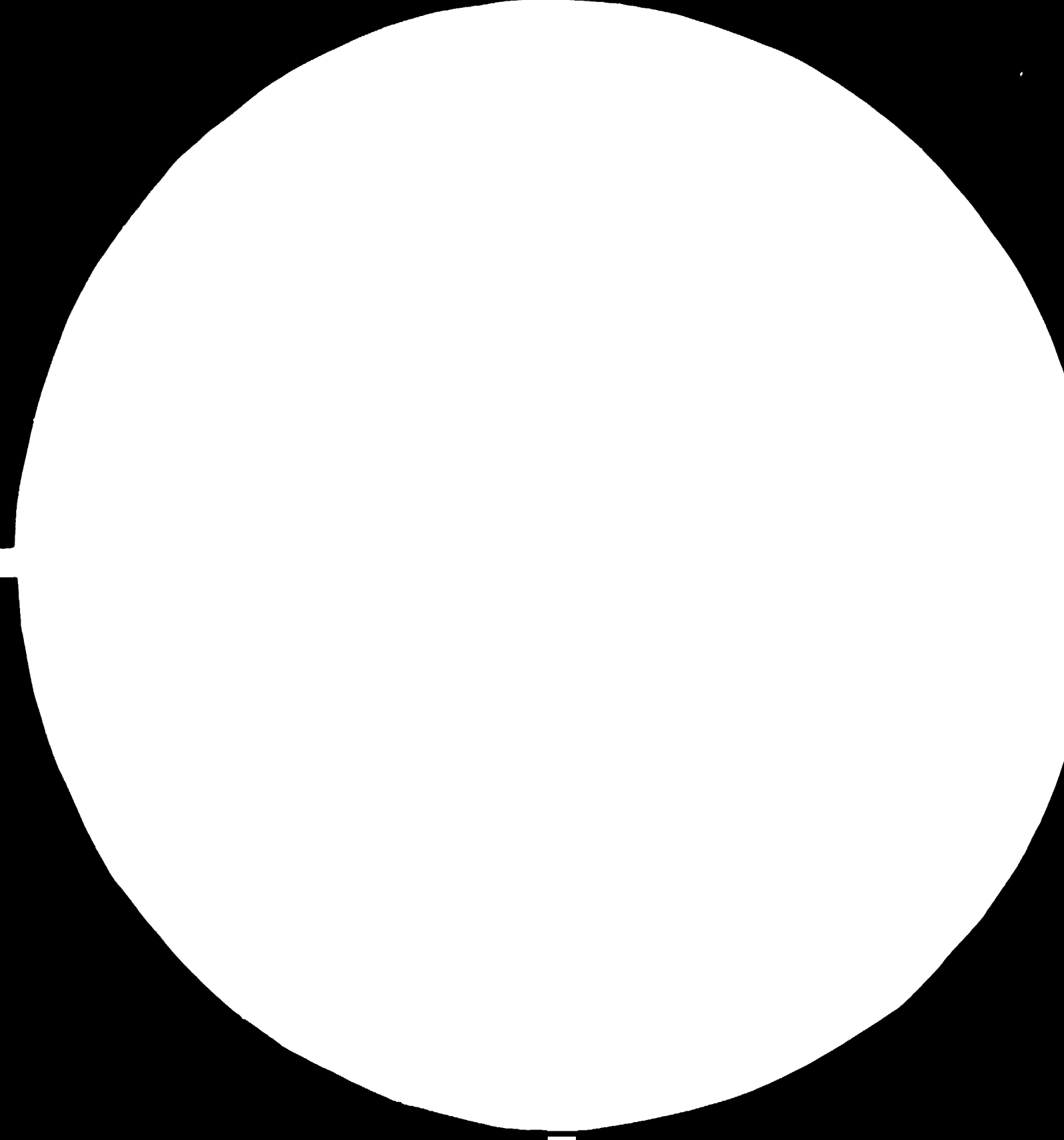
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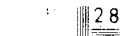
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ON THE AGRICULTURAL MACHINERY INDUSTRY IN LATIN AMERICA

(Survey)

A.N. Lyubavin

Chief Expert,
Department of Economic Cooperation
with Latin American Countries

The agricultural machinery is an oldest and, to an extent, developed processing industry in Latin America.

The first agricultural machinery plant was built in Argentina in 1878. In 1930s various seeders, harvesters, and other mechanisms were manufactured in the region but the demand was chiefly satisfied by imports.

A crucial period in the history of the industry was World War II when Latin America, a traditional exporter of farming goods, was cut off from supplies of crop raising and livestock breeding machinery.

Simultaneously with expansion of the car building industries, 1950s saw a dramatic breakthrough in the agricultural machinery industry. Tractor assembly and later manufacture was launched in Argentina in 1954 and in Brazil in 1959. In 1970s Mexico, Peru, and other countries joined the list. Tractor building is in the lead of the industry and accounts for about 70 percent of the total production worth of the industry.

A wide range of machines, mechanisms, and attachments manufactured in the industry covers as much as 60 percent of the agricultural needs; in this respect Latin America is well ahead of other developing regions.

On the other hand, if the agricultural sector is to achieve the mechanization level of developed countries, the sales of agricultural machinery have to be expanded 15 to 20 times. Therefore the potential for expansion and sophistication is immense.

National policies and planning efforts

General considerations. The unswerving drive of Latin American countries to develop their own agricultural machinery industry is on the whole a welcome trend.

Agriculture in Latin America, for all its disadvantages,

remains the cornerstone of the national economy in most countries of the region. It insures much of their export earnings as well as satisfaction of their vital needs.

The industry's development is now unthinkable without appropriate mechanization; doing this with reliance on the country's own resources would be doubly beneficial. In this way not only the much-needed machinery is provided but also the foreign currency is saved, employment increased, industrialization enhanced, the overall economic potential improved. Therefore creation of a national agricultural machinery industry is the goal of most countries.

For the objectives to materialize, a significant industrial infrastructure and a fairly large market making the industry cost effective must be available.

Inadequacy of these factors dictates the actual practices of specific countries and, obviously, explains the variations in the scale and sophistication of the industry from country to country.

About 90 percent of agricultural machinery in the region is manufactured in Brazil, Argentina, Mexico, and some medium size countries such as Peru and Venezuela. Their governments use various incentives to stimulate the national agricultural machinery industry which will be listed in this section.

The industry is, as a rule, financed by private (foreign, mixed or national) capital and the governments do not possess direct leverage to plan and manage the industry. An exception is made by new tractor and diesel engine assembly works in Mexico, Peru, and Venezuela where the national share belonging to government organizations is 51 percent ⁺⁾ but the rule still holds for

⁺⁾ The Cuban agricultural machinery industry is left out of this survey

the user of their products is agriculture where private ownership and utilization of land remain unchallenged.

Furthermore, the foreign investors into the industry are transnational corporations, TNC, which dominate the world market of agricultural machinery. True, they profit from local production, but their desire to expand direct marketing of agricultural machinery in the region is thus countered.

Elements of planning. Expansion of the agricultural machinery industry as a major sector of the national economy is provided for in global and sectoral programs of national economic development which are worked out by the government bodies in Latin American countries but the targets are more in the way of forecasts; if they do not match the business interests of the factories, the industry falls far short of them.

In Peru tractor and diesel engine manufacture were envisaged in the framework of industrialization programs incorporated into the 1971-1975 National Development Plan and the 1977-1980 "Tupac Amaru" Government Plan. In Mexico the need to expand the tractor manufacturing industry is formulated in Programa de Fomento para la Fabricación de Tractores Agrícolas para 1980-1985. A measure of growth is also envisaged in economic development programs of Brazil, Argentina, Columbia and other countries.

Incentives. An indirect but effective way to help the expansion is to step up the farming production, in particular by better utilization of cultivable lands. According to the Inter-American Committee for Advancement of Agriculture, by mid-1960s in seven countries which provide two thirds of the farming production in the region as little as 24 percent of cultivable lands were till-

ed of which 16 percent were in large holdings. In 1960s-70s land reforms were enacted in Venezuela, Peru, Panama, Ecuador, and Columbia. The actual implementation of the reforms did not settle the social problems but activated medium size farms and helped involve large holdings into market oriented production. In Mexico land reform was carried out in 1910-17; now the government backs consolidation of traditional peasants' holdings (ejidos) and their transition to market-oriented production. The Argentine government leaves intact the prevalent land ownership system but encourages market-oriented production and cultivation of new areas in remote parts of the country.

Another kind of incentive is direct subsidizing and loans on favorable conditions for improved mechanization in tillage, cultivation, harvesting, storage and transportation of farming products. Since 1982 the Argentine state provides loans on favorable conditions for farms which buy machinery and construct grain storages. State-owned service stations for agricultural machinery are set up.

State loans are given to farms which purchase locally made agricultural machinery in Brazil. In compliance with a global plan of national economic development, the needs of agriculture, including mechanization, are funded in Mexico by the profits from oil sales.

A significant contribution to the national agricultural machinery industry is also made by the state sector activity in development of the infrastructure, including power stations, expansion of capital goods industry and other facilities and materials that are useful in the agricultural machinery technology.

Still another way employed by Latin American governments to

promote national industries is to control the technology transfer procedures and to set up and maintain research bodies such as the National Institute of Agricultural Technology in Argentina which concentrates on systems research in national agriculture, in particular, improved agricultural mechanization.

Most Latin American countries producers of agricultural machinery employ various protection policies. Thus in Brazil import regulations practically ban importation of assembled tractors whilst for importation of other kinds of farming machinery a one year deposit worth the price of the equipment must be made. In Mexico no duty is imposed on imports of tractors, especially as units, but an import licence must be obtained before they can be bought. As a result the tractor import fell from 16,700 units in 1970 to 5,400 in 1980.

With the introduction of the "open economy" policy in 1976 the Argentine government significantly reduced the import duties for equipment, in particular agricultural. The goal was free competition which would enforce the local industry to improve the performance and cost-effectiveness. However, the agricultural machinery industry did not rise to the occasion and the tractor manufacture fell from 19,100 in 1975 to 1,900 in 1981 even though the agricultural production and, in all probability, the agricultural machinery market, expanded significantly during that period.

The legal foreign share in the capital of mixed capital agricultural machinery factories has been cut back in Mexico, Peru, and Venezuela to 49 percent. Foreign participation is also reduced through replacement of imported parts by those manufactured locally. In these measures, however, the authorities are often moti-

vated by the desire to stimulate the national industry rather than by its actual potential; therefore the replacement takes longer than expected or fails.

To expand the agricultural machinery market for their national industries, Argentina and Brazil employ the mechanism of regional economic organizations for exportation of their products. In Peru and Venezuela the tractor and diesel engine assembly works were constructed with a view to exporting their produce chiefly to other countries of the Andean Pact within the framework of agreements on cooperation in industrial production.

Such are likely important measures adopted by Latin American countries to promote their agricultural machinery industries.

Present situation and trends of the agricultural
machinery industry

A total of 80,000 to 90,000 tractors, about 120,000 self-propelled harvester combines, and an immesuarale number of other facilities, implements, and attachments are annually manufactured in Latin America.

About 90 percent of this amount is manufactured by Brazil, Argentina, and Mexico which are also ahead of other countries in the variety of products. They cover their own need in practically all kinds of agricultural machinery including sophisticated facilities such as tractors, harvester combines, and milking machinery. Brazil and Argentina export some of their produce, chiefly to neighboring countries.

Tractors are also assembled in Peru, Venezuela, and Uruguay but this activity is hampered by numerous factors, of which marketing problems are most important.

Most countries of the region manufacture implements and attachments whilst sophisticated machinery is imported.

In what follows the status of the agricultural machinery industry in the leading and some other Latin American countries will be discussed.

Brazil

The country has an immense market and so agricultural machinery can be manufactured on an impressive scale.

Farmlands cover 294 million hectares. Large (over 100 hectares) farms cover 76.5 percent, medium (10 - 100 hectares) 20.4 percent. Small farmers account for one half of all holdings. About 35.3 million hectares are under cultivation.

The tractor park of Brazil is estimated as 260,000 units the average area-to-tractor ratio being 136 hectares/tractor.

In 1980 \$1,800,000,000 worth of agricultural machinery, including 68,000 tractors, was manufactured. The 1982 production is estimated as 1,550,000,000 of which tilling facilities accounted for about 30 percent, seeders and fertilizing equipment five percent, cultivators two percent, irrigation and drainage facilities seven percent, crop protection facilities nine percent, harvesters 32 percent, transportation facilities five percent, and storage and other facilities 10 percent.

In 1980 about 400 companies manufactured agricultural machinery, of which 190 tillage facilities, 120 harvesters and post-harvest crop processing facilities, 60 animal farm equipment, and 20 milking equipment.

Tractor manufacturing is concentrated in the hands of ten corporations of which six are subsidiaries of transnational corporations. The leading positions are held by the Canadian-based

Massey do Brasil (a total of 19,000 tractors sold in 1977), Finnish-based Valmet do Brasil (14,500), Ford do Brasil (3,700), Brazilian-French Agrale Tractores (4,100) and Compa^{SA} Brasileira de Tratores (3,500, some parts shipped from Poland and Rumania).

Massey Ferguson and five Brazilian companies, Penha de Maquinas Agricolas, Marchesan Implementos e Máquinas Agrícolas Tatu, Máquinas Agrícolas Jacto, Industria de Máquinas Agrícolas Funkch and Nicola Rome Máquinas e Equipamentos manufacture one half of tillage facilities.

The leading companies in manufacture of harvesters and grain processing equipment are the US-based Sperry Rand do Brasil - Divisão New Holland, the Brazilian Schneider Logement, Massey-Ferguson, and the Brazilian-based Industrial Santa Matilda and Santa Equipamentos.

Automatic milers are manufactured chiefly by Alfa-Laval Equipamentos, Sweden; Westphalia Separator do Brasil, West Germany; and Trilho Otero Industria de Máquinas Agrícolas.

Other facilities for animal farms are manufactured by numerous Brazilian companies, of which the largest is Case S.A. Industria e Comercio.

Despite the fact that quite a lot of Brazilian factories are engaged in agricultural machinery manufacture, subsidiaries of transnational corporations dominate the industry, partly owing to the government policies of attracting foreign capital. The uncontested leader is Massey-Ferguson with its 1977 sales worth \$ 50 million which manufactured every third Brazilian tractor and a significant amount of tilling and harvesting facilities. It owns two factories in the state of São Paulo and one in Rio Grande do Sul.

Much of agricultural machinery is exported. The export was \$ 44 million worth and was expected to reach \$ 61 million in 1982, of which 60 percent were accounted for by tractors, 20 percent by harvesters, and 16 percent by tilling facilities. The chief markets were Paraguay, Uruguay, Columbia, Ecuador and Venezuela.

In 1977 Brazil imported agricultural machinery worth \$ 29 million, which amounted to 2.3 percent of the total consumption. The 1982 import was expected to be \$ 103 million, or six percent; the increase is attributable mostly to the softening of import regulations.

As a rule, the Brazilians prefer locally made facilities the purchases of which are subsidized. Imported facilities are purchased by large farms which need powerful machinery. Three quarters of the total import worth in 1977 was from the USA, the remainder being supplied from the FR of Germany, Japan, Belgium, Sweden, and Argentina. Most producers of the imported facilities have subsidiaries in Brazil.

The agricultural machinery industry is one of the most vigorously run in the country. Since market-oriented production in the country's agriculture tends to grow, this industry will probably also expand in Brazil. The increasing involvement of large holdings in market production must result in a great rise of production of powerful cost effective facilities.

Argentina

The agricultural machinery industry is one of the leaders among process-industries. Its performance is enhanced by the considerable industrial infrastructure and a fairly large market. Farmlands cover a total of 178,000,000 hectares of which

about 35,000,000 are tillable and 21,000,000 hectares are actively utilized.

The land ownership pattern remains practically intact since the land was put to agricultural uses. Large, over 400 hectares, holdings cover 84.5 percent of farming lands, medium (25 - 400 hectares) 14.5 percent, and small, less than 25 hectares, one percent, Gigantic holdings, over 5,000 hectares, cover as much as 47.6 percent of all farmlands.

There are about 190,000 tractors, one for an average of 110 hectares, which is below the level of developed countries, but every tractor is used for three to five thousand hours annually.

The annual consumption of tractors depends on the current status (rise or fall) of the agricultural production and varies from 1,400 to 26,000.

Argentina pioneered in creation of the agricultural machinery industry in Latin America and now is second only to Brazil in the scale of the industry. The list of agricultural facilities manufactured in Argentina includes over 250 items. The total capability of tractor factories is about 30,000 units annually, which saturates the domestic market and leaves some for exportation.

In 1977 25,600 tractors were manufactured. Then the production dramatically fell and was 1,400 units in 1981, Table 1. In 1982 it rose to 3,900 but the industry remains stagnant. The chief cause of this is the decision made by the government in 1976 on liberalization of the import (elimination of restrictions and reduction of import duties), which significantly reduced the competitiveness of the national industry in the domestic market.

Table 1

Consumption, manufacture, and import of tractors in Argentina			
	(in units)		
	1979	1980	1981
Visible consumption	...	4,827	3,435
Manufacture	10,610	3,658	1,378
Import	...	1,980	2,360

Agricultural machinery is manufactured in about 100 factories. Tractors are manufactured by four subsidiaries of transnational corporations Massey-Ferguson Argentina, John Deere Argentina, Deutz Argentina, and Fiat Diesel Argentina. Until 1980 the leading role was played by Massey-Ferguson which accounted for 35 percent of the total. With the reduction of tractor manufacture during the recent years Deutz and John Deere have rushed forward with 742 and 394 tractors, respectively, in 1981. Tilling facilities are manufactured by Agrometal, Gerardi Hijos, Industria Maracos, Industrias Walter, Nestor, etc. Harvesters, including self-propelled combines, are manufactured by Roque Vassali, Señor e hijos, Daniele, Araus, Giuvergia, Metallurgica Magnino, Rotania, etc. Milking facilities is the speciality of Alfa-Laval, I.E.C.O., and Solari. Other facilities for animal farms are supplied by Mainero, Huici, Berini, Catanese, Famagro etc.

Some of their products are exported, notably to Brazil, Bolivia, Uruguay, Paraguay, Venezuela, and Columbia (\$14 million worth in 1973). On the whole the tractor export amounted to 9,000 units in 1977-81.

The Argentine subsidiary of Massey-Ferguson invested in Peru into Tractores Andinos S.A. which specializes in assembly of wheeled tractors and has an annual capability of 2,000 units. In 1975-79 Argentine parts accounted for 68 percent of the price of the company's products.

Argentina imports some kinds of agricultural machinery. This market is now noticeably expanding.

Mexico

According to the 1970 census, the cultivable lands totalled 28 million hectares, of which 16.3 million have been put to agricultural uses, the remainder being dry and in need of irrigation. The agrarian code provides for two kinds of land ownership, communal (ejidos) and private. Peasant societies own 14 million hectares of cultivable lands and are chiefly small low commodity farms. The private sector features better lands, large farms, and production for marketing.

With the adoption of wide ranging agricultural programs (Mexican Food System and National Plan of Agricultural Development) the government allocates significant funds to agriculture. The ejidos may cooperate with private farms and lease communal lands for intensive farming.

The improvement of agriculture entails increased consumption of facilities. In 1981 there were 176,500 agricultural tractors in the country, one for every 92.5 hectares (in 1970, for 163.9 hectares). In the framework of Programa de Fomento para la Fabricación de Tractores Agrícolas this index is to be reduced to 52.5 hectares.

Five companies of which four are subsidiaries of transna-

tional corporations manufacture 14 models of tractors. Since 1973 direct foreign investments cannot exceed 49 percent in local factories but in some cases this figure is allowed to be surpassed.

Table 2

Consumption, manufacture, and import of tractors
in Mexico in 1979-81

(in units)

Consumption manufacture import Consumers	Foreign investments, percentage	Rated capability	1970	1980	1981	Mean an- nual growth, percent
<u>Visible consum- ption</u>	-	-	20,513	21,756	23,766	7.6
<u>Manufacture</u>	-	20,000	14,613	16,356	20,766	19.4
Agromac	Massey-Fer- guson	8,000	5,818	5,403	6,866	10.0
Ford Motor	license	4,500	4,150	5,564	6,069	21.6
International						
Harvester	49	2,500	1,795	2,717	3,029	31.4
John Deere	49	2,500	2,215	1,977	2,302	2.8
Sidena (T-25)	license from the USSR	2,500	635	695	2,500	134.6
<u>Import</u>	-	-	5,900	5,400	3,000	26.5

The leader in Mexican tractor manufacture and generally in the agricultural machinery industry in 1979-81, 33 percent of the market, was Agromac, which is a subsidiary of Massey-Ferguson Canada, and specializes in 30 - 59 hp tractors.

Powerful, over 90 hp, tractors are manufactured by subsidiaries of International Harvester and John Deere.

Siderurgica Nacional (Sidena), a state-owned company, has purchased a license for assembly of wheeled Soviet 30 hp T-25 and 67 hp Ford-660 tractors. The T-25 contract provides for expansion of the operation and lists parts to be transferred to Sidena for manufacture locally.

Tractors are manufactured for the domestic market alone and not in sufficient supply at that. In 1979-81 29 - 13 percent of the need was covered by import. On the other hand, the import tended to decrease in terms of both the units and the percentage of the total. Because Mexico limits the import, the chief

import item, over 60 percent of the total, were high power, over 126 hp, tractors which are not manufactured there.

The forecast of the tractor manufacture and consumption ratio for 1983-90 is as follows.

The annual growth of tractor consumption is expected to be 6,8 percent, the 1985 level estimated as 25,000 units, and the 1990 level as 42,000 units. The share of medium, 30 to 50 hp, tractors will fall to 10 percent, and of those over 60 to 90 hp grow to 73 percent of the sales. According to NAFINSA, a Mexican organization, tractor manufacture will grow and amount to 23,000 in 1985 and to 40,000 in 1990, the per unit power also growing. The import will continue to decrease and by 1990 will fall to about 2,000 tractors.

The commissioning of a new state-owned agriculture tractor factory is scheduled for 1983. Ford Motor decided to move the production from a Sidena factory to a new plant which will manufacture 13,000 70, 86, and 135 hp tractors. The operation was

also scaled up in 1981-83 in International Harvester and John Deere plants, to 6,200 and 4,600 tractors, respectively.

Peru

The agricultural machinery market in Peru, although far from being saturated, is limited.

The theoretical estimate of farmlands is 18,600,000 hectares of which merely 3,700,000 have been put to actual farming use (in particular, 1,900,000 are tilled), chiefly in the coastal area (Costa) and partly in the mountains (Sierra). The remaining lands are either non-fertile or inaccessible; their utilization would require significant funds, notably for creation of the necessary infrastructure.

Following the 1969-77 land reform which limited private lots to 150 - 300 hectares in the Costa and 15 - 55 hectares in the Sierra, and 30 - 110 hectares in the Selva. Large and medium farms account for 42.5 percent of tilled lands. Among these, cooperatives take up 29.5 percent of the total. There are large, well-equipped combines based on former private agro-industrial businesses. Well-run medium size farms account for 16.5 percent of the total. Small holdings, 54.2 percent, are largely low-productivity minifundia.

The machinery utilization is generally low. There is one tractor for every 224 hectares of tillable lands, but in the Costa this indicator is 82.6, in particular in large (over 100 hectares) farms 70, medium farms 56 - 48, and in small, below five hectares, farms it is 192. In large farms of the Sierra there is an average of one tractor for every 92 hectares.

The tractor park amounts to about 8,000, the annual consump-

tion being about 400.

Until 1970 the needs of Peru in agricultural machinery, notably in sophisticated facilities, were covered mostly by imports.

In 1973 mixed-capital companies, Tractores Andinos S.A. (TASA) specializing in assembly of wheeled tractors and Motores Diesel Andinos S.A. (MODASA) for assembly of diesel engines were established in pursuance of the government program for development of national industries. TASA included the Peruvian state organization INDUPERU (51 percent of the capital) and the Argentine subsidiary of Massey-Ferguson (49 percent); investments into MODASA were made by INDUPERU (32 percent), Perkins Engines Ltd., Britain, (24 percent) and Volvo A.B., Sweden (24 percent). In 1975 TASA commissioned a 2000 units per year tractor assembly plant the capacity of which was to expand to 7,000 units, of which 70 percent were to be exported to other Andean Pact member nations.

Massey-Ferguson committed itself to supplies of spares and CKDs on the world market prices, the share of the local production being set at 60 percent. The 10-year contract was extendible.

TASA averaged only 320 tractors annually in 1975-80, all consumed by the local market. Parts were first imported from Argentina and then from Brazil and Britain. The national share never exceeded 32 percent. The causes of this low performance were high production costs, shortage of foreign currency, and problems of marketing in neighboring countries. Nevertheless, the TASA activity is highly appreciated; its products now account for over 30 percent of all the tractors used in the country.

MODASA commissioned in 1979 a factory which was to make up

to 15,000 diesel engines annually, of which one half was to be exported to the Andean Pact member nations. In 1979 2,200 engines were assembled. Some of these were installed in locally assembled tractors but at a later stage TASA preferred cheaper engines of British make.

Every fifth of the total of 400 tractors sold annually in Peru in 1975-80 was imported by one of about ten foreign companies such as Massey-Ferguson, Ford Motor, International Harvester, and John Deere whose sales in 1961 - 78 totaled 2,994, 1,437, 1,162, and 1,329 tractors, respectively.

In 1980 the Peruvian government lifted the import restrictions and reduced the import duty to 60 percent of the sales price for tractors. To maintain its leading position in the country's market in the face of increased competition, TASA adapts its tractors to the local tillage conditions.

Venezuela

Of the total of 22,100,000 hectares of farmlands only 4,800,000 are utilized for crop raising.

Large, over 500 hectares, holdings cover 80 to 84 percent of farmlands while medium size farms, 12 percent.

The 1960 land reform gave the peasants some state-owned land and land purchased from large holdings. . These lands have for the most part never been tilled, are far removed from agricultural centers, and, because heavy financing is needed, have not been put to intensive use until now.

In 1973-74 the government invested two billion dollars to breath new life into agriculture, chiefly through increased importation of machinery. Still, the country's farming is

stagnant, chiefly because the prevalent large holdings do not easily integrate into market-oriented production. In the framework of the national agricultural development program, a plant with a rated capability of 6,000 agricultural 60 - 120 hp tractors was put into operation in 1977. The plant, owned by a mixed capital company FANATRACTO, was also to make diesel engines at an annual rate of 8,000 and crawler tractors at an annual rate of 200 units. As in the case of Peru, some of its produce was to be exported to the Andean Pact member nations.

FANATRACTO is jointly owned by the government (45 percent), John Deere (20 percent), and private investors (35 percent). John Deere allowed FANATRACTO the right to manufacture under its trademark, access to all Venezuelan registered patents, provided aid in construction, and agreed to the 60 percent local share in the production.

Because FANATRACTO tractors proved to be 33 percent more expensive than identical imported models, the company temporarily discontinued their production in 1980.

The annual Venezuelan market of agricultural tractors does not exceed 3,500 to 4,000. Companies of 10 countries sell their tractors in Venezuela. In 1979 3,981 tractors were imported whose total worth was 41,700,000, of which from the USA 1.212, from Britain 715, from the FRG 638, from Brazil 457, from Belgium 280, from the Netherlands 180, and from Argentina 15.

The most active exporters were Ford Motor, Fiat, International Harvester, John Deere, and Klöckner Humboldt Deutz, which have installed dealers, repair workshops, and stores of spares in farming districts.

Some Other Countries

Uruguay. The small area (176,000 square kilometers) and population (2,880,000) make economical manufacture of farming equipment well-nigh impossible. On the other hand, the country is rich in resources for intensive farming. Ninety percent of the area are farmlands, of which 1,800,000 hectares are tillable. Agriculture is relatively well-advanced and is a major sector of the national economy.

Large, over 100 hectares, holdings, cover 92 percent of farmlands are intensively utilized and set the pace of agricultural production. The land there is managed either by the owners (52.7 percent) or is leased in various forms (47.3 percent).

About 40,000 tractors are employed, one for every 44 hectares. The population outflow from rural areas tends to accelerate the rate of mechanization.

The demand for agricultural machinery is satisfied chiefly through exportation. A wide range of machines and attachments, from tractors and combine harvesters, to ploughs and harrows, are imported from practically every country which is a major producer. There are over 250 models of tractors, whose power ranges from 10 to 350 hp. Tractors with sets of implements are shipped from Brazil, Argentina, the USA, Britain, the FRG, and other countries, and grain harvesters from the USA and FRG. Small lots arrive from socialist countries.

The import is controlled by local importer companies which have government permits for foreign purchases of authorized lists of goods and must insure service and supply of spares for the equipment imported through them.

Thus Interagroval S.A. imports products of International Harvester, Bosso S.A. of John Deere, and Mayfair S.A. of Massey Ferguson. Czechoslovak machinery is imported through Čeda S.A. and Polish machinery through Santa Rosa Automobiles S.A.

Table 3

	1978		1979		1980		1981	
	units	\$ million	units	\$ million	units	\$ million	units	\$ million
Tractors	265	3.1	2,305	22.4	...	26.4	881	9.1
Sets of parts for assembly of tractors	...	3.4	634	4.5	...	2.0	74	0.7

Until 1979 only parts were allowed to be imported for subsequent assembly in local plants. Once the government allowed import of assembled tractors, the import of parts has noticeably reduced. The reduction of the import of tractors in 1981, Table 3, is attributable to the crisis phenomena in the country's agricultural production.

Columbia. The area of farmlands in Columbia is about 27,000,000 hectares of which 3,600,000 hectares are tillable. Large, over 500 hectares, account for 45 and medium, 5 to 500 hectares, holdings, for 52 percent of farmlands.

The 1961 land reform whereby latifundia which had not been utilized for ten years were to be purchased and transferred to the peasants was a non-starter. By 1973 the peasants received 3,300,000 hectares but these were chiefly unutilized state-owned lands. The land reform has been discontinued and measures

are being taken instead to improve the farming efficiency through market-oriented production.

The annual consumption of agricultural tractors is about 3,000 which are imported from economically developed countries and also from Brazil and Argentina.

Implements such as ploughs, cultivators, seeders, etc. are manufactured locally in sufficient amounts by 30 national companies. Industrias Metallurgicas S.A., Interagro S.A., Electromanufacturas S.A., and Allaguico S.A. manufacture 95 percent of tractor-mounted implements. Some of the products are exported, chiefly to neighboring countries.

To summarize this section, the basic features of the Latin American farming machinery industry are:

- the production in the leading countries of the region is fairly advanced and meets most of the domestic demand;
- the capabilities of the existing plants are not utilized to the full, which reduces their efficiency but holds the promise of stepping up the production in the coming years;
- the network of national plants is fairly extended but the commanding positions are held by subsidiaries of transnational corporations and mixed capital factories which, between them, dictate the level of local production. Massey-Ferguson produces every third tractor in the region. John Deere, International Harvester, Ford Motor, Valmet, Fiat, Klöckner Humboldt Deutz, etc. enjoy secure shares of the local markets;
- the on-going importation covers 40 percent of the total consumption. In the leading countries the share of import is 15 to 20 percent, made up of units which are not manufactured locally. The main exporters are the same transnational corpora-

tions which are active in the local industry;

- the high local production costs reduce the competitiveness of the national products against imported goods. In this context governments take protectionist measures to enhance development of national industries;

- the expansion of market-oriented production, a trend observed in most countries of the region, entails expansion of the local agricultural machinery market, which seems to be the most important factor which will contribute to production increase in the near future.

Interrelationships between agricultural machinery and capital goods industries

The agricultural machinery industry and capital goods industries (CGI) are closely interrelated and their relationships is a major factor which determines the potential and development level of the agricultural goods industry.

These interrelationships can be referred to as "familiar" because the agricultural machinery industry itself is production of capital goods, machinery for the agricultural sector, but has its own specifics. As it manufactures special-purpose goods, this industry is heavily dependent on other CGI sectors, which supply the equipment, metal, and numerous components whose production by the industry itself would be uneconomical. In its turn, the agricultural machinery industry acts in the CGI sphere as internal market whose dynamics dictates, to a significant extent, the actual performance and promise of production in other its sectors.

Historically, the relationships between the industry and CGI in Latin America are remarkable in that agricultural machi-

nery production was launched in the leading countries of the region at the first industrialization step, in 1930s and during World War II, or long before the CGI structure was built and acted in those times as a major stimulant of national industries.

In the post-war years, or at the second stage of industrialization, the development of the national metallurgy, in its turn, helped the agricultural machinery industry to manufacture a wide variety of products to meet the needs of agriculture in those countries.

The effect of the iron and steel industry on the scale of the agricultural machinery industry is quite visible even now. In the countries of the region where national iron and steel industries exist, the agricultural machinery industry either is on its own feet or in the making. This is true, above all, of the "big three", Brazil, Argentina, and Mexico and, to an extent, of Peru and Venezuela.

Of course, the interdependence of the iron and steel and agricultural machinery industries should not be overemphasized, for the performance of the latter industry also depends on the market dynamics, the fraction of local production in the total, etc. On the other hand, the market of the iron and steel industry is much wider than supplies of the agricultural machinery industry plants. Nevertheless, their interdependence is obvious, as shown in Table 4.

Table 4

Steel and agricultural tractor production in 1979

	Steel production, million tons		Tractor production, thousand units	
	Capability	Actual	Capability	Actual
Brazil	...	13.9	70	64.0

Mexico	9.9	7.2	20	14.6
Argentina	4.8	3.2	30	10.6
Peru	0.6	0.44	2.0	0.3
Venezuela	2.0	1.3	6.0	...

Long-term industrial development programs in the leading Latin American countries stipulate further increase of the iron and steel production in the near future through both expansion of the existing and construction of new works. The planned annual growth in Brazil is 7.7 and in Mexico, 10 percent. Even though it has no significant resources of the ore or coal, Argentina intends to become self-sufficient in steel production in 1980s.

If these programs are at least partially successful, the industrial output, notably of agricultural machinery, could be stepped up.

The iron and steel industry requires much funding and is run in the region chiefly by the state sector which dominates the field, as is seen in Table 5 for Brazil. The part played by the state in the iron and steel industry has been enhanced by the nationalization of the leading plants in Peru and Venezuela in 1970s and is to increase. As for foreign participation it is limited but not eliminated in the leading countries of the region, for it remains the chief source of up-to-date technology.

The lead which the state-owned iron and steel industry takes is favorable, on the whole, for other sectors of CGI, notably the agricultural machinery industry because the metal supply is stable while there is no need for them to invest into its production. One negative feature of this arrangement is low

productivity and high production costs of most state-owned metal works, which leads to high prices for metal and, consequently, to high costs for metal consumers, one of which is the agricultural machinery industry.

The machinery producing industry which is the so-called "uppermost" element in CGI is concentrated in the "big three" which account for about 90 percent production in the region. Unlike the iron and steel, the machinery producing industry relies completely on private investments, above all of foreign capital which controls the production in this sector almost unchallenged.

Table 5

The structure of capital investments in some
Brazilian CGIs, percent

	State sector	National private sector	Foreign sector
Iron and steel	65	32	3
Nonferrous metal industry	1	80	19
General machinery producing	1	57	42
Power engineering	-	38	62
Tractor manufacture	-	30	70

Subsidiaries of TNCs and mixed capital companies with various shares of foreign capital occupy the commanding positions in the industry. Among these corporations are Vigorelli in the machine tool industry and General Electric in the power industry. This has been shown above to be equally true of the agricultural machinery industry, notably of the tractor building.

The extensive involvement of TNCs in the machinery producing

industry is encouraged by Latin American governments which believe that this approach is the most realistic and that the technological gap cannot be bridged and up-to-date equipment manufactured as long as the finances, engineering and scientific skills, and know-how are in short supply.

TNCs are, however, useful in construction of the machinery producing industry only to an extent. Even in the leading countries the performance of the industry is not high. In mid-1970s the region possessed as little as 20 percent of the needed machine tool and press-forging plants. Especially low was the production of nonstandard equipment for many "uppermost" CGI elements, the agricultural machinery industry including. The electric machinery production was in a somewhat better shape. On the whole, the local factories satisfied only one half of the local demand for machinery, 90 percent of the capabilities being used owing to low efficiency in most plants of the industry. The outdated technology, low quality, and high cost of the products resulted in low competitiveness against imported goods even with government incentives such as subsidies, tax exemptions, and protectionist barriers.

For the agricultural machinery industry which needs machine tools, press-forging plants, and parts which are manufactured by other national machinery producing industries these shortcomings result in higher costs, low performance and cost-effectiveness, and, which is probably most important, makes the programs of making the industry fully national unrealistic. As a result, the dependence on imports cannot be overcome.

The above negative aspects in the Latin American machinery producing industry are true of the agricultural machinery industry.

Technologies utilized at present

The agricultural machinery industry especially manufacture of sophisticated equipment utilizes chiefly the technology imported from economically developed countries. This fact is attributable to the very process of the industry's birth and development in the region which proceeded in three stages, 100 percent imported; assembly of imported parts; and local manufacture with a share of imported components.

There are numerous causes of using foreign technologies in the industry of the region such as:

- the years-long entanglement of agriculture with foreign machinery, the availability of the associated infrastructure which came into existence during the agricultural mechanization with imported machinery and mechanisms;

- the government policies of attracting foreign technologies for implementation of national industrialization programs, which provided for, in particular, creation of the agricultural machinery industry. In the short-term this policy may be justifiable, for it yields quick results and may prove to be the only realistic approach if the industries are inexistent and the R&D system inexistent or ineffectual. In addition, the transfer of technologies entails foreign investments which cover much of the factory construction costs.

In the long term, however, this policy brings about negative results because as local factories expand their technological and material dependence on foreign sources grows and handicaps the creation of truly national production;

- the TNC policies aimed at maintaining the control of the agricultural machinery market, in particular through sharing in

the local production. On the one hand, this participation is enforced on TNCs by import restrictions imposed by the governments but, on the other hand, the TNCs profit from this participation because in this way they cut back the costs of product transportation, remove from their own countries labor-intensive processes, occupy commanding heights in the production and markets of the host countries, and, finally, make use of the preferences in machinery sales in other Latin American countries in the framework of regional economic bodies. In addition, local factories find themselves closely tied to TNCs which supply many components from their own countries where they also concentrate on the technology and product improvement efforts.

What is also important is that the technology which TNCs transfer into Latin America was originally developed for economically developed countries with their large- and medium scale farms employing intensive farming techniques. Therefore most of the machinery which is manufactured in the region under the TNC guidance is too sophisticated and expensive for small farms, especially so because its local manufacture is costlier than in economically developed countries. This makes the local market shrink, especially at this stage where small holdings are most numerous and improvement of their productivity is an important component in the overall drive to increase the agricultural production.

In 1977-81 over 300 kinds of agricultural machinery were locally manufactured, including tractors, harvester combines, seeders, reapers, cultivators, threshers, driers, dusters, stackers, ploughs, harrows, irrigation facilities, animal farm equipment, incubators, elevators, etc.

In the tractor manufacture which is concentrated in Brazil, Argentina, Mexico, and, to a lesser degree, in Peru and Venezuela, four-wheeled multi-purpose 30 - 300 hp tractors is the prevalent product. The most widely used are medium-power, 30 - 90 hp tractors but in the leading countries of the region a trend for increased manufacture of very powerful tractors is visible, which is to sustain more vigorous production in medium and, partly, large farms.

In the Mexican tractor industry the share of 60 - 90 hp tractors has grown to 42 to 77 percent during the last decade while the share of 30 to 59 hp tractors has reduced from 57 to 12.7 percent. The Brazilian pattern in 1979 was as follows: four-wheeled tractors, 86 percent; mechanized cultivators, five percent; and minitractors, four percent.

The distribution of tractor manufacture by power between the main suppliers is summarized in Table 6.

Table 6

Distribution of tractor manufacture by power
in hp between the main suppliers

	Brazil	Argentina	Mexico	Peru	Venezuela
Massey-Ferguson	45-114'	45 - 114	30-59	75	-
John Deere ...		135	90		60-120
Ford Motor ...			60-90		-
Valmet	52-85	-	-	-	-
International					
Harvester ...		-	90	-	-
Klöckner					
Humboldt					
Deutz ...		35-160	-	-	-
Kamatsu	75-160	...	-	-	-

In Mexico Soviet-licensed 30 hp T-25 tractors are manufactured. In Brazil Agrale Tractores, a company with a French share, manufactured tractors with up to 36 hp engines, including four to 16 hp minitractors.

As a rule, tractors are supplied complete with a set of tractor mounted tools and implements. In most models the engines were diesel, of Perkins, Mercedes-Benz, Detroit, Ford, and Volvo make.

In contrast with tractors, in combine manufacture the share of local technology is high. About 120 Brazilian factories are engaged in manufacture of self-propelled combines; of the six leading companies four were Brazilian which used foreign licenses with their own modifications. The most important combine producers were, however, subsidiaries of the US Sperry Rand New Holland and Massey-Ferguson Canada. Argentina which pioneered in 1930 in manufacture of the world's first self-propelled combine, makes them chiefly in national factories by licenses.

The milking equipment is manufactured in Brazil and Argentina by Swedish (Alfa-Laval) and West German technologies.

Licensing is widely practised in the region in manufacture of other agricultural machinery in hundreds of small locally owned factories which specialize in tools and implements adapted to the conditions prevailing there.

Obstacles to the future expansion of the production of agricultural machinery

The numerous problems facing the agricultural machinery industry in Latin America can be traced either to exogenous or to internal causes.

These problems prevent expansion of the agricultural machi-

nery industry and result in continuous under-capacity operation of the industry in many countries of the region.

Thus in 1977-81 the tractor plants of Brazil operated at 77 percent of their capacity, in Mexico at 75 percent, in Argentina at 31 percent, and in Peru at 15 percent. The only Venezuelan tractor manufacturing capability of Fanatracto company had to cease operation. The manufacturers of other agricultural machinery also face serious problems, despite the various government-sponsored programs designed to encourage agricultural production in Brazil, Argentina, Mexico, Venezuela, and some other countries.

One of the causes of stagnation in the industry are problems of internal marketing. The annual growth rate of the industry in the region is estimated as 8.5 to 9 percent in the region during 1970s whereas the agricultural production growth rate did not exceed three to four percent. As a result, during that decade the capability of the industry combined with import left behind the slowly growing demand for mechanization of agriculture at the current stage of its development.

On the other hand, the potential market of agricultural machinery has not by far been saturated. To catch up on developed countries, Latin America needs 15,000,000 tractors but as few as 900,000 are in actual use. Every tractor ploughs an average of 160 hectares, which is 1.8 times of the average for the developing world, 298 hectares, but is far behind economically developed countries, 34 hectares.

The agricultural mechanization in the region is seriously hampered by the existing outdated and ineffectual land ownership and land utilization practices. Large holdings, latifundia,

have been shown to cover about 86 percent of tillable lands of which as little as 16 percent have been put to actual uses whereas they possess lands most suitable for intensive mechanized farming.

On the other hand, minifundia, parcels of less than five or ten hectares, cannot make effective use of agricultural machinery which they often cannot afford. With their scarce incomes small peasants cannot run the risks of purchasing expensive machinery even with state-provided subsidies and loans especially because machinery requires additional costs of fueling, maintenance, repairs, etc.

The latifundia - minifundia system significantly handicaps agricultural production and, consequently, expansion of the agricultural machinery market. The land reform proclaimed in Venezuela, Peru, Panama, Ecuador, and Columbia in 1950s and 1960s failed to change the essence of the system. True, the fraction of medium economically active farms has increased, large holdings tend to become more market-oriented but this process is slow.

The effect of this system is at its worst in small countries of the region which find it especially difficult to find access to the necessary technology because TNCs do not, as a rule, gain from creation of local industries which are regarded as unpromising and incompatible with the overall schemes of streamlining the agricultural machinery production.

Regional trade and economic cooperation agreements may improve the marketing potential of local agricultural machinery industries. Indeed, Argentina and Brazil export into other countries of the region. But Peru and Venezuela face real prob-

lens in manufacture of tractors and diesel engines for Andean Pact member nations which can be overcome only with time.

The agricultural machinery industry itself in Latin America has its own problems. One of these is high production cost, which tells on product sale prices. Without government protectionism local machinery would be 30 to 40 percent more expensive than similar imported machinery. According to some UN estimates in Latin American agricultural machinery is more expensive than anywhere in the world, even in other developing regions. As a result, the market narrows and this prevents expansion of the industry.

Another factor responsible for the high prices of agricultural machinery in Latin America is inflation the rate of which became alarming in 1970s. Still, the chief cause is high production cost and this is attributable to low labor productivity in the plants of the industry and of the suppliers of equipment, raw material, and parts and to high cost of import.

The development program of most agricultural machinery plants provide for gradual reduction of import of parts and their manufacture in their countries. But these plans take much time in materialization and often prove unrealistic because the national industries are inadequate.

Furthermore, these plans run contrary to the interests of TNCs for which supply of parts is an integral part of their sales scheme in the Latin American market.

Competition with imported machinery is another problem. Despite the protectionist barriers introduced by many governments, local (chiefly large) customers often give preference to foreign machinery. Moreover, TNCs which manufacture up-to-date

machinery in their own countries at a profit can afford selling at acceptable prices, heavily invest into advertising and maintain a service and training network; in these respects the national industry, even aided by the state (subsidies, loans, and scarce service centers), is lagging.

The currency and financing problems also take their toll. In 1982 foreign debts of the region's countries were as high as \$ 274 billion against \$ 107 billion in 1977. With relatively low growth rates of the national economies the funding of government agricultural basic industrial development programs has inevitably to be cut back in this context.

Contribution of international industrial cooperation to the development of the agricultural machinery industry

International cooperation is a major factor in development of the agricultural machinery industry in the region.

As noted above, the development of the industry required from the outset foreign technologies, know-how, and finances, notably those of TNCs, the transfer of which may look like cooperation.

The relations between Latin American countries and TNCs can, however, hardly be described as cooperation. For the countries of the region they are dictated by the need to obtain technologies whereas TNCs want to sell in the market of the region at a profit and cannot benefit from the creation of large scale state-of-the-art industry as stipulated in development programs of at least some of these countries. Maintaining their commanding heights in the agricultural machinery industry of the region, TNCs successfully counter all "latiniza-

tion" attempts, especially because the countries themselves do not have sufficient resources or skills.

Industrial cooperation became a reality in Latin America in 1960s when economic integration began. The initial form of cooperation and specialization in manufacture of agricultural machinery was trade which helped expand the market and make better use of the manufacturing equipment. Agricultural machinery could be purchased on favorable conditions in the framework of regional economic groups such as LAFTA and the Andean Pact. When the Association for Latin American Integration replaced LAFTA, the member nations were classified into three groups, the least developed to receive most benefits from trade.

Over the period from mid-1960s to late 1970s Latin American countries signed 25 agreements on industrial cooperation and specialization ("complementarity agreements"). The fraction of regional export in the trade of Latin American countries has increased to 20 - 30 percent as compared with 10 percent before the integration processes were launched.

Argentina and Brazil (the Mexican agricultural machinery industry sells only in the internal market) became continuous suppliers of other countries in the region such as Uruguay, Paraguay, Bolivia, Ecuador, Columbia, Peru, and Venezuela. The latter two countries are allowed to manufacture tractors for sale in other countries of the Andean Pact.

In 1970 the cooperation and specialization in agricultural machinery manufacture took a new turn. Argentina and Brazil began exchange of parts and Uruguay started tractors assembly of Argentine and Brazilian parts. The countries of the region enter

agreements on technical aid and set up mixed capital factories. Thus Argentina transferred technology and supplies parts for the Peruvian tractor plant which was commissioned in 1974. It also helped start the operation, trained the personnel, and financed in part the construction and operation of the plant.

Still, it would be erroneous to exaggerate the scale of cooperation in this field. The Peruvian tractor plant is the only such case; furthermore, Argentina is represented there, rather than by a national organization, by a subsidiary of Massey-Ferguson, which is evidence of flexibility shown by this TNC in seizing the opportunity to expand the market as integration proceeds in Latin America.

Another sphere of cooperation is science and industrial technology where information is exchanged, R&D bodies set up, and a coordinated policy is worked out vis-avis transfer of technology from economically developed countries. Documents of the Andean Pact do cover technology exchange and joint utilization. Trinidad and Tobago has set up the Caribbean Institute of Industrial Research and Guatemala, the Central American Institute of Industrial Technological Research. The first ever workshop of Central American countries on development of science and technology was held in Guatemala in 1974; a committee for exchange in science and technology was set up. A Latin American conference on science and technology was held in Mexico in the same year. In 1976 Costa Rica signed agreements with Brazil and Mexico on scientific exchange.

However, aside from the declarations and decisions, the actual results in regional scientific and industrial technological cooperation do not look impressive, which is attributable

to the low scientific and technological potential of the region and shortage of funds allocated for its expansion.

In trying to expand their scientific and technological potential, Latin American countries still rely on technology imported from economically developed countries, more specifically, transferred by TNCs (even though it was developed without regard for the regional specifics); they are unanimous in desiring a favorable technology exchange system. Following their initiative, technology exchange was lively discussed by the Second UNIDO General Conference, Lima, 1975; proposals of Latin American countries were taken up by the Third UNCTAD Conference.

In their drive for an equitable technology exchange the countries of the region are backed by socialist countries which practise such exchange. Thus Mexico the Soviet T-25 tractor assembly process was licensed to Mexico without any restrictions on manufacture or sales or royalty payments and with a proviso that the share of imported parts will continuously decrease.

UN agencies support the industrial development, in particular of the agricultural machinery industry, in Latin America. ECLA continuously studies the economic and social development of the region, general and specific phenomena of the countries in the regions, gives advice and runs workshops and conferences on experience and information exchange, organizes joint discussions of agricultural, industrial, scientific and technological development.

Development of industries, in particular of agricultural machinery, is also enhanced by UNIDO activity. Aid from this international organization is especially valuable for it has

a direct bearing on the scope of the industry and covers technology improvement, R&D activities, personnel training, and interaction of the industry with other industries and the market. UNIDO analyzes the status of industrial sectors, taps the resources and runs various aid programs, organizes multilateral discussions of key aspects in industrial development and cooperation in this field.

The Lima Second General Conference of UNIDO in 1975 provided a forum for Latin American countries to make a joint proposal on changing the technology exchange system and setting up an industrial data bank (and also regional and sectoral data banks discontinuing the practice of restricting the uses of technologies, eliminations of conditions enforcing shipment of undersired products, and lifting other TNC-imposed barriers to development of national agricultural machinery production.

The Second UNIDO Consultation to be held in Buenos Aires next October and devoted entirely to development of the agricultural machinery industry will be an important contribution to expansion of this industry in Latin America and elsewhere in the developing world.

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