

# **Agricultural Machinery Industry of Korea**

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## **ABSTRACT**

This paper provides insight into the government policies undertaken by Korea throughout the latter-portion of the twentieth century to re-invigorate their agricultural machinery industry as well as maintain high-levels of food production in the face of a shrinking agricultural-producing work force. The Korean model could lend guidance to other countries facing a similar industrialization phenomenon.

**Keywords:** Korea, agricultural mechanization, agricultural machines, agricultural cooperatives

## **1. INTRODUCTION**

The Korean Agricultural Machinery Industry had been in a very poor condition before the 1950s, mainly due to the Korean War. The agricultural sector, with the largest portion of the population, was also depressed. Until this time, most agriculture depended on existing, traditional methods. A hope for agricultural mechanization started with the distribution of the domestically-produced power tillers during the 1960s. The Korea Agricultural Mechanization Program started in earnest throughout the 1970s after a preparation period during the 1960s.

The driving force of this program was mainly attributed to rapid industrialization at that time. As industrialization was occurring, many farm workers were moving into cities, resulting in a severe shortage of man-power in farming districts. In order to accelerate industrialization by utilizing the rural work forces, the government actively promoted the Agricultural Mechanization Program. A long-term vision of this program was made by the establishment of the 1978 Agricultural Mechanization Promotion Act. Since that time, the program has led farming villages to modernization by producing and distributing new machinery with cutting-edge technologies. This program suffered a long-term price freeze in the 1980s along with rapidly changing agricultural situations at home and abroad; despite this, the program has been evaluated as a successful model.

The agricultural machinery industry of Korea achieved within the past 30 years (1970-2000) a performance-level that advanced countries had made over the course of the previous century and the industry is now reaching the level of the developed nations. If the Korean model is introduced to countries that want to encourage agricultural mechanization, they can avoid much trial and error in reaching their targets.

## **2. AGRICULTURAL MECHANIZATION PROGRAM PROCESS**

### **2.1 Before the 1960s**

This period utilized traditional methods applied in every sector of agriculture. Major farming tools and equipment were traditional Korean shovels, hoes, ploughs, Dorike, and Yongdure, including foot-pedaled threshers and engines. Low-speed engines distributed around 1945 were the only power source and are known as the first internal-combustion engine use in the entire Korean industry at that time. Thus, it could be said that the agricultural machinery industry had been a basis for the development of the entire Korean machinery industry.

### **2.2 The 1960s**

During the 1960s, relatively cheap farm labor forces were flowing into urban-industrial areas. This period was a kind of preparatory stage in the process of agricultural mechanization and in that sense there are some memorable facts in the history of the Korean agricultural mechanization.

Power tillers played an important role in Korean agricultural machinery development for a long time. They were first introduced in 1963, when agricultural machinery producers had launched into business expansion or changed business practices from home-craft to larger corporations. Power tiller manufacturers recognized the necessity of a group that speaks for their interest and as the result, the Korea Agricultural Machinery Industry Cooperative was established in 1962. The technological development of agricultural machinery needed an examination center to test the quality of machinery as well, leading to the establishment of the National Agricultural Instruments Examination Center (now included in National Institute of Agricultural Engineering) in 1967.

The government provided a 60 percent financial subsidy to farmers who bought agricultural machinery and other agricultural equipment, including tractors, that were imported and supplied starting in 1967. The details of the support policy of the government for agricultural machinery during the 1960s changed annually.

### **2.3 The 1970s**

This period is considered the starting point of the program for using agricultural machines for rice farming. Machines such as power tillers, walking-type rice transplanters, and tractors were distributed to rural communities. While the quality was poor compared with current products, it is true that they contributed significantly to the modernization of farming villages. On the other hand, walking-type rice transplanters and combines were first domestically produced along with tractors due to the necessity for rice farming mechanization in 1978 and formed a basis for accelerating the domestic agricultural mechanization.

One of the most historic events in the Korean history of agricultural machinery during the 1970s was the establishment of the Agricultural Mechanization Promotion Act in 1978. This act provided a stepping stone for the Agricultural Mechanization Program and it also

currently plays an important role in shaping other Korean agricultural mechanization programs and related businesses.

#### **2.4 The 1980s**

The lack of farm labor in the agricultural districts became severe and the direction of the Agricultural Mechanization Program began to focus on "making up such shortage and promoting rice cultivation-centered mechanization." The purpose of the program was to realize "a complete mechanization of plains, and 50 percent mechanization of semi-remote places," and "increase of the rice farming mechanization rate to 90 percent and also mechanization promotion in horticulture and livestock farming sectors." That is to say, this period required new machines for the mechanization of the long-neglected livestock farming, horticulture and dry-field farming. Walking-type controllers were first developed and distributed in 1988, which opened a new era of dry-field farming mechanization.

Since 1981, support from the Government has included a 40 percent subsidy and 60 percent loan to the organizations that were using agricultural machinery jointly. And it also has provided a 50 percent subsidy, 40 percent loan, leaving farmers' own expense at ten percent (with an eight percent annual interest rate) to the organizations since 1986, minimizing the burden of farmers in purchasing agricultural machinery.

#### **2.5 The 1990s**

The 1990s witnessed various measures to protect each nation's agricultural industry while discussions for opening markets for agricultural products were being imposed on countries around the world. During the late 1980s through the early 1990s, as the Uruguay Round reached an agreement, agricultural exporters started putting pressure on the opening of other countries' agricultural markets. Nations like Korea, which have higher production costs for agricultural products, were seriously affected by an inflow of low-priced foreign agricultural produce and the domestic agricultural machinery industry that was directly linked to agriculture had difficulties as well.

Public opinion that Korea should transform its agriculture into a structure that produces high value-added agricultural products was strongly advocated and the government promoted various policies for such agricultural structure rearrangement, which led to the reshaping of the agricultural machinery industry. In other words, during this time, machines for horticulture, livestock farming and dry-field farming were actively developed and marketed. The supply of equipment necessary for greenhouse production and livestock farming was particularly impressive.

What we should take notice of in this period is that a new policy that "supports half of the price of agricultural machinery which costs less than 2 million KRW(₩) (about US\$ 2,000) to farmers" was set up. Power tillers, walking-type controllers and walking-type rice transplanters were over-supplied because of the policy, which artificially changed the supply and demand flow of the domestic agricultural machinery. This caused long-term instability of

the domestic agricultural machinery market environment until the policy was abolished. But the largest scaled-domestic agricultural mechanization program in the history of Korea was achieved due to the government policies that were implemented.

On the other hand, since 1988, a negative opinion about the agricultural mechanization program has prevailed and various assistance measures have been reduced. As a result, the domestic market of agricultural machinery has also shrunk. The 1980s experienced both growth and decline in the agricultural machinery industry.

## **2.6 The 2000s**

This period was the worst recorded because of the events that took place in the 1990s. That is, "the domestic industry stagnation caused by the 1997 financial crisis" and "the abolition of the existing policy of supporting half of the price of agricultural machinery" led the domestic agricultural machinery industry into a serious depression. From this, the Agricultural Mechanization Promotion Program experienced the worst situation in the year of 2003 and brought about a crisis in the domestic agricultural machinery industry.

However, the Korean agricultural machinery industry has done its best to improve new export markets as a measure to overcome the domestic crisis and, as a result, thanks to increased exports, the industry gradually stabilized and now maintains the balance between the domestic consumption and exports. The domestic agricultural machinery market saw the increased demand of large-scaled and computerized agricultural machinery during that time. The existing subsidy policy operated by the government ran counter to the WTO regulation, so that the aid was completely abolished.

Entering 2000, farming villages experienced a drastic decline in the domestic agricultural machinery market due to variables (Uruguay Rounds, International Monetary Fund market-opening pressure), and the volume of the domestic agricultural machinery market decreased to less than 500 billion KRW(₩) (US\$ 500 million), which forced the Korean agricultural machinery manufacturers to find new overseas markets for their survival.

## **2. AGRICULTURAL MACHINERY PRODUCTION**

The trends of the domestic agricultural machinery production during the 1970s saw a shortage of work forces on farms, even though farmers represented more than 30 percent of the total population. Thus, the initial stage-powered agricultural machinery, such as popular threshers, sprayers, binders and tillers, were produced extensively.

The 1980s saw an increased amount of agricultural machinery on farms and the development of machines required in rice-planting and harvesting that require a great deal of labor. Also during the period, the domestic agricultural machinery industry remarkably developed its technological level and the existing machines became more modern and sophisticated along with the further development of other agricultural machines, including tractors.

Since the 1990s, agricultural machinery produced in Korea has been much more advanced, especially in rice farming machines. Ergonomic designs have also been applied in development of machinery necessary for long-alienated livestock farming, horticulture, and dry-field farming. Approximately 200 kinds of agricultural machines are now produced in Korea, not including many machines for livestock farming and controlled agriculture. If all kinds of machines are included, it is estimated that the number will increase slightly. Some 400 companies are estimated to produce agricultural machinery in Korea and 330 of them are members of the Korea Agricultural Machinery Industry Cooperative, the only domestic organization for agricultural machinery production companies. About 300 member companies are producing finished products and 30 are producing components.

The agricultural machinery companies are relatively small-scaled, compared with other industry sectors and their operating ratio is also low (see Table 1). Power tillers' operating ratio has decreased remarkably as tractors have risen, resulting in the low level of its 37.5 percent of operating ratio. Tractors have rather higher 89.6 percent of operating ratio thanks to the increased demands and exports. Combines and rice transplanters are mainly import end-products, with a 52.6 percent and 41.7 percent, operating ratio, respectively.

Table 1. Operating ratio of agricultural machinery

(Unit: %)

Classification	2005		Operating Ratio					
	Production Capability	Production Performance (define)	2000	2001	2002	2003	2004	2005
Power tiller	12,790	4,793	33.3	49.7	38.6	41.7	32.4	37.5
Tractor	35,246	31,594	78.6	78.5	69.9	79.3	84.1	89.6
Combine	7,860	4,135	90.1	65.0	53.0	53.4	62.7	52.6
Rice Transplanter	14,621	5,640	76.8	70.7	74.3	66.4	59.9	41.7
Cultivator	48,818	17,837	37.0	26.0	27.5	30.0	32.7	36.5
<b>Total Operating Ratio</b>	119,331	64,000	61.1	56.7	51.7	53.6	50.7	53.6

(Note) source: business data (Ministry of Agriculture and Forestry, year-on-year)

### 3. AGRICULTURAL MACHINERY DISTRIBUTION SYSTEM

The distribution system for agricultural machinery is mainly divided into two parts in Korea. One is a supply system through private agencies and the other is a supply system through agricultural cooperatives. The backbone of this system remains nearly unchanged. Before 1971, agricultural cooperatives and a farmland improvement association had been the principal suppliers of agricultural machinery, but since 1972, manufacturers and agricultural cooperatives have taken the role of suppliers, as can be seen in Table 2.

Table 2. Changes of agricultural machinery supply system

Classification	Suppliers	Supply Subject	Loan Business	Reasons for Changes
Pre-1971	Mainly agricultural groups	Agricultural cooperative (AC), farming organizations	AC	Strengthening after-sales service
1972-1973	Mainly producers	Producers	AC	Smooth production and supply of agricultural machinery Strengthening after-sales service
1974-1976	Mainly AC	AC	AC	
1977-1980	Polarization by kinds of machinery (new product manufacturers)	AC, producers	AC	Building free-selling basis, inducing private-led free competition
1981-1982.6	Polarization of all kinds of machinery	AC, producers	AC	Enhancing quality, strengthening agricultural cooperative's selling operation Convenient to buy from AC's selling operation
1982.7-1984.6	Unification of producers Limited	Producers	AC	
1984.7-1988.9	polarization of all kinds of machinery (AC 40%)	AC, producers	AC	Building free-selling system
1988.10-Present	Polarization of all kinds of machinery (lifting restrictions AC's selling activities)	AC, producers	AC	Liberalization of distribution and pricing of agricultural machinery

Source: business data (Ministry of Agriculture and Forestry, 2005)

For the current Korean distribution system of agricultural machinery, big suppliers (Daedong, Kukje, Tong-yang, LS, Asia) have a supply line of "manufacturers → business offices at each Do (Province) → agencies or supply agricultural cooperatives → users," while small-sized companies have a distribution network of "manufacturers → agencies or supply agricultural cooperatives → users." That is to say, large-scaled agricultural machinery producers have a three stage-distribution system and small or mid-sized companies have a single stage (producers → users), or possibly two stages. As of November 2006, the number of agencies totalled 1,186 and agricultural cooperatives totalled 658. Agencies and agricultural cooperatives provided 86.4 percent and 13.6 percent of agricultural machinery, respectively, in 2005.

Like many other countries, the agricultural competitiveness of Korea is very weak and has a lower purchasing power compared with other industries. And most Korean farmers also tend to buy agricultural machines with the government-assisted loan (without subsidy). Of course, farmers can select any machinery made at home or abroad, and any models in purchasing. Farmers submit the necessary documents to buy agricultural machinery, with the help of the government's loan, to their local agricultural cooperatives or agencies and then are entitled to purchase agricultural machinery.

## 5. AGRICULTURAL MACHINERY SUPPLY AND HOLDINGS

### 5.1 Agricultural Machinery Supply

In the history of Korean agricultural mechanization, power tillers were used mainly for soil preparation and tillage. Binders and threshers were used in harvesting until the 1970s and rice transplantation was normally done by farmers. Along with these machines, walking-type rice transplanters and tractors began to be introduced in the 1970s. In the early 1980s, walking-type rice transplanters, tractors and small-sized combines were fully utilized. Tractors became more advanced and larger, automated rice transplanters and combines were regularly introduced to the domestic market in the late 1980s. The domestic agricultural machinery industry of the 1990s faced serious difficulties due to the agricultural market-opening pressure from agricultural exporters. At the same time, computerized machines were actively supplied along with more advanced agricultural machines as well. Equipment for horticulture and livestock farming was also fully provided. The 2000s have seen a drastic decline in power-tillers use and a corresponding increase in tractors. For combines, the use of sack-type combines has been reduced with grain-tank type ones now widely used. For rice transplanters, the demand for walking-type rice transplanters is gradually decreasing while the use of riding-type ones are growing.

For the domestic supply trends of agricultural machinery, 70,000 power tillers were produced annually, but since 2000, the number has fallen sharply, to less than 10,000 units. The future demand of this machine is expected to maintain its current level, but its work will gradually be replaced by tractors. The demand for tractors is expected to gradually increase in the near future. The demand for grain-tank type combines and riding-type rice transplanters will also increase.

Table 3. Major agricultural machinery supply performance

(Unit: 1,000)

Classification	1990	1995	2000	2001	2002	2003	2004	2005
Cultivator	40.8	79.8	7.8	3.9	1.5	1.3	0.9	0.7
Tractor	15.0	17.3	22.7	14.2	10.0	8.1	9.2	10.1
Combine	15.9	8.1	11.8	5.8	3.3	3.1	3.6	3.8
Rice Transplanter	37.6	34.2	15.9	12.7	9.0	7.3	7.1	6.4

Source: business data (Ministry of Agriculture and Forestry, year-on-year)

### 5.2 Agricultural Machinery Holdings

The international statistics usually use H.P.(horse power) or KW (kilowatts) in calculating agricultural machinery holding status, but in Korea, only the total numbers are available. As shown in Table 4 below, the remarkable decrease in holdings in 2003 may be explained by the fact that threshers, water pumps and cutters have limited use or the supply was excluded from this investigation. Even if these machines were considered, there seems no significant change in the holding numbers.

Table 4. Holding amount of agricultural machinery

(Unit: %, 1,000)

Classification	1990	1995	2000	2001	2002	2003	2004	2005
Holding No.	1,163	1,756	2,230	2,161	2,237	2,202	2,198	2,212
Index	100.0	150.1	191.7	185.8	192.3	189.3	189.0	190.2

(Note)

1. Machines: tractors, power tillers, combines, rice transplanters, binders, dryers (grains and farm produce), controllers, speed sprayer
2. Source: 2005 Agricultural Machinery Holdings Status (2005, Ministry of Agriculture and Forestry)

From the holding status of major agricultural machines, tractors, rice transplanters and combines have increased or maintained their previous levels. But the holding numbers of small-sized machines like cultivators (in 1990; 51 ea → 1995; 239 → 2000; 379 → 2005; 393) and power tillers (in 1990; 751 → 1995; 869 → 2000; 939 → 2005; 819) have decreased. On the other hand, the preference for big tractors, combines and rice transplanters is continuously increasing and especially remarkable are the heavy combines and rice transplanters, as shown in Table 5.

Table 5. Holdings trend by kinds of machinery

(%)

Classification		1990	1995	2000	2001	2002	2003	2004	2005
Tractor	Unit(1,000)	41.2	100.4	191.6	201.1	206.3	211.6	219.7	227.9
	Households/unit	42.9	15.5	7.2	6.9	6.6	6.0	5.8	5.4
	Diffusion rate(%)	2.3	6.4	13.9	14.5	15.2	16.5	17.4	18.4
Rice Transplanter	Unit(1,000)	138.4	248.0	342.0	342.6	340.7	335.3	333.6	332.4
	Households/unit	12.8	6.3	4.0	4.0	4.0	3.8	3.8	3.7
	Diffusion rate(%)	7.8	15.9	24.8	24.8	25.2	26.2	26.4	26.8
Combine	Unit(1,000)	43.6	72.3	87.0	87.8	87.4	86.9	87.5	86.8
	Households/unit	40.5	21.6	15.9	15.8	15.5	14.7	14.5	14.3
	Diffusion rate(%)	2.5	4.6	6.3	6.3	6.5	6.8	6.9	7.0

Source: business data (Ministry of Agriculture and Forestry, 2005. 9)

In Korea, the supply and selection of agricultural machinery has been closely connected with the Agricultural Mechanization Program of the Government. Therefore, it seems likely that the mechanization program will be greatly influenced by future government policies.

## 6. AFTER-SALES SERVICE SYSTEM FOR AGRICULTURAL MACHINERY

Korea has a good after-sales service system for agricultural machinery compared with many other countries. In Korea, each center located in Myeon has after-sales serviced for small troubles of agricultural machinery, and in case of larger problems, like transmissions and engines, after-sales service centers in each Gun fix them. Repair centers operated by agencies of manufacturers in each Do (or Province) deal with serious problems of agricultural machines. This system is absolutely necessary for large agricultural machinery like tractors in Korea. Figure 1 illustrates this system.

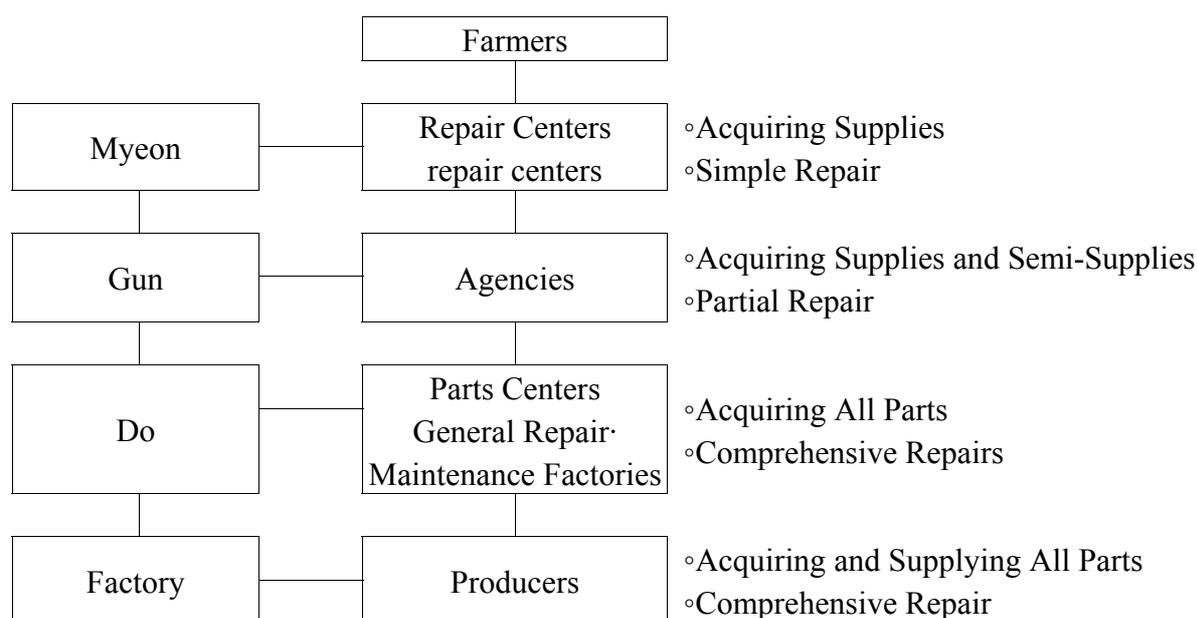


Figure 1. After-sales service system for agricultural machinery

In Korea, agricultural machinery suppliers are all responsible for the after-sales service and should be equipped with proper facilities for repair and maintenance and also should be certified from their local governments. This is for farmer convenience and all suppliers should abide by this regulation. Agricultural machinery suppliers in Korea can be seen in Table 6.

Table 6. Agricultural machinery suppliers status

Year	Total	Agency	Agricultural Cooperative
1991	1,231	709	522
1995	1,604	897	707
2000	1,861	1,120	741
2001	1,752	1,127	625
2002	1,844	1,154	690
2003	1,881	1,207	674
2004	1,817	1,159	658

Source: business data (Ministry of Agriculture and Forestry, 2005)

## 7. AGRICULTURAL MACHINERY IMPORT AND EXPORT

### 7.1 Agricultural Machinery Export

A remarkable change in domestic agricultural machinery is the expansion of the export market. The export of agricultural machinery, as shown on the table below (Table 7), exceeded US\$ 340 million in 2005. The export-market expansion has been mainly affected by external elements rather than internal ones. The 1997 financial crisis and the late 1990s Uruguay Round, asking for market-opening pressure, had a great negative impact on the Korean agricultural environment, which consequently brought about a drastic decrease in the domestic consumption of agricultural machinery and forced manufacturers to find alternative markets.

The domestic agricultural machinery industry has made every effort to develop new export markets and, as a result, tractor-centered export has increased. For this, the domestic companies have focused on producing quality products and have participated in overseas fairs to open up new markets. Their products have also passed the strict regulations of each country. From this, it is judged that the export volume is expected to maintain the current status for years to come.

Table 7. Agricultural machinery export status year-to-year

Classification		1990	1995	2000	2001	2002	2003	2004	2005
Domestic Consumption(₩ 100 mil, A)		4,523	9,064	10,561	7,189	5,435	4,903	5,906	6,363
Export	US\$ million	14.5	42.5	134.8	146.4	147.5	230.0	279.2	341.0
	₩ 100 million (B)	104	329	1,698	1,941	1,956	2,760	2,792	3,410
Ratio (% , B/A)		2.3	3.6	16.1	27.0	36.0	61.3	47.2	53.6
Exchange rate applied (₩/1\$)		1,100	1,100	1,100	1,100	1,100	1,100	1,000	1,000

Source: totaled by Korea Agricultural Machinery Industry Cooperative

When one analyzes the trends in Korean agricultural machinery exports, small agricultural equipment rather than larger agricultural machinery accounted mainly for exports in the past. But because of cheap Chinese agricultural machinery, this trend is gradually dwindling and the export of powered agricultural machines, like tractors, is rising.

Tractors have the highest export value, US\$ 203.724 million, accounting for 60 percent of the total export and milling machines have the second-highest export value, (US\$ 28.243 million, 8.3 percent) and transplanter take the third-highest (US\$ 11.284 million, 3.3%)(Table 8). In addition to this, various machines, including pest controllers, devices for tractors and others, are currently exported and foreign consumers note the high quality of Korean-made agricultural machinery.

Table 8. Agricultural machinery export performance (kinds of machines)

(Unit: US\$ 1,000)

Classification	2005		2004(B)	A/B %
	Volume	Dollar(A)		
Small Agricultural Instruments	-	8,699	9,387	92.7
Engine	6,108	8,517	4,646	183.3
Agricultural Products Dryer	354	718	942	76.2
Pest Controller	243,973	6,248	4,316	144.8
Machines	15,965	8,141	8,769	92.8
Rice Transplanter	18,372	11,284	3,715	303.7
Reaper	14,324	1,450	1,328	109.2
Bailer	453	4,221	5,388	78.3
Harvester	4,457	8,621	2,831	304.5
Selector	53	665	420	158.3
Dairy Machine	542	150	163	92.0
Livestock Farming Machine	23,857	867	1,404	61.8
	338,967	2,450	2,749	89.1
Polishing machine	13,063	28,243	26,193	107.8
Tractor	20,993	203,724	160,716	126.8
Other machines	7,322	245	98	250.0
Components	0	46,779	40,693	115.0
TOTAL	708,803	341,022	273,758	124.6

Source: totaled by Korea Agricultural Machinery Industry Cooperative

The major exporting countries of agricultural machinery include USA (US\$ 166.088 million), China (US\$ 41.741 million) and Japan (US\$ 19.574 million), as shown in Table 9. North America and Europe are the two biggest markets in the world for agricultural machinery. The ASEAN countries still remain smaller than these other two markets. Korean agricultural machinery has achieved some success in the US market, but it has limited acceptance in the European market. Thus, it is necessary for the Korea agricultural machinery producers to develop other markets.

The export of Korean agricultural machinery has recently shown a gradual increase and this trend is expected to be maintained through continued efforts. That means both the development of price-competitive products that satisfy the import nation's environment and quality enhancement to expand and find new export markets.

Table 9. Agricultural machinery export performance (Nations)

(Unit: US\$ 1,000, %)

Classification	2005		2004(B)	Ratio (=A/B) %
	Volume	Dollar(A)		
USA	55,675	166,088	134,315	123.7
China	31,542	41,741	23,184	180.0
Japan	27,681	19,574	16,849	116.2
Australia	5,323	16,789	11,196	150.0
the UK	3,380	3,904	3,966	98.4
France	1,622	3,580	2,531	141.4
Portugal	392	3,570	3,425	104.2
Thailand	7,994	3,320	1,793	185.2
Spain	5,914	3,218	2,489	129.3
Egypt	11,726	2,637	1,165	226.4
New Zealand	462	2,471	1,835	134.7
India	123	2,368	2,409	98.3
Sri Lanka	838	2,184	653	334.5
Vietnam	181,692	2,094	3,953	53.0
Malaysia	2,027	2,077	3,819	54.4
Germany	32,385	1,628	901	180.7
Iran	12,162	1,424	319	446.4
Turkey	385	1,314	4,448	29.5
Peru	86	1,281	232	552.2
Latvia	95	1,247	53	2352.8
the Netherlands	17,243	1,232	1,323	93.1
Indonesia	418	1,203	7,104	16.9
Canada	232,651	1,167	1,460	79.9
Kazakhstan	82	1,013	547	185.2
Others	76,905	53,898	43,789	123.1
TOTAL	708,803	341,022	273,758	124.6

## 7.2 Agricultural Machinery Import

Korean agricultural machinery is well-known for its high quality and domestic farmers are very interested in the latest machines. Therefore, new machines from developed countries are continuously introduced to Korea, as shown in Table 10. The import volume of agricultural machinery to Korea changes annually and the exchange rate also greatly affects import performance.

Table 10. Agricultural machinery import status year-on-year

(Unit: USD 1,000\$)

Classification	1990	1995	2000	2001	2002	2003	2004	2005
Import Performance	60,727	194,093	315,050	134,163	118,056	153,243	221,396	282,314

Source: totaled by Korea Agricultural Machinery Industry Cooperative

Tractors, rice transplanters, and harvesters are imported to Korea in order of volume. In the case of tractors, heavy-duty tractors with more than 80 H.P. are mainly imported from foreign countries and large rice transplanters and combines also come from Japan. In the case of rice transplanters, in 2006, domestic companies developed and supplied riding, six-row type rice transplanters, equivalent to the quality of those from Japan, which will contribute to the decrease of imports of similar machines from Japan.

Table 11. Agricultural machinery import status (kinds)

(Unit : US\$ 1,000)

Machines	2005		2004(B)	Year-on-Year(A/B) %
	Volume	Dollar(A)		
Tractor	3,725	71,896	63,790	112.7
Transplanter	7,504	44,493	32,869	135.4
Harvester	822	28,720	22,715	126.4
Components	-	24,751	18,141	136.4
Poultry·Bee Culture Machine	762,077	19,816	7,174	276.2
Reaper	20,277	18,050	13,533	133.4
Bailer	11,031	13,986	9,078	154.1
Polishing Machine	752	13,238	14,822	89.3
Pest Controller	259,343	11,614	10,469	110.9
Machine	13,861	9,940	7,768	128.0
Livestock Farming Machine	2,606	9,105	5,340	170.5
Small Agricultural Instruments	-	6,330	5,838	108.4
Other Machines	2,805	3,249	2,985	108.8
Selector	948	3,142	2,290	137.2
Dairy Machines	10,064	2,872	2,347	122.4
Agricultural Products Dryer	52	1,112	2,237	49.7
TOTAL	1,095,867	282,314	221,396	127.5

Source: data from Korea Agricultural Machinery Industry Cooperative

Korean imports agricultural machinery from Japan, Germany, Italy, US and China, in order of volume. Heavy-duty transplanters, combines and tractors come mainly from Japan. This is because renowned Japanese agricultural machinery suppliers, Kubota and Yanmar, established local agencies for active sales in Korea. Most heavy-duty tractors are imported from Germany, Italy and US, whereas small-scale agricultural machinery is imported from China, as shown in Table 12.

Table12. Agricultural machinery import status (Nations)

(Unit: USD 1,000\$, %)

Nation	2005		2004(B)	Year-on-Year(A/B)
	Volume	Dollar(A)		
Japan	92,819	115,341	91,631	125.9
Germany	15,950	40,571	38,796	104.6
Italy	206,270	34,498	23,781	145.1
USA	276,619	30,197	20,717	145.8
China	134,491	13,342	9,364	142.5
the Netherlands	277,673	12,276	5,512	222.7
the UK	5,609	6,864	4,148	165.5
Switzerland	163	6,333	12,358	51.2
Turkey	251	5,359	3,452	155.2
Denmark	280	4,293	1,566	274.1
Others	85,742	13,240	10,071	131.5
TOTAL	1,095,867	282,314	221,396	127.5

Henceforth, tractors with more than 80H.P. will be continue to be imported from Japan and with the exception of the riding, six-row type-tractor, which are also produced by Korean brands. Riding, eight-row type-tractors will be solely imported from Japan as no Korean producers currently make these machines. In the case of combines, Korea has just one five-row model, which means a continued dependence on Japanese combines until Korean companies develop the item.

## 8. DIRECTIONS OF AGRICULTURAL MECHANIZATION OF KOREA

### 8.1 Necessity of Agricultural Mechanization

As the economy continues to grow, the dependency on agricultural machinery will become increasingly urgent. That is to say, industrial development causes a lack of work forces from farming villages, which was, is, or will be experienced in most countries. This problem needs to be solved through agricultural mechanization. Korea experienced a severe shortage of work forces in farming districts due to its sharp industrialization during the 1960s-1980s, which the government alleviated through its agricultural mechanization program.

The Korean agricultural mechanization of the 1990s was a supply-oriented policy that substituted for the shortage of labor. The future direction of it should focus on enhancing the quality of life and acquiring an agricultural competitive edge. Therefore, the government's future agricultural mechanization policy should be set towards the reduction of annual labor-input-hours, maximization of agricultural productivity, the strengthening of agricultural competitiveness and promotion of farmers' welfare.

Although the farming population has drastically decreased in Korea, productivity is increasing. The results can be seen in Table 13.

Table 13. Change trend of agricultural labor hours through agricultural mechanization

Classification		Labor-Input-Hours(hr) per 10a		
		1981	2002	Increase (%)
Foods Crops	Paddy	92.8	27.0	70.9
	Barley	101.3	12.2	88.0
Horticulture Crops	Cabbage	175.6	93.5	46.8
	Red Pepper	248.8	193.9	22.1

As shown above, it is generally accepted that agricultural mechanization has greatly reduced labor-input hours, which has contributed to the creation of the nation's added-value. Mechanization has been a success in rice cultivation but the horticulture and livestock farming sectors need additional mechanization.

## 8.2 Goals of Agricultural Mechanization

Unlike the previous supply-focused policy, the future agricultural mechanization of Korea will move toward a use-oriented policy which includes export increases in agricultural machinery.

The goals of each crop in promoting agricultural machinery follow:

### *Rice*

- Soil preparation: from rotary hoe, soil preparation plate balance to automatic tractor, LASER soil preparation balance
- Transplantation: from rice transplanter using tray to integrated operation of rice transplantation, fertilization, weeding spray
- Direct sowing: from dry paddy seeder, watered paddy seeder to integrated operation of strip tillage, seeding, weeding, spray
- Pest control: from power sprayer, duster to integrated Boom sprayer works
- Harvest: from sack-type combine to grain tank-type combine
- Drying: from circulation dryer to high-performance continuous dryer

### *Horticulture and dry field crops*

- Seedling: from self-seedling to plug-seedling
- Transplantation: from manual to all automatic transplanter
- Irrigation: from dripping to automatic dripping with each plant's growth
- Pest control: from sprayer, fog machine to unmanned automatic pest controller
- Harvest and transport: from manpower, truck to harvest and transport by automated robot(path type)
- Environmental management: from individual module to remote multiple module

### *Livestock Farming*

- Management: from herd or flock management to all computerized-individual management
- Feed supply: from man power, semi-automated supply to computerized supply by individual information
- Milking: from semi-automatic to all automatic robot milking

### **8.3 Future Directions of the Agricultural Machinery of Korea and Its Mechanization**

The future of the Korean agricultural mechanization program is expected to focus on after-sales service and their use, rather than supply-oriented policy. Unlike the past, quantity-focused policy, qualitative measures seeking efficient and safe use of machinery will be given more emphasis.

In order to achieve this goal, the future agricultural mechanization program will include 'cost reduction of agricultural machinery', 'promotion of development and supply of agricultural machinery', 'strengthening of safety management of agricultural machinery' and 'construction of agricultural machinery infrastructure.'

For the cost reduction of agricultural machinery, the government is considering the development and distribution of low-priced machines with high performance and various measures for efficient use of agricultural machines, including joint-use of machines in farming villages. Along with this, a lease business to reduce the burden of farmers when purchasing agricultural machinery is planned to expand.

To promote development and distribution of agricultural machinery, the mechanization program also has plans to activate the development of agricultural machines of long-neglected sectors. For this, mechanization for environmentally-friendly and high-quality rice production will be promoted. In the red pepper, garlic, onion, and flowering plant sectors, 'all mechanization from seeding to harvest by production area management groups' and 'mechanization of after-harvest treatments centered on general treatment plants' will be done. In the livestock farming sector, plans such as 'practical use of animal excrement and development of technology that lowers foul odor' and 'management computerization and development of unmanned device' will be positively executed. In addition, recognition of producers' examination capacity for safety and quality of agricultural machinery is also necessarily required.

For constructing the infrastructure to activate the agricultural mechanization program, it seems that policies introducing price-schemes conducive to sound distribution order, strengthening of after-sales service for user convenience and balanced development of import and export through export promotion are needed. Along with this, technological development and export-market expansion should be actively driven for the future growth of the Korean agricultural machinery industry.

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