INFLUENCE OF LEGISLATION/SUBSIDIES, TO HELP AGRICULTURE AND/OR AGRICULTURAL MECHANISATION, ON THE MARKET OF AGRICULTURAL MACHINERY (The case of BRAZIL)

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Part I. Agricultural system

1. Economic conditions

From 1901 to 2000, the Brazilian population grew from 17.4 to 169.6 million people. Only 10 % of this growth was attributable to migration. During this period, the Gross Domestic Product (GDP) of the country increased one-hundred fold, and the Gross Domestic Product per person (per capita GDP), increased twelve-fold.

This was accompanied by an increase in the area of usable agricultural land (UAL) from 37.8 million to 49 million hectares (30 %). The productivity of the principal agricultural crops rose even more, jumping from 1.5 to 2.8 t/ha on average (87 %).

Brazil's territory, characterised by diverse weather conditions, regular rainfall, abundant solar energy and nearly 13 % of the total available freshwater on the planet, comprises 388 million ha of high-productivity fertile agricultural soils, with another 90 million that have yet to be exploited.

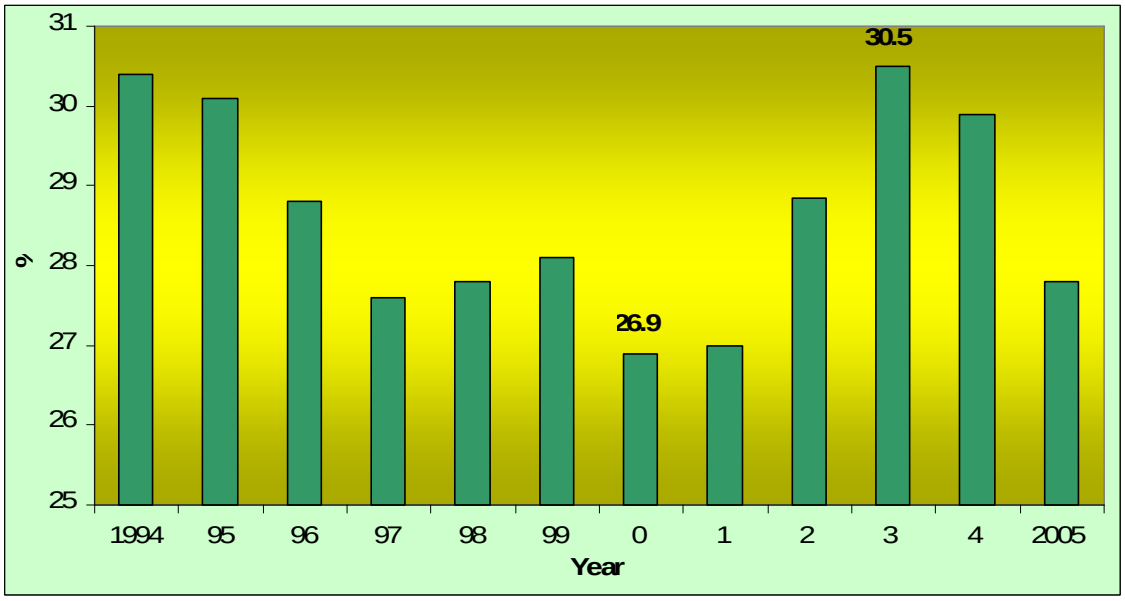


Figure 1: Contribution of agribusiness to Brazil's Gross Domestic Product from 1994 to 2005 (Source: Centro de Estudos Avançados em Economia Aplicada - CEPEA, ESALQ, USP).

Figure 2 : Share of Brazilian Gross Domestic Product due to Agribusiness, variation from 1995 to 2005 (Source: Centro de Estudos Avançados em Economia Aplicada - CEPEA, ESALQ, USP).

Table 1: Share of Brazilian Gross Domestic Product attributable to Agribusiness, agriculture and cattle from 1994 to 2005 (Source: Centro de Estudos Avançados em Economia Aplicada - CEPEA, ESALQ, USP).

Year	GDP AGRI (%)	GDP BR (IBGE) (million US$)	Agribusiness Agriculture (%)	Agribusiness Agriculture (million US$)	Agribusiness Cattle (%)	Agribusiness Cattle (million US$)
1994	30.45	**676,346**	21.96	**148,555**	8.48	**57,381**
1995	30.07	**704,914**	21.45	**151,222**	8.62	**60,732**
1996	28.81	**723,654**	20.71	**149,883**	8.10	**58,631**
1997	27.65	**747,328**	20.09	**150,163**	7.56	**56,509**
1998	27.78	**748,314**	19.89	**148,849**	7.89	**59,020**
1999	28.07	**754,192**	19.76	**149,030**	8.31	**62,669**
2000	26.92	**787,079**	18.55	**145,998**	8.37	**65.909**
2001	27.04	**797,411**	18.66	**148,782**	8.38	**66,827**
2002	28.86	**812,775**	20.25	**164,627**	8.61	**69,972**
2003	30.58	**817,205**	21.69	**177,220**	8.90	**72,710**
2004	29.90	**857,248**	21.27	**182,352**	8.63	**73,962**
2005	27.87	**876,964**	19.59	**171,816**	8.27	**72,560**

For 2006, the contribution of agribusiness to GDP, assuming the same rate of growth is maintained in the remaining months of the year, is expected to decline by 1.28 %. The annual Cepea/CNA projection indicates an agribusiness GDP of US$ 241.26 billion in 2006, compared with US$ 244.38 billion in 2005.

The 48 % appreciation of the Brazilian currency (the real) since May 2004, which represented the strongest performance among 67 other currencies, has eroded profits from agricultural exports, while the prices of products such as soybean have collapsed. The price of soybean, which is the country's dominant field crop, has dropped by 44 % on the Chicago stock market over the past two years.

An overvalued currency is the principal cause of the agricultural crisis. Brazil is clearly going through another currency valuation cycle, similar to that experienced in the period 1994-1999. International prices in US$ terms have remained within the historic average ranges (with rare exceptions) but, because of the worsening of the exchange rate of the real, they were dramatically increased, knocking down the production costs, which increased with the relevant increment of the production costs.

Approximately 50 % of agricultural costs are indexed to the dollar, but the part influenced by the real has continued to increase. One such example is diesel oil, which during the year showed the steepest increase, of 0.7 %. In the past 12 months, the peak has reached 12.3 %. Since 2003, the purchasing power of farmers has gone down by 18.4 % while the exchange ratio (products/production costs) has declined by 21.5 %. The productivity has risen only by 3.7 %.

For the second consecutive year, Brazilian farmers have planted with the dollar rate higher than at the time of harvest. In the year 2004/2005, the dollar rate at the time of planting was R$ 3.00, while during the harvest it was R$ 2.60, corresponding to a 14.3 % increase in the real's value. During the year 2005/2006, the US currency cost R$ 2.40 at the time of planting, after which it went down to R$ 2.10 and then up to R$ 2.15 at the time of harvest, corresponding to a 9.2 % appreciation of the Brazilian currency.

According to Agriculture Minister Roberto Rodrigues, the crisis experienced by agribusiness over the past two years has caused R$ 30 billion worth of losses to farmers. He says that a crisis on this scale is unprecedented, and can be attributed to numerous factors. However the main causes are the inflated currency, the very high interest rates, the excessive tax burden and the country's deficient logistics infrastructure. Droughts are destructive, but localised events, not attributable to any economic or structural cause. And although there is political debate concerning future financial aid to the agriculture sector, agricultural producers are facing a shortage of cash during the present year which may lead to a reduction in the planted area in the 2006/2007 season.

Brazil has reached a limit that can only be overcome if its structural problems are resolved. Farmers have done their part for correcting the pH of the soil, adopting no tillage methods, using new-generation chemicals, increasing the mechanisation level, sowing two or three times in the same year, improving their management skills and acquiring more information about the market. However they are still unable to effectively plan their investments and sell their yield (output) in the planned manner.

Roads which are nearly impossible to negotiate, poor quality train tracks compared with those of other countries, impaired navigation on rivers, congested seaports and a shortage of storage facilities have worked against the likelihood of good harvest results to match the efficiency achieved in primary production in the last decade. On top of this, there are the interest rates among the highest paid by farmers in the world, the high tax burden and a

lack of efficient and affordable rural insurance.

2. Manpower in Brazilian agriculture

The process of modernisation of Brazilian agriculture has been geographically fragmented and disuniform, exhibiting different dynamics depending on the region or state. Overall, the outcome has been a decrease in the rural population, with a strong "exodus" toward urban centres. The results of the adoption of a productivity model on employment of manpower can be seen not just in the number of employees but also in the quality of employment (jobs). An increase in temporary work and a decline in the income of farmers have been two outcomes of the development model adopted by Brazilian agriculture.

The worldwide drop in the prices of agricultural commodities has had a direct effect on reducing the income of farmers, while advances in technology have decreased the demand for manpower in agricultural activities. The falling prices associated with the modernisation of agribusiness have forced farmers to seek out novel forms of agricultural activities, or to combine their agricultural activity with other non-agricultural undertakings which may or may not be related to their form of business (self-employed, working on their own), and either registered or unregistered.

The Brazilian population, which was prevalently rural in the 1940s, is principally urban nowadays. The rate of urbanisation was 30 % in 1940 (first household sample census survey), and reached almost 80 % in 1996 (last census survey, 1996).

From 1981 to 1992, the Brazilian population grew at a rate of 1.8 % a year, but the population in the rural areas, eroded by the so-called "rural exodus", declined by 0.7 % per year.

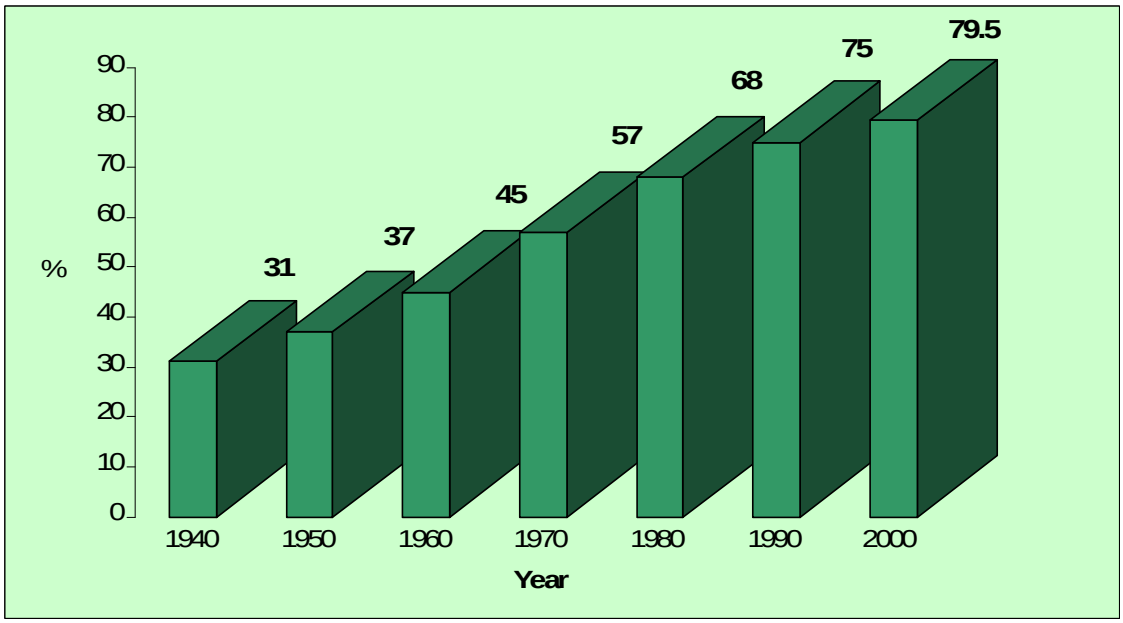


Figure 4: Percentage of urban population relative to total population (Urbanisation Level of the Brazilian population) in Brazil from 1940 to 1996 (Source: Instituto de Pesquisa Econômica Aplicada – IPEA, 2000).

The rate of agricultural employment continued to grow, by 0.4 % on average, during this period.
The next figure shows the changes in the total rural population, and in the economically active (EAP) and non-economically active population (people on welfare programs) for the period 1971/98. Despite a steep decline in the total rural population (7.8 million from 1970 to 1998), the EAP remained practically constant (declining by just half a million during that period - corresponding to a decrease of 0.14 % per year), which is a consequence of a population with an older profile.

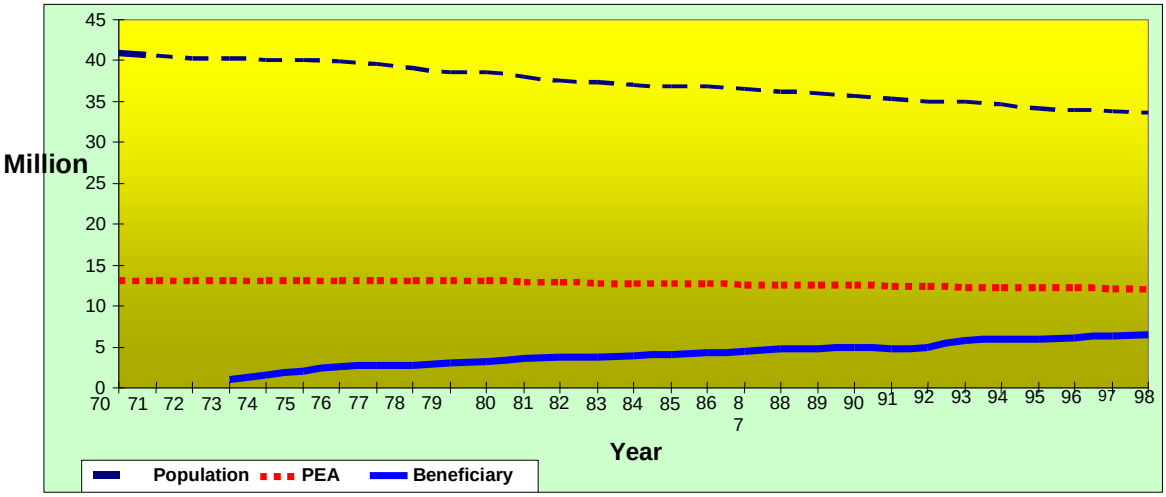


Figure 5: Total rural population, economically active (EAP) and non economically active, in Brazil from 1970 to 1998 (Source: Instituto de Pesquisa Econômica Aplicada - IPEA, 2000).

Up until the ‘60s, the rural population continued to increase. But from 1970 onward it began to decline, with negative growth rates approx to 1 %.
Brazil's rural population fell 25 % between 1990 and 2001, going from 36 million to 27 million people. And what is even more serious, according to IBGE/PNAD (the Brazilian Census Bureau National Household Sample Survey) the data shows an acceleration in the absolute decline in the rural population during the more recent period from 1999 to 2001. While the Brazilian population has increased from 160,336,471 to 169,369,557 people, the rural population has decreased by 5.3 million, going from 32,585,066 to 27,269,877 people. This corresponds to a decline of 16.3 % in just three years.

This data on the decline in the rural population, when compared with the total population which departed from rural areas between 1999 and 2001, bears out the hypothesis that most of them were involved in non-agricultural activities.
There are almost 15 million economically active people in the Brazilian rural environment (The PNAD - National Household Sample Survey for the year 1999 excluded the North region of the country). However around a third of these, 4.6 million, are engaged in non-agricultural occupations situated in rural areas. They are bricklayers, drivers, housekeepers, maids, etc., occupations that have increased most in the field – by an average of 3.7 % per year in the ‘90s,

more than twice the rate of population increase in the country. On the other hand, rural employment, due to the adoption of mechanisation, has fallen at a faster pace (1.7 % per year), to exceed 10 % a year between 1992 and 1999.

Table 6 - Agricultural Holdings – Units – Brazil – 1996 (Source: Agricultural Census–IBGE).

Utilisation	Farmer status			
	Owner	Tenant	Partner	Occupant
Permanent fields	1,321,335	28,271	52,052	131,196
Temporary fields	2,744,340	242,837	252,842	623,282
Temporary fields lying fallow	636,109	10,382	11,838	60,234
Natural pastures	1,716,824	42,947	32,858	121,967
Cultivated pastures	1,492,560	29,434	19,095	77,322
Natural forests	1,747,768	37,420	34,920	135,469
Cultivated forests	364,475	10,771	9,877	13,350
Productive fields not cultivated	731,069	9,936	11,076	69,703
Non-productive fields	2,653,966	84,908	100,870	280,119

According to Pastore (2001), Brazil still has an economically active population of some 25 million people in the rural sector. Of these, more than 15 million (almost 20 % of the EAP) are involved in agricultural activities, while another 10 million are engaged in non-agricultural work (mining, fisheries, pottery, etc., and even commerce, industry and local services).

In the period 1990-2000, the demand for agricultural manpower was centred around six products: rice, coffee, sugar cane, bean, cassava and corn.

In 2000, this group accounted for 67.5 % of the total man-year-equivalent demand of the country's principal crops, and for 59.1% of its cultivated area. It is important to point out that, in terms of cultivated area, soybean predominates with 28.4% of the total, corresponding to 13.6 million hectares, and surpassing the cultivated area devoted to corn. However, soybean accounts for only 5.8 % of the demand for agricultural manpower, well behind that of corn (16.7 %), coffee (11.6 %), bean (10.6 %), cassava (10 %), sugar cane (9.6 %) and rice (9 %). This is due to the high level of mechanisation of soybean, as compared with the more labour intensive requirements of coffee and sugar cane, and the family-farm production profiles of corn and cassava crops.

Technological developments have brought about a reduction in the cultivated area for some important crops. Today, corn is the main user of manpower, due to its extensive cultivated area (11.6 million hectares in 2000) and the diverse range of technologies adopted in the different Brazilian states and regions. The South, Southeast and Centre-West regions use more mechanised methods, while the Northeast and North employ more labour-intensive methods, sometimes even with use of animal traction. Due to problems relating to plant-protection, weather and low prices, coffee has shown marked reduction in its cultivated area during the 1990-95 period, and this is reflected in its manpower use (absorption).

Grains and oilseed crops have on average been responsible for nearly 40% of the total labour demand,

signifying the importance of their role in agricultural employment. In 2000, they accounted for 36 % of the total EHA, despite occupying 73.6 % of the cultivated area. These different percentages reflect the high mechanisation level of these activities, from tillage through to harvest.

Table 8: Annual agricultural Labour Demand by Crops, in man-year-equivalent and cultivated area, Brazil, 1990, 1995 e 2000 (Source: Graziano Da Silva et al. (1990) and Sensor Rural Seade (1996 and 2001), apud (BALSADI, 2002)).

Crop	EHA			2000	Variation (%)	Area (1,000ha)			2000	Variation (%)
	1990	1995	2000	(%)	1990-2000	1990	1995	2000	(%)	1990-2000
Cotton	369,525	302,282	198,228	3.3	-46.4	1,383.6	1,121.1	799.4	1.7	-42.2
Rice	468,704	583,616	540,469	9.0	15.3	3,944.9	4,384.8	3,655.3	7.6	-7.3
Coffee	1,206,199	838,337	694,031	11.6	-42.5	2,905.8	2,058.4	2,269.9	4.7	-21.9
Sugar cane	1,158,124	1,079,969	572,933	9.6	-50.5	4,270.9	4,512.4	4,846.0	10.1	13.5
Bean	515,648	580,244	633,338	10.6	22.8	4,680.1	5,003.9	4,332.3	9.0	-7.4
Tobacco	193,645	211,338	214,961	3.6	11.0	273.8	290.2	310.0	0.6	13.2
Orange	184,810	197,234	140,190	2.3	-24.1	958.5	815.5	850.9	1.8	-11.2
Apple	26,632	33,976	17,275	0.3	-35.1	22.3	27.2	30.0	0.1	34.8
Cassava	1,071,026	1,065,343	599,619	10.0	-44.0	1,933.6	1,967.8	1,721.7	3.6	-11.0
Corn	1,102,890	1,386,362	1,002,957	16.7	-9.1	11,390.7	14,009.3	11,614.7	24.1	2.0
Soybean	190,633	198,267	350,684	5.8	84.0	11,496.3	11,651.6	13,640.0	28.4	18.6
Wheat	24,752	8,525	9,322	0.2	-62.3	2,686.5	987.0	1,065.9	2.2	-60.3
Grape	50,516	57,507	66,922	1.1	32.5	66.0	60.3	59.3	0.1	-10.1
Total	7,642,934	7,501,059	5,997,791	100.0	-21.5	49,445.7	49,707.9	48,099.4	100.0	-2.7

3. Technical skills and educational level of the workforce (manpower)

The future of rural manpower in Brazil faces two major challenges: low schooling and a low-level of basic education (primary school). While technology continues to advance in the field, with increasingly sophisticated techniques, machinery and systems, manpower skill levels do not appear to be progressing at the same rate (RABELLO, 2005).

There are programs for the qualification of rural manpower, however these often need to be preceded by basic literacy lessons to enable the workers to absorb the training. The National Rural Training Service (Senar), a private vocational training institution, has enabled some 300,000 rural workers to acquire basic literacy.

A study conducted by the National Council of Agriculture (CNA) showed that in most cases there were no more than 4 years difference in schooling between owners and tenants – who account for the majority of the work force in the sector. The younger members of this population do attain a higher level of schooling, but they also tend to abandon agriculture and the rural areas. The result is a demographic of older owners and tenants who have only primary education, which hampers the efficient adoption of technology.

Part II. Agricultural and food markets

1. Internal Market

Brazil has an area of approximately 11.2 million square kilometres, of which 8,547,403 km² are on land and about 2.66 million km² are in the sea. It is a very large country, with a national territory 23 times bigger than Japan and 15 times bigger than France; it accounts for about 1.6 % of the total surface and about 6 % of the land masses of the globe, 20.8 % of the American continent, 41.5 % of Latin America and 47.7 % of South America. It is the third fastest growing country in the American continent, just behind Canada and the United States. A population of over 170 million makes Brazil one of the biggest consumer markets in the world. Today, some 80 % of Brazil's food production is domestically consumed, while just 20 % of its production is exported.

With the advantages of a highly fertile soil, water availability and incomparable biodiversity, Brazil offers extraordinary conditions for the development of cattle farming as well as for all other activities related to agribusiness. There are few countries as well equipped as Brazil for raising livestock in temperate and tropical areas. Nature has truly blessed Brazil, with an agriculture that can produce two grain harvests per year, and cattle farming that is being extended over the entire territory.

Brazilian agribusiness is a safe and profitable activity. With its diversified climate, regular rainfall, abundant solar energy and nearly 13 % of all the planet's available fresh water, Brazil offers a huge cultivable area, comprising fertile soils with high yield potential, also including 90 million hectares that are available for agriculture but have not yet been exploited. All these factors make the country an ideal site for cattle farming as well as for the various agribusiness production chains.

Agribusiness is the most important component of the Brazilian economy. It accounts for 33 % of the Gross Domestic Product (GDP), 42 % of total exports and 37 % of Brazilian employment-- including both direct and indirectly generated jobs in the agribusiness supply chain. Its share of GDP reached US$ 180.2 billion in 2004, against US$ 165.5 billion in 2005. Between 1998 and 2003, the average growth rate of GDP from cattle farming was about 4.67 % per year. In 2005, foreign sales of the cattle farming sector gave Brazil an income of US$ 36 billion, with a surplus of US$ 25.8 billion.

The performance of Brazilian cattle farming is unrivalled. There is no other country in the world that has in recent years achieved growth in this sector comparable to that of Brazil.

By way of comparison the grain harvest rose from 57.9 million tons to 123.2 million tons, between the harvests of 1990/1991 and 2002/2003 (table 9).

During this period livestock farming also displayed enviable growth, and in particular that of poultry farming, whose production rose 234 % (about of 16.7 % per year), going from 2.3 million to 7.8 million tons.

It is no coincidence, therefore, that this sector, with its high productivity, excellent health standards and high technology level, has attracted more and more international investments in the past few years.

Table 9: Output, cultivated area and average productivity of grains in Brazil – Period 1991-2005 (Source: National Company of Provisioning Source: CONAB, 2005).

Season	Output (million t)	Planted area (million ha)	Productivity (kg/ha)
1990/91	57.900	37.894	1.528
1991/92	68.400	38.492	1.777
1992/93	68.253	35.621	1.916
1993/94	76.035	39.094	1.945
1994/95	81.065	38.539	2.103
1995/96	73.565	36.971	1.990
1996/97	78.427	36.575	2.144
1997/98	76.559	35.001	2.187
1998/99	82.438	36.896	2.234
1999/00	83.030	37.824	2.195
2000/01	100.267	37.847	2.649
2001/02	96.747	40.198	2.407
2002/03	123.168	43.947	2.803
2003/04	119.114	47.423	2.512
2004/05	113.481	48.736	2.328

Since 1990, Brazil's grain production has increased by approximately 110 %. During this period, the planted area has expanded by just 28 %, from 37.8 to 48.7 million of hectares. The rise in output was therefore primarily achieved through an increase of approximately 83 % in the productivity of the last harvests. The productivity of the principal agricultural crops rose from 1.5 to 2.8 t per hectare.

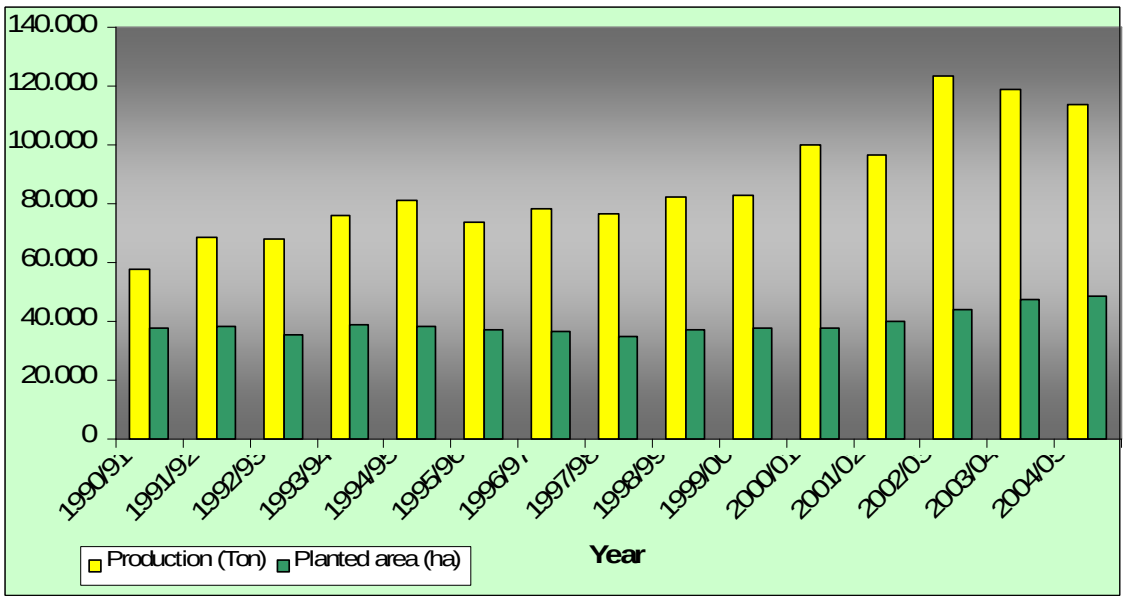


Figure 7: Grain production and planted area in Brazil from 1990/91 to 2004/05 (Source: CONAB, 2005).

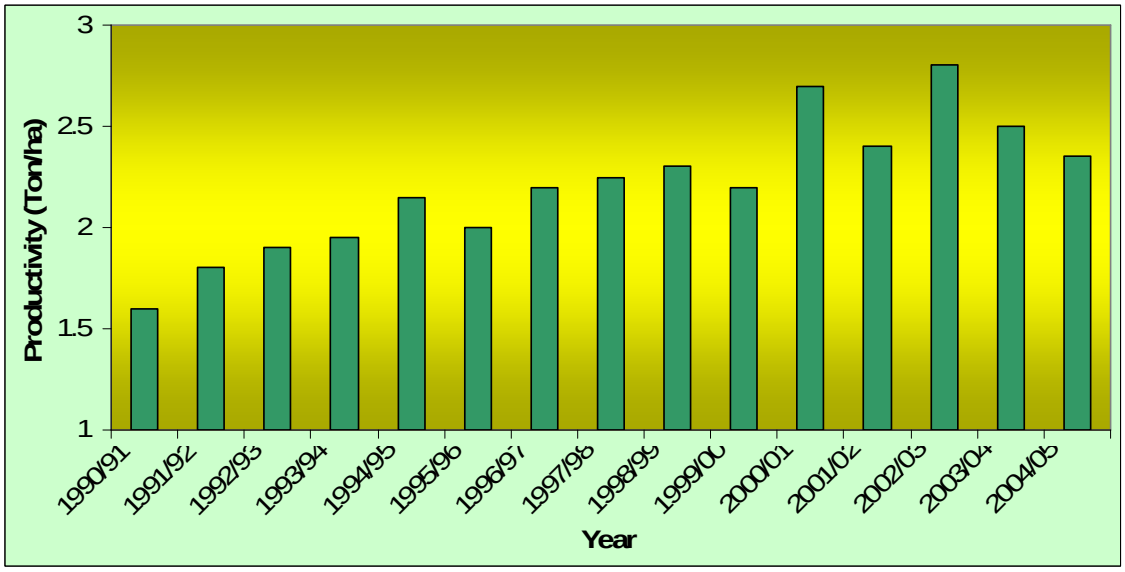


Figure 8: Productivity in Brazil, from 1991 to 2005, tons per hectare (Source: CONAB, 2005).

There are over 90 million hectares of arable land in Brazil that have not yet been exploited and are readily accessible. Brazil could potentially increase its present grain production at least three-fold in a short period of time: from the present 113.4 million for 340 million tons. However this capacity could be even higher if we consider that 30 % of its 220 million hectares are today occupied by pastures, which must be incorporated at the agricultural production in terms of an expressive increasing of cattle farming. The country has the potential to easily attain a cultivated area of more than 140 million of hectares, mainly through an expansion of agriculture into the Centre-West and Northwest. All this without any damage whatsoever to the Amazon forest and in total adherence with the environmental legislation.

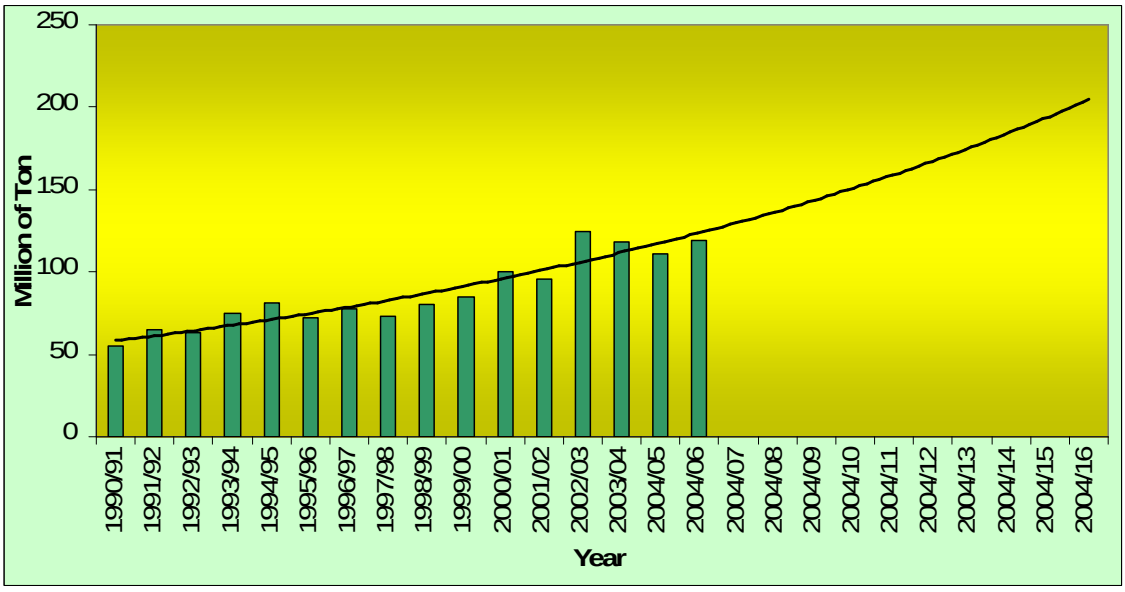


Figure 9: Grain output in Brazil (1991 – 2006) and projected 2015/2016 harvest, million tons (Source: CONAB, 2005).

Table 10: Arable area potential of Brazil and the world. Source: FAO, 1997.

Area (million ha)	World	Part. (%)	Brazil	Part. (%)
Total area	13.000	100.0	846	100.0
Total arable area	2.900	22.3	547	64.6
Planted area	1.500	51.7	53	9.7
Arable area available	1.400	48.3	494	90.3

If we consider that world food demand is expected to increase over the next few years, that the economic trends in the major countries (especially the developing ones) will tend to increase the demand, and that a good part of the world's population is still hungry due to factors such as a unequal distribution of income, there is an urgent need for a major expansion of food production in the world. Brazil is one of the few countries with the enormous potential necessary to meet this need.

Grain output increased by about 375% between 1965 and 2004, mainly thanks to outstanding harvests of soybean, corn and rice. The potential grain output capacity is about 500 million tons, at the current productivity levels.

According to the United Nations Food and Agriculture Organisation (FAO), given the present rate of global population growth, it will be necessary to double the amount of food produced by 2050. According to FAO data, today we have an average of 0.74 acres of cultivated area per person; in the past 25 years this ratio was about 1.24 acres per person, while 30 years from now each inhabitant of the planet will require 0.37 acres. This indicates that as populations increase they consume more and cultivate less.

Brazil's huge potential for agribusiness, coupled with the capabilities of its institutions and the recognised creativity of its researchers, affords great scope for external and private investment in research and development within the country. Cosmetics, precision farming, the use of biotechnology to develop species and breeds that are resistant to parasites, diseases, blights, water shortages or prolonged dry weather, together with the use of information technology in cattle farming and precision agriculture, are some of the areas which offer the best opportunities for investments by public-private associations in the generation of technical-scientific knowledge.

The static grain storage capacity of Brazil, despite having increased along with the increases in national grain output (Figure 10), has nevertheless proven insufficient during record grain harvest years, such as 2002/03. This factor has had impacted on the final prices of agricultural commodities, by often forcing farmers to sell their products at very low prices during the harvests because the necessary grain storage facilities were not available close to their farms.

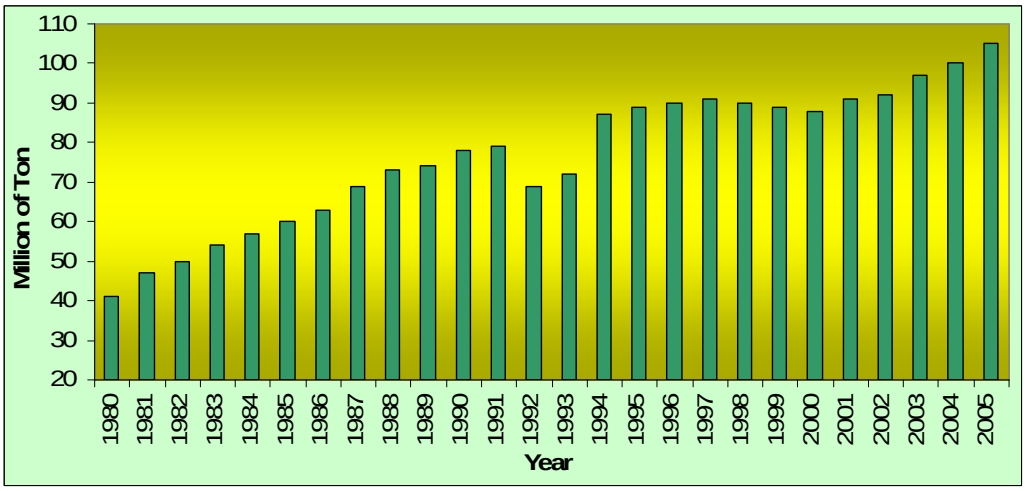


Figure 10: Static storage capacity in Brazil, in million tons. Period of 1980-2005
Source: CONAB, 2005.

The country offers the conditions for operating in international agribusiness on a large scale, and for increasing food production, due to its unique combination of a reasonable infrastructure and an abundance of the most scarce resource on a global scale, the available agricultural land. What is needed now is for Brazil to achieve the maximum efficiency across its supply chains, and for the public sector to create the favourable economic conditions (including modernisation of the logistics infrastructure and fundamental changes to the tax structure and the labour laws) that will enable national agribusiness to operate securely and competitively within new market settings, and devote ever greater energy and determination to eliminate the distortions that still affect international trade.

2. Main agricultural products

In the past few years, crops with a strong export potential have shown excellent performance in terms of output. Among these we can single out soybean, sugar cane and corn, and animal productions (pork, cattle and poultry), as Figure 11 illustrates.

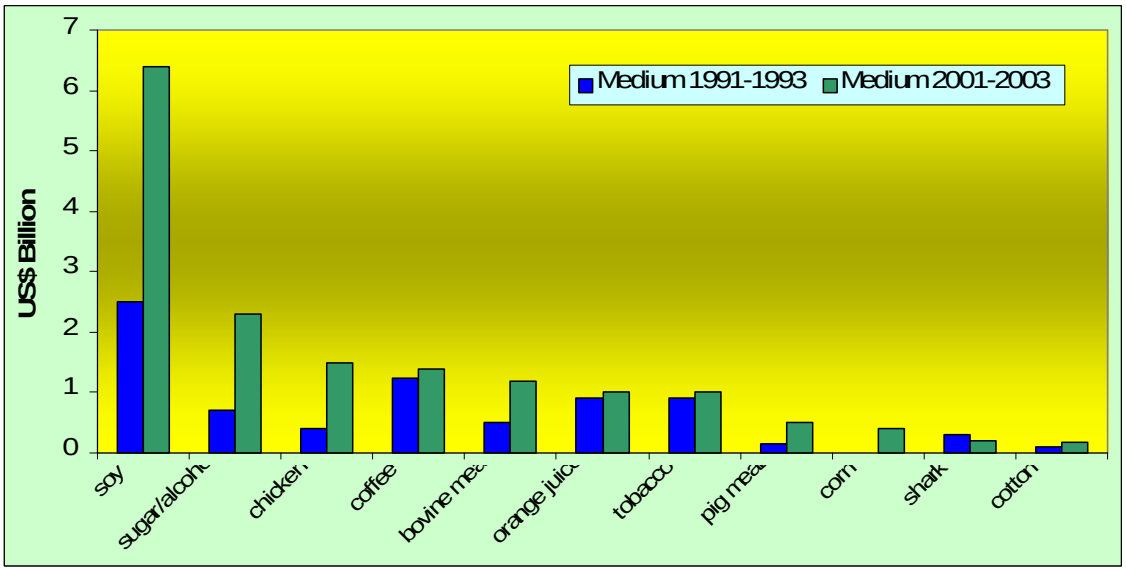


Figure 11: Main agricultural export products.
Source: Ministry of Development, Industry and External Trade. Source: MDIC, 2003.

However, the unequal performance between farms with export potential and those which target the domestic market is mainly attributable to the national economic policies. Exporters can take advantage of credit granted by foreign importers who apply much lower taxes than those within Brazil. All this tends to lower the costs of export agriculture, compensating the lack of credit and scarcity of grain storage facilities within Brazil.

Soybean

Originally from China, soybean is today the principal crop of Brazilian agribusiness. The country is the second largest world producer of oleaginous crops, with a harvest of 52 million tons and a planted area of 18.4 million hectares in the 2002/2003 season. Soybean arrived in Brazil in 1882, when it was introduced into Bahia State. Beginning in 1940, it began to gain importance in the country's agriculture. After almost 64 years, it became the most important product of Brazilian agribusiness. In 2003, Brazil became the leader in the international market for soybean complex (grains, meal and oil), with exports of US$ 8.1 billion, 31% higher than the value reached in 2002. The expansion of soybean cultivation is one of the best examples of the potential and vocation of Brazilian agriculture. The growth achieved by this crop in Brazil has been impressive. In the 1990/1991 season, the harvest was 15.3 million tons, with a planted area of 9.7 million hectares, while in the 2002/03 season the harvest was 52 million tons. This means the output more than tripled over the course of 12 harvests, thanks chiefly to improvements in the productivity of the crop.

Sugar cane

With a planted area of 5.4 million hectares and an annual harvest about 354 million tons, the country is the world's biggest producer of sugar cane. As a consequence, it is also the most important producer of sugar and alcohol. In 2003, sugar exports reached 12.9 million tons, corresponding to US$ 2.1 billion in revenue, a result 2.2% higher than that of 2002. The main importers of our product were Nigeria, Russia, the United Arab Emirates and Canada. Production in the 2003/2004 season reached 24.8 million tons of sugar. Sugar cane is also a raw material for the extraction of alcohol. Each ton of cane has an energy potential equivalent to 1.2 barrels of petroleum. Today, alcohol powers 15% of the country's automotive fleet. In 2003/2004, Brazil produced 14.4 billion litres of fuel alcohol. In 2005, the volume of alcohol exports reached 800 million litres. As a low-polluting fuel, alcohol is a product that increasingly interests those nations looking to reduce the emission of gases harmful to human health. Countries such as China and Japan have already manifested the intention of importing this fuel. The prospect is that exports of alcohol will increase considerably over the coming years.

Coffee

For what concerns coffee, following unsuccessful attempts to develop this crop in the North region, coffee growing became established in the Southeast region of the country and subsequently also expanded to the States of Paraná and Bahia, making Brazil into the world's biggest producer and exporter of coffee. With a planted area of 2.2 million hectares, Brazil's output was 28.82 million bags in the 2003/04 season. Last year, Brazilian exports of the product reached 1.43 million tons, with a revenue of US$ 1.51 billion. The main importers were the United States, Germany, Italy and

Japan. Today, the country holds a 28% share of the world market for coffee in the form of beans.

Fruit

With a surplus of US$ 267 million in 2003, fruit growing is fundamental to Brazilian agribusiness. This sector occupies an area of 3.4 million hectares. The production of fruits makes it possible to obtain a gross revenue of between US$ 440 and US$ 8,900 thousand per hectare. Today, the internal market absorbs 21 million tons per year and the exportable surplus is about 17 million tons. With a diversified fruit culture, Brazil is one of the biggest global producers of fruit juices, with exports that last year reached US$ 1.25 billion. Of the total, 95.5% is accounted for by orange juice, of which the country is the world's biggest producer and exporter. The sector generated US$ 1.2 billion of foreign exchange income in 2003, up 14.6% from the export sales revenues in 2002. The main importers were Belgium, the Netherlands, the United States and Japan. Brazil is the world's third largest fruit grower, with an annual output of about 38 million tons. In 2003, export sales of fresh fruit reached US$ 335.3 million, corresponding to a 39% increase over the US$ 241 million obtained in 2002. This year, the value is expected to increase by approximately 15%, to reach US$ 375 million, making it look increasingly feasible that Brazil will reach its target of US$ 1 billion fresh fruit exports at the end of this decade.

Cotton

Cotton growing in Brazil is expected to increase in the coming years. With the expansion of the planted area, the country looks set to take on a prominent role in world cotton growing. Thanks to their high level of technology, cotton farms have shown promising results in terms of output and productivity. In the 2003/04 season, the country is expected to produce 1.2 million tons of the product in fibre form, compared with 847.5 thousand tons in the preceding period. This constitutes a 46.3% increase, corresponding to an increase of 392.6 million tons in cotton output. The planted area is expected to increase from 735.1 million to 1 billion hectares.

Cocoa

Initially cultivated in the country's North region, the cocoa bean only became important following its introduction into the southern parts of Bahia State, where it found the favourable natural conditions it needed to expand. Today, this area is the country's main centre of cocoa production, a sector which has played an important role in the economy and policies of Brazil over the past decades. Exports of cocoa and products derived from it rose 55.4% in 2003, jumping from US$ 206 million in 2002 to US$ 321 million last year.

Animal production

Brazil possesses the world's biggest commercial herd of cattle, with more than 83% of its 183 million head of livestock raised in areas free from the highly contagious foot-and-mouth disease which has caused economic devastation in some countries. Brazil has also been classified by the European Union Veterinary Committee as an area at minimal risk for the incidence of the “mad cow” disease which decimated entire populations in Europe, and has recently also arrived in the American continent. For what concerns other animals, Brazil is the world's second largest poultry producer, and has the world's third biggest swine population. The livestock farming sector has shown spectacular growth. From 1990 to 2003, the production of beef increased 85.2% (6.1% per year), going from 4.1 million

to 7.6 million tons. However, the most notable performer has been poultry, whose production increased 234% (approximately 16.7% per year, on average), from 2.3 million to 7.8 million tons per year, while swine increased 173.3%, (12.4% a year). Production of pork increased from 1 million to 2.87 million tons. The meat production sector, which also includes other types of products, has invested in research into genetic improvements, and certification of the provenance of products. All this with a view to offering consumers safe and high quality meat from so-called "green cattle"-- animals fed only on pastures, and therefore raised by a very different system from that adopted in other producer countries. The graph below (Figure 12) shows the changes in output of the main Brazilian agricultural products between the harvests of 2004/05 and 2005/06.

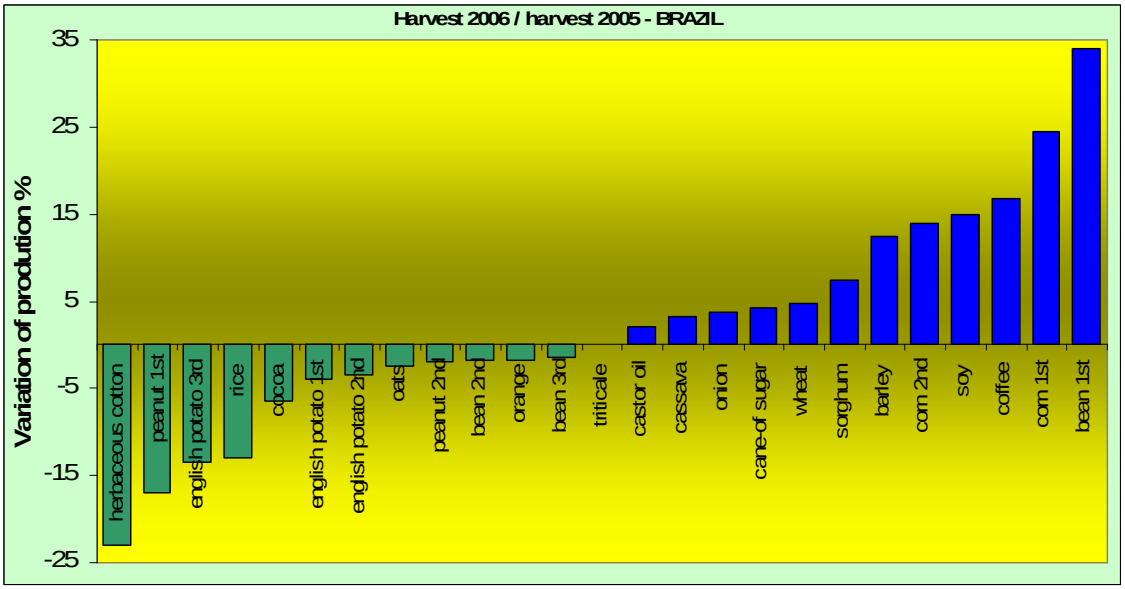


Figure 12: Variation (%) in national output of the main agricultural products between the 2004/05 and 2005/06 harvests. Source: Brazilian Institute of Geography and Statistics. Source: IBGE, 2006.

3. Deficit

Among the food products for which the country generally records a deficit, there are cereals and their derived products, which in the year 2003 alone accounted for 1.450 million US dollars of the nation's imports. According to FAO (1998) data, Brazil imports around 18% of the total cereals which it consumes. The main imported cereal is wheat, and comes principally from Argentina, China and the European Union. Imports also meet 30% of the country's total demand for barley, of which 90% is used by the brewing industry.

Another important case is that of corn, for which Brazil's output was 34.8 million tons in the 2004/05 harvest, against a total demand of 39.8 tons, therefore requiring imports of 700 thousand tons of corn in the year of 2005, with the remainder made up by the internal stores of the cereal.

In the horticultural sector, certain products such as garlic and onions are imported in large quantities, mainly from countries such as China and Argentina, during critical periods of production or during the times between the harvests of these products in Brazil.

4. Subsidies

In practice, subsidies for agricultural production are implemented by the

governments of all the major producer countries, in different ways and to varying extents, as policies for creating incentives, under the justification that climate factors pose an additional risk faced by agricultural activity, as compared with industry or trade. They can take the form of direct or indirect benefits granted by a government for the production or distribution of goods, or for complementing other services.

There are two main types of subsidies: those targeted at exports, and those for domestic production. Export subsidies are tax rebates granted by the government to enterprises that are dependent on exports. Domestic subsidies are benefits that are not directly linked to exports. There is no agricultural system in the world which does not have subsidies - not in the United States, nor in Europe, nor in Brazil. Agriculture needs to be subsidised, and this constitutes a healthy measure for society as a whole.

To take advantage of the growing opportunities in the production and sale of food, it is indispensable for Brazil to implement appropriate policies for enabling the food industry to adapt to the current regional and global conditions, increasing its competitive base. The recent changes that have occurred in Latin America, and the prospects for reform of the protectionist policies that are still in place, will enable this sector to realise its production potential. The experiences with agricultural policies adopted by America in previous decades have shown that subsidies for inputs (input subsidies), price supports, subsidies, taxation of exports, protection against imports and a regime of preferences (trade preferences) are detrimental to the agricultural sector, limiting it ability to compete. The liberalisation of trade, through regional and multilateral agreements, has bolstered the reform of domestic policies and enabled agriculture to increase its competitiveness.

5. External market: exports

Brazil is one of the world's main exporters of agricultural commodities and processed food. The food products sector accounts for over a quarter of the country's total employment, 13% of GDP and approximately 30% of export profits. The share of total export volumes accounted for by agricultural products has also been continuously increasing. There is great potential for expansion of the food production industry, as well as for more intensive trade, both on world markets and within the Americas. Agriculture and food processing are important components of the economy of Brazil, which is the biggest and most industrialised country in Latin America. Brazil's market for agricultural and food products has been changing rapidly, as it has in other Latin America countries and other parts of the world. The great impact of global economic developments and adjustments to macro-economic policies have brought about changes in the Brazilian food industry, stimulated by the open flow of information, investments and technology. As a consequence of these effects, and given the importance of establishing the conditions for economic stability and growth, Brazil and most of the countries of Latin America have implemented unilateral and far-reaching policy reforms, in addition to the liberalisation of trade and changes to agricultural policy.

The Brazilian livestock sector is today one of the most modern in the world. The safety and high quality of the country's beef, pig and poultry products have enabled meat exports to reach US$ 4.1 billion in 2003, corresponding to a 31% increase over the result for 2002. This result puts Brazil among the

world's top exporters of beef and poultry. Exports of fresh and processed beef increased 40% in 2003, to reach US$ 1.5 billion. In volume terms, they totalled 1.4 million tons and went mainly to Chile, the Netherlands, Egypt, the United Kingdom, Italy, Saudi Arabia and Germany. These figures put the country in first place in the world ranking for sales of this sector, overtaking Australia which had until then been the leader in international trade of beef products. Exports of leathers rose more than 10.2% in 2003, to reach US$ 1.06 billion. The sector of manufactured leather products showed the best results, increasing its volume of business by 29.5%, corresponding to almost US$ 469 million in revenue, to reach a 44% share of total leather exports. Foreign sales of leather products amounted to nearly US$ 1.4 billion last year, with leather shoes accounting for 91.5% of exports. The United States bought 91.5% of all leather products, followed by the United Kingdom and Canada. In 2003, Brazil also became the world's leading exporter of poultry, recording a 20% increase with respect to 2002. Brazilian exports of unprocessed and processed poultry added US$ 1.8 billion, corresponding to about 2 million tons. Most of these products went to Saudi Arabia, Japan, the Netherlands, Germany, Russia and Hong Kong. Brazil also recorded growth in foreign sales of pork, which increased 12% in the year of 2003, to reach US$ 526 million (about 550 thousand tons). Russia, Hong Kong, Argentina, Singapore and Uruguay were the main importers of Brazilian pork.

The economy of the region is joining forces under MERCOSUL (Common Market of the South) and other commercial agreements. Due to their scope and significant resource base, the forthcoming trade negotiations could open up important opportunities for Brazilian agriculture. With its large and growing economy, and having now become a full member of MERCOSUL, Brazil is in a position to strongly influence and potentially benefit from the next round of WTO (World Trade Organization) negotiations. Brazilian agriculture has achieved significant growth, despite the difficulties experienced in the 1980s, and has since then been showing great potential for taking advantage of a more open commercial environment. In recent years, few countries have displayed such impressive growth as Brazil in the international agribusiness trade. This is borne out by the figures: in 1993, the exports of this sector amounted to US$ 15.94 billion, with a surplus of US$ 11.7 billion. In ten years, the country increased its revenues from foreign sales of agricultural products and achieved a 100% increase in the balance of trade. These results led the United Nations Conference for Trade and Development (UNCTAD) to forecast that the country will be the world's biggest producer of food in the next decade.

Brazil is a world leader in the production and export of various agricultural products. It is the number one producer and exporter of coffee, sugar, alcohol and fruit juices. It also leads the rankings for foreign sales of soy, beef, chicken, tobacco, leather and leather shoes. What is more, projections indicate that the country will in a short time become the world's major producer of cotton and biofuels, derived from sugarcane and vegetable oils. Corn, rice, fresh fruit, cocoa, chestnuts, nuts, pork and fish all also play a prominent role in Brazilian agribusiness, which employs 17.7 million workers in the field alone.

Fruit growing is fundamental for Brazilian agribusiness. With a surplus of US$ 267 million in 2003, the sector occupies an area of 3.4 million hectares. Today, the internal market absorbs 21

million tons and the exportable surplus is about 17 million tons per year.

With a population of more than 170 million, Brazil has one of the biggest consumer markets in the world. About 80% of Brazilian food production is consumed internally, with only the remaining 20% exported to over 209 countries. In 2003, Brazil sold more than 1,800 different products to foreign markets. In addition to the traditional importers, such as Europe, the United States and the countries of MERCOSUL (Argentina, Uruguay and Paraguay), Brazil has been extending sales of its agribusiness products to the markets of Asia, the Middle East and Africa. With respect to trade, the necessary measures can today be divided into two categories. The first involves the establishment of an efficient foreign trade promotion system, and the second the pursuit of a dynamic and aggressive trade diplomacy.

The methods of foreign trade promotion that are already widely adopted by the world's major exporters are made up of two components: financing of exports, and marketing. For the former, the Brazilian government's role would be to create an appropriate mechanism for financing exports in the same way as is systematically done by other exporter countries. In the specific case of agricultural exports, given the cyclical nature of agriculture and the high degree of competitiveness of agricultural markets, such mechanisms are crucial. With respect to marketing, the policies would involve, in the first place, the allocation of resources dedicated exclusively to the promotion of Brazilian products abroad, with two fundamental goals: enlargement of the traditional markets, and the creation of new markets. With respect to the establishment of a more aggressive trade diplomacy, concrete actions are needed to eliminate the existing commercial barriers against Brazilian agricultural products in some countries.

Brazil could, for example, through a more aggressive trade promotion strategy, be in a position to take advantage of the global rise in the demand for food, and mainly for food with high income elasticity. This expansion, as we know, has appeared mainly due to the price-effect, resulting from a certain degree of liberalisation in certain areas such as dairy, beverages, fruit and meats, in large markets (such as the European Union and Japan) formerly dominated by severe protectionists measures, and due to the income-effect, magnified by the high index of economic growth of certain developing countries, primarily in Asia.

According to FAO data, the world's major export product groups, including wine, dairy, palm oil, fruits, meats and soy, exhibited great dynamism--that is to say a high growth index--in the international market during the decade of the nineties, and therefore offer better prospects within the today's new context of world trade, characterised by extensive liberalisation and growth in per capita income. It is on all those products that Brazil's export efforts should be concentrated, without however neglecting other products of which the country is already an established major exporter, such as coffee, sugar, orange juice, leathers, etc.

In addition to this, Brazil has the ideal conditions for entering a new segment of the global agricultural market that is growing at a rapid pace, mainly in the developed countries, and which already has a volume of business of over US$ 20 billion per year: that of natural or organic agriculture. This production chain comprises products ranging from coffee to various types of cereals and meats. Depending on the product and the country, consumers are willing to pay up to 200% more than the price of the ordinary product. Brazil has the

biggest "green" cattle herd in the world, and in several places is already producing organic products.

In 2003, Brazil was the world's third largest exporter in the agricultural sector, behind only the United States and the European Union (Figure 13).

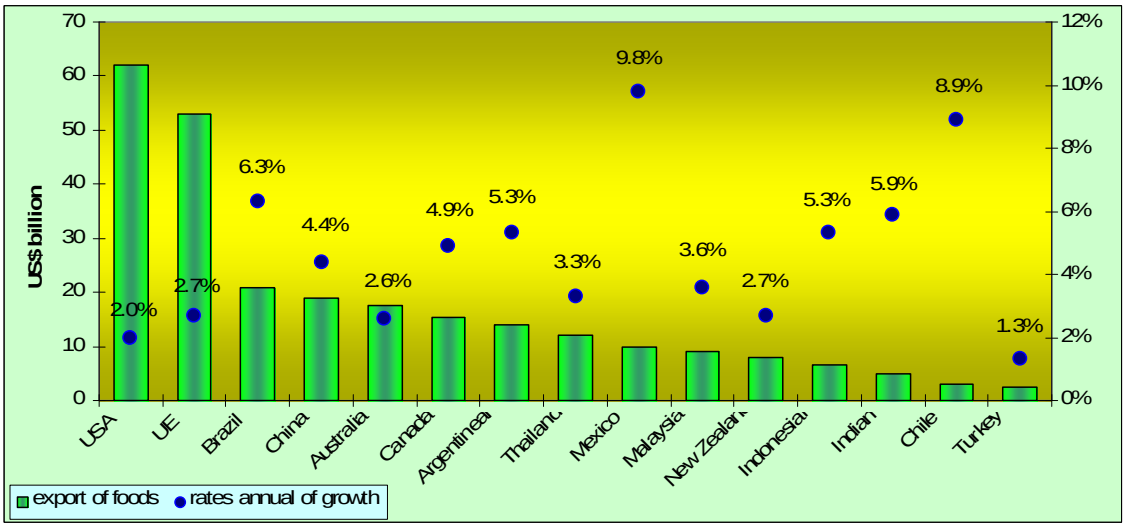


Figure 13: Main world exporters of food. Source: FAO, 2003.

The share of Brazilian exports accounted for by agriculture, despite having significantly declined with the industrialisation process of the country, it is still very significant. More than a quarter of Brazilian exports still originate from the agricultural sector. The country stands out in the international arena as a major exporter, offering a diversified line of agricultural exports, of which the main products are: coffee, orange juice, grains, soybean oil and meal, sugar, tobacco and cigarettes, paper and cellulose, beef, pork and chicken.

The significant increase in Brazil's agricultural exports has been associated with a change in the composition and method of trade. Soybean and its derivates, along with other products such as sugar, poultry and pork, have been those mainly responsible for the upswing in Brazilian exports. Despite the rapid growth of its exports, most of Brazil's agricultural production continues to be consumed by the domestic market. The percentage of output exported has generally varied from around 20 to 25%, although it rose as high as 30% in 2004. This is a value comparable to that of the USA (which also has a large domestic market), but smaller than that of other agricultural exporters, such as Canada, where 40% of production is exported, and Australia, where the share of exports is two thirds on average.

In general, there has been an alteration in the composition of exports, with a shift from traditional tropical products, such as coffee and orange juice, towards soybean, sugar and meats, especially poultry and pork. The trade flows have also changed. Although the markets of the OECD countries are still very important, with over 40% of Brazilian farm exports going to the European Union (Figure 14), and exports toward most OECD countries are increasing in absolute terms, the fastest growth in foreign sales has been observed toward countries outside the OECD area, and in particular China and Russia.

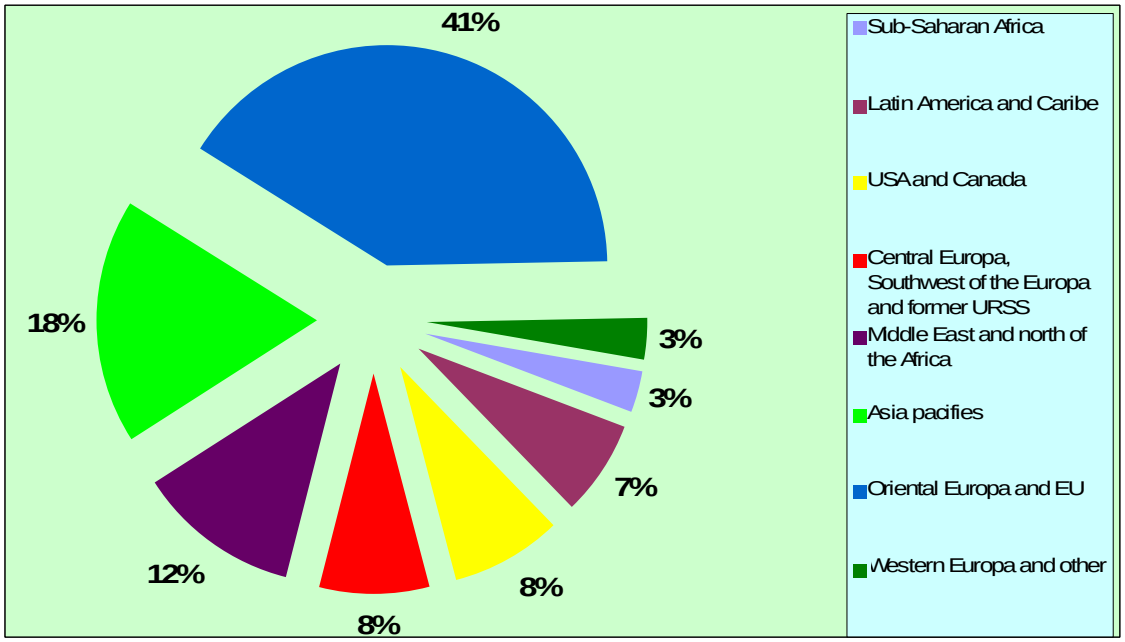


Figure 14: Brazilian agricultural exports by destination area, average 2000-2003.
Source: MDIC, 2003.

Analysing the various products exported by the country, we note the prevalence of grains and primary products. As already noted, soybean and its derivatives are the dominant exported agricultural products (more than 7.5% of the total). Raw coffee beans, orange juice and poultry are among the other most important agricultural exports.

6. External market: imports

Like all agricultural countries, Brazil predominantly exports grains and products of the primary agriculture sector, while it is conversely forced to import various industrialised and processed products. That said, the country's food imports are minimal, and consist chiefly of cereals such as wheat, imported in large amounts from Argentina.

Part III. Market of agricultural machinery and tractors

1. Domestic Production

The Brazilian agricultural machinery industry is characterised by a heterogeneous market structure with manufacturers of different sizes. In particular we note the market for wheeled tractors, combines and mechanical traction equipment. Whereas the tractor and combine sector consists of large companies, the equipment and implements sector generally consists of small factories, mainly located in São Paulo state and in the South region of the country.

Until 1960, wheeled tractors were not manufactured in Brazil. In 1961, the country started to produce agricultural tractors, prompted by a law instituting the National Plan for the Agricultural Tractors Industry (Law no 47473 of 22 December 1959), and small self-propelled tillers pursuant to the National Plan for the Self-Propelled Tillers Industry (Law 1249 of 25 June 1962). Crawler tractors and loaders and backhoes started being produced widely in Brazil in 1966 and 1969, respectively. Combines started being produced in the 1970s, even though ANFAVEA (The National Association of Automotive Vehicle Manufacturers) only started recording them in 1977.

From a global analysis of the production of agricultural machinery, looking chiefly at tractors and combines, we can discern a natural increase, motivated by state policies, which started in 1960 and continued up until the 1980s. From 1980 to 1990 it stabilised, and then began to decline until the effective opening of the export market, in 2004. Between 2002 and 2004, the number of exported tractors and combines increased four-fold, respectively from 8,000 tractors in 2002 to 23,000 tractors in 2004 and from 1,000 combines in 2002 to 4,500 combines exported in 2004, according to estimated figures.

An important factor in this increase in sales was the opening up of Argentina's market, which needed foreign machinery in order to reach and surpass its target of 50 million tons of grains.

Imports, on the other hand, are small, due to the limited purchasing power of farmers, who are today monetarily hampered by a market with high interest rates and an overvalued currency.

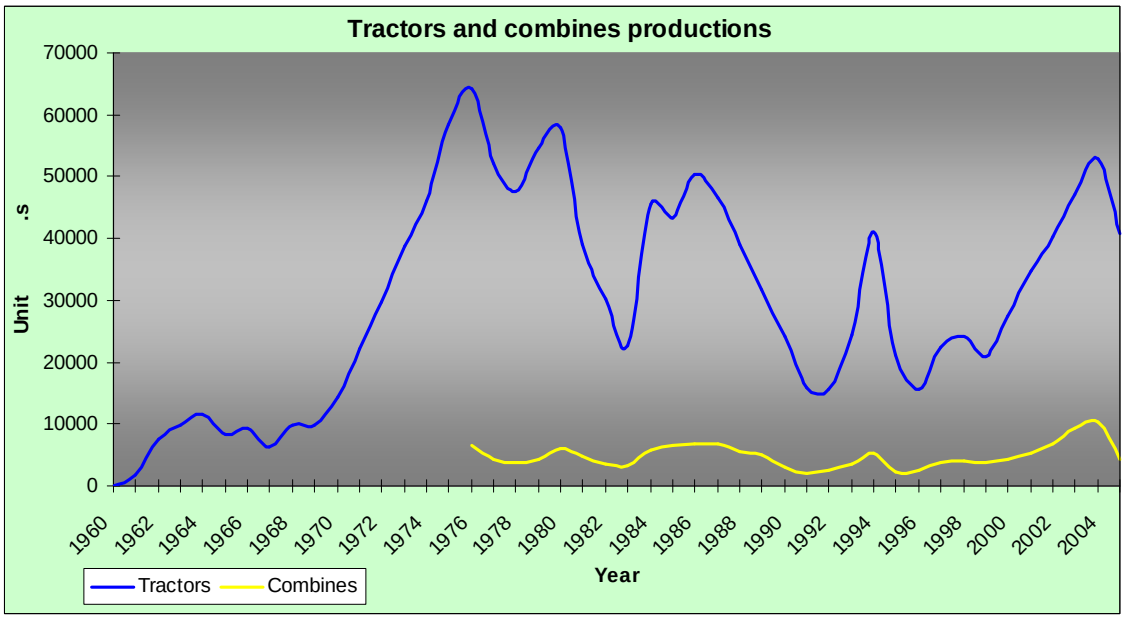


Figure 15: National Production tractors and combines in Brazil, from 1960 to 2005. Source: Anfavea

The production of agricultural machinery in Brazil has faced a crisis situation since 1995, predominantly due to multinational companies. From 1960 to 2005 1,378,094 agricultural tractors were produced, of which 1,178,157 by the internal market, while 2,180 were imported and 199,753 were exported to various countries. The annual historic average production of tractors was 29,959 per year, of which 25,612 sold on the internal market.

For what concerns combines, a total of 145,495 machines were manufactured 1977-2005; of them, 115,904 machines of different sizes were sold in the internal market and 26,998 were imported, mainly in the last ten years. The average annual machinery production was 4,850 units, with 3,864 units per year going to the internal market. The highest production occurred in 2004, with 10,443 machines produced, and the lowest production was during the 1991 crisis, with only 1,959 combines produced.

Last year, in 2005, Brazil produced 2,183 tillers, 40,871 wheeled tractors, 2,681 non-agricultural wheeled tractors, 4,229 combines and 2,907 loaders and

backhoes, for a total of 52,871 machines.

According to ANFAVEA (2006) data, today there are six major tractor and combine factories in Brazil: Agrale S.A., Case Brasil & Cia., New Holland Latino Americana Ltda, AGCO do Brasil Com. e Ind. Ltda, John Deere Brasil S.A., and Valtra do Brasil S.A. These industries produced a total of 25,098 agricultural machines between January and August 2006, accounting for 97% of the national production in that year. Among the Brazilians states, the biggest maker of agricultural machines is Rio Grande do Sul, with the factories of three of the six brands located in Brazil. Combines today take second place in the ranking of Brazil's agricultural machinery production, having been overtaken by wheeled tractors, predominantly in the 50 to 200 hP power range. Of the agricultural machinery industries located in Brazil, AGCO is the market leader, accounting for 41% of the wheeled tractors produced in the country.

Table 13: Production and internal sales of wheeled tractors in 2005 and 2006 per brand. Source: ANFAVEA

	2005		2006	
	Production	Internal sales	Production	Internal sales
TOTAL	**40,871**	**17,543**	**36,342**	**19,942**
AGRALE	1,053	924		1,117
CASE CNH	102	138		130
JOHN DEERE	4,417	1,755		1,689
MASSEY FERGUSON	19,019	5,881		6,069
NEW HOLLAND CNH	6,444	2,799		4,062
VALTRA	7,745	5,369		5,751
OTHERS	2,091	677		1,123

Table 14: Production and internal sales of combines in 2005 and 2006, by brand. Source: ANFAVEA

	2005		2006	
	Production	Internal sales	Production	Internal sales
TOTAL	**4,065**	**1,534**	**2,380**	**816**
CASE CNH	296	137		88
JOHN DEERE	2,066	549		288
MASSEY FERGUSON	892	332		157
NEW HOLLAND CNH	811	516		282

The agricultural machinery sector creates some 40,000 direct jobs in total, with both the big and medium-sized manufacturers, while the smaller manufacturers produce small equipment, mainly implements for region-specific use. The machinery factories associated to **ANFAVEA** engaging in large scale production accounted for about 13,000 direct jobs, a result down – 1.6% compared with the previous period.

Table 15: Agricultural machines, self-propelled, production by type in Brazil - 1960/2005 Source: ANFAVEA, 2006a.

ANO *YEAR*	CULTIVADORES MOTORIZADOS *TILLERS*	TRATORES DE RODAS *WHEEL TRACTORS*	TRATORES DE ESTEIRAS *CRAWLER TRACTORS*	COLHEITADEIRAS[1] *COMBINES*[1]	RETROES-CAVADEIRAS *LOADERS & BACKHOES*	TOTAL *TOTAL*
1960	-	37	-	-	-	37
1961	751	1.679	-	-	-	2.430
1962	1.240	7.586	-	-	-	8.826
1963	1.110	9.908	-	-	-	11.018
1964	1.765	11.537	-	-	-	13.302
1965	2.403	8.401	-	-	-	10.804
1966	3.336	9.360	13	-	-	12.709
1967	2.500	6.295	73	-	-	8.868
1968	2.463	9.819	106	-	-	12.388
1969	1.946	9.841	91	-	41	11.919
1970	2.065	14.326	185	-	131	16.707
1971	2.190	22.192	770	-	296	25.448
1972	2.916	29.754	1.426	-	653	34.749
1973	3.466	38.705	1.961	-	977	45.109
1974	5.463	46.060	2.678	-	1.338	55.539
1975	5.606	58.301	3.942	-	1.545	69.394
1976	5.275	64.175	4.631	6.481	2.070	82.632
1977	5.384	52.227	3.474	4.242	1.569	66.896
1978	5.522	47.640	2.981	3.719	2.436	62.298
1979	6.062	54.599	3.202	4.228	2.153	70.244
1980	6.896	57.974	4.285	6.003	2.320	77.478
1981	4.548	39.138	3.133	4.891	1.998	53.708
1982	5.364	30.126	1.900	3.434	1.245	42.069
1983	3.213	22.663	751	3.323	449	30.399
1984	2.595	45.523	1.348	5.806	960	56.232
1985	3.300	43.398	1.762	6.427	1.328	56.215
1986	7.128	50.450	2.409	6.747	2.236	68.970
1987	4.313	46.702	2.677	6.727	2.249	62.668
1988	2.026	39.147	2.596	5.651	2.056	51.476
1989	3.007	31.715	2.038	5.020	1.900	43.680
1990	2.519	24.223	1.746	2.971	1.655	33.114
1991	1.886	15.868	1.068	1.959	1.419	22.200
1992	1.790	15.648	989	2.445	1.212	22.084
1993	1.403	24.500	1.234	3.445	1.595	32.177
1994	1.538	41.094	1.705	5.326	1.670	51.333
1995	1.568	21.044	1.875	2.371	1.480	28.338
1996	926	15.545	1.543	2.531	1.644	22.189
1997	844	22.464	2.035	3.715	2.599	31.657
1998	692	24.092	2.072	4.063	2.493	33.412
1999	778	20.911	1.248	3.760	1.524	28.221
2000	813	27.546	1.429	4.296	1.417	35.501
2001	947	34.781	1.351	5.196	2.064	44.339
2002	1.079	40.352	1.665	6.851	2.063	52.010
2003	1.597[2]	47.109	1.520	9.195	1.605	61.026
2004	1.703	52.768	2.229	10.443	2.275	69.418
2005	2.183	40.871	2.681	4.229	2.907	52.871

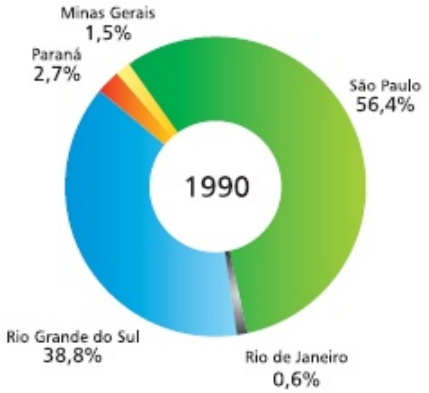
. Informações sobre colheitadeiras disponíveis a partir de 1976.
. Desde janeiro de 2003, não há empresas associadas à Anfavea fabricantes de cultivadores motorizados.
. *Information on combines is available after 1976.*
. *Since January, 2003, there is no tiller assembling company associated to Anfavea.*

Table 16: Agricultural wheeled tractors and combines, production by brand in Brazil, in 2005. Source: ANFAVEA (2006a).

Brand	**Wheeled tractors**	Combines
AGCO do Brazil Ltda.		
Massey Ferguson	Made 19,019 units 5,881 in internal market 13,077 to export	Made 892 units 332 in internal market 617 to export
AGCO Allis	Made 994 units to export	Made 164 units to export
CNH		
Case	Made 102 units 138 in internal market 114 to export	Made 296 units 137 in internal market 187 to export
New Holland	Made 6,444 units 2,799 in internal market 4,028 to export 65 imported	Made 811 units 516 in internal market 413 to export
Valtra		
Valtra	Made 7,745 units 5,369 in internal market 2,464 to export	
Challenger	159 units produced	
John Deere Brazil S.A.		
John Deere	Made 4,417 units 1,755 in internal market 2,946 to export 121 import	Made 2066 units 549 in internal market 1619 to export 1 import
Agrale S.A.		
Agrale	Made 1,053 units 924 in internal market 169 to export	

Table 17: Combines and wheeled tractors, production by brand in Brazil, from January to August 2006. Source: ANFAVEA (2006b).

Brand	Combines	Wheeled tractors	**Total**
AGCO do Brazil Ltda.	357	10,024	10,381
New Holland L. Amer. Ltda.	342	5,296	5,638
Valtra	----	5,077	5,077
John Deere Brazil S.A.	689	2,131	2,820
Agrale S.A.	----	770	770
Case Brazil & Cia	199	213	412
Others	----	717	717
	1,587	24,228	25,815

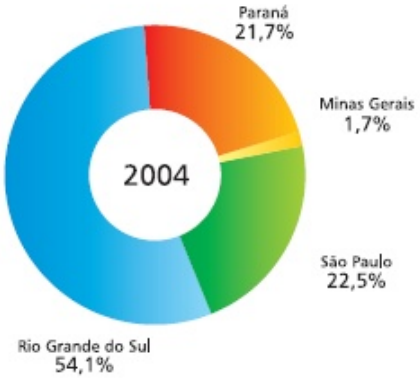


Estados/*States*	Empresas/*Companies*
Rio Grande do Sul	Agrale, Ideal, Maxion, SLC
Paraná	Ford New Holland
São Paulo	Caterpillar, CBT, Engesa, Ford New Holland, JI Case, Komatsu, Kubota, Valmet, Yanmar
Rio de Janeiro	Muller
Minas Gerais	Fiatallis

Máquinas agrícolas automotrizes produzidas
Agricultural machinery assembled
33.114
unidades/*units*

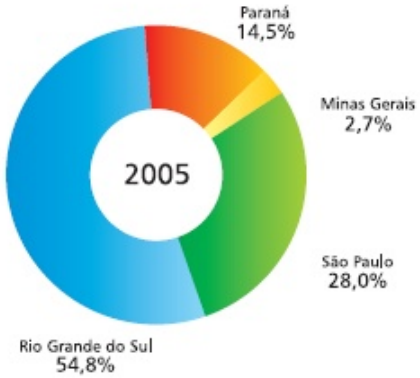
Estados/*States*	Empresas/*Companies*
Rio Grande do Sul	AGCO, Agrale, John Deere
Paraná	CNH Case, CNH New Holland
Minas Gerais	CNH Case, CNH Fiatallis
São Paulo	CNH Case, Caterpillar, Komatsu, Valtra, Yanmar

Máquinas agrícolas automotrizes produzidas
Agricultural machinery assembled
61.026
unidades/*units*



Estados/*States*	Empresas/*Companies*
Rio Grande do Sul	AGCO, Agrale, John Deere
Paraná	CNH Case, CNH New Holland
Minas Gerais	CNH Case, CNH Fiatallis
São Paulo	CNH Case, Caterpillar, Komatsu, Valtra

Máquinas agrícolas automotrizes produzidas
Agricultural machinery assembled
69.418
unidades/*units*



Estados/*States*	Empresas/*Companies*
Rio Grande do Sul	AGCO, Agrale, John Deere
Paraná	CNH Case, CNH New Holland
Minas Gerais	CNH Case, CNH New Holland (antes de 1º/2/05, CNH fiatallis)
São Paulo	CNH Case, Caterpillar, Komatsu, Valtra

Máquinas agrícolas automotrizes produzidas
Agricultural machinery assembled
52.871
unidades/*units*

Gráfico / *Chart* 18

Figure 16: Combines and wheeled tractors, production by state – 1990/2003/2004/2005. Brazil. Source: ANFAVEA, 2006a.

2. Domestic demand

According to the Ministry of Development, Industry and Trade (1996), there has been a degree of instability in the production and sale of agricultural machinery in Brazil since the 1990s, resulting from the continual uncertainty farmers face arising from frequent changes in the rules applied to lending, financing and the marketing of products. According to the Minister, there internal market has a strong repressed demand, caused by the lack of the financial conditions needed to invest, and the inability of Brazilian farmers to obtain credit. According to Vegro (2000), Brazil has a low level of agricultural mechanisation, even relative to other countries with a comparable agricultural area, such as the USA and Canada.

The figures for internal agricultural machinery sales within Brazil from 1960 to 2005 (ANFAVEA, 2006a), show that in past ten years the country has maintained average sales of 22,410 wheeled tractors per year. Brazilian production of these tractors has over the past decade been maintained at an average of 32,643 machines per year. Brazil imported some 2,143 machines since 1996, corresponding to average imports of 214 wheeled tractors per year.

Looking at wheeled tractor sales by power range, there has been a shift in preferences from higher to lower powered machinery purchases in the period between 1999 and 2005, reflecting the lower prices of cotton and soybean (IAE, 2006). According to the Institute of Applied Economics (IAE), this fact shows that large-scale agriculture, especially grain production, has been particularly affected by the poor investment conditions faced by farmers and the growing indebtedness of the sector. However, the increased demand for smaller, lower-power equipment does not indicate a revitalisation of small-scale agriculture, but rather reflects the demand for machinery used in citrus fruit and coffee growing, both segments characterised by medium scale and large scale farms (IAE, 2006).

For self-propelled tillers, analysis of the sales data for the last decade shows an average consumption of 1,067 machines a year, with about 1,156 produced internally per year.

Brazilian demand for crawler tractors has declined significantly from the second half of the 1990s, with average sales since then of 562 tractors a year.

For combines, internal Brazilian sales corresponded to an annual average of 3,368 machines over the past 10 years, during which the record number of combines produced was 5,427 in one year. Despite the fact that domestic combine sales accounted for only 62% of the combines produced in Brazil, 464 machines were imported in the last 10 years, corresponding to an average of 46 combines imported per year.

Among the Brazilian regions, the South and Southeast consume the most agricultural machines, principally wheeled tractors, which are top selling item. Of the total 17,729 tractors purchased by Brazilian farmers, 803 went to the North region, 1,385 to the Northeast, 8,957 to the Southeast, 5,147 to the South and 1,437 to the Centre-West agricultural border region . Fore the domestic combines market, the leading region, according to 2005 data, was the South, which accounted for 581 machines, while 484 went to the Centre-West, 294 to the Southeast, 115 to the Northeast and only 60 to the North.

If Brazil succeeds in reaching its ambitious output target of 100 million tons of grains, it will urgently need to increase its domestic production of machinery for both fleet expansion and

the replacement of ageing equipment. Today there are between 500,000 and 550,000 tractors and about 65,000 combines in Brazil, with only 350,000 of those tractors and 50,000 of those combines in full operational condition. Moreover, Brazil's machinery fleet is ageing, with excessive operating times, resulting in a loss of confidence in the machines and their efficiency.

According to ANFAVEA data (1999), the wheeled tractor fleet was 62.7 thousand in 1960, and reached its maximum historic value of 551 thousand in 1985, after which it has continued to decrease, reaching around 460 thousand units in 1998. Our fleet is larger than Argentina's (280 thousand), but smaller those that of Canada (711 thousand), the United Kingdom (500 thousand), France (1.3 million) and the United States (4.8 million).

The same source asserts that agricultural mechanisation, as quantified by the ratio between the cultivated area and the number of wheeled tractors, changed from 410 ha/tractor in 1960 to 116 ha/tractor in 1998. In comparison with the developed countries, Brazil's index is lower than that of Canada (61.3 ha/tractor) and the United States (36.5 ha/tractor). In European countries this mechanisation index is more impressive, for example in France (13.9 ha/tractor) and the United Kingdom (12.2 ha/tractor), although this data may also be indicative of excessive mechanisation prompted by income support polices and subsidies to farmers.

The figures for internal sales of wheeled tractors and of agricultural machinery in total (including crawler tractors, combines, tillers) since 1985 have followed the country's economic cycles.

According to ANFAVEA data (1999), the year 1986 saw a sales boom which has yet to be surpassed, with some 54,000 agricultural machinery units, of which 45,000 were wheeled tractors.

Table 18: World Market for Agricultural Tractors with internal sales of three leading manufacturers in different countries in 2005. Source: Trade magazines.

	units	%
Germany	**23,506**	
John Deere	4,972	21.2%
Fendt	3,938	17.4%
Deutz-Fahr	2,368	10.1%
Belgium	**2,303**	
New Holland	679	29.5%
John Deere	489	21.2%
Deutz	210	9.1%
Slovenia	**1,206**	
New Holland	205	17.0%
John Deere	114	9.5%
Landini	108	9.0%
Spain	**16,213**	
John Deere	4891	30.7%
New Holland	2566	15.8%
Massey Ferguson	1116	6.9%
Finland	**4,507**	
Valtra	1,948	43.2%
John Deere	795	17.6%
New Holland	544	12.1%
Italy	**33,064**	
New Holland	6,900	20.9%
Landini	3,950	12.0%
Same	4,154	12.6%
Norway	**4,507**	
Valtra	1,948	43.2%
John Deere	795	17.6%
New Holland	544	12.1%
Portugal	**6,248**	
New Holland	1,235	19.8%
John Deere	781	12.5%
Same	566	9.1%
Sweden	**4,021**	
Valtra	1,101	27.4%
John Deere	723	18.0%
New Holland	684	17.0%
Brazil	**17,951**	
Massey Ferguson	5,881	32.8%
Valtra	5,369	29.9%
New Holland	2,734	15.2%

That same year coincided with the implementation of the "Plano Cruzado", with prices controlled by the government, and a boost to the economy. The years 1993 and 1994 (Plano Real) saw another recovery and upswing in the economy, followed by a subsequent decline due to a lack of investment funds resulting from the rise in interest rates and appreciation of the currency.

According to ROMERO (2001), the United States, with its highly mechanised agriculture, now has only 2,194 million farmers, corresponding to less than 1% population. In Brazil there are 5 million farmers, corresponding to nearly 3% of the population.

Table 19: Historic data for 55 kW tractor/product from 1995 to 2004. Source: DERAL and CONAB.

	Flooded rice	**Corn**	**Soybean**
Year	**50 kg**	**60 kg**	**60 kg**
1995	2,187	4,751	2,659
1996	1,941	3,519	1,869
1997	1,818	4,434	1,717
1998	1,578	3,881	2,144
1999	1,794	3,598	2,032
2000	2,306	3,096	1,943
2001	2,183	4,369	1,783
2002	1,897	2,793	1,310
2003	1,652	3,949	1,636
2004	2,029	4,509	1,862

Table 20: Historic data for 6-cylinder combine/product from 1995 to 2003. Source: DERAL and CONAB.

	Flooded rice	**Corn**	**Soybean**
Year	**50 kg**	**60 kg**	**60 kg**
1995	6,154	13,361	7,477
1996	5,202	9,457	5,005
1997	5,258	12,819	4,964
1998	4,859	11,981	6,629
1999	5,824	11,642	6,586
2000	8,384	11,244	7,037
2001	8,001	16,025	6,543
2002	7,203	10,604	4,972
2003	6,217	14,987	6,177

The tables, showing the change the usage of tractors and combines for three main cereal products, confirm that it was very difficult to acquire machinery for the mechanisation of corn and that these ratios fluctuated from year to year, in step with the crisis of the sector. These frequent alterations created instability within the industry, making it necessary the implementation of aid plans for farmers.

Table 21: Domestic Sales of Agricultural Machinery in Brazil by type, from 1960 to 2005 (ANFAVEA, 2006a).

Nacionais / *Nationally manufactured*

Unidades/*Units*

ANO *YEAR*	CULTIVADORES MOTORIZADOS *TILLERS*	TRATORES DE RODAS *WHEEL TRACTORS*	TRATORES DE ESTEIRAS *CRAWLER TRACTORS*	COLHEITADEIRAS[1] *COMBINES*[1]	RETROESCAVADEIRAS *LOADERS & BACKHOES*	TOTAL *TOTAL*
1960	-	37	-	-	-	37
1961	751	1.679	-	-	-	2.430
1962	1.240	7.586	-	-	-	8.826
1963	1.110	9.908	-	-	-	11.018
1964	1.765	11.535	-	-	-	13.300
1965	2.403	8.401	-	-	-	10.804
1966	3.120	9.543	-	-	-	12.663
1967	1.971	6.506	72	-	-	8.549
1968	2.535	9.376	104	-	-	12.015
1969	2.081	9.977	54	-	5	12.117
1970	2.241	14.586	24	-	154	17.005
1971	2.215	21.947	807	-	270	25.239
1972	2.619	29.254	1.419	-	650	33.942
1973	3.543	38.918	1.869	-	980	45.310
1974	5.147	45.226	2.373	-	1.309	54.055
1975	5.378	57.101	3.615	-	1.478	67.572
1976	5.537	62.700	4.719	5.315	1.944	80.215
1977	5.152	47.815	3.251	5.127	1.518	62.863
1978	5.251	41.017	2.570	3.457	1.627	53.922
1979	6.165	48.963	3.140	5.087	1.885	65.240
1980	6.225	50.195	3.753	5.410	2.070	67.653
1981	4.724	27.949	2.393	4.522	837	40.425
1982	5.157	24.615	1.503	3.285	618	35.178
1983	2.996	22.546	877	3.512	569	30.500
1984	2.566	41.645	1.198	5.469	825	51.703
1985	3.139	40.736	1.600	5.775	1.215	52.465
1986	6.558	45.297	2.245	6.544	2.146	62.790
1987	3.593	38.815	2.010	5.747	2.022	52.187
1988	1.854	29.921	1.360	4.753	1.596	39.484
1989	2.617	26.310	1.493	3.942	1.527	35.889
1990	1.911	21.241	1.140	2.350	1.562	28.204
1991	1.983	13.495	589	1.718	1.159	18.944
1992	1.570	11.727	532	2.004	1.011	16.844
1993	1.096	21.396	908	2.735	1.272	27.407
1994	1.308	38.491	1.180	4.049	1.428	46.456
1995	1.210	17.584	1.155	1.423	1.334	22.706
1996	714	10.291	500	899	1.489	13.893
1997	707	15.731	777	1.662	2.152	21.029
1998	587	18.158	764	2.406	2.242	24.157
1999	629	18.788	582	2.850	1.194	24.043
2000	722	24.291	583	3.628	1.312	30.536
2001	856	28.090	490	4.054	1.762	35.252
2002	1.050	33.186	543	5.616	2.079	42.474
2003	1.585[2]	29.405	449	5.434	1.045	37.918
2004	1.682	28.636	526	5.598	1.174	37.616
2005	2.141	17.543	408	1.533	1.410	23.035

1. Informações sobre colheitadeiras disponíveis a partir de 1976. / *Information on combines is available after 1976.*
2. Desde janeiro de 2003 não há empresas associadas à Anfavea fabricantes de cultivadores motorizados. / *Since January, 2003 there is no tiller assembling company associated to Anfavea.*

Table 22: Agricultural Machinery Imports by type – 1994/2005 (ANFAVEA, 2006a).

ANO YEAR	CULTIVADORES MOTORIZADOS TILLERS	TRATORES DE RODAS WHEEL TRACTORS	TRATORES DE ESTEIRAS CRAWLER TRACTORS	COLHEITADEIRAS COMBINES	RETROESCAVADEIRAS LOADERS & BACKHOES	TOTAL TOTAL
1994	-	27	4	-	-	31
1995	-	10	23	-	-	33
1996	-	21	5	1	4	31
1997	-	318	65	47	6	436
1998	-	519	31	118	28	696
1999	-	417	64	56	116	653
2000	-	300	9	152	65	526
2001	-	113	6	44	108	271
2002	-	31	8	32	23	94
2003	-	71	-	6	-	77
2004	-	167	-	7	-	174
2005	-	186	-	1	-	187

Informações sobre vendas internas de produtos importados disponíveis a partir de 1994. /Information on domestic sales of imported products is available since 1994.

3. MODERFROTA Program

With the aim of further enhancing the competitiveness of its agribusiness, the Brazilian government has deployed various agricultural policy instruments. In 2000, during the government of President Fernando Henrique Cardoso, the "Program for the Modernisation of Agricultural Tractors and Implements and the Combines fleet" (MODERFROTA) was launched. This program consisted of rural credit and financing initiatives aimed at the renovation of the Brazilian agricultural machinery fleet, through the provision of favourable interest rates and repayment terms for farmers and cooperative owners (Neves, 2005).

Under the Moderfrota program, farmers had the opportunity to purchase new equipment, resulting in new demand for machinery, primarily wheeled tractors and combines.

The Moderfrota Program, administered by the National Bank of Economic and Social Development (BNDES), began in March 2000. According to BNDES (2005), the beneficiaries of the program were farmers and cooperative owners. The repayment periods for tractors, tillage equipment, coffee dryers and benefits were of up to six years, and for combines up to eight years. These data, referred to the beginning of the Program, were valid until the end of February 2003. During the second phase of the program (Moderfrota 2), under the government of President Luís Inácio Lula da Silva, some important changes were introduced. The interest rate was raised to 9.75% and 12.75% per year, depending on income bracket (the previous rates were 8.75% and 10.75% per year). Payment periods were reduced from six to five years for tractors and from eight to six for combines. The loan limits, which were 90% of the loan requirement for those with gross income above R$ 150 thousand, were reduced to 80%, while the remained at 100% for those with gross income below R$ 150 thousand (68 thousand dollars).

4. Brazilian agricultural machinery exports

According to ANFAVEA, the Brazilian agricultural machinery sector exported 450 million dollars in 1999, 962 million in 2003, 1.4 billion dollars in 2004 and 1.7 billion dollars in 2005. According to the export data available from ANFAVEA (2006a), Brazil exports agricultural machines to all continents, with the largest part going to South America, which absorbs 51% of the Brazilian sector's exports.

However, according to the Institute of Agricultural Economics, the concentration of agricultural machinery exports in markets with a similar profile to that of Brazil (tropical and subtropical areas of developing countries) means its international business is susceptible to repercussions very similar to those experienced on the domestic market (IEA, 2006). Brazil therefore needs to open up new markets and develop more stable markets.

From 1999 to 2002 internal sales of agricultural machines grew significantly (176.7%), though with a 13% drop in 2003 relative to 2002, while exports grew 296% between 1999 and 2003. It is important to note the return of Argentina's import market, which accounted for 28.3% of Brazilian exports of wheeled tractors in 2003. And by October 2004, this percentage had increased to 29.5%. For wheeled tractors, it is important to emphasise the role of the United States as the second market for these machines, and the uniform growth in sales in several other markets (NEIT, 2004). Looking at the breakdown by continent, in 2005 12,393 tractors were sold to neighbouring countries of South America, 4,957 tractors to North America, 2,684 tractors to the African continent, 2,661 tractors to Asia, 851 tractors to Central America, 350 tractors to Oceania and only 72 tractors to Europe.

Table 23: Ten biggest commercial partners of Brazil in the tractors and combines market in 2005. Source: Anfavea.

Countries	Tractors	Combines
Argentina	5,485	1,195
Unites States	4,291	-
Venezuela	3,246	285
Chile	1,210	-
South Africa	1,043	-
Thailand	895	-
Mexico	666	-
Paraguay	637	278
Malaysia	558	-
Uruguay	547	64
Iran	-	150
Bolivia	-	139
Germany	-	108
Spain	-	77
Poland	-	68
Colombia	-	66

Combine exports in 2002 amounted to 50 million dollars, increasing in 2003 to approximately 135 million dollars, corresponding to a 169% rise in one

year. This strong increase in sales was entrained by demand from Argentina and Paraguay. In 2004, exports again rose in response to growing sales to the Argentinean market and to other new markets, in particular Venezuela and Bolivia. In terms of continents, South America is today our principal partner, with 2,162 combines, followed by Europe with 447 machines, Asia with 223, Africa with 124, Central America with 65 and finally North America with only 8 combines imported from Brazil.

According to NEIT (2004), significant growth in exports is noteworthy because it can indicate a structural change in the strategies of companies. Such growth reflects the tendency of factories to put more emphasis on external markets as an important destinations for their products. The data show that this change occurred following a period of strong expansion of the internal market, during which factories increased their productive capacity.

Wheeled tractors are the most important Brazilian machinery export. In the 10 last years, Brazil has exported 100,785 wheeled tractors, corresponding to an average of 10,078 tractors per year. For self-propelled tillers, exports reached 891 machines in the last decade, corresponding to an average of 89 tillers exported per year. For combines, Brazil exported 19,888 machines, corresponding to average exports of 1,988 combines per year.

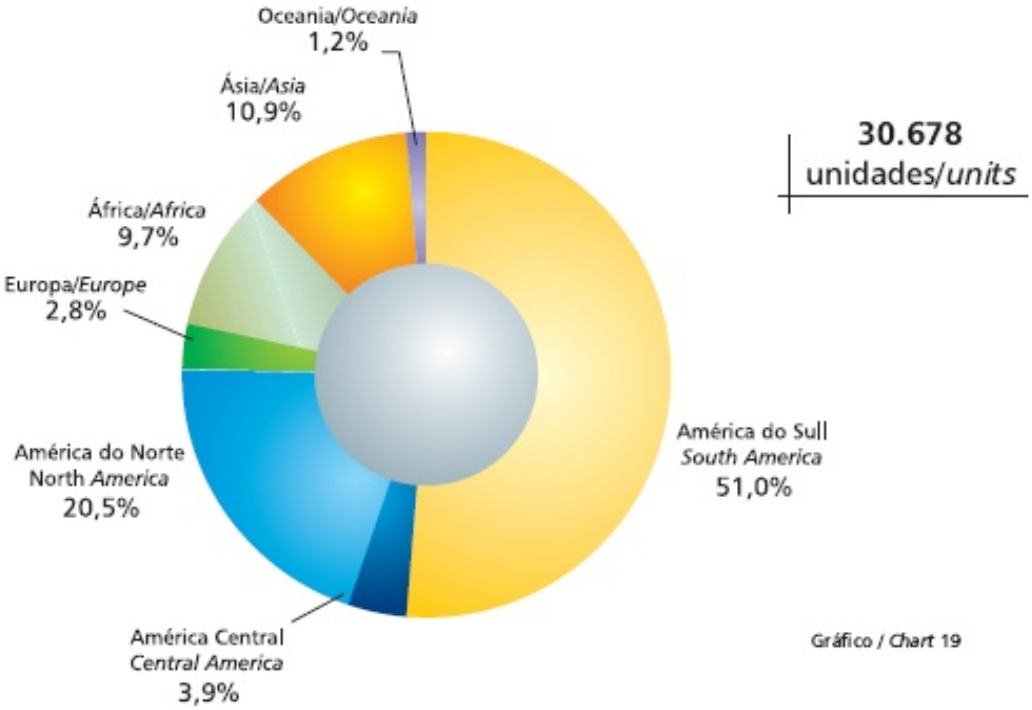


Figure 17: Agricultural machinery exports by destination continent, in 2005 (ANFAVEA, 2006a).

Figure 18: Agricultural machinery exports by destination country, in 2005 (ANFAVEA, 2006a).

The import/export trade balance is 1,097 billion dollars versus 1,728 billion dollars, respectively.

5. Marketing and import barriers

In addition to certain systemic and general aspects (similar to those affecting other sectors) that still hamper competition, the Brazilian tractor and agricultural machinery industry is further impaired by a number of specific restrictions (According to the Ministry of Development, Industry and Foreign Trade):

a) Decrease of the sales of the sector. Starting in 1990, a market for imported tractors and agricultural machines began to appear, principally for specialised ones.

b) Crisis of the Brazilian agricultural sector, which is dependent on the tractor and agricultural machinery industry, leading to a lack of financing for farmers.

c) Highly industrial and not totally utilised sector capacity.

d) Rising prices of the industrial components of tractors and agricultural machines, which are principally imported.

e) Differences between the external tax on imports/exports (TEC -Tarifa Externa Comum), in a distribution of taxes on different products, with a higher fee on imports than on components of a finished industrial product.

f) Failure to obtain the benefits of the internal tax on trade (ICMS) of tractors and agricultural machines, - Complementary Law 87/96, because most farmers are not taxpayers and don’t have credits to exchange.

Table 24: Agricultural machinery exports by type – 1964/2005 (ANFAVEA, 2006a).

Unidades/*Units*

ANO *YEAR*	CULTIVADORES MOTORIZADOS *TILLERS*	TRATORES DE RODAS *WHEEL TRACTORS*	TRATORES DE ESTEIRAS *CRAWLER TRACTORS*	COLHEITADEIRAS [1] *COMBINES* [1]	RETROES-CAVADEIRAS *LOADERS & BACK-HOES*	TOTAL *TOTAL*
1964	-	2	-	-	-	2
1965	-	-	-	-	-	-
1966	-	6	-	-	-	6
1967	10	31	-	-	-	41
1968	89	7	-	-	-	96
1969	50	7	-	-	-	57
1970	76	41	-	-	-	117
1971	-	98	-	-	-	98
1972	-	186	-	-	-	186
1973	6	386	88	-	6	486
1974	52	877	175	-	26	1.130
1975	85	611	176	-	62	934
1976	237	460	44	80	55	876
1977	132	4.546	202	129	79	5.088
1978	205	6.123	206	145	345	7.024
1979	193	7.201	522	224	219	8.359
1980	337	7.685	428	279	322	9.051
1981	179	10.040	397	314	1.042	11.972
1982	59	6.234	329	120	359	7.101
1983	103	1.895	221	164	80	2.463
1984	213	3.294	227	310	61	4.105
1985	259	3.279	216	534	47	4.335
1986	467	5.437	200	525	59	6.688
1987	641	6.593	599	522	240	8.595
1988	357	9.173	843	776	364	11.513
1989	223	6.150	903	1.227	318	8.821
1990	551	2.758	542	891	138	4.880
1991	174	2.974	365	447	258	4.218
1992	164	4.263	486	569	341	5.823
1993	336	2.725	518	611	293	4.483
1994	283	2.748	544	1.204	249	5.028
1995	327	3.138	721	948	129	5.263
1996	235	5.273	985	1.689	177	8.359
1997	138	6.384	1.199	1.906	437	10.064
1998	101	5.469	1.214	1.766	312	8.862
1999	144	2.335	824	677	227	4.207
2000	90	3.455	878	683	164	5.270
2001	74	5.814	888	1.202	268	8.246
2002	46	7.945	1.117	1.199	136	10.443
2003	6 [2]	16.589	1.067	3.232	528	21.422
2004	23	23.553	1.718	4.533	1.195	31.022
2005	34	23.968	2.202	3.001	1.473	30.678

1. Informações sobre colheitadeiras disponíveis a partir de 1976.
2. Desde janeiro de 2003 não há empresas associadas à Anfavea fabricantes de cultivadores motorizados.
1. Information on combines is available after 1976.
2. Since January, 2003 there is no tiller assembling company associated to Anfavea.

Part IV. Mechanisation trends in agriculture and the Brazilian tractors market

1. Introduction

Brazilian agribusiness is currently at a stage of economic maturity, and its socio-economic importance has been recognised. As a result, pride in taking part in agricultural activity is being restored, although there is still a degree of social exclusion. A vision is being consolidated for the sustainable development of food, fibre and energy production, flora and fauna products, and various other functions of the primary agriculture sector, through the aggregation of leisure activities, rural tourism and environmental conservation.

The diversification and specialisation of producers, and the organisation and restructuring of the supply chains is underway, yielding products for internal provisioning and for exports as a complementary market. Efforts have been made to achieve the differentiation and aggregation of value, in addition to shortening the product life cycles. A reduction in government intervention can be observed in the traditional policies for credit, minimum prices and agricultural security, along with an increased integration and co-dependence between producers and the market.

The main trends at a general level for the different sectors are:

- An increase in the concentration and scale of agricultural holdings and of agricultural industries and companies.
- An increase in the technological competitiveness of production and administrative processes.
- Greater integration into the production chains.
- Enhanced professionalism.
- Improved access to information.
- Lower government intervention in the policies of the sector.
- An increase in cooperation.

2. Current situation and prospects

One of the main problems of Brazil, as mentioned previously, is its shortage of facilities for storage of agricultural products. While the national output continues to increase each year, the storage capacity has remained practically the same. Today, Brazil produces 121 million tons and has a static storage capacity for 94 million tons, which makes for a deficit of nearly 30 million tons. The most significant problem is the lack of storages silos within farms, which forces the harvested products to be immediately transported, causing producers to incur the losses arising from deterioration of the product in the trucks on the highways, or in congested ports.

In Argentina, 25% of the storage capacity is found on rural properties, and this proportion reaches 50% in the main European countries and 65% in the United States. In Brazil, it has thus far reached 10%. The current agricultural crisis has at present prevented significant investments in this area, however this could be a way to solve the storage deficit and part of the logistic impediments that hold back the growth of agricultural exports and elevate transport costs.

Producers are doubly impacted by the storage and transport problems. The fact is that the Brazilian harvest is dependent on the highways. According to CONAB estimates, more than 64% of the agricultural output is transported by road. By contrast, in the United States highways are only the third-ranked method for transporting harvests, after waterways and railroads. In addition to being expensive, cereals transported by road are subject to physical losses.

According to CONAB, between 8% and 10% of the agricultural production is lost after the harvest, in other words due to losses incurred between storage on the farms and the end consumer or point of export. Soybean producers spend an average of US$ 57 to transport one ton of product, which is more than three times the US$ 18 spent by American farmers. This added logistical cost directly affects the producers' pockets.

The income crisis which has emerged, principally in the cereals sector, has altered the profile of movement of agricultural loads within the country's main ports during the past year. However, generally speaking, total volume of traffic has increased. From the farms to the doors of Brazilian agribusiness exporters, the use of rail transport has increased with respect to road haulages, chiefly due to its lower costs and investments made in the system. Rail freight is estimated to cost 30% less, on average, than road freight for distances greater than 500 kilometres.

The resolution of the crisis is further hampered by the fact that the government neither participates in the negotiations nor evaluates its extend, according to a professor from the University of Sao Paulo (USP). Brazilian agriculture is going through its third crisis in 20 years and, according to Guilherme de Silva Dias, professor of Agricultural Economics at the San Paulo University School of Economics, Administration and Accountancy (FEA-USP), the current crisis is one of the most serious and severe since that of 1986. In his view, the difficulties of that time were followed by a period of euphoria which lasted up until 2004, when success encouraged rural producers to increase their debts, without evaluating the risks of an eventual fall in the commodity prices caused by a policy of an overvalued currency and high interest rates.

Professor Silva Dias is conducting a data survey to evaluate the extent to which the agricultural economy has been compromised. The study is not yet complete, but he has already observed certain peculiarities that will render more difficult the resolution of the present crisis. Unlike in the past, when all the debts were with official banks, farmers now owe more to the private sector. “The current crisis was already announced in the middle of 2004, when prices began to fall. But despite this, no measures were taken", he observes.

"The current scenario is worrying", says Dias. In his view, it could result in the disintegration of the sector. Rural producers have debts above their capacity in an adverse scenario. The greatest difficulty is that the majority of the debts were contracted with the suppliers of inputs and through real bonds. “Now it’s difficult for the government to coordinate the negotiation of the payments."

In the two previous crises (1986 and 1994), the source of the credit was official. In the past decade, the solution was by the debts. Ever since, rural producers started to invest in the activity, which caused an accelerated cycle of growth. "Many producers decided to buy land, and now they are having to reduce the cultivated area”. Dias believes that a part of those operations will be undone or renegotiated. Another difficulty is that the sector is in a saturated phase. Neither exports, nor increased productivity are sufficient to compensate the exchange rate losses and the financial costs resulting from high interest rates. Another adverse effect of the economic policies is that banks are unwilling to grant credit because the operation is considered at high risk. The level of undercapitalisation of this sector, according to Dias, is the worst it has been since the middle of the last decade.

This has occurred as an effect of the unprecedented loss of the change relationship in agriculture. As a result, there is no working capital available to maintain the activity without incurring new debts. According to the professor, the loss of income of the agricultural sector has been too severe and can now only result in assets loss.

The situation is one in which the supply of agricultural products exceeds demand, indicating a need to cut back production, however it is not possible anticipate which sector will decline the most. "What is more, the forms of agriculture that have been developed in recent times, particularly due to their means of financing, will lose their backers". Dias believes that international banks should withdraw and deny credit to the great trading, which will thus stop offering credit to the producers.

The prices of agricultural commodities are significantly undervalued but have a good potential for growth, according to a study conducted by Deutsche Bank, which indicates that the potential growth for certain sectors are: coffee 235%, sugar 213%, cocoa 189%, corn 130%, cotton 115%, wheat 105% and soybean 87%.

Commodity prices in all the principal sectors have seen numerous readjustments during this decade. Record values of nominal prices have already been reached in certain sectors of energy and precious and industrial metals. During the past few months, agricultural prices have started to increase. This is in marked contrasts with the performance of previous years, when many prices of agricultural commodities were lower.

There is a trend toward a recovery in the world prices of agricultural commodities over the long term. With the expansion of the international economy, demand for food should continue to be high. The demand for cereals in China could exceed 530 million tons in 2010. The gradual reduction in available arable land, which has already reached its exploitation limit will prevent the Chinese from attaining self-sufficiency.

Since 1997, the industrialisation and urbanisation process has occupied some 7 million arable hectares. If this expansion continues on the same scale, China will lose another 6.5 million hectares in the coming years. In this scenario, there is also the risk of water shortages which would impede economic growth in India, China and in Asia in general.

It does not make sense for Brazil to continue expanding at a slower pace than the other three major emerging countries of the global economy - Russia, India and China. China and India are the two most populous countries on Earth, both with more than 1 billion inhabitants. They are therefore destined to become the biggest consumers of the 21st century. Due to a shortage of fertile lands and the exhaustion of water resources (the production of a ton of grain requires approximately a thousand tons of water) these countries cannot be considered global suppliers of food and natural products. Such a task will certainly fall to Brazil, which is still far from reaching its natural limits for agricultural expansion.

A study by the Ministry of the Agriculture found that Brazil has a cultivated area of 62 million hectares. But there are 200 million hectares occupied by pastures, of which 90 million hectares are suitable for agriculture. In other words, the country has an enormous agricultural potential, even without impinging on the Amazonian forests. In less than 10 years, according to the study, the country will be producing 170 million tons of grain, 30 million tons of meat and 24 million tons of sugar.

The Brazilian government wants to reduce the average interest rates for rural credit in the 2006/2007 Harvest Plan. Last year, the average rate of interests paid by farmers was 16% per year. The aim is to lower the cost of rural financing to 12%. The average interests are a compounding of credit issued at a controlled interest rate of 8.75%, and other loans issued at a free rate, which in that year reached 25%. The volume of resources under controlled interest rates should increase.

In the 2005/2006 Harvest Plan, the government allocated R$ 44.35 billion to agribusiness, an amount 12% greater than in the previous year. In the 2006/2007 harvest, the increase will not be so impressive. Brazil will have to plant a smaller area of grains in the next harvest, and for this reason there is no need for a large increase in financing, according to the government.

Certain structural approaches to the sector will be defined, such as those relating to fiscal and tax matters, rural insurance and rural credit resources. Another aspect being examined is the promotion of changes in the taxation of PIS/COFINS and ICMS. The government wants to avoid distortions in those taxes that could potentially damage the agricultural system.

The insurance sector has been one of the priority areas for the Ministry of the Agriculture, but there are still difficulties in creating a system that includes effective participation by the private sector. An efficient system of rural insurance would in part help avert the defaulting on payments by producers.

The government also intends to implement certain actions parallel to agriculture that should benefit producers' income, such as improvements in the infrastructure. One of the crucial issues is transport: a more efficient and competitive system would reduce costs, and this benefit could partially translate into higher profits for producers.

3. Domestic demand

Considering that Brazil is one of the few countries with the capacity to expand its agricultural output, through an expansion of the planted area and through improvements in productivity, mechanisation has a fundamental role to play in attaining this potential. The participation of Brazil in the international grains market shows its potential for expansion during the coming decade, with the abatement of barriers to the entry of foreign products into the developed countries, and the increase in demand resulting from population growth and the entry of new participants into the market. In China, for example, there is already a shortage of water, and the country intends to cut back on investments in agricultural production in favour of expanding industry. It is expected to become one of the biggest importers of food in the near future.

Agricultural employment, displaced by agricultural mechanisation, is falling at a faster pace (rates from 1.7% per year). If this trend continues, in the year 2014 most of the Brazilian rural population will be occupied in non-agricultural activities. In some states, such as Sao Paulo, it is possible that this may already occur before 2014.

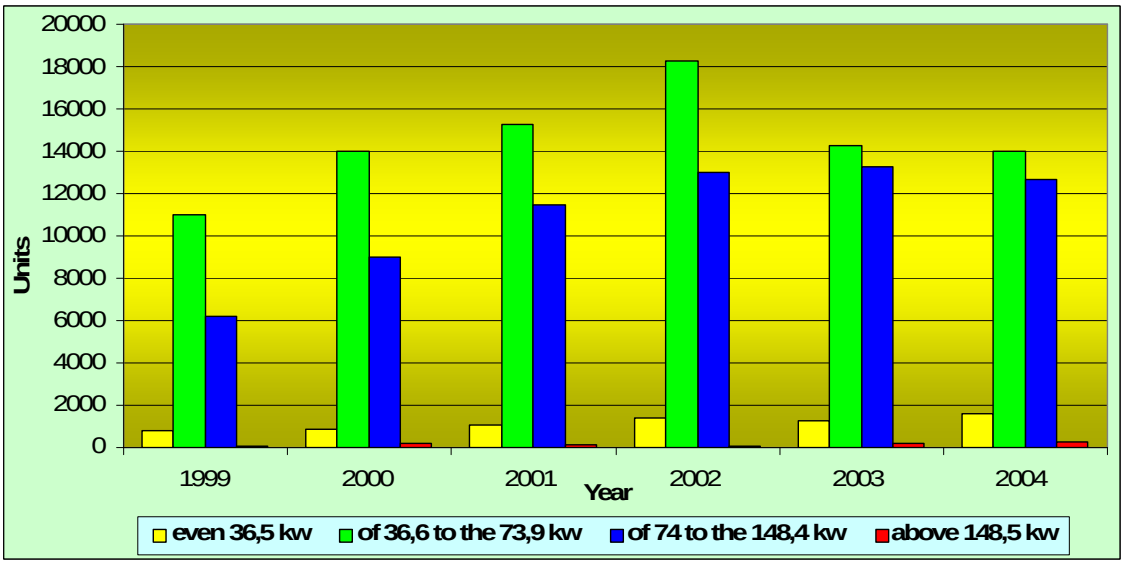


Figure 19: Number of units sold in the internal market by power range, Brazil, 1999 to 2004. Source: ANFAVEA.

Looking at the sales of wheeled tractors subdivided by power range, it could be noted a shift in preference from the purchase of high powered machines toward lower powered machines during period from 1999 to 2005, as a consequence of the drops in cotton and soybean prices. This fact suggests that large-scale agriculture, particularly that of grains, leads to decapitalisation and indebtedness of the sector.

The progress of lower-power equipment does not, however, reflect any reestablishment of family agriculture, but rather the demand for machines for use in citrus and coffee growing on the part of large and medium-sized producers, which are fairly representative of the productive structure of both segments. The use of higher-power equipment in farm management reflects an increase in the productivity per machine-hour, and a decrease in the unit costs. This trend is coupled with the growth of farm sizes, especially those situated in the vast savannas, therefore as a phenomenon justified on the earnings of Agribusiness efficiency.

The State of Sao Paulo continues to be the main market for agricultural machines, followed by Parana and Rio Grande do Sul. In the case of Sao Paulo, the alcohol and sugar segments are responsible for the State's leadership in demand for machinery, especially wheeled tractors. With countless projected new mills, scheduled to be installed through 2007, and the natural renewal of the park of current mills, Sao Paulo will most likely continue to be the main market for agricultural machines in Brazil.

The shortage of manpower and the expansion of sugar cane growing have driven mechanisation in Brazil, which has had record combine sales; this crop has helped to counter the damage suffered by suppliers due to the crisis of grain crops. It might take some time for it to become fully established and planted, however in the opinion of technicians, agronomists, managers and company directors, it is an irreversible process. And one for which combines have been principally responsible. Criticised for raising questions and doubts in the technological, social and economic spheres, these machines appear to offer an alternative for solving the problems specific to those sectors. Today, they have become the "object of

desire" for new mills and existing production units.

On the market, 180 cane combines are expected to be sold in 2006, compared with 130 machines in the previous year. The combination of favourable factors for the mechanisation of sugar cane– lack of labourers and expansion of the activity--has provided revenue for the companies which supply the sugar cane sector and helped offset the decline which has hit the grain crops affected by the Brazilian crisis.

According to market estimates, about 90 new sugar and alcohol mills will be installed in Brazil between now and 2013, in addition to projects for the enlargement of existing units. Producers will increase the area of the country planted with sugar cane from the current 5 million to 9 million hectares in that same period.

According to the sales director of Case IH, Isomar Martinichen, the expansion of sugar cane growing calls for an increase in productivity, which will benefit the offerings of mechanisation technology. "In new places, mainly pastures, the mechanisation trend is the most important, from planting to crop. So the sales prospects are very interesting". The company plans is to double its sales of combines in just four years." We expect to grow 25% per year", says Martinichen. The business of machinery for mechanical cutting is also expected to grow proportionately, according to Case IH's forecast. Market forecasts indicate that nearly 400 units of equipment will be sold in 2010.

The development of mechanisation offers attractive potential profits to commercial directors. The use of machinery for cutting sugar cane in Brazil is still very limited as compared with the application of the technology in Australia, for example, where 100% of sugar cane cutting is carried out mechanically.

Today, only 30% of the 5 million hectares of cultivated sugar cane area in the country are harvested by machine. The State of Sao Paulo, with 75% of the total, leads the ranking of mechanisation use. "Another reason why mechanisation is an advantageous option is the shortage of labour. There won't be enough workers when the planted area reaches 9 million hectares", points out the marketing manager of AGCO agricultural tractors, Rubens Sand de Moura. Moura also notes that the alcohol and sugar sector tends to renew its fleets more frequently than do other crops. "The sugar mill operates 24 hours a day, the wastage of the machine is enormous. A tractor used in sugar cane has working lifetime of up to seven years, compared to about 15 years for grain".

Brazil already has new-generation tractors and combines, but there are certain technical details which call for further development. "For this reason, we have invested in research and new products", says the director of Case IH. In addition to this company, all the other manufacturers of sugar cane equipment have launched products on the market in 2006. If the potential machinery sales afforded by the expansion of sugar cane is a sufficient argument for investments on the part of suppliers, the grains crisis has provided yet another reason for companies to focus their efforts on technological innovations for sugar cane cultivation.

Data from the National Association of the Manufacturers of Self-Propelled Vehicles (ANFAVEA) indicate a decline in machinery sales for use in grains crops. According to the association, the tractors business declined 72.6% between 2004 and last year, going from 5.6 thousand to 1.5 thousand units sold. "The average for 2006 should not be very different. Sugar cane will continue to support the revenue of many manufacturers. Those

who only supply grains producers are going to experience a critical period", says the marketing manager of AGCO.
The president of the Sectorial Camera of Agricultural Machines, Francisco Maturro, however points out that revenue from sugar cane offsets, but doesn't fully compensate, the collapse in manufacturer's sales. According to Maturro, sugar cane growing accounts for just a small portion of the planted area in Brazil, while soybean--for example--exceeds 23 million hectares. In addition to that, only 20% of the sugar cane areas are cultivated each year, because the crop is semi-perennial and assures up to five cuttings. Soybean has a -day cycle. Sugar cane can therefore not fully compensate the damages. If it covered the entire arable area, we would have only sugar to eat and would die of hunger", he argues.

CONCLUSIONS

As a grains producer, Brazil has a dynamic agriculture with enormous potential for growth. However there is the need to resolve certain problems in its global efficiency, relating to low average productivity of crops, reduction in fertilisers use, high cost of inputs, as well as improve its international competitiveness by increasing the quality of agricultural products. It is also necessary to improve the efficiency of machinery and equipment utilisation, as well as achieving nation-wide equalisation of the extreme regional disparities in the incomes per cultivated area of this sector.
Brazil has the potential to become a major agricultural machinery manufacturer thanks to its agricultural vocation, which generates strong internal demand due to aging of the fleet, abundance of raw materials, enormous availability of labour, excellent automotive fleet, expertise resulting from over 40 years of experience in agricultural vehicles, and an installed industrial capacity and potential, heavy industry of installed car spares and socio-political disposition to grant fiscal rebates to new industries, both national and foreign.
The country is not growing as a manufacturing power and machinery consumer because in Brazil there is continual uncertainty surrounding agriculture, and this sector is low on capital. Its role as an exporter country of agricultural machines is very recent, and relies on the dependent market of Argentina. What is more, the country's export experience is limited to big manufacturers with a head office formed by few big ones rather than many small ones, which might prove a more viable solution for the long term.
With a view to expanding the internal market, there is an immediate need to formalise a medium to long term agricultural policy, which also incorporates family agriculture into mechanised production. It is also necessary to facilitate access to state financing and improve existing programs such as MODERFROTA and FINAME, aimed at increasing the mechanisation index and reducing machinery lifecycles. Finally, it is also necessary to increase the use of mechanisation in fruit growing, stimulating the market in this activity.

Thanks to Gismael Francisco Perin, André Casali, Luiz Henrique Ereno and Marçal Elizandro Dornelles for their work in the bibliography search.

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