EC Project EUMERCOPOL

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Competitiveness of Maize Agri-Systems

Argentina and Brazil

Coordinators:
Hildo Meirelles de Souza Filho (GEPAI/UFSCar)
Mário Otávio Batalha (GEPAI/UFSCar)

Research Team:
Danilo Rolin Aguiar (GEPAI/UFSCar)
Márcia Maria Penteado Marchesini (GEPAI/UFSCar)
Paz González (INTA)
Rosane Lúcia Chicarelli Alcântara (GEPAI/UFSCar)

São Carlos, April 2008

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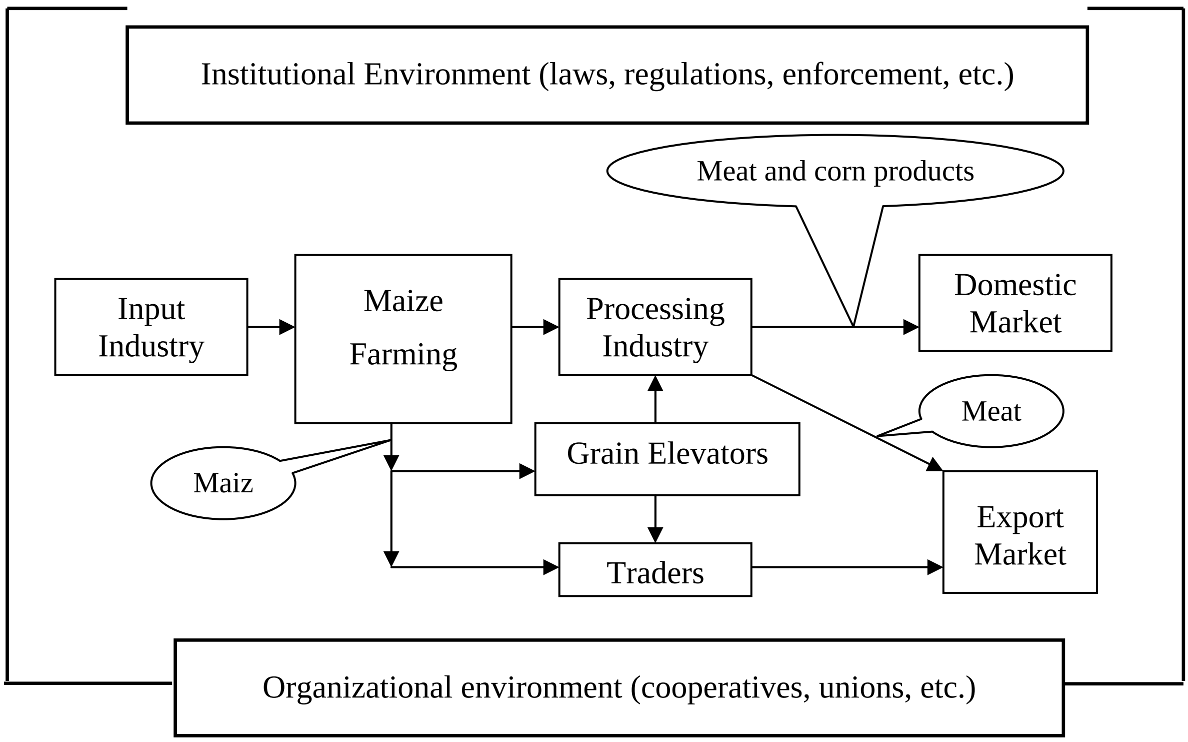
1. Introduction

This report comprises the main results of the analyses for the maize agri-systems, as part of the research project "Analysis of the competitiveness of Mercosur's key agri-food sectors, comparison of policies and the ex-ante impacts of EU-Mercosur trade liberalization ". Its main goal is to evaluate the capacity of maize agri-systems of two Mercosur countries – Brazil and Argentina – to respond to possible free trade agreements between the European Union (EU) and Mercosur.[1]

The maize agry-systems of Mercosur's countries are quite complex once they involve the generation of several products for human consumption (starch, flour, beverages, etc.), besides the grain maize is an important input for the animal feed industry. Figure 1 illustrates how the maize agry-system is organized in the two countries studied. The corn can be purchased by the processing industry, be sold directly to traders or be sold to grain elevators (cooperatives, private and public warehouses, etc.) that will keep the product stored for some time to sell their stock to the processing industry or the traders.

Figure 1 – Typical organization of corn sector in the Mercosur countries



[1] A more thorough analysis of each country's agri-system can be found in individual reports available on the Project EUMERCOPOL web page (www.eumercopol.org).

The processing industry represented in Figure 1 involves, actually, two types of industry. The first type is the livestock industry – mainly poultry and pig, followed by bovine – which use maize for feed production, and supply domestic and foreign markets with meat. The second type is the industry of processed maize products, such as oil, starch, flour, beers, soft drinks, cakes, soups, etc. In this case, maize is processed in mills (wet or dry process), allowing the development of other products. These products are mainly sold in the domestic market. Exports are usually made by trading companies; mostly transnational companies specialized in trade of grains and byproducts.

The methodology used in this study relies on the concept of agri-system and competitiveness. Competitiveness of an agri-system takes into account the verticality of the economic system and the combined impact of several factors. These factors are taken as drivers of competitiveness, and are closely related to the efficiency and efficacy of an agri-system. Taking the economic, organizational and technological environments, nine drivers of competitiveness were evaluated in this study: International trade policies, Industry programs and special policies, Domestic taxation, Food safety and inspection services, Technology, Market structure and governance structure, Firm management, Inputs, and Storage and transport. These drivers also guided the identification of strengths and weaknesses of the agri-system in order to take advantage of possible opportunities of increasing export to EU in face of scenarios of trade agreement, which is a SWOT analysis.[2]

Next section presents a summary description of the international context in which the production, consumption and commercial flow of the agri-system's commodity is inserted. Section 3 presents the main aspects of maize agri-system competitiveness in the two countries studied. In section 4, the SWOT evaluation of the critical elements of this agri-system in the two Mercosur countries is presented. Section 5 provides final comments and indication of actions and investment areas in order to improve competitiveness.

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[2] SWOT is a planning tool that was used in this study to identify the major factors affecting competitiveness and capacity to trade. Eumercopol researchers, after taking into consideration their own analysis of competitiveness drivers and experts evaluation, presented their perception of critical points of the agri-system.

2. World Consumption, Production and Trade Flow

The United States and China are the main consumer of maize. Together, they consume more than 50% of worldwide consumption. The United States, alone, consumes a third of worldwide consumption. They are followed by Brazil, Mexico, Japan and India, which add 14% of worldwide consumption, what means they are far behind of the first two. The consumption of all 27 European Union countries reached 61 million tons in 2005/06, with a share of 8.7% of worldwide consumption

Table 1 - Consumption of maize in the main countries (thousands tons)

Years	World	USA	China	Brazil	Mexico	Japan	India
1995/96	531.622	160.552	101.200	36.600	23.200	16.100	9.488
1996/97	572.840	177.590	105.750	36.250	23.440	16.100	10.304
1997/98	589.700	185.090	109.500	33.400	23.100	15.900	10.946
1998/99	582.530	185.790	113.920	33.200	23.040	16.436	10.853
1999/00	605.710	192.500	117.300	33.500	23.660	16.317	11.350
2000/01	609.540	198.100	120.240	34.500	24.000	16.200	11.950
2001/02	622.500	200.940	123.100	35.000	23.600	16.300	13.050
2002/03	627.678	200.748	125.900	35.800	24.700	16.800	12.000
2003/04	648.423	211.644	128.400	36.300	26.400	17.200	13.500
2004/05	687.323	224.648	131.000	38.500	27.900	16.500	13.900
2005/06	703.880	231.722	137.000	39.500	27.900	16.700	14.200

Source: USDA, data base, 2007.

World production of maize overcome 700 million tons and is led by the United States and China, which together produce about 60% of the world total. These are followed, in order of importance, by Brazil and Argentina which together produce 8% of the total. The joint production of the 27 European Union countries overcome more than 60 million tons, which represents more than 8% of worldwide production of maize (Table 2)

The evolution of yields of the main countries shows Argentina reaching a level close to that of countries with greater yields, such as United States and France. In Brazil, however, average yield is still very low (Table 3). The evolution of Argentina's yield can be scaled comparing their situation with that of the

United States: the average yield of Argentina was half the United States in 1995, reaching almost 80% in 2005.

Table 2 - World production of maize in selected countries (thousands tons)

Years	World	USA	China	Brazil	Argentina	Mexico	India	Canada
1995	515276	187.969	112.362	36.267	11.404	18.353	9.534	12.740
1996	586726	234.527	127.865	32.185	10.518	18.024	10.769	14.530
1997	583792	233.867	104.648	32.948	15.537	17.656	10.816	16.832
1998	613392	247.882	133.198	29.602	19.361	18.455	11.148	15.206
1999	606021	239.549	128.287	32.038	13.504	17.706	11.510	15.357
2000	591279	251.854	106.178	31.879	16.781	17.557	12.043	16.018
2001	613827	241.377	114.254	41.955	15.359	20.134	13.160	16.408
2002	601842	227.767	121.497	35.933	14.712	19.298	11.200	16.440
2003	641815	256.278	115.998	48.327	15.045	20.701	14.900	11.991
2004	723390	299.914	130.434	41.788	14.951	21.670	14.100	16.372
2005	709366	282.311	139.510	35.134	20.483	18.012	14.710	13.850

Source: FAOSTAT, Statistics Division 2007.

Table 3 - Yields of maize in the main producing countries (kg / ha)

Years	USA	France	Argentina	China	South Africa	Brazil
1995	7123	7718	4523	4996	1380	2601
1996	7978	8383	4040	3990	2704	2697
1997	7952	9060	4556	4416	2520	2623
1998	8438	8453	6078	5396	2161	2797
1999	8398	8949	5370	4946	2227	2759
2000	8591	9076	5433	3162	2849	2745
2001	8673	8566	5455	4788	2437	3393
2002	8118	8979	6079	4928	2852	3061
2003	8926	7117	6478	4816	2658	3728
2004	10065	8991	6393	5217	3039	3327
2005	9287	8371	7359	5302	3646	3051

Source: FAOSTAT, Statistics Division 2007.

The volume of exports of maize grains in 2005 was 84 million tons, which corresponds to 12% of world production. This low rate indicates a high degree of self-supply of grain from major consuming countries.

Exports are led by the United States, with 45 million tons in 2005, corresponding to 48% of total volume, coming in second place Argentina with 14 million tons, 13% of the total. France and China, with varying amounts, complete the group of the main exporters of this cereal, with a participation of 11% each. The variability of the export of China makes Argentina back to third place when reaches its maximum. Brazil is now among exporters, although for several years it has imported grain, mainly to support the expansion of its poultry production (Tables 4 and 5).

Table 4 - Exports of the main exporting countries (millions of US$)

Years	USA	Argentina	France	China	Ukraine	South Africa	Hungry	Germany	Brazil
1996	8.482	1.224	1.410	0	0	0	0	0	0
1997	5.248	1.331	1.209	859	0	0	126	0	41
1998	4.448	1.298	1.200	532	0	0	175	0	0
1999	4.976	775	1.206	450	0	11	140	146	1
2000	4.545	980	987	1.052	0	0	97	115	0
2001	4.564	967	821	625	0	0	133	83	493
2002	4.915	903	1.029	1.167	0	0	184	87	260
2003	4.806	1.215	1.051	1.766	104	102	158	128	370
2004	5.826	1.174	1.071	324	166	0	220	182	582
2005	4.863	1.348	1.141	1.096	267	235	228	148	102

Source: UNITED NATIONS, COMTRADE data base.

Japan stands out as the main buyer of maize worldwide, followed in order of importance by Korea, Mexico and other Asian countries. In 2005, Japan imported just over one quarter of world imports of maize, while Korea imported about 12% (Table 6).

Table 5 - Exports of the main exporting countries (thousand tons)

Years	World	USA	Argentina	France	China	Ukraine	South Africa	Hungry	Germany	Brazil
1996	65.928	52.321	7.069	6.538	0	0	0	0	0	0
1997	68.024	41.702	10.969	7.221	6.617	0	0	1.161	0	349
1998	68.391	41.217	12.578	7.826	4.686	0	0	2.076	0	2
1999	74.960	51.886	7.903	8.188	4.305	0	119	1.657	993	3
2000	78.218	47.948	10.897	7.734	10.466	0	0	957	908	1
2001	79.588	47.486	10.896	6.812	5.997	0	0	1.520	679	5.626
2002	82.738	47.487	9.469	8.250	11.673	0	0	2.095	707	2.740
2003	86.522	43.250	11.898	6.924	16.399	940	624	1.270	845	3.562
2004	77.096	47.702	10.678	5.854	2.318	1.226	0	1.288	973	5.019
2005	84.057	45.294	14.627	7.244	8.611	2.793	2.101	1.779	963	640

Source: FAOSTAT, data base.

Table 6 - Total imports of the importing countries (millions of US$)

Years	Japan	Korea	Mexico	Asia	Spain	Colombia	Netherlands	Canada	Germany
1996	16.002	8.704	5.870	0	2.106	1.704	1.585	856	900
1997	16.096	8.312	2.468	0	2.511	1.734	2.038	996	976
1998	16.047	7.111	5.208	0	2.730	0	2.000	1.190	944
1999	16.604	8.115	5.617	0	2.994	2	1.831	967	994
2000	16.110	8.714	5.834	4.942	3.525	1.926	1.816	1.498	909
2001	16.220	8.482	6.462	5.198	2.764	1.768	2.156	3.148	818
2002	16.419	9.125	5.614	5.055	3.442	2.096	248	398	920
2003	17.062	8.782	5.756	5.075	4.256	2.030	2.093	3.718	1.025
2004	16.478	8.371	5.509	4.860	2.707	2.271	2.233	2.078	1.325
2005	16.654	8.533	5.732	4.980	4.272	2.463	2.268	2.122	1.770

Source: UNITED NATIONS, COMTRADE data base.

3. Mercosur Agrisystem Competitiveness

In this section, the key issues regarding competitiveness of maize agri-systems in the leading producing Mercosur countries will be addressed. The main aspects in terms of production, including yields, are presented. The section provides qualitative and quantitative aspects of each country, according to the drivers of competitiveness.

Data presented in the previous seccion already showed that the main Mercosur's countries concerning world production are Brazil and Argentina. Besides Brazil and Argentina, also Paraguay and Uruguay produce the grain. Although both have very low share in Mercorsur's production, consumption and worldwide trade, they end up having some regional importance once they supply the markets of Brazil and Argentina in periods of shortage. Indeed, as will be seen in item 3.2, Paraguay has been the main source of Brazilian imports.

The importance of Argentina and Brazil is evident by the fact that Brazil is the third and Argentina is the fourth in the worldwide ranking of maize production; although the joint participation of the two countries in world production is around 8% to 9%, given the prominence to the United States and China.

The joint share of Brazil and Argentina of the world market has reached 17% of the total volume of trade in 2004, with prospects for even greater share in coming years. Yet on international trade, Argentina has higher share than Brazil, once most of Brazilian production is sold in the domestic market.

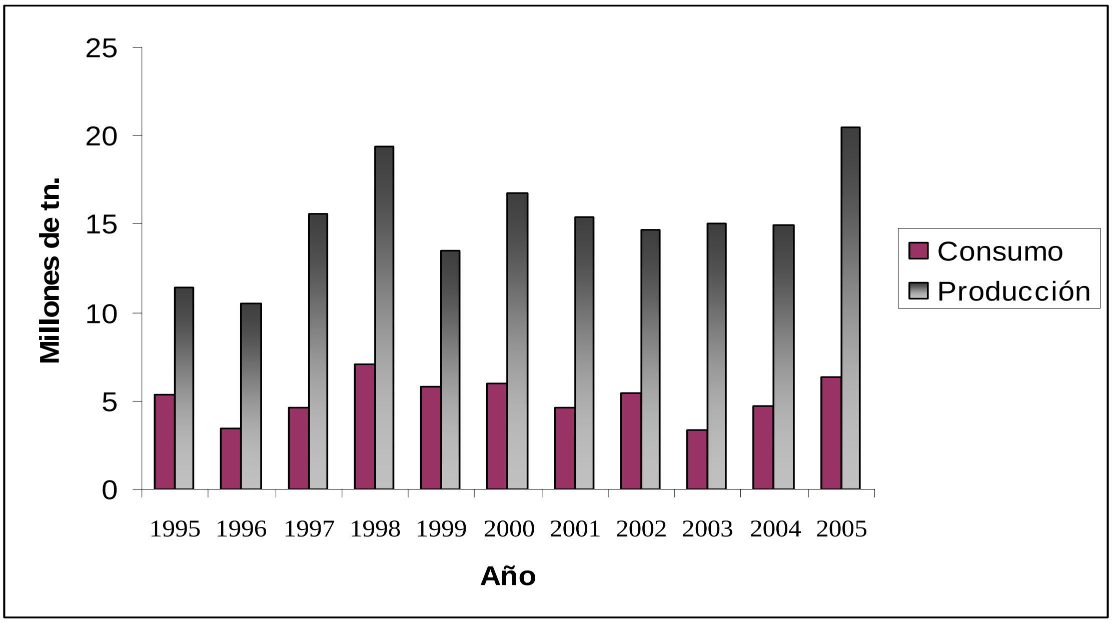
The next two sub-sections deal specifically about the competitiveness of maize agri-system in Argentina and in Brazil.

3.1 - Argentina

In the last decade, the average planted area of maize in Argentina was three million hectares. The production has fluctuated between 15 and 20 million tons, subject to changes of yields, but with upward trend.

The domestic consumption has changed according to Argentina's economic cycle, reaching around five million tons, but with a strong recovery in recent years due the growth in the country's livestock production. (Figure 2)

Figure 2 - Apparent consumption and Production and of maize in Argentina, millions tons, Years 1995 to 2005



Source: Based on data from SAGPyA (2007).

The high surplus illustrated in Figure 2 shows that the main destination of maize production in Argentina is the international market, which has ranged between 10 million and 20 million tons in recent years. Still, the domestic market is growing, as reported above, and has compensatory policies for the companies that use grains as input.

In 2005, from 5.7 million tons domestic demand, 3.5 million tons were animal feed demand and the remaining 2.2 million were used in the processing industry (wet and dry milling).

Indirect estimates of maize's consumption by sector in 2005 indicate that poultry industry demand of maize was 2.8 million tons, significantly higher than in the previous years. The dairy industry demanded between 1.8 and 3.5 million tons, beef industry demanded between 2.7 and 4.5 million tons, pork industry consumed 800 thousand tons, wet milling industry used 1.1 million tons, and dry milling consumed 600 thousand tons. Adding these quantities, reaches a total between 10 and 13 million tons of maize domestically consumed during 2005. The difference between this total and the volumes shown in Figure 2 can be explained by the integration of maize production with livestock production, which means that most of the consumption does not go through the trade circuit (MAIZAR, 2007).

The Argentine production of maize doubled between the 1995/96 and 2004/05 seasons due the technological innovation, based on the adaptation of hybrids to the local environment, intensification of the use of fertilizers and mechanical technologies, such as direct tillage, applied in large scale on the best soils available and, in some cases, the use of irrigation systems. As a result, estimates show that the area of direct tillage reaches 72% of maize area in the country, while the use of transgenic seed reaches 52% of the area.

R&D applied to maize entails large transnational companies which integrate the genetic and chemical improvements, protected by patents, as well as public and private networks that carry out specific developments, adaptation, evaluation of income and extension to farmers. INTA (National Institute of Agricultural Technology) stands out as the main public R&D organization, whose directive council, integrated by representatives of the public sector, national universities and organizations of farmers, defines the institutional policies at national level.

Maize, similarly to soybeans, is cultivated in several regions of Argentina, more than 15 provinces. Meanwhile, production is concentrated in the Pampas region, mainly in the provinces of Cordoba (34.5%), Buenos Aires (30.6%) and Santa Fe (14.7%), as shown in Table 7. It should be noted that Cordoba stood out in the last five years, lowering Buenos Aires to second place (Table 7).

Table 7 - Argentine provincial production of corn (thousands tons)

Province	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
BUENOS AIRES	8.216,32	9.031,30	5.702,70	6.590,90	5.525,64	4.047,78	4.267,45	4.998,61	6.266,88
CATAMARCA	36,00	45,00	36,90	40,50	40,50	40,50	40,50	20,25	31,50
CHACO	325,90	213,00	203,30	480,20	191,00	369,20	332,00	330,05	221,28
CORDOBA	2.607,10	4.422,10	2.799,80	4.765,80	4.201,11	5.656,07	6.160,14	3.941,20	7.061,80
CORRIENTES	14,50	9,99	14,80	12,54	11,60	8,91	10,79	12,17	21,63
ENTRE RIOS	892,20	1.176,00	1.020,20	630,90	1.275,58	911,75	1.182,41	1.451,33	1.625,60
FORMOSA	61,10	25,00	63,80	19,00	62,40	74,09	54,39	61,95	61,80
JUJUY	19,70	19,20	19,60	20,30	23,85	28,00	28,00	15,62	15,50
LA PAMPA	251,60	376,00	251,70	482,30	616,54	539,21	380,74	591,34	1.250,04
MISIONES	15,30	3,67	14,20	24,45	19,55	8,80	6,32	49,71	8,24
SALTA	278,30	231,30	263,50	245,10	165,55	144,00	124,00	141,50	120,00
SAN LUIS	35,10	101,90	101,60	210,90	179,55	296,40	199,50	260,00	392,00
SANTA FE	2.326,80	3.133,60	2.556,20	2.521,86	2.531,27	2.083,37	1.909,14	2.558,86	3.006,66
SANTIAGO DEL ESTERO	271,40	334,40	241,90	467,06	234,06	252,00	289,65	408,24	210,28
TUCUMAN	185,50	238,20	213,90	268,84	281,00	252,00	59,50	110,00	189,36
TOTAL PAIS	15.536,82	19.360,66	13.504,10	16.780,65	15.365,94	14.712,08	15.044,53	14.950,83	20.482,57

Source: Secretaría de Agricultura, Ganadería, Pesca y Alimentos.

The widespread cultivation of maize in Argentina, and the differences in soil and weather conditions, makes the period of tillage extending from August to early January, depending on the province. This territorial and timing dispersion in cultivation in Argentina helps stabilize maize supply.

Although Argentina had shown enormous growth of its average yeild between 1995 and 2005, the average (7,359 kg/ha) do not shows properly the gain experienced by the main producing areas of the Pampas region. The three main provinces, Buenos Aires, Cordoba and Santa Fe, showed average yield of 8,200 kg/ha in 2005.

Concerning inputs availability, Argentina is in a very favorable situation regarding several of the main world producers, but some pressure are present in terms of cost, largely driven by the own profitability of the maize crop. The supply of seed is dominated by the private sector, with exception of some varieties developed at INTA. The original genetic material and products generated from them are protected by patents, owned by few transnational private companies, such as Dekalb, Nidera, Novartis, Morgan and Zeneca, which control generation, production and international trade of seeds.

Fertilizers have also great importance in maize's supply. In 2002/03 crop, the maize share was of 16% of total consumption of fertilizers in Argentina, with 87 thousand tons of Nitrogen and 58 of Phosphorus. Although most of the fertilizer used in the country is imported, domestic production of nitrogenous fertilizers is large. Phosphate fertilizers are totally imported.

Of all factors of production, land availability is the main concern. Land prices in the producing region of maize in Argentina have increased in recent years. Between 1995 and 2006, average prices of land in maize-producing regions came to rise over 200%. The increase in the land price is related to the increase in yields, to the rise of international prices of major agricultural commodities, and a market dominated by large local and international investors.

Concerning the storage infrastructure, there is the need to enlarge its capacity due the higher volume of crops, and the need to establish new points of storage as the farming are is expanding. In the specific case of maize segregated to different markets according to their genotypic characteristics, the demand for storage increases even more, since this kind of handling reduces rotation and occupation in the whole circuit, from the field to the ports of embarkation.

The storage capacity /production relation is an important indicator to calibrate the adequacy of the infrastructure of storage to the levels of harvest; and

Argentina has shown serious deficiencies in this sense, not responding with investments in fixed storage facilities to the increase of production. In recent years, the temporary storage, identified as "silo bag," became a fast and short-term low cost alternative to respond to the successive increases of production.

Most of grain transportation is made by trucks, with a share of 82% of the total volume that reaches the ports; despite their higher average costs when compared to other means, such as railroad, which as share of 16% of grain transportation, or the waterway, with a share of only 2%. During the harvest period, demand for trucks is higher than its supply, as trucks remain in large queues while the ships are loaded, as well as in traffic jams, thus cost increases because loss of time. Besides, the maize harvesting overlaps with the harvest of other products, mainly soybeans, which overloads the entire structure of storage and transportation of the country.

Concerning the market structure, in the primary stage of the system, there is a very large number of diversified farmers. On the other hand, there is high concentration in the export market. The Herfindahl index reached 1.524 in 2006. The share of the two largest companies in the volume of maize exported was 42% in 2006. The first four accumulated 70% of the total, although there were 42 exporters operating in the market of maize in Argentina.

So, the maize market structure for export can be characterized as oligopoly, with a predominance of transnational corporations. It must also be highlighted the participation of associations of farmers in the market, integrated to cooperatives that have storage facilities and in some cases are also exporters.

In the maize market, 90% of products traded in the primary stage are commodities, traded at lower prices. The exceptions are the special products (flint corn, pisingallo, products for dry milling), in which the development of external niche markets requires close relations with suppliers and the identification of the origin of the grains. In these cases, companies develop strategies for voluntary segregation associated with the hiring of external certification companies. The need to ensure the attributes of the special products leads to the establishment of closed contracts with farmers.

The adoption of management tools by farmers has increased continuously. They have institutional support from both, the public sector, which has specific programs for the activity, as the private sector. The number of farmers hiring private consultants is increasing. As a result, these farmers are now in better conditions to face market changes, control and supervise their production and financial processes, identify bottlenecks in their activities, take decisions, create strategies, calculate costs and adopt management tools (certification, cash flow and strategic planning systems).

The Argentine exports of maize are distributed by about 50 countries. The five main destinations of Argentine exports have changed over time totaling a volume of less than 15% (Table 8). In 2004, Brazil accounted for 15% of Argentine exports, with 1.5 million tons. However, Brazil became a net exporter, so Argentina has been reoriented its exports towards new destinations such as the Southeast Asia and Africa.

Table 8 – Main destinations of Argentine maize exports (thousands tons)

Years	Total	Malaysia	Egypt	Chile	Saudi Arabia	Peru	Algeria	Spain	Morocco
1996	6.394	566	371	102	68	434	83	111	100
1997	9.958	978	800	625	237	669	0	286	245
1998	10.888	188	1.098	629	296	801	0	706	159
1999	6.995	268	573	731	113	378	0	1.508	0
2000	10.097	172	1.212	1.064	270	594	0	1.378	246
2001	9.868	668	890	1.242	440	658	309	504	291
2002	8.896	0	995	1.010	572	717	199	847	236
2003	11.217	0	1.370	977	1.025	768	375	1.056	553
2004	10.049	831	600	975	1.099	878	757	746	427
2005	13.138	1.834	1.518	1.229	1.202	1.146	1.032	1.029	724

Source: UNITED NATIONS, COMTRADE data base.

The Argentine imports of grains are not significant; mainly from neighboring countries such as Brazil in 2000 and Paraguay in 2001, around 50 thousand tons.

There are tariff and non-tariff (technical or administrative) barriers in the international trade of maize. The restriction for exporting to the EU consists of a specific tariff of 52.37 euros per ton of Argentine maize; except for Flint maize (Tariff Code 1005900020), for which tariff is reduced to 28.37 euros.

There are countries which have preferential tariffs for trade with Argentina, such as Peru, which has a tariff of 11.2% for maize. Mexico has also introduced, although high, a 158.4% preferential tariff for the Argentine maize, which is reduced to 16% for Pisingallo and to 8% for Flint.

Japan has a mixed mechanism between a tariff of 50% of the value of Mercosur's corn and a specific charge of 12yen/kg, reducing it to 0% for pop corn. Korea maintains a uniform tariff of 2.6% for both pop corn and for the forage maize.

Countries that have an equivalent tariff of 50% or more for imports of maize from Mercosur are: Turkey, Norway, China, India and African countries (Bhutan, Kenya, Tanzania and Uganda). To this group follows another which applies tariffs between 30% and 50% of which are part: Israel, Belize, Spain, Portugal, Cyprus, Slovenia, Poland, Romania and Serbia, among others, that in many cases apply specific tariffs to maize.

Meanwhile, the main destinations of Argentine exports of maize in 2005 had tariffs equal to zero, like Malaysia, Chile and Saudi Arabia, or very low, as Egypt and Algeria. Peru is in an intermediate level, with preferential tariff for Argentina, and Morocco, with importing tariff of US$ 2.5 per kg, a 0.25% rate for imports, and the TVA, a tax similar to IVA in Argentina, of 20% (Foundation to Export).

Most countries require different tests and inspections to protect human health. European Union requires GMO certification, while several countries require tests on the maximum permissible content of mycotoxins, which raises the cost of trade of maize due the cost of these tests.

Cereal farmers have access to operating credit from public and private financial institutions. There are restrictions on the maximum amount and interest rate. Suppliers of machinery and other inputs also provide credit for farmers.

Supply of agricultural insurance is largely available. In season 2003-04, 4.5 million hectares of cereals were insured.

Another policy that affects the sector is taxation. Since 2002, the policy of retentions of international trade became the main problem in this area. A 20% retention tariff is charged on maize FOB price. Some simulations show a relative weight of directly or indirec taxes of around 28% of the FOB price of maize.

Food safety is another crucial issue in international trade of maize. Two types of services are held in Argentina on this matter: (a) official control (compulsory), made by SENASA (National Service of Animal Health) and (b) private control (optional), held by certifying companies of the Argentine Chamber of Certification for Food, Organic Products and Related, of which the public agency INTI takes part. For the maize, we can distinguish the conventional classification (type, color and pattern) from of the differential classification (quality, certification, preserved identity of grains free of GMOs or with added value, such as corn with high content of lysine). The health legislation applied in Argentina to ensure the safety of food is the Codex Alimentarius, the Program of Food Norms established in 1963 by FAO / WHO (United Nations for Food and Agriculture / World Health Organization), of which the country is signatory. The Codex guidelines are related to aspects of hygiene and of the nutritional properties of food, covering code of practice and standards of: food additives, pesticides and residues of veterinary drugs, contaminants, labeling, classification, methods of sampling and risks analysis.

3.2 - Brazil

Maize is one of the main commodities of Brazilian agribusiness, accounting for about 29% of the total quantity of the national production of grains (2005/06 harvest). Although its share in Brazilian exports is currently small, an increasing trend can be identified for the coming years, because of worldwide price and demand increase.

In 2004, 64% of the Brazilian total consumption of maize came from the livestock production (animal feed, 35% by poultry, 20% by swine, 5% by bovine and the remaining by other animals). From the remainder, about 11% is exported, almost 10% is use as input in other industries, 3.5% for direct human consumption and the rest has other purposes. However, it is estimated that, considering also the indirect human consumption through other products, human consumption can reach 15%.

Table 9 shows the evolution of national production of maize between 1995 and 2005. A cyclical behavior can be noticed: in the years of scarcity of production, prices increase, and this encourages farmers to invest in the production of maize in the following harvest, which causes the overproduction and low prices in the following season; low prices depress planted area in the following harvest. Such fluctuations in production increase market risk for farmers.

The cultivation and harvesting of maize in Brazil occur in two seasons: the first in summer time and the second in the winter. The second season of maize is an additional crop option for farmers in the period of winter, reaching 20% of the total harvest of the country in some years.

Table 9 shows the evolution of domestic consumption of maize over the years. Consumption increases 12.6 million tons, or 41%, from 1995 to 2003. This growth is strongly related to the growth of poultry farming (chicken meat) and swine (pork meat).

Table 9 – Evolution of Production and Consumption of maize in Brazil

Year	Production(tons)	Consumption (tons)	Production /Consumption (%)
1995	36.266.952	30.795.094	117,8
1996	32.185.180	31.589.593	101,9
1997	32.948.040	29.756.257	110,7
1998	29.601.750	28.158.353	105,1
1999	32.037.624	29.541.397	108,4
2000	31.879.392	30.245.681	105,4
2001	41.955.264	37.736.205	111,2
2002	35.933.000	32.318.560	111,2
2003	48.327.300	43.484.086	110,4
2004	41.806.000	n.d.	n.d.
2005	34.859.600	n.d.	n.d.

Souce: FAOSTAT

Table 9 also shows that over the years the Brazilian production of maize was able to meet its demand, generating even exportable surpluses. Despite these surpluses, in some years, the North and Northeastern, both deficient production regions, have imported maize from Argentina and Paraguay because lower prices or exchange rate advantages. In fact, transportation of maize from the Center-West (the surplus production region) to those regions is very expensive because deficient transport infrastructure.

The main maize producing regions in Brazil, in descending order, are: south, southeast, center-west, northeast and north. The share of the southern region in total Brazilian production has been decreasing while the other regions, mainly southeast and center-west, have been increasing. Three main regions can be observed: regions south, southeast and center-west; a share of 88.3% of the total production (2005/2006 season). Table 10 presents data on production and planted area in major maize-producing states in Brazil. The ranking, in descending order of importance, is: Paraná, Minas Gerais, Sao Paulo, Mato Grosso and Goiás. Together, the five states account for about 72% of national maize production and for 53% of its planted area of maize. From 2000 to 2005, it is observed the increasing share of the State of Mato Grosso: from about 4.5% to 10% of production (in area, it grew from 4.6 % to 9%).

Table 10 - Evolution of maize production of the main producer states of Brazil

Paraná				
Year	**Production**	**Harvested Area**	**% Production**	**% Area**
2000	7.354	2.230	22,75	18,75
2001	12.647	2.817	30,14	22,84
2002	9.798	2.457	27,26	20,89
2003	14.390	2.846	29,78	21,95
2004	10.935	2.470	26,17	19,90
2005[1]	8.572	2.028	24,40	17,55
Minas Gerais				
Year	**Production**	**Harvested Area**	**% Production**	**% Area**
2000	4.232	1.241	13,09	10,43
2001	4.021	1.209	9,58	9,80
2002	4.808	1.204	13,38	10,23
2003	5.326	1.259	11,02	9,71
2004	5.952	1.319	14,24	10,63
2005[1]	6.244	1.354	17,77	11,71
São Paulo				
Year	**Production**	**Harvested Area**	**% Production**	**% Area**
2000	3.060	1.084	9,47	9,12
2001	4.200	1.123	10,01	9,10
2002	3.943	1.064	10,97	9,05
2003	4.732	1.114	9,79	8,59
2004	4.647	1.074	11,12	8,65
2005[1]	4.094	1.075	11,65	9,30
Mato Grosso				
Year	**Production**	**Harvested Area**	**% Production**	**% Area**
2000	1.430	542	4,42	4,56
2001	1.743	536	4,15	4,35
2002	2.311	720	6,43	6,12
2003	3.193	881	6,61	6,79
2004	3.409	941	8,16	7,58
2005[1]	3.506	1.053	9,98	9,11
Goiás				
Year	**Production**	**Harvested Area**	**% Production**	**% Area**
2000	3.659	840	11,32	7,06
2001	4.157	908	9,91	7,36
2002	3.390	731	9,43	6,22
2003	3.633	716	7,52	5,52
2004	3.523	696	8,43	5,61
2005[1]	2.854	615	8,12	5,32
Total dos 5 Estados (2005)			**71,92**	**52,99**

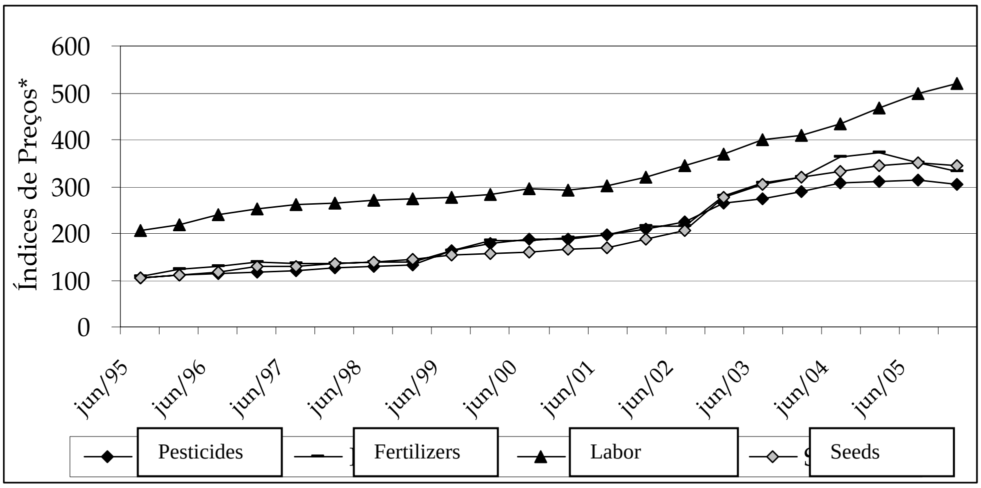
Source: Ministry of Agriculture - Site MAP: www.agricultura.gov.br, accessed in 17/01/2007

The average yield of maize in the country is quite low (3.370 kg /ha in the year of 2004), but changes greatly depending on the state and region of the country. In the Southeast, yields are higher in the states of Sao Paulo (4.181 kg /ha) and Minas Gerais (4.051 kg /ha). In the South, yields are higher in Santa Catarina (4.260 kg /ha) and Parana (4238 kg /ha). In the Center-West, the Federal District (5.597 kg /ha) and Goias (4.675 kg /ha) stand out. In the North, Roraima presents an average of 2.500 kg /ha. Finally, in the Northeast region are Bahia (1.395 kg /ha) and Piaui (1.318 kg /ha).

Another indicator of the technological level is the use of high yield seeds. The rate of diffusion of high yield seeds changes from state to state, but in the main producing states is equal or greater than 70%, reaching 90% or more in the states of Sao Paulo, Rio Grande do Sul, Mato Grosso, Bahia and Santa Catarina.

The cost of production is highly determined by fertilizers prices. Estimates show that in the harvest of summer the share of fertilizers in total cost is 42%, while the share of pesticides is 20%. Figure 3 shows the growth price trend of the main inputs between 1995 and 2005.

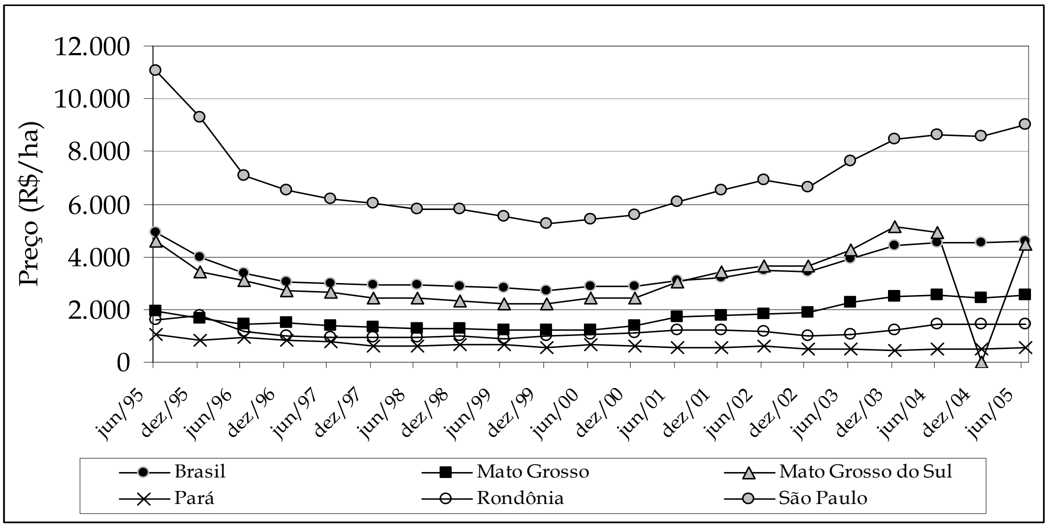
Figure 3 – Evolution of index paid prices for pesticides, fertilizers, labor and seeds; June of 1995 to 2005; Index - August/94 = 100.



Source: CONAB.

Figure 4 shows the evolution of land prices. It can be seen that the prices increased in the last years. The highest price is in the State of Sao Paulo (Southeast), while the lowest is in the State of Para (North).

Figure 4 – Evolution of land prices in Brazil and in five states (Pará, Mato Grosso, Rondônia, Mato Grosso do Sul and São Paulo; in Brazilian Real, June and December of each Year – 1995 to 1005; 2005 June values, deflated by the IGP-DI (general index price)



Source: FGV - PA.

Finally, it is important identifying the availability of areas for expansion of agriculture, for which the edge frontiers are in the Center-West and North regions. In these regions, the potential for increasing the cultivation of maize is huge. In 2003, there were 59 million hectares in Brazil possible to be used for agriculture.

The logistics infrastructure is also a crucial question in Brazil. There are a total of 15.572 warehouses in Brazil with total capacity for 113.4 million tons. Most of them are in bulk storage facilities (75.9%), while only 24.1% are conventional. Most of the warehouses (around 53% of total) are in the south region, mainly in the State of Rio Grande do Sul.

The 2001 new Law of Storage encourages the expansion of storage capacity within the rural properties. But there are still high costs of storage which are higher than U.S. rates (higher storage rate).

Around 10.000 farmers concentrated 38.35% of national production, predominating farms of less than 10 hectares (94.3% of farmers). Again, differences between regions can be noticed, with the average size of the properties much smaller in the North and Northeast regions than in others. The market of maize grains is concentrated, highlighting large oligopoly processing firms of poultry and pigs, as well as transnational trading companies operating in the export market of grains.

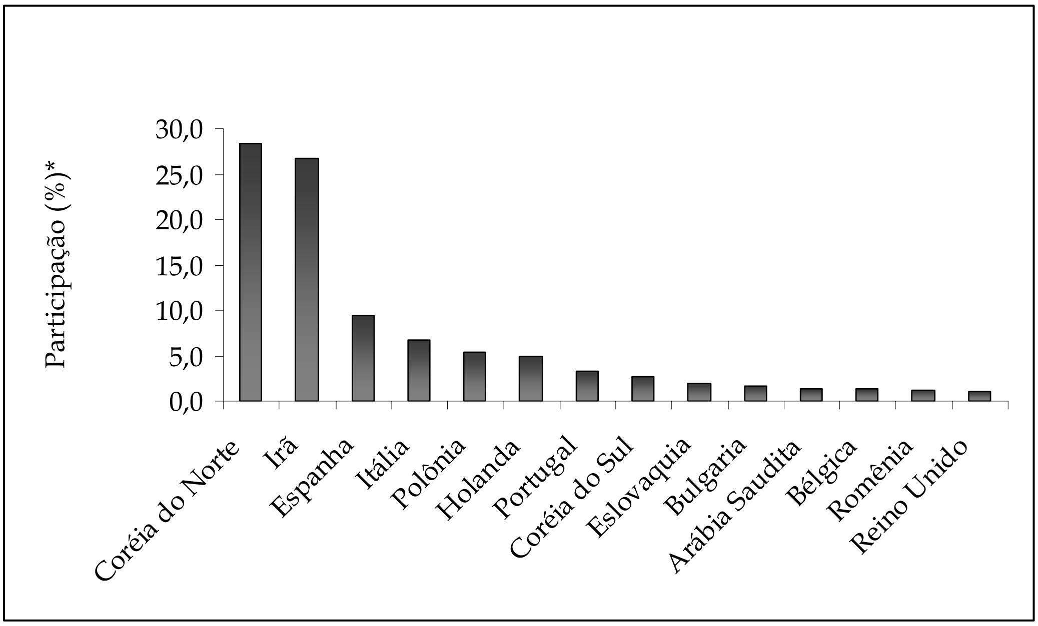
Transactions between farmers and buyers are held under spot market conditions, where there is no contractual relationship between them. However, there are few cases in which processing companies hold contracts with farmers, mainly for high quality maize.

The level of diffusion of management tools in maize farms is very low in Brazil. However, in other segments of the agri-system (processing, storage and export) the level of diffusion is high: the logic of competition in these segments requires adoption of the main instruments of management.

In the export market, as already seen, Brazil is in the 4th position of the ranking, reaching a market share of 5.6% in 2004. The U.S. is reducing their exports since 1995, unlike Argentina, France and Brazil. Exportation of maize from Brazil is growing since 1995. In 2004, there was a peak of 5.3 million tons.

Figure 5 presents the main destinations of Brazilian maize exports in 2004. There are 14 different destinations accounting for 96% of total exports of maize of the country. In 1997, the Netherlands was the main destination, however, in 2004, several other countries became also important destinations: North Korea, Iran, Spain, Italy and Poland.

Figure 5 - Destinations of Brazilian maize exports in 2004, % share of each country (export value/total export value).



Source: United Nations, COMTRADE.

Table 11 presents the main countries from which Brazil imports maize. A geographical change of Brazilian imports can be noticed: in 1997, Argentina was the main origin, followed by Paraguay. In 2004, Paraguay became the main supplier (78.5% of total imports of the country) followed by Argentina (21.5%).

Table 11 – Origin of Brazilian imports of maize, import value/total import value (%).

Year/Partner	Paraguay	Argentina	USA	Uruguay	TOTAL
1997	15,1	80,4	3,8	0	99,3
1998	6,0	88,9	2,7	2,1	99,8
1999	19,1	69,2	11,6	0	99,9
2000	11,6	86,2	1,4	0	99,1
2001	30,9	65,7	3,3	0	100,0
2002	83,3	16,5	0	0	99,8
2003	84,6	13,7	1,8	0	100,0
2004	78,5	21,5	0	0	100,0

Source: United Nations, COMTRADE.

There are several tariff and non-tariff barriers affecting the maize market, established either by Brazil on its importations and by other countries that prevent or hinder the export of Brazilian maze. Among the importing countries, high tariff is imposed by Mexico (158.4%).

The Brazilian tariff on imported maize is 9.5% for most countries and types of maize, which is lower than those established by other importing countries.

There are also many domestic government programs that affect the maize market in Brazil. Some are specific for the maize sector while others are designed to the agricultural markets as a whole, which may also be applied to the maize sector. These include farming credit policy, for which many farmers have no access and interest rates are high when compared to the Brazil's competing countries. Besides conventional operating and investment credit, there are credit programs for small farmers (PRONAF), which have very low interest.

Another set of programs is linked to target price and marketing. Among these are the policy of guarantee of minimum price and a number of "awards", purchased at public auctions, in which the government guarantees payment of the difference between the minimum prices and the market prices, when the latter are depressed. Depending on the modality, the premium can be paid to the farmer or to traders. Also, the Ministry of Agriculture manages a program of sale options (puts). The farmers purchase sale options that are launched by the government company CONAB on electronic auctions; and if the options are exercised, farmer's production becomes a part of the government strategic stocks.

Farming insurance is a challenging policy issue in Brazil. The government program, called PROAGRO (Program of Guarantee for Farming Activity), was created to support agribusiness as a whole. It is credit insurance for farmers who seek protection for their operating credit financial obligations, when their production is affected by natural phenomena, pests and diseases. The program has not been successful in providing access to a large number of farmers. Also it has not been self-funding in the long term.

Concerning taxation, on one hand, Brazilian maize agry-system is exempt from taxes for export. For the called Kandir Law, 1997, the exportation of primary and semi-processed products is exempt from the Tax on Processed Products (IPI) and of the VAT (ICMS, ranges 7% to 12%). On the other hand, several taxes are collected internally. According to several studies, taxes such as IPI, ICMS, PIS (Program of Social Integration) / PASEP (Program for Forming of the Heritage of the Public Server, ranges from 0.65% to 1.65%) and COFINS (Contribution to Finance Social Security 3%) burden national industries, but they do not charge imported products, which can harm the competitiveness of the national maize production in face of imported maize. In the current tax system, there are also problems of excess of taxes, taxes in cascade, and tax rates change from state to state in the country, generating several distortions. Usually, the tax rate of ICMS ranges from 7% to 12% on maize transaction value.

High taxation in a complex system favors informality. Furthermore, the existence of several tax rates of ICMS constrains future market development, since the value of contracts shall reflect the spot price excluding ICMS. Without the certainty of this tax value and thus its neutrality in the transaction of the future market, the final price will be unknown to the buyer, which creates uncertainty.

International standards of quality are followed in the Brazilian market of maize. Such standards are set by the Codex Alimentarius, as maize may be subject to contamination by a wide diversity of fungi in all stages of its production and trade.

Legislation concerning the classification of maize in Brazil date from 1976 (Ordinance 845) and has three types of classification for maize according to its consistence, its color and its quality. Studies show that the classification's standards of maize are inappropriate to the needs of the feed industry and the processing industry. The very lack of differentiation in price according to quality hampers standardization and investment in quality improvement. Therefore, there is the need of recasting the law of 1976. A new system of classification, in which price incentives could take place, must be created.

The legal cultivation of transgenic maize in Brazil has not been yet approved by the Congress.

4. Critical Issues from SWOT Analysis

Some critical points can be object of public and private efforts to increase the competitiveness of these agri-systems, and to meet the possible future expansion of production and exports. As seen in Table 12, each country has its own set of priorities, which are not necessarily common. In this sense, seven critical points can be pointed out in this agri-system: technology, logistics, food safety, market structure, special programs, firm management and taxation.

Table 12. Critical issues from SWOT analysis

	Brazil	Argentina
Technology	+	+++
Logistics	--	-
Food Safety and Quality	++	++
Market structure	0	+
Special programs	+	+
Firm managment	-	+
Taxation	--	--
Inputs	++	+

++ very favourable; + favourable; 0 neutral; - unfavourable; -- very unfavourable

Technology:

Brazil has had great technological improvements, in both, either in genetic improvement as in production techniques, but average yield is still much lower than of other important players of the international market (the average yield in Brazil is around 3,000 kg / hectare, while in South and Southeast regions the average yield reaches 4,000 kg / ha). There is still much to be done in terms of R&D and technology diffusion to reduce the gap between the more efficient farmers and the majority still behind. In Argentina, technology diffusion has been an important factor fostering this agri-system. The widespread adoption of high-yielding varieties and new farming techniques, such as zero tillage, allowed average yield increases 62.7% over the last 10 years (7,359 kg / ha in 2005). In the main producing regions of Argentina, the average yield exceeded 8,200/ha. In the province of Cordoba, the main producing region, average yield increases 139% over the last 10 years.

Logistics:

Deficient logistic infrastructure has negative effects on competitiviness in the two countries. It is a more serious problem in Brazil, where the large territorial extension and the reliance on road transport combined with bad conditions of roads and the limitations of port facilities severely restrict the competitiveness of the country's exports. In Argentina, supply of transport vehicles does not match demand because the harvest season of maize overlaps with the soybeans one. Besides transport, both countries are about to face limitations on the storage capacity, if they sustain the current increasing production trend.

Food safety:

Importers restrictions on genetically modified seeds are the main food safety factor affecting this market. In Argentina, adoption of genetically modified seeds of maize is legal and the level of diffusion is greater than 50%. However, a significant part of production is obtained with adoption of non-genetically modified seeds, which allows Argentina to export to countries that do not accept GMOs. In Brazil, there are legal restrictions for the use of genetically modified seeds of maize, which increases the availability of maze accepted in any market. In both countries, high quality grain maize is available. Also, accredited certifying companies provide certification which facilitates access to international markets (in Brazil, there are 48 accredited organizations to perform classification of maize). Still, the Brazilian legislation for classification of maize is very old (1976), requiring reestructuring. In both countries, rules are well defined and controlling mechanisms are known in the case of microbial contamination and residue of farming chemicals.

Market structure:

In both countries the average size of farms has grown, which has allowed economies of scale. However, markets are concentrated at export level, mainly in Argentina, where transnational trading companies are the leading force. Both countries export to several destinations, which reduces market risk and market power of importers. Two factors are still relevant: (a) maize is a easy storage commodity (non-differentiated product), which reduces to some extent the market power of traders; (b) maize market information is very inaccurate and unbalanced, largely because significant amount of production is not traded in the formal market, but integrated in other production systems. In the vertical coordination, dominates the spot market; contractual relations are exceptions.

Special programs:

Special credit programs are available for farmers and processors in both countries. In Brazil, interest rates are still high and access to credit is more difficult; while in Argentina, the cost of borrowing is lower. Low income small

Brazilian farmers have access to low cost credit provided by PRONAF. There are deficiencies in the policy instruments for farming insurance in Brazil, while in Argentina it is largely diffused. In Brazil, government operates sale options (puts) to form public stocks and reduce risks for farmers. This instrument is part of the minimum price guarantee policy and the government policy of strategic stocks (food security).

Firm management:

Improvements in management at farm level are necessary in both countries. In the other segments of the agri-system – processing, export traders and storage – adoption of good management tool is at the best world top level. At farming level in Brazil, low yields and high cost of production are good indicators of its worse position. There is still a huge heterogeneity among farmers in the use of management tools, which hampers Brazilian international competitiveness. In Argentina, adoption of management tools at farm level is more widespread, which is an important determinant of its enormous international competitiveness.

Taxation:

The high tax burden in is a serious problem for the competitiveness of the Brazilian agri-system. Besides taxes on inputs, there are taxes on maize processed products and on products, such as meat, in which maize is an important input. Besides, the complexity of the tax system in Brazil causes distortions in the efficiency of maize production. Already the export of Brazilian maize is exempt from some taxes. In Argentina, the problem of taxation shows up even more serious since the creation of "retenciones" in 2002. To ensure the domestic supply, the Argentine government created variable levy on export maize and on other farming commodities.

Input:

The growth of Brazilian production was mostly based on increasing planted area. There is still huge availability of land in Brazil that can be used for maize production, but soybean and sugarcane compete with maize for this area. The expansion of these two cultures, due the increasing demand for bio-fuels and food, has pushed the best land price up, which can hinder the expansion of maize, unless diffusion of technology speeds up. Another important element is the availability of fertilizer. The prices of this input, mostly imported by Brazil and Argentina, have sharply increased. In Argentina, maize production has to compete with the production of soybean, not only for logistic infrastructure but also land. The availability of hybrid seeds is widespread in both countries. Even facing the competition with other crops for land, and restrictions in the fertilizer market, the availability of production factors is a comparative advantage for the two MERCOSUR countries, particularly for Brazil, given its huge availability of arable land.

5. Final comments and indication of actions and investment areas

The two countries have enormous potential to increase maize production. The competitiveness of Argentina is based on extremely fertile soil, diffusion of high technology and efficient management. Brazil is taking advantage of its enormous availability of low cost arable land and availability of technology (although level of diffusion is still low). Brazil faces the negative effects of high technological heterogeneity at farming level, with low level of diffusion of technology and management tools. In common, both countries face problems of logistics (more serious in Brazil) and excessive tax burden (worse in Argentina, since the creation of "retenciones").

Brazil and Argentina show conditions to assume leading positions in the international market of maize, considering the increased worldwide demand for bio-fuels and food. Consumption of maize in the United States and China is increasing and it is unlikely that they will generate exportable surpluses (in U.S., the use of maize for ethanol production eliminated its exportable surpluses). But to the MERCOSUR countries taking advantage of this favorable scenery, some policy interventions are necessary:

a) Investing in logistic infrastructure, such as: roads that connect the producing regions to ports and alternative transport modals (railways and waterways); and port infrastructure, to reduce time of boarding and port costs (in both countries).

b) Expansion of grains storage capacity, according to the expected increase in production, mainly in new producing regions where there is greater lack of storage facilities (in both countries).

c) Reform of the taxation system in Brazil, which penalize competitiveness of processed maize products in several states of the federation.

d) Reduce the tax on maze exports in Argentina (“retenciones"), which is a major factor precluding international competitiveness.

e) Restructuring of the farming insurance policy in Brazil.

f) More resources for rural credit, at a more favorable interest rate, in order to speed up technology diffusion.

g) Legislation on food safety should be harmonized, either standards an controls, in order to match international market demand. Mercosur countries should formalize agreements on technical equivalence with countries outside the economic bloc.

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