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Global Shifts in Agro-Industrial Capital and the Case of Soybean Crushing: Implications for Managers and Policy Makers

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Abstract

Tremendous shifts are occurring in the location of agro-industrial capital around the globe. To focus discussion on this topic a session was convened at the annual meeting of the International Food and Agribusiness Management Association in Montreux, Switzerland in June of 2004. The session brought together researchers and industry leaders to better understand these dramatic shifts and the implications they hold for the agri-food system. The following article emerges from that session. The first part of the article provides the context for the discussion by looking at global shifts in soybean processing investment. The second part entails reaction by three industry panelists.

Keywords: soybeans, processing, investment, global strategy

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Note from the IFAMR Editor: This Research Paper and the Industry Commentary were presented in an Organized Discussion Session at the IAMA XIV World Food and Agribusiness Forum and Symposium, held in Montreux, Switzerland, June 2004. The IFAMR desires to document the value of the activities taking place at the annual Symposium, and, most importantly, intends to promote this innovative approach to addressing relevant and timely agribusiness issues by bringing together quality academic research and industry feedback with the opportunity of a live discussion at the Symposium. The IFAMR will support quality innovative contributions serving the information needs of IAMA members and agribusiness at large.

Summary

This paper examines the development of soybean production and processing in North America, South America, Asia and the European Union since 1990's. It aims to convey: 1) the new trends in global soybean processing investment and 2) industry commentary on these trends.

The main findings are:

1. As world soybean production and crush have been steadily increasing since 1990s, the regional distribution of production and crush has changed dramatically. From 1991/92 to 2003/04, U.S. share of world soybean production declined from 50.39% to 37.83%, Brazil's share increased from 17.99% to 26.98%, Argentina's share increased from 10.39% to 17.83%, and China's share declined from 9.04% to 8%.
2. During the same period, US share of world soybean crush declined from 37.26% to 25.26%, European Union's share declined from 14.35% to 9.91%, Brazil's share increased from 16.31% to 17.35%, Argentina's share increased from 8.41% to 14.51%, China's share jumped from 3.7% to 15.48%.
3. The world's largest soybean processors are remapping their global strategies. ADM has reduced its soybean crushing capacity in North America in recent years, and increased its crushing capacity in South America and China. In 1996, 66% of ADM's oilseeds processing capacity was in North America, 0% in China, and 0% in South America. In 2003, 15% of its oilseeds processing capacity is in China, 9% in South America, while its North American share declined to 50%². Since 2000, Bunge has closed its soybean processing operation in Vicksburg, Miss. and idled its facilities in Cairo, Illinois and Marion, Ohio. Cargill has closed its Guntersville, Alabama, soybean crushing facility. Both Bunge and Cargill have significantly expanded their crushing capacities in South America; and Cargill has expanded as well into China.
4. While the US share of world soybean crush declined, its total crush volume did not decrease. In recent years, cooperatives have been building crush plants in the Northern US, adding approximately 12,000 metric tons of daily capacity.
5. In recent years, major soybean processors and other multinational companies (MNCs) have integrated further into higher valued ingredients and products, investing heavily in soy foods, bio-products, and soy protein products in North America, South America and China.

² Goldman Sachs 7th Annual Agricultural Forum, New York, February 27, 2003.

6. The recent shift in production combined with the current inability for seed companies to receive royalty payments for their soybean technologies in many of the new soybean growth areas may compromise future investment in soybean seed development. The current shift in the location of global crushing investment is occurring into countries where seed patents rights are difficult to enforce. If soybean research is compromised by the property rights problem investments in soybean crushing too may be at risk.

Research Methodology

The objective was to survey all relevant and accessible sources of information describing soy processing activities since 1990. To that end a comprehensive literature review of information and data regarding global soybean processing was completed. Sources included:

1. US Department of Agriculture, Foreign Agricultural Services.
2. Annual reports, SEC filings of publicly traded companies, ADM and Bunge, and press releases of privately held companies, Cargill and Louis Dreyfus.
3. Research reports of equity analysts.
4. Newspapers, Feedstuffs and The Wall Street Journal.
5. Trade associations, including American Soybean Association (ASA), Brazilian Association of Vegetable Oil Industries (ABIOVE), The Soybean Processors Association of India (SOPA), EC Seed Crushers' and Oil Processors' Federation (FEDIOL).
6. Websites of China's Ministry of Agriculture and COFCO.
7. The following databases:
 - a. ABI/Inform
 - b. Hoover's online (News)
 - c. Investext Plus
 - d. ISI Emerging Markets
 - e. LexisNexis Academic.
 - f. OneSource
 - g. RDS Business & Industry

Global Soybean Processing

From 1991/92 to 2003/04 (marketing year), world soybean production increased by 93.4% (from 107.30 to 207.53 mmt), soybean crush increased by 91.2% (from 91.59 to 175.08 mmt)³ (Figure 1). The regional distribution of production and crush has changed considerably (Figures 2 & 3). During the same period, US soybean

³ US Department of Agriculture (USDA), Foreign Cultural Services, PSD Online, <http://www.fas.usda.gov/psd/Psdselection.asp>

In this paper, world soybean production and crush data are quoted from the USDA unless otherwise stated. The figures for 2003/2004 marketing year are forecasts.

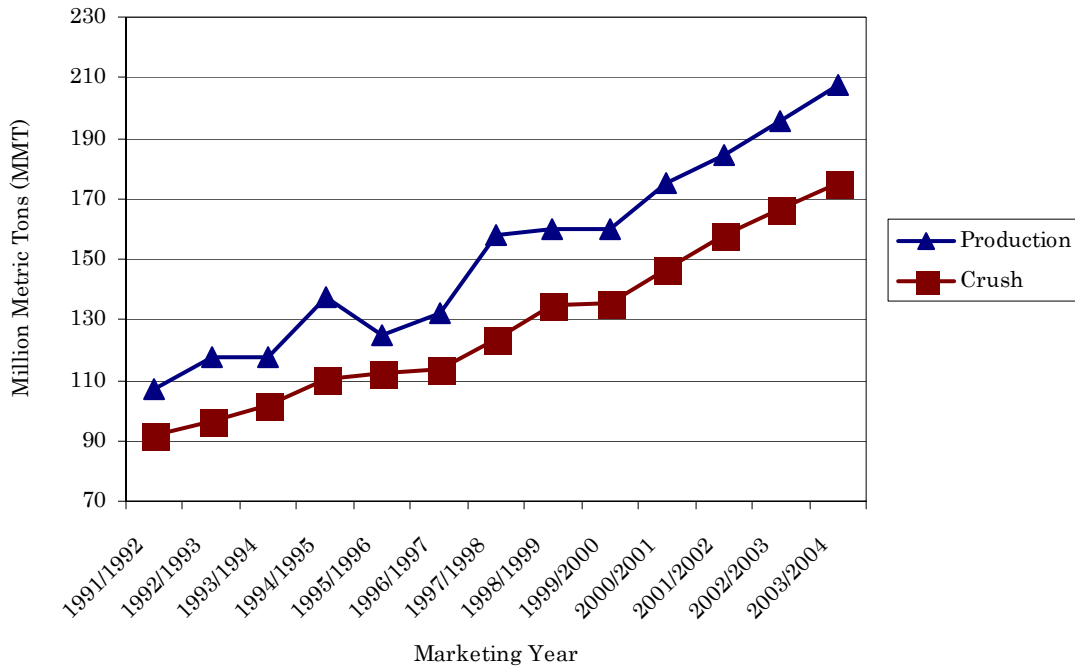


Figure 1: World Soybean Production & Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

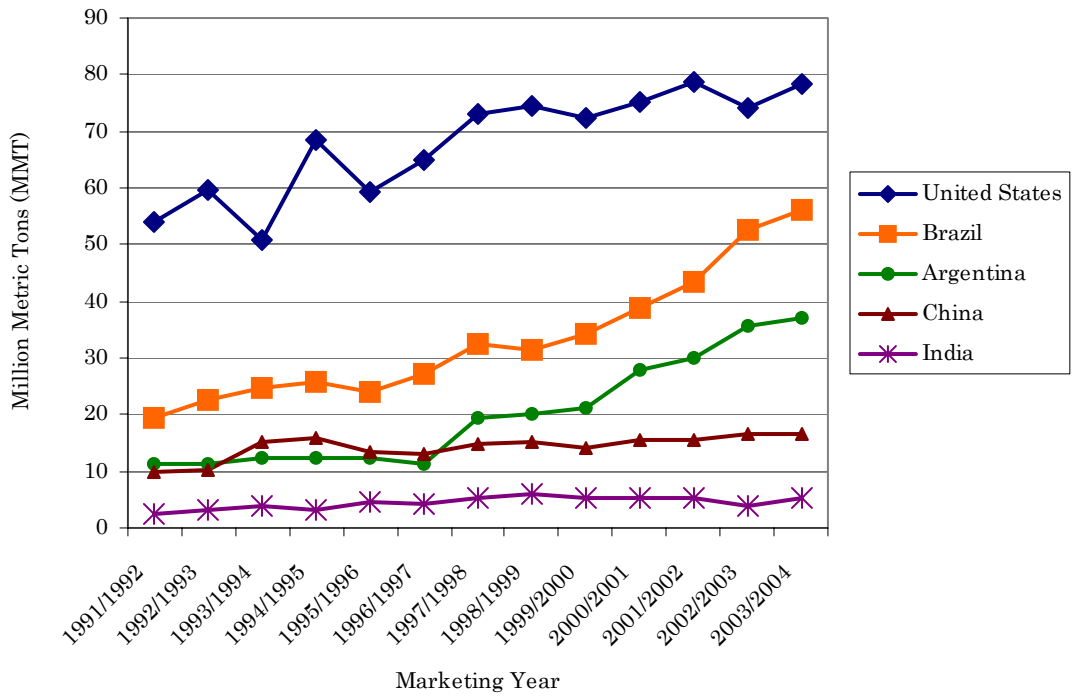


Figure 2: Leading Soybean Countries- Producing
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

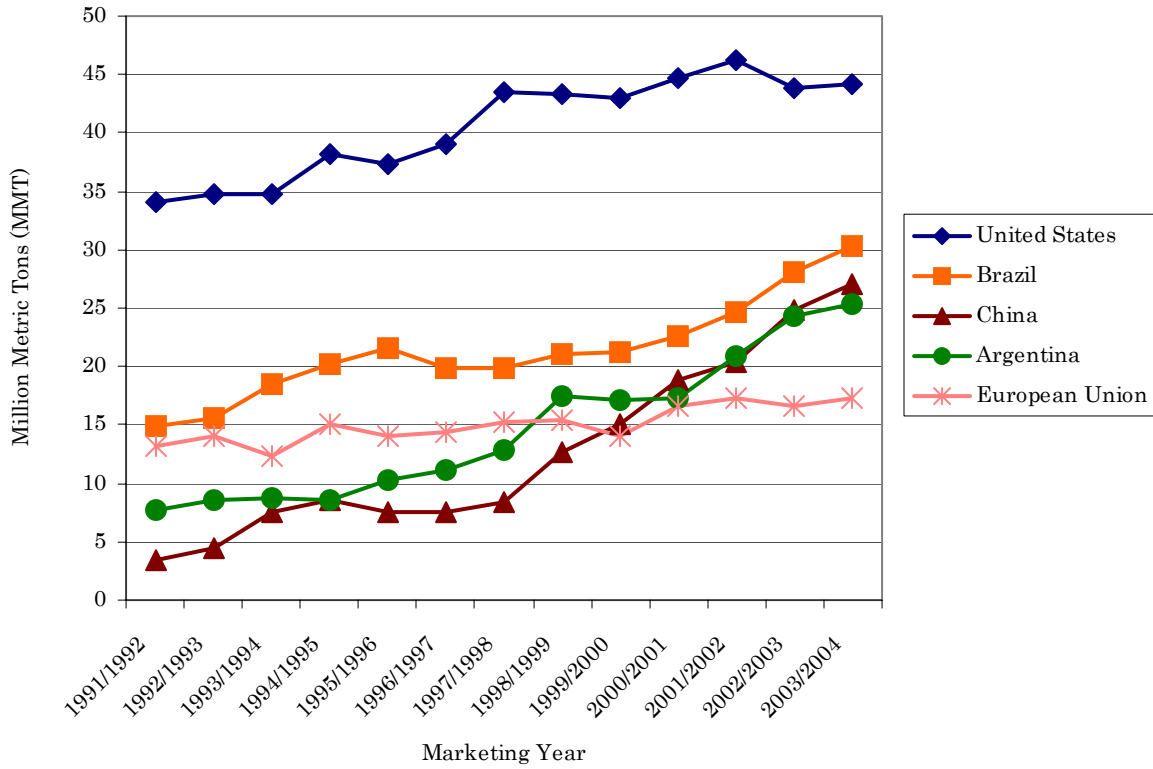


Figure 3: Leading Soybean Countries- Crushing

Source: US Department of Agriculture (USDA), Foreign Agricultural Services

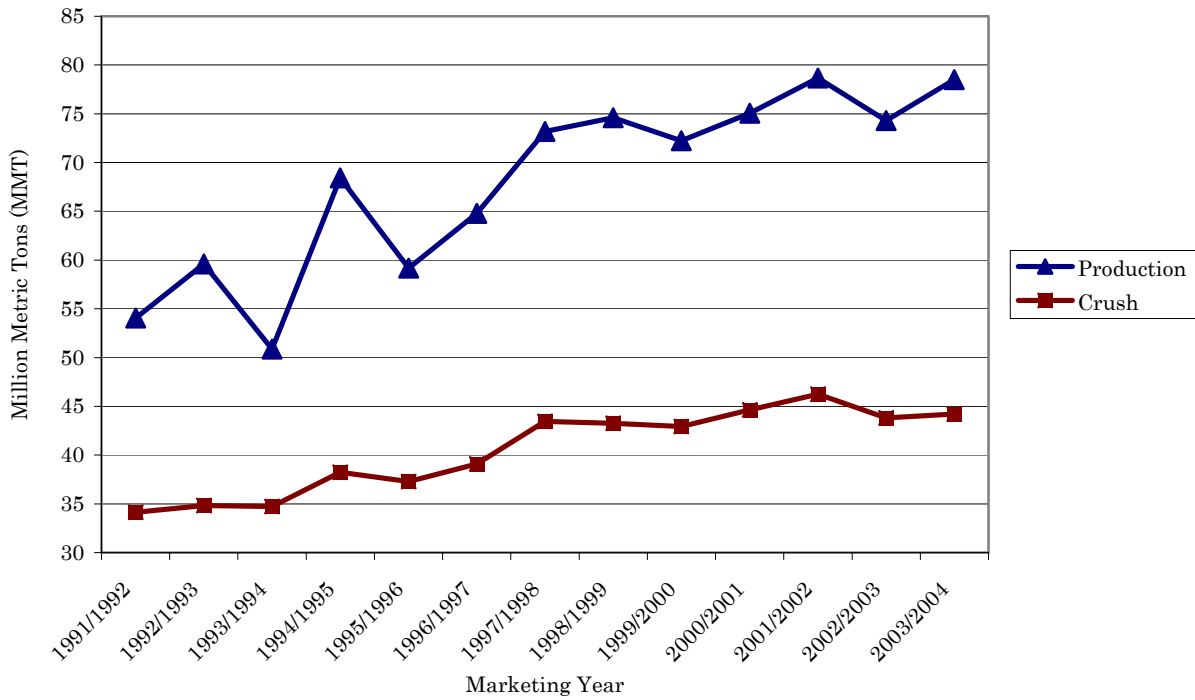


Figure 4: U.S. Soybean Production and Crush

Source: US Department of Agriculture (USDA), Foreign Cultural Services

production increased by 45% (from 54.07 to 78.52 mmt), soybean crush only increased by 29.6% (from 34.13 to 44.23 mmt) (Figure 4).

In the European Union, soybean production declined 44.81% from 1.54 million to 0.85 mmt, accounting for only 0.41% of the world total (Figure 5). But soybean crush increased by 32% (from 13.14 to 17.34 mmt). It is estimated that soybean imports will reach 18.30 mmt in 2003/04.

In the last ten years the most dramatic changes have occurred in South America and China.

From 1991/92 to 2003/04, Brazil's soybean production almost tripled (from 19.30 to 56 mmt), soybean crush doubled (from 14.94 to 30.38 mmt) (Figure 6). In Argentina soybean production increased by 232% (from 11.15 to 37.00 mmt), soybean crush increased by 230% (from 7.70 to 25.40 mmt) (Figure 7).

China is another dramatic story. While soybean production increased by 71% (from 9.71 to 16.60 mmt), soybean crush surged by 700% (from 3.39 to 27.10 mmt) (Figure 8). China has become the largest soybean importer in the world, and is expected to import 20.5 mmt in 2003/04 with the US and Brazil maintaining similar shares of the market.⁴ By surpassing Argentina and approaching Brazil in soybean crush, China has become a major growth area for global soybean processors.

Regional Dynamics

Behind the above-mentioned aggregated statistics are the strategic moves of major soybean processors in the Americas, Europe and Asia.

North America

The last ten years has seen both significant investments as well as closures in North America. It has been estimated that 25 plants were closed in the US between 1990 and 2003 (Anonymous Personal Communication, 2003).

In March 2000, Cargill announced that it would close its Guntersville, AL, soybean crushing facility (with a capacity of 2,700 tons/day). China's preference of importing raw soybeans rather than processed soybean products had been cited by Cargill as a

⁴ US Department of Agriculture, Foreign Agricultural Service, "China Importing Record Levels of Soybeans." Circular Series FOP 10-03, October 2003.
<http://www.fas.usda.gov/oilseeds/circular/2003/03-10/Octcov.pdf>

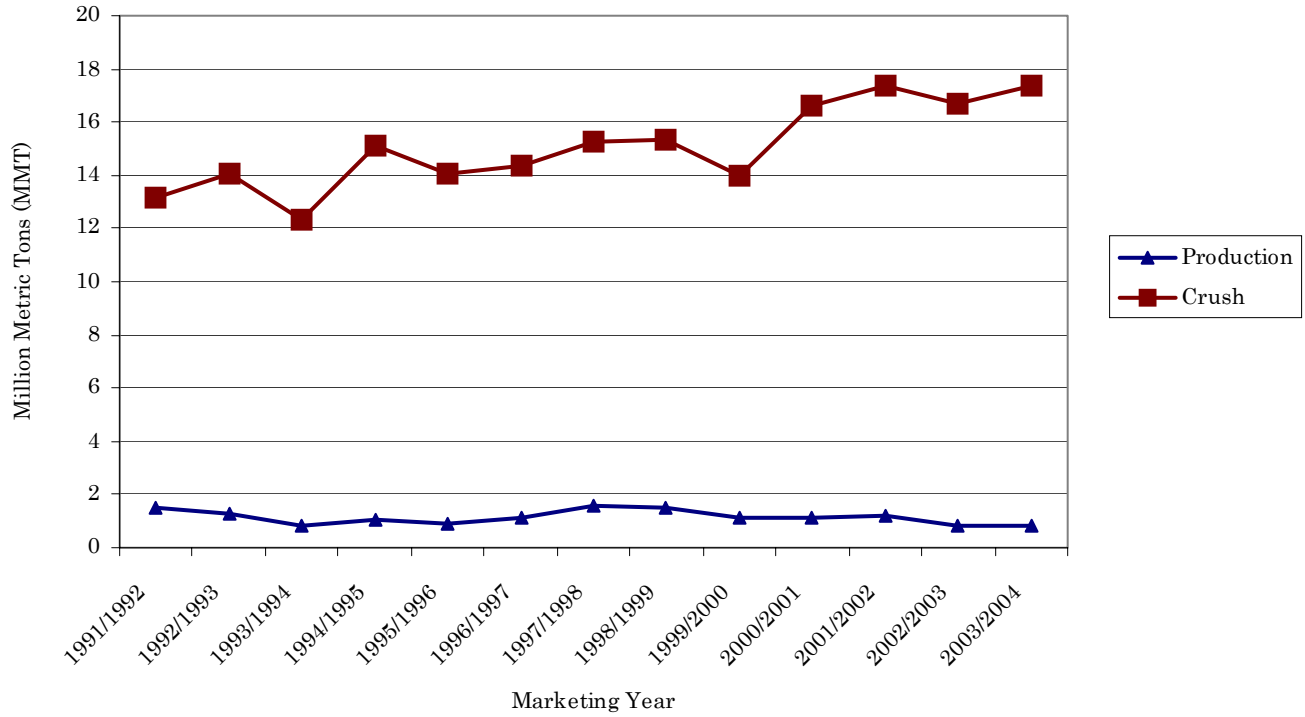


Figure 5: E.U. Soybean Production and Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

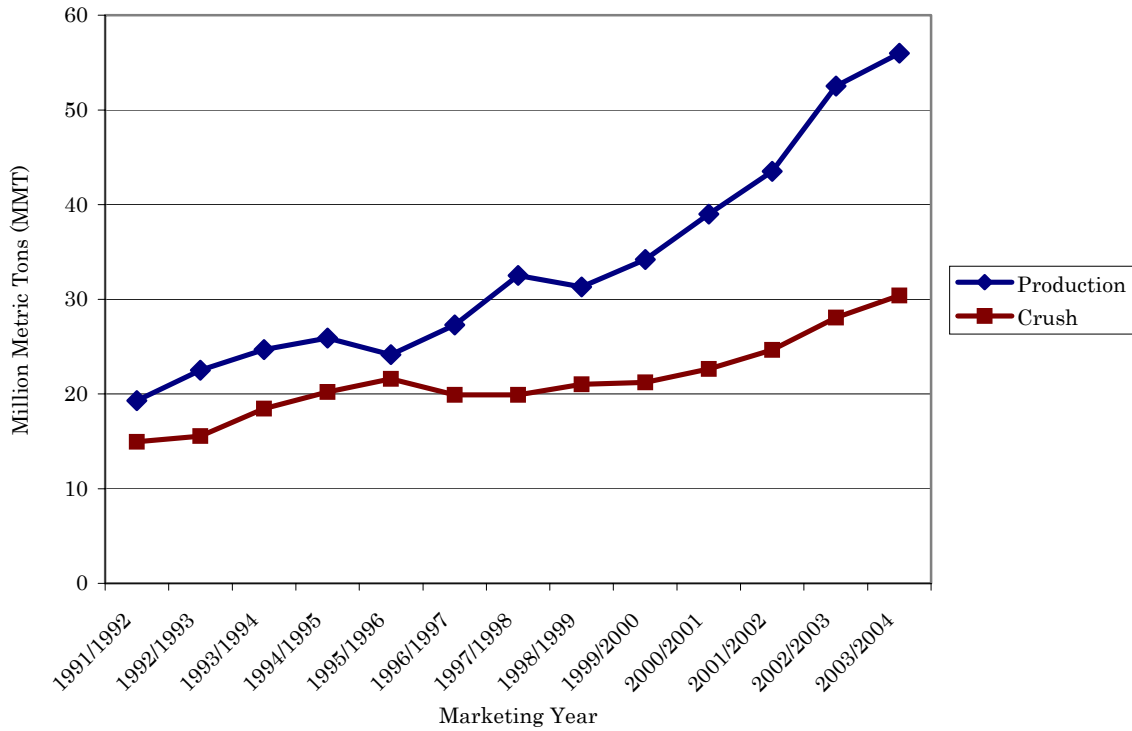


Figure 6: Brazil Soybean Production and Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

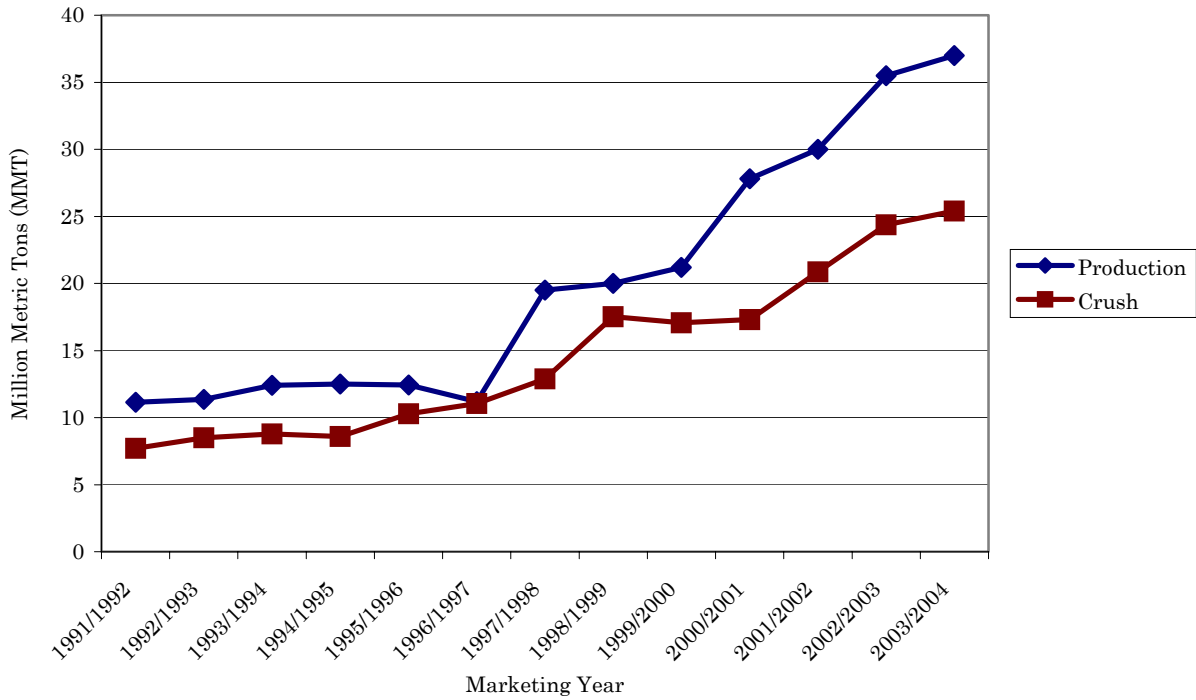


Figure 7: Argentina Soybean Production and Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

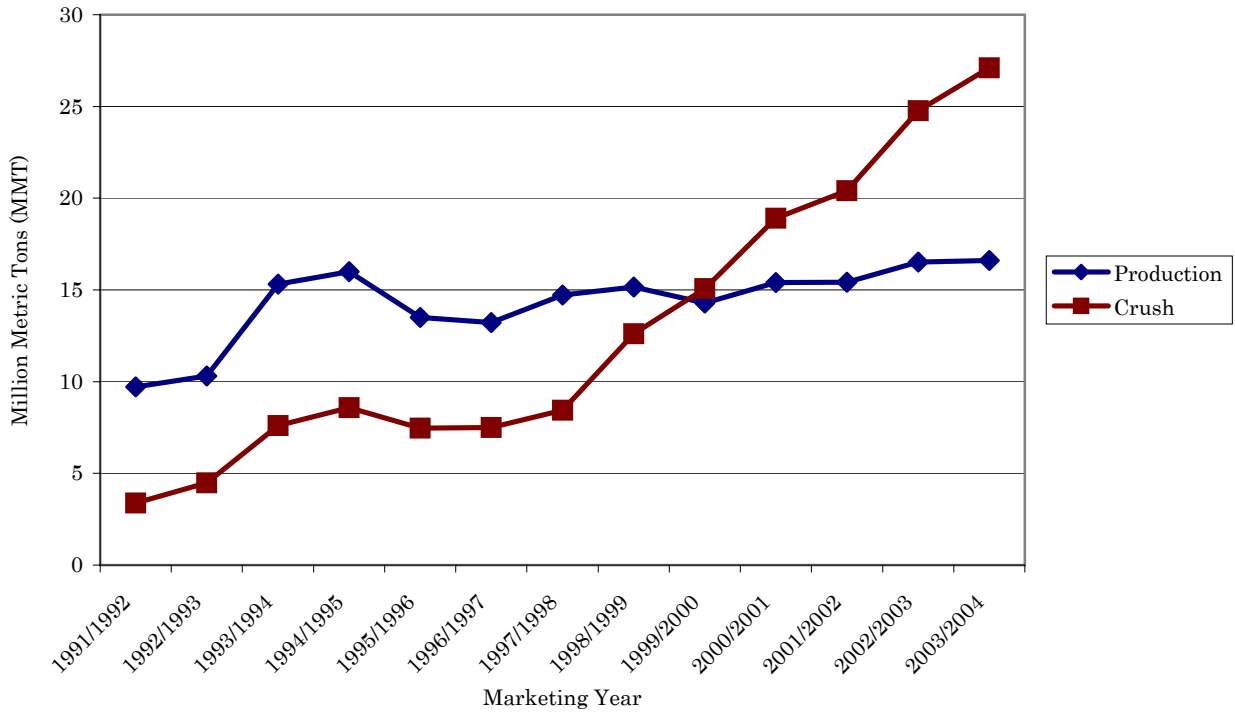


Figure 8: China Soybean Production and Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

primary reason for their actions.⁵ During the same year, ADM closed its plants at Helena, Arkansas and Taylorville, Illinois, and Bunge closed its plant at Vicksburg, Mississippi (Table 1).

Table 1: Soybean Crushing Plant Closures and Idleness in the US

Company	Plant Location	Capacity (t/d)	Note
ADM	Helena, Arkansas		Closed May 16, 2000
ADM	Taylorville, Illinois		Closed Sept. 2000
ADM	Fredonia, Kansas	1,500	Idled March 2003
ADM	Little Rock, Arkansas	2,100	Closed
ADM	Fostoria, Ohio	2,100	*
ADM	Kershaw, South Carolina	1,650	*
ADM	Quincy, Illinois	5,000	*
ADM	Valdosta, Georgia	3,075	*
ADM	North Kansas City, Missouri	3,000	Closed July 2003
Bunge	Vicksburg, Mississippi	2,400	Closed June 2000
Bunge	Cairo, Illinois	3,900	Closed Spring 2003
Bunge	Marion, Ohio	2,000	Closed Spring 2003
Cargill	Guntersville, Alabama	2,700	Closed April 2000

* ADM announced on 12/16/02 that it would reduce crushing rates at these plants.

Sources: Milling & Baking (2000); Feedstuffs (2000b; 2003a; 2003c; 2003d); Salomon Smith Barney (2002; 2003)

During the 2002/03 marketing year, tight supplies of domestic soybeans and weak demand for soybean meal squeezed crush margins to historic lows. CBOT crush margins for the fourth quarter of 2002 were down 49% on a year-over-year basis.⁶ Dismal margins pressured North American soybean processors to close plants or reduce crush rates.

On December 16, 2002, ADM announced that it would be reducing soybean crushing rates at six of its U.S. soybean crushing plants through a combination of reduced operating rates and plant closures due to weak crushing margins in the U.S. The facilities involved are plants in Fostoria, Ohio; Fredonia, Kansas; Little Rock, Arkansas; Kershaw, South Carolina; Quincy, Illinois; and Valdosta, Georgia. This would reduce ADM's U.S. soybean crushing capacity by approximately 10-14%, and reduce total U.S. soybean crushing capacity by approximately 2.5-3.5%.⁷ At the same time there were widespread closures there was also significant investment. In 1999, Bunge opened a \$100 plus million soybean crushing and oil refining facility in Council Bluffs, IA. The plant was the largest of its kind in North America. Its crush

⁵ "Cargill Follows ADM and Bunge Leads, Will Shutter Soybean Processing Facility." *Milling & Baking News*, March 21, 2000; Jerry Fruin, Associate Professor, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, MN 55108.

⁶ Doris de Guzman, "Dismal US Soybean Crush Margins to Continue." *Chemical Market Reporter* 263, No. 4 (Jan. 27, 2003), p.11.

⁷ David Driscoll, Salomon Smith Barney analyst report, *ADM: Weak N. American Soybean Crush Margins Prompt ADM Plant Closures*, December 16, 2002.

capacity was about 1.5 million tons per year (5,000 tons/day) and could refine around 410,000 tons of vegetable oil each year.⁸

A number of smaller players have also constructed crushing plants in the last 10 years. These include Incobrasa, a Brazilian firm, which constructed a 2,100 ton per day plant near Gilman, Illinois in 1997. Recently refining capacity was added at that location. Consolidated Grain and Barge built a 1,950 ton per day plant at Mt. Vernon, IN in 1997⁹.

While the multinational firms are reducing their crush levels in the U.S., domestic farmer organizations are building crushing plants, adding over 12,000 tons of daily capacity since 1996. Though family owned, and not a cooperative, Zeeland Farm Services opened in Michigan in 1996 with 800 tons per day capacity. South Dakota Soybean Processors, a cooperative, opened a facility in 1996 and now crushes 2,400 tons per day. Thumb Oil Cooperative, more of a specialty plant, began in 1998 crushing about 85 tons per day.¹⁰ Another cooperative Ag Processing Inc. brought two plants on line in 1999¹¹, one in Emmetsville, Iowa and one in Hastings, Nebraska. Both had a capacity of 1,800 tons per day. Two new plants are scheduled to open in 2003 in Minnesota, a crushing deficit state. One at Fairmont is owned by Cenex Harvest States (CHS), a major grain, feed and agricultural supply cooperative in the region. The plant will have a capacity of 3,000 tons per day. The other plant at Brewster is owned by Minnesota Soybean Processors (MSP), a new producer cooperative, and will also have a capacity of 3,000 tons per day.¹²

Latin America

Global soybean processors Bunge, Cargill, ADM, Coinbra of Louis Dreyfus have all significantly expanded their crushing capacities through acquisitions and plant expansions in Brazil, Argentina and other parts of Latin America.

In October, 1996, Cargill announced that its Argentine subsidiary would spend \$17 million on expanding the crushing capacity at its Puerto San Martin soybean processing plant and in the construction of a barge terminal. The expansion of the plant on the Parana River would bring crushing capacity to 7,000 metric tons a day, making it one of the largest in the world.¹³

⁸ "Bunge Launches Crushing Plant in Iowa." *Feedstuffs*, November 1, 1999.

⁹ Carlson, R.W. "Opportunities for Value-Added Utilization of Oilseeds and Oilseed Products in Minnesota." Agricultural Utilization Research Institute, Marshall, Minnesota. 2000.

¹⁰ <http://www.green.msu.edu/october.pdf>. 1999. Accessed Fall 2003.

¹¹ Ibid.

¹² Jerry Fruin, Associate Professor, Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, MN 55108. 1999

¹³ "Cargill Argentine Unit Expands." *The Wall Street Journal*, October 18, 1996.

On April 4, 2003, Cargill opened its new \$20 million port terminal in Santarem in Brazil's northern state of Para. The terminal has the capacity to store 60,000 metric tons of soybeans, and will handle nearly 800,000 metric tons of soybeans per year. It will operate as an alternative route for transporting soybeans from Mato Grosso and Para states to Europe and Asia. Jose Luiz Glaser, soy complex director for Cargill said, "Cargill believes in the economic expansion of Santarem and also in the transport of grain during the dry season, from June to October."¹⁴ Truck transportation is still a significant obstacle in the region because of the poor conditions of the roads and bridges and the lack of rail access¹⁵. Once better transportation is implemented research shows that routes north will be extremely competitive with western and southeastern routes currently in place.¹⁶

In 2000, ADM completed two acquisitions in Brazil. In March, ADM acquired Granja Rezende's soybean operations in Uberlandia, State of Minas Gerais, for nearly \$25 million and rented (with a call option) JB Duarte's soybean processing plant located in Santo Anastacio, in the state of Sao Paulo. With these new deals, ADM's production capacity in Brazil increased to 9,000 metric tons per day.¹⁷ In April 2000, ADM announced that it had purchased a soybean crushing plant from Sadia Ltd. in Uberlandia, Brazil. The company said the acquisition reflected a "strategic decision designed to strengthen the company's investments in South America and make ADM one of the top three oilseed processors in Brazil."¹⁸

In September, 2000, Bunge announced that it planned to invest \$500 million in Brazil, as part of a \$900 million investment plan over the following three years. Bunge planned to build two new soybean crush plants in Sorriso, Mato Grosso (Center-West), and Uruci, Piaui (Northeast), as well as expand a production unit in Rondonopolis, Mato Grosso.¹⁹ With this expansion as well as taking over the Fatisul plant in Mato Grosso do Sul (Center-West), Bunge is expected to operate 12 crushing plants in Brazil by the 2003/04 crop year. With these expected additions to its portfolio, Bunge Alimentos' total soy crushing capacity in Brazil should reach 28,300 tonnes per day, compared with its current capacity of 26,600 tonnes.²⁰ If fully deployed this would comprise 30% - 33% of Brazil's crush capacity, based on 2003 output.

¹⁴ "Cargill Opens New River Port Terminal in Santarém." *Gazeta Mercantil*, April 14, 2003.

¹⁵ Hirsch, R. "Regional Competitiveness Analysis of the Soybean Industry and Transportation Infrastructure in Brazil." Unpublished Master's Thesis. The University of Illinois, Department of Agricultural and Consumer Economics. 2003.

¹⁶ Ibid.

¹⁷ "ADM Amplia Suas Operacoes com Soja." *Gazeta Mercantil*, March 27, 2000.

¹⁸ "ADM Purchases Crushing Plant from Sadia." *Feedstuffs*, Issue 17, Vol. 72, April 24, 2000.

¹⁹ "Bunge Will Sow \$500 Million." *Gazeta Mercantil*, September 4, 2000.

²⁰ Foodingredientsfirst.com. "Brazil's Bunge leases Mato Grosso Soy Plant."

http://www.foodingredientsfirst.com/newsmaker_article.asp?idNewsMaker=4249&fSite=AO545
Accessed Fall 2003.

On March 4, 2002, Bunge completed its acquisition of La Plata Cereal S.A., a leading Argentine agribusiness company, paying approximately \$3 million in cash and assuming \$42 million in debt.²¹ This acquisition made Bunge the largest soybean processor in Argentina. Its soybean crushing capacity increased 83% to 4.4 million metric tons per annum.²²

On January 13, 2003, ADM announced that it would double its soybean crushing capacity at its Rondonopolis facility in the state of Mato Grosso, Brazil. In total, ADM now had 6 soybean crushing plants in Brazil, capable of crushing an estimated 2 million metric tons of soybeans per year, representing 7% of the Brazilian soybean crushing capacity.²³ ADM reported that an expansion would be completed by mid-2004 and would raise its total processing capacity in Brazil to the range of 3 to 3.5 million metric tons. ADM's worldwide capacity at that point would be about 29 million tons. ADM's President and COO Paul Mulhollem said, "South American soybean production is constantly increasing, and as a global processor and supplier, participation in this growth is a critical element of our strategy."²⁴

In April, 2003, Coinbra, of Louis Dreyfus, announced that it was investing \$64 million in the construction of a new soybean crushing plant in Mato Grosso, the expansion of two others and the purchase and reform of railway cars and locomotives. Coinbra's crushing capacity in Brazil would jump from 7,000 to 12,500 metric tons a day. Its director Thimoty Carter said, "Brazil and Argentina are our priorities."²⁵

Apart from the multinational firms, local Brazilian companies have been expanding their soybean processing capacities as well. In August 2001, the Brazilian National Development Bank (BNDES) approved the release of \$3.6 million to help finance expansion projects of ABC Inco, a Brazilian soybean processing firm. ABC would expand its production capacity from 1,500 to 1,800 metric tons per day and its soybean oil processing capacity from 300 to 400 metric tons per day. Total investments were estimated at \$9 million.²⁶ Caramaru, a leading Brazilian processor has two major facilities in Goias totaling 2,300 mt/day capacity.

In May, 2003, Caramuru, one of the five largest soybean processors in Brazil, announced that it would erect a new soybean processing facility at Ipamiris, Goias

²¹ Bunge Ltd. SEC filing 20-F, March 31, 2003.

http://ir.bunge.com/ireye/ir_site.zhtml?ticker=BG&script=1901 Accessed Fall 2003.

²² "Bunge Completes Acquisition of La Plata Cereal." *Feedstuffs*, Issue 10, Vol. 74, March 11, 2002.

²³ Salomon Smith Barney (David Driscoll), *Archers Daniels to Increase Soybean Crushing Capacity in S. America*, January 13, 2003.

²⁴ "Bunge Postpones Expansion at Morrissett Soy Plant." *Feedstuffs*, Issue 3, Vol. 75, January 20, 2003.

²⁵ "Coinbra Will Crush Soybeans in Mato Grosso." *Gazeta Mercantil*, April 16, 2003.

²⁶ "BNDES Lends R\$ 9m to Soya Bean Processing Company." *O Globo*, August 13, 2001.

that already hosted two of the company's plants (Sao Simao and Itumbiara). Caramuru had an installed capacity of 4,000 metric tons of soybeans per day. The new investment was estimated at \$17 million and the company expected to increase its grain processing capacity by 50%.²⁷

Europe

The EU utilizes over 26 mmt (12% of world supply) of soybean meal annually (2001). It supplies approximately 50% of its needs domestically while importing almost all of the soybean raw material (Figures 9, 10, 11). Since 1990, domestic soybean meal production has increased 2.6% per year while soybean meal demand has increased 3.4% per year, or 30% faster, creating a need for greater reliance on imported soybean meal.

The two largest crush plants in Europe are owned by ADM and are located in Germany and the Netherlands. ADM bought the 6,600 mt/day Rotterdam plant in 1984 from Unilever, originally constructed in 1978.

Table 2: Recent Soybean Crushing Capacity Expansion in Latin America

Date	Company	Plant Location	Capacity (mt/d)	Investment	Note
Oct-96	Cargill	Puerto San Martin, Argentina	7,000		Expansion announced
Feb-97	Cargill	Tula, Mexico	1,500	\$30 m	Production begun
End 1997	Bunge	Pederneiras, Sao Paulo, Brazil		\$100 m	Investment announced
Sep-98	Cargill	Barreiras, Bahia, Brazil		\$15 m	Doubling of capacity announced
Mar-00	ADM	Uberlandia, Minas Gerais, Brazil		\$25 m	Acquired from Granja Rezende
Mar-00	ADM	Santo Anastacio, Sao Paulo, Brazil			Rented with call option from JB Duarte
Apr-00	ADM	Uberlandia, Brazil			Purchased from Sadia Ltd.
Sep-00	Bunge	Sorriso, Mato Grosso & Sao Luiz, Maranhao, Brazil		\$500 m	Plan announced to build 2 plants
		Rondonopolis, Mato Grasso, Brazil			Expansion announced
Jan-02	Bunge	Piaui, Brazil	1,500	R\$420m (\$177m)	Investment announced
Nov-02	Bunge	Passo Fundo, Rio Grande do Sul, Brazil	1,200		Leased from Bertol, S.A.
Jan-03	ADM	Rondonopolis, Mato Grasso, Brazil			Expansion announced
Apr-03	Coinbra	Mato Grosso, Brazil			Construction announced
May-03	Caramuru	Ipamiris, Goias, Brazil		R\$50m (\$17m)	Construction announced

Sources: The Wall Street Journal (1996); Cargill (1997); Gazeta Mercatil (1997, 1998, 2000a, 2000b, 2003); Feedstuffs (2000a, 2002); Salomon Smith Barney (2003); South American Business Information (2003)

²⁷ South American Business Information, *SABI – Business News*, “Caramuru Erects New Soybean Processing Plant.” May 29, 2003.

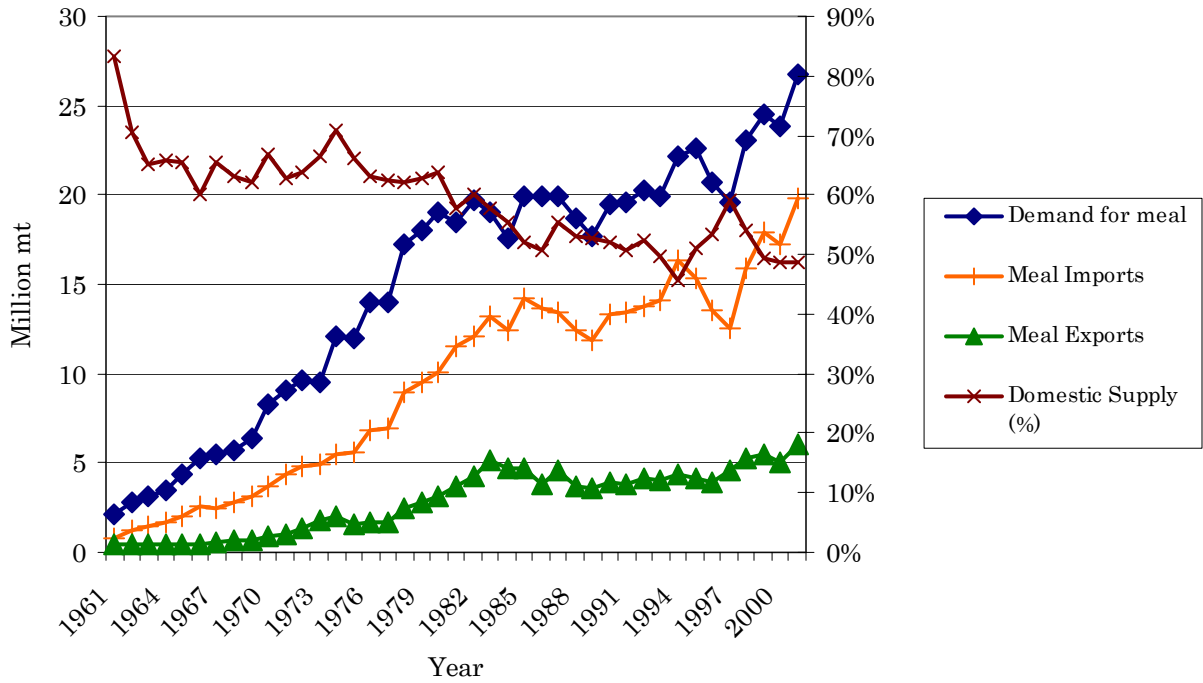


Figure 9: Demand and Supply of EU Soybean Meal
Source: FAO, 2003 and Authors' calculations

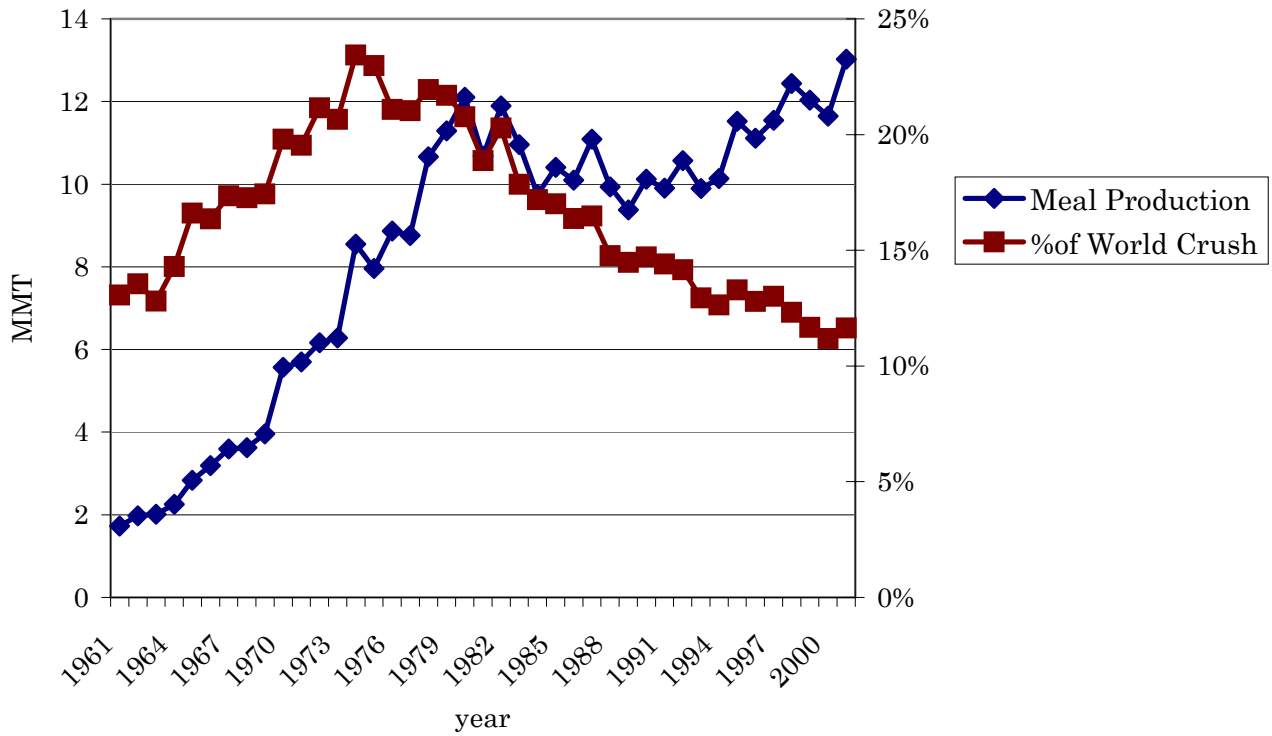


Figure 10: E.U. Soybean Meal Production
Source: FAO, 2003 and Authors' calculations

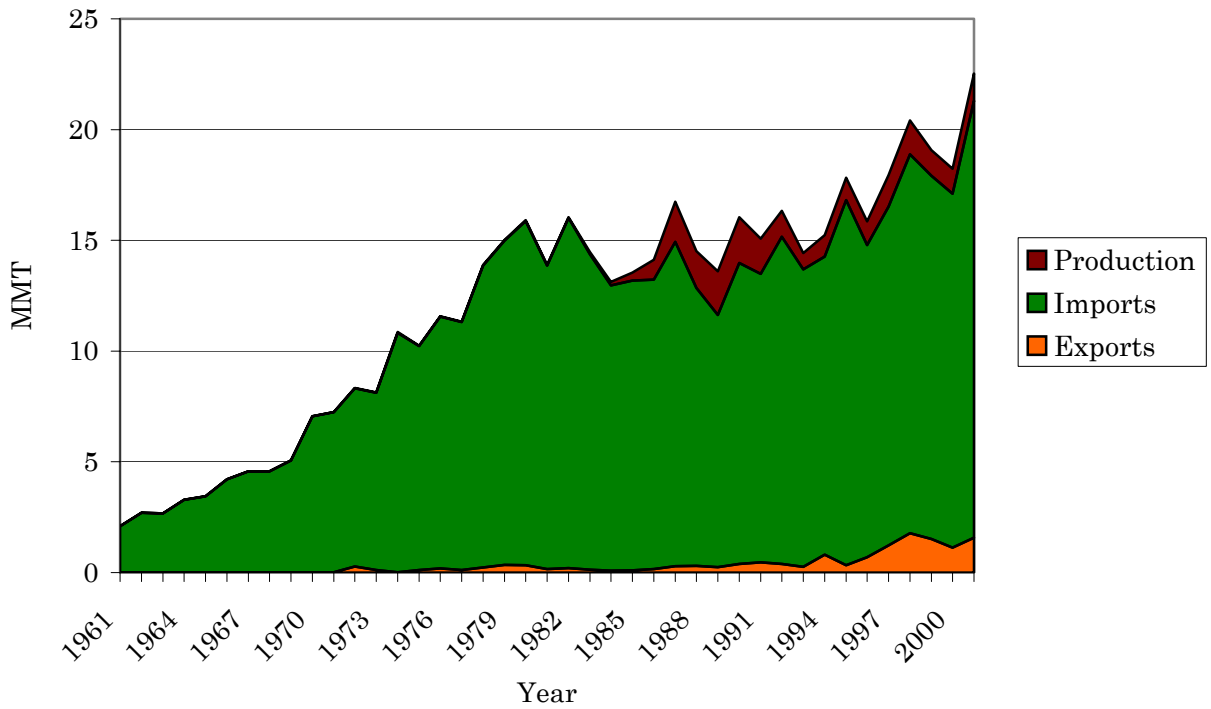


Figure 11: E.U. Supply and Demand for Soybeans
 Source: FAO, 2003 and Authors' calculations

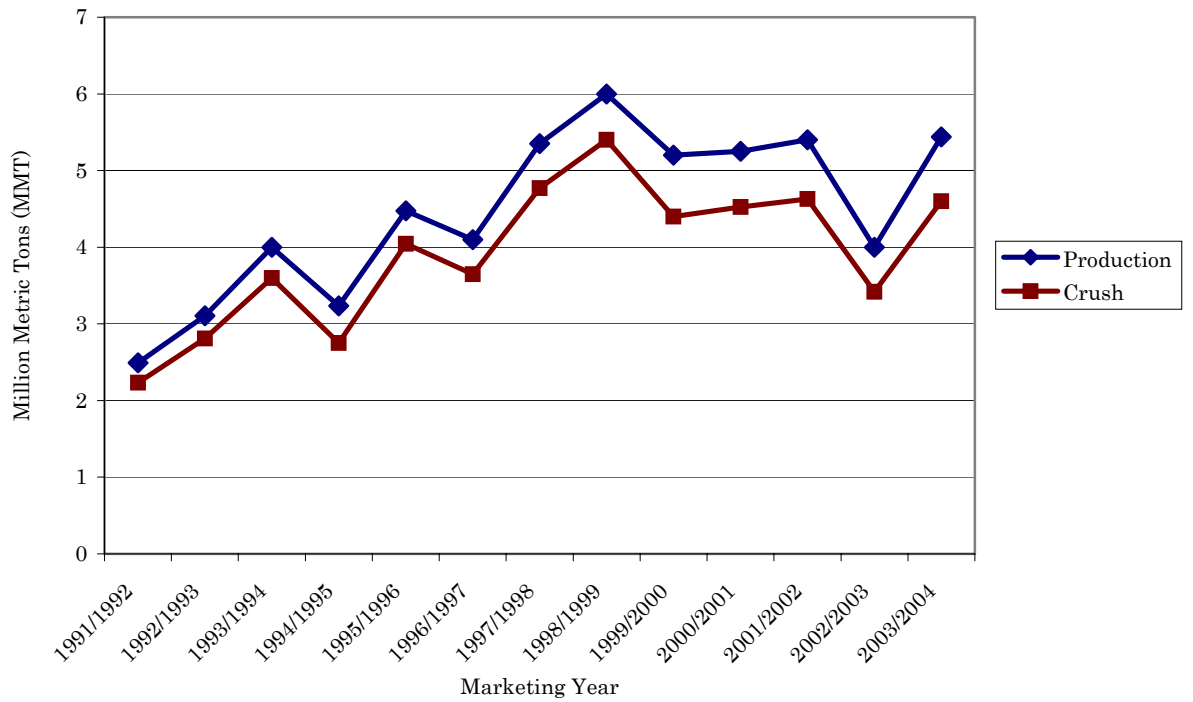


Figure 12: India Soybean Production and Crush
 Source: US Department of Agriculture (USDA), Foreign Cultural Services

On October 15, 2002, Bunge acquired from Edison S.p.A. (Edison) a 54.69% controlling interest in Cereol S.A., a leading oilseed processor in Europe and North America and a leading producer of edible oils, soy protein concentrates and lecithin worldwide, for approximately 449 million Euros (\$441 million) in cash. Bunge also paid Edison 14 million Euros (\$ 14 million) for a three-year non-compete agreement. On December 4, 2002, Bunge purchased additional shares of Cereol that were publicly traded on the Euronext market for approximately 351 million Euros (\$357 million) in cash.²⁸

Bunge's acquisition of Cereol would increase its ability to supply Europe, which is the world's biggest regional importer of soybeans. Through the deal, Bunge would now be able to process its own soybeans in the region.²⁹

China

ADM is now the largest oilseeds processor in China (Appendix 1). It has opened 10 joint venture processing plants with the state-owned COFCO, a fortune 500 company, and Singapore's Wilmar. (ADM's average equity ownership is 33%). Among these plants, the largest is East Ocean Oils & Grains Industries (EOGI) located in Zhangjiagang of East China's Jiangsu Province. It is presently the third largest oil and grain processing complex in the world. Its crushing plants I & II have a capacity of 6,000 mt/day. The refinery has a capacity of 1,600 mt/day. It processes mainly soybean oil.³⁰

Cargill entered China's oil processing industry shortly after ADM. With Taiwan's Uni-President Enterprises Corp., it has set up a soybean processing joint venture with a capacity of 3,000 mt/day in Dongguan of South China's Guangdong Province.

In July 2003, Alberto Weisser, Bunge's Chairman and CEO, said that while it has been a profitable strategy to sell soybeans and other products directly to Chinese processors, certain governance and legal issues are making the company wary of entering the world's largest market with physical plants. Bunge said it has a long-term strategy for Asia that involves India and Southeast Asia, not just China.³¹

Apart from Singapore's Wilmar, other processors from Southeast Asia are also competing for the Chinese market. In November, 2002, Singapore Great Wall Pte. Co. and Fuling District Government of Sichuan Province decided to build a joint

²⁸ Bunge Ltd. SEC filing 20-F, March 31, 2003.

http://ir.bunge.com/ireye/ir_site.zhtml?ticker=BG&script=1901

²⁹ Scott Kilman, "Bunge Increases Grain Position with Bid of \$830 Million for Cereol." *The Wall Street Journal*, July 22, 2002, p. C.14.

³⁰ China National Cereals, Oils & Foodstuffs Imp. & Exp. Corp. (COFCO), http://www.cofco.com.cn/en/2.0/jiagong/2_08.htm Accessed Fall 2003.

³¹ Michael McHugh, Dow Jones Newswires, "Bunge Leery of Opening Processing Facilities in China." July 29, 2003.

venture Xinfu Food Co., Ltd. Total investment would be \$48 million with a first phase investment of \$24 million. The plant's processing capacity (including soybeans, palm, and corn) would be 6,000 mt per day.³²

In order to compete with joint ventures, local Chinese firms have also built large-scale plants. In August 2000, a large soybean processing facility, jointly invested by Dalian HuaNong Enterprise Group and Zhanjiang Port Office, started its construction in Zhanjiang Port in South China. Total investment would be \$60.24 million and the facility would have a soybean processing capacity of 2 million metric tons per year.³³

India

Edible oil is emerging as a major sector for attracting foreign direct investment in India, which is dependent on imported refined oil. Wilmar, Cargill Asia Pacific and Bunge are choosing India as the base to refine crude edible oil.³⁴

In June 2003, Bunge announced that it would acquire Hindustan Lever's edible oils and fats business based in Bangalore, India for an undisclosed amount. Hindustan Lever was a 51% owned subsidiary of multinational Unilever PLC. The acquisition includes one oil refinery and several brand names. Bunge will maintain three refineries and one crushing plant in India (Figure 12).³⁵

Table 3: Notable Soybean Crushing Activities in China

Company	Plant Name	Location	Capacity (mt/d)	Investment	Note
ADM	East Ocean	Zhangjiagang, Jiangsu	6,000		JV with COFCO, ADM 33%
ADM	Great Ocean	Fangchenggang, Guangxi	3,000	1st phase \$29.50m	JV with COFCO, ADM 33%
Cargill		Dongguan, Guangdong	3,000		JV with Taiwan's Uni- President
Singapore Great Wall	Xinfu Food	Fuling, Sichuan	6,000	1st phase \$24m	JV with Fuling District Govt. multiseeds
Dalian HuaNong		Zhanjiang, Guangdong	6,700	Total \$60.24m	JV with Zhanjiang Port Office

Sources: China Grain & Oil(2000); SinoCast (2002); Cofco(2003)

³² SinoCast China Business Daily News, "Fuling to Build the Asian Largest Soybean Processing Plant." November 7, 2002.

³³ "Large Soybean Processing Project Started in Zhanjiang." *China Grain & Oil*, August 3, 2000.

³⁴ Asia Africa Intelligence Wire, January 15, 2003.

³⁵ Morgan Stanley (Kenneth B. Zaslou), "Bunge Limited: A Small Strategic Step in a Large and Growing Market." June 20, 2003.

Soy Protein Products

Facing low margins and slow growth in their crushing operations, ADM and Cargill have been targeting the nutraceuticals market. In April, 2001, Cargill Nutraceuticals launched its first product in an evolving a line of naturally occurring soy isoflavones under the Advanta-Soy brand. Merrill Lynch estimated that ADM had invested over \$500 million in its bioproducts and nutraceuticals divisions. Manufacturer sales of soy foods were expected to increase from nearly \$6 billion in 2000 to \$6.9 billion in 2005, an average annual growth rate of 2.7% during the five-year forecast period.³⁶

In 2000, Bunge completed the construction of its soy ingredients plant in Esteio, Brazil.³⁷ In September, 2002, Bunge Alimentos, invested \$3.5 million in its Center of Excellence in Research and Development of functional ingredients for soybean derivatives at the Esteio industrial park in the Porto Alegre region. By 2005, Bunge plans to invest \$10 million to double the production capacity of its Esteio factory; the only facility to produce isolated protein from soybeans in the Southern Hemisphere.³⁸

In recent years, investments in soy protein production have greatly increased in China. As part of its strategy to expand its soy protein business in Asia, DuPont announced in June 2001 that it would acquire a soy protein facility in Central China's Hubei Province. Estimated total investment was about \$20 million. Known as DuPont Yun Meng Protein Company, Ltd., the new food and nutrition venture would manufacture high-quality soy protein isolates.³⁹

In June 2002, The DuPont China Group set up a joint venture in Central China's Henan Province with Shuanghui Group, the biggest user of soybean protein in China. DuPont would take a 65% stake in the new venture, Shuanghui (Luohe) Protein Company, which would produce soybean protein additive.⁴⁰

On March 28, 2003, ADM announced that it was constructing a soybean processing facility in Shanhaiguan, China, in partnership with Wilmar Holdings. Construction was expected to be completed by mid-2004. The facility would produce ADM's exclusive Arcon line of highly functional soy protein concentrates, specialty soy flour for soy sauce fermentation, and whole edible soybeans.⁴¹

³⁶ Carey Krause, "Oilseed Processors Target Soy Specialty Products to Lift Sales." *Chemical Market Reporter*, May 14, 2001.

³⁷ Bunge Ltd. SEC filing 20-F, March 28, 2002.

http://ir.bunge.com/ireye/ir_site.zhtml?ticker=BG&script=1901

³⁸ "Bunge Begins Work on Soya Research Center." *Gazeta Mercantil*, September 20, 2002.

³⁹ "DuPont Acquires Soy Protein Facility in China." PR Newswire, June 12, 2001.

⁴⁰ "Second China Soy Protein Venture for DuPont." *CEInet – Where to Invest*, June 21, 2002.

⁴¹ "ADM Venture to Construct Soy Facility." *Feedstuffs*, Issue 15, Vol. 75, April 14, 2003.

Investments in soybean processes have moved beyond food products. In April 2003, a large-scale soybean-protein fiber plant, with an expected annual production capacity of 18,000 metric tons, began mass production of China's self-developed synthetic fiber in Jiangsu Province. Jianghe Tianrongsi Fiber Co. Ltd., a privately-owned firm with total investment of \$42.17million, put China ahead in botanic fiber applications. As the world's largest textile manufacturer and exporter, China imports some 1.3 million metric tons of chemical fibers annually.⁴² Soy protein fiber could become a significant substitute for chemical fibers.

Table 4: Recent Investments in Soybean Protein Products

Company	Plant Location	Product	Investment	Note
Bunge	Esteio, Brazil	Soy ingredients		Construction completed 2000
Bunge Alimentos	Esteio, Brazil	Research of functional ingredients	\$3.5 m	September 2002
DuPont	Yunmeng, Hubei, China	Soy protein isolate	\$20 m	Acquisition announced June 2001
DuPont	Luohe, Henan, China	Soybean protein additive		JV established June 2002, DuPont 65%
ADM	Shanhaiguan, China	Arcon line of soy protein concentrates		JV, construction to be completed mid-2004
Jianghe Tianrongsi	Jiangsu, China	Soybean-protein fiber	\$42.17 m	Production capacity 18,000 mt/year

Sources: PR Newswire (2001); Bunge (2002); CEInet (2002); XFN (2003); Feedstuffs (2003b); Gazeta Mercantil (2003)

Conclusion

There has been significant changes on crushing location and investment as the global soybean producing regions have shifted. Investment in basic processing depends on economies of scale and full capacity utilization, necessitating access to readily available soybean supplies. The US, the traditional global leader in soybean production and processing, is a mature market in both the supply of soybeans and the demand for meal. South America on the other hand continues to achieve 10% annual growth rates in their soybean production accompanied by dynamic livestock sectors. While obviously not sustainable forever, the full potential of the South American land base will not occur until for a number of years to come⁴³.

The dominant trend in processing plant location is the shift away from mature markets where plants are older and smaller, technology more dated, farmer

⁴² Xinhua Financial Network (XFN) Daily News, "China Launches Soybean-Protein Fiber Plant with Annual Capacity of 18,000 tons." April 2, 2003.

⁴³ Hirsch, R. "Regional Competitiveness Analysis of the Soybean Industry and Transportation Infrastructure in Brazil." Unpublished Master's Thesis. The University of Illinois, Department of Agricultural and Consumer Economics. 2003.

suppliers smaller, and regional production flat. Soybean processing investment in step with the new growth areas affords firms the ability to employ the newest technologies, improved economies of scale, and a growing supply base from which to draw. While most of Brazil's crushing still occurs in the traditional bean producing states in the South, the dominant trend is for disinvestment in the South and investment in the Center-West, North, and Northeastern regions of the country. This is driven by the favorable economics of access to the fast growing supply base, rapidly decreasing costs of transport, strategic opportunities internationally, and a tax policy bias favoring exports. China, unlike Brazil and Argentina, is trending away from producing and crushing its own soybeans. It has chosen a path of soybean importation and domestic oilseed processing. In Europe the trend continues of being increasingly reliant on both imported soybean meal and imported beans with little incentive to expand crush capacity.

The implication of these trends is that US crushing assets will be increasingly focused on two strategic thrusts, the domestic livestock industry (a commodity market) and the growing knowledge-intense products (a differentiated market) such as isolates, proteins, flours, isoflavones, and oils. On the commodity side the challenge will be to find opportunities for growth within a livestock industry that is having trouble expanding and too is seeing significant off-shore investment. On the differentiated product side the challenge is two-fold; one reorienting the industry to a customer-focus with emphases on flexibility, customization, innovation, and service; and two finding enough value to help off-set the industry's maturing traditional market.

Finally, soybean supply and processing is shifting to countries that currently have weak intellectual property right protection regimes (See Goldsmith et al, 2003), i.e. Argentina, Brazil, China. This is significant because the availability of Roundup Ready® technology and without patent protection in Argentina and Southern Brazil has greatly accelerated the switch from traditional crops and pasture to soybeans. This ample and growing supply of soybeans has fueled the expansion of soybean exports, crushing investment in Argentina, and soybean meal exports. The agronomic and genetic R&D behind the growth originated in the US where technology fees provided the incentives for life science firms to invest in soybean research. EMBRAPA's (Brazil's government research system) continues to invest in soybean research and development. The combination of low-latitude adapted varieties, plentiful land availability, and improving transportation infrastructure has created a favorable environment to open new lands to soybean production.

If a soybean contraction continues in the US, the incentives for soybean research in the US will be dampened. Corn research will offer the private research community comparatively better expected returns on investment. Who then will provide the research going forward for temperate zoned soybean varieties? Without the research not only will disease risk increase and performance be affected, but the

overlay of crushing assets that depends on the abundant supply of soybeans too would be at risk. Therefore the soybean processing industry has a stake in making sure soybean research continues going forward. Currently, as noted above, EMBRAPA is actively engaged in supporting the R&D needs for the low latitude regions of Brazil. How will the temperate-region needs be met in the future?

Industry Commentary

Mr. Gustavo Grobocopatel, CEO, Grupo Los Grobo, Argentina

The business of soybeans and its derivative products, especially meal, has shown tremendous growth during the last thirty years. This trend is expected to continue in the next few years due to increased consumption of meat and the difficulties of replacing meal with another protein sources. If the per capita consumption of meat were to increase in China, India, and Africa, even moderately, it will necessitate four times more protein meal than is currently available. Argentina has participated and led the growth to address the increasing demand.

Its growth in production and crushing capacity is one of the most remarkable stories in the agro-food industry in the last decade. 95% of production is exported, mostly as soybean derivatives such as protein meal. Together with Brazil they are leading the world in soybean production and products and it is expected that they will solidify this leadership position in the next few years. In the next decade, in Argentina it is expected that crop land will expand 20% and production will increase 45%, reaching 100 million tons (current production is 70 million tons) of which 50% would be soybeans and sunflower.

Nevertheless there are various factors that limit this prospect. The evolution of subsidies and protectionism around the globe are troublesome. Internal to Argentina there are problems of infrastructure such as storage capacity. The country needs at a minimum 30 mmt more, and 60 mmt would be ideal. With respect to transport, 20, 000 more trucks are needed. With respect to processing capacity, 40 mmt more is needed- approximately six plants. Also needed are 13,000 mt/h additional port capacity and the development of navigable waterways to originate 25 mmt from interior Brazil, Bolivia, and Paraguay. There has been significant capital investment in Argentinean agribusiness. \$800 million USD has been directed to processing, ports, roads, and storage.

On the other hand financial instruments, such as futures markets, options, and warrants are not well developed. Other important institutional issues are tax distortions, access to export rights, intellectual property protection for seed royalties. There has been great interest on the part of government to address the intellectual property issue through a proposed national royalty system. Additionally a group the Argentinean No-Till Association (Asociación Argentina de Productores

en Siembra Directa- AAPRESID) created BIOCERES a company that invests in biotechnology and that has achieved joint investment with the public sector. Early indications show this as an innovative way for accessing knowledge and developing agreements to recognize (and protect) property rights.

Ms. Sally Jorgensen, Agricultural and Trade Attaché, Canadian Embassy, South Korea

China is currently the world's fourth largest soybean producer, with estimates of current production in the 16.5 to 16.7 million tonne range. China was more or less self sufficient in soybeans until 1996-97 when imports started in earnest. Imports now are around 22 million tonnes.

The Chinese crushing industry also has increased considerably. In the last ten years, China's share of the world soybean crush capacity has increased from 3.7% to approximately 15.5%, surpassing that of the EU and of Argentina. Its total oilseed crush capacity is estimated at 57 to 60 million tonnes.

Over the past five years, soybean oil production has doubled, while canola oil production has fallen slightly and peanut oil remained stable.

Historically small crushing plants were located in the northeast close to domestic soybean production. Since the early 1990's large, modern facilities have been established, mostly in the southern part of the country. Consolidation continues, with the smaller crushers closing and the large, more efficient ones expanding.

Today crushers are divided into three groups - those in the north which focus on domestic soybeans and peanuts; the crushers in the south central part in the Yangtze Valley which crush canola; and those on the south coast which mainly crush imported soybeans. Most of the crushers can switch between soybeans and canola.

All indications point to increasing demand in China. With 1.2 billion people and a 1.1 percent population growth rate, 13.5 million new people are added in the country every year. This compounded with economic growth of 6-8 percent per year will support demand for soybeans and products well into the foreseeable future.

The pent up demand for vegetable oils is considerable. The current per capita consumption of vegetable oils in China is only twelve kilograms, and is growing at a rate of 8% per annum. Per capita vegetable oil consumption in Hong Kong and Taiwan, by comparison, is close to forty kilograms.

The demand for meal is also expected to rise, driven in large part by the rapid increase in dairy production. Meat production and the aquaculture sector are also

forecast to require increasing amounts of meal. For example meat per capita consumption in China is fifty-one kilograms and is growing at 4% per annum. This compares with meat consumption in North America of close to 122 kilograms.

How will this demand be met? There is scope for increased production in China. Soybean acreage in the north east can be increased and there is still potential to increase yields. Perhaps just as important is the potential that could be realised through a decrease in the considerable post harvest losses.

In all likelihood, however, production will lag well behind demand. Certainly in the longer term declining water reserves will be a major constraint. Increased imports are inevitable - only the degree is uncertain and dependant, in part, on Chinese government policy.

Chinese government policy can be opaque at times, but it is currently stated policy to increase soybean production in the north east; to adjust the planting structure into a production base within the next three to five years; and to develop the soybean processing industry. The government also hopes to encourage the export of any surplus soybean meal. The neighbouring countries currently import eight to ten million tonnes of meal yearly from South America. Chinese meal would be of lower cost and with shorter transportation distances. It will also be possible to directly ship to local ports with smaller vessels.

In terms of market access, there is currently a 3% tariff on soybeans, and a 5% tariff plus 13% Value Added Tax on meal. As part of China's accession to the World Trade Organisation, concessions were made on soybean oil. There is a Tariff Rate Quota which rises to 2.3 million tonnes in 2005 before being eliminated in 2006. The tariff within the quota is 9%; outside the quota it is 48%. Upon elimination of the TRQ in 2006 all soybean oil will allow in at 9%.

Under recently instituted regulations pertaining to soybeans imported for processing, after the meal is exported, the refined oil can be sold in the domestic market but will be treated as imported soybean oil and taxed at an in-quota rate.

So will there be increased foreign investment in the Chinese crushing industry? Certainly the demand is huge and getting bigger for both oil and to a lesser extent meal, and labour costs are low. The recently granted ability to have 100% foreign ownership is also an incentive. Forecasts are for increased soybean imports and stable or decreasing soybean oil imports. There will probably be incentives to locate facilities in the north east to support the government policy of increasing production and processing there. Facilities in the south would use imported beans and would be closer to the greatest consumer demand.

On a cautionary note, a lot of foreign companies have lost a lot of money investing in China. The lack of transparency can be a major obstacle for foreign companies,

and competing policy objectives between the rural and urban sectors can lead to instability. There are also issues of inadequate infrastructure that are still being addressed. However, if the risk tolerance is high and the investment pockets deep, China as a soybean crushing and processing investment destination makes sense.

Ing. Hector Laurence, CEO, McLaren Holdings S.A., Argentina

An article written by Sarah Muirhed (“Global Soybean Processing Trends Show Shift in Strategies.” *Feedstuffs*. January 26, 2004) clearly shows new trends in global soybean processing and shifts in strategies that include a significant remapping of the world’s largest soybean processors vis a vis with the dramatic change in the last few years in the distribution of production followed by the crushing activity.

Together with the key aspects of the implications for managers and policy makers we have also two important question marks.

1. How big is the threat of the lack of legal protection or weak law enforcement to the countries, such as Brazil and Argentina as key soybean producers, that for their development need strong research and new products that should be covered by plant variety protection and /or patent rights.
2. Are those countries and others going to be affected in their future ability to develop and compete as well as have access to new sophisticated technologies, by the reduction in terms of quality, quantity and also innovation in soybean research in the US if that industry loses competitiveness in the US?

I will briefly address these topics.

Implications for Policy Makers

Very few areas of the economy are as affected or influenced by the policy makers as agriculture and consequently the whole agribusiness industry and chain. It is difficult to find with similar level of distortion and protectionism, an area where policy makers have shown such an amazing number of dispositions in trade, taxes, incentives, soft credits subsidies, sanitary barriers, etc. No wonder why this topic is among the hardest in all present negotiations of international level (WTA and inter commercial blocks).

The current shift in soybean processing responds to a natural competitiveness of certain areas of the world in terms of production, quality and costs. But there is no doubt that policy makers can be neutral, enhancers or adverse to these trends. It is easy to compare, in that regard, the trend shown by China, by favoring bean imports and local crushing with the current situation in Argentina, that pushed to

the edge by the country's fiscal needs, taxed soybean exports with an over 20% withholding tax on beans exports. On the contrary (and both are clearly negative for farmers and industry) processed oils are also taxed but at a lower level. These two examples are clear and self explanatory of how much good or damage the policy makers can do.

Nevertheless, and regardless some shifts that also respond to a growing demand , soybean and the related industry won't loose in my opinion their appeal and importance in the US. Just the opposite, I believe that even for rotational purposes the US soybean production will be substantial and research will continue due to the needs of all the stake holders of the chain.

The influence of new technologies and the second wave of biotech with human health applications will provide new incentives to its production and sophisticated processing, including perhaps bio energy use.

Clearly policy makers, managers, countries and industries fight within the rules, and sometimes forcing them for one key aim: who gets the added value, the extra wealth ad where does it stay.

Strategic Imperatives for Managers

Adding to what has been said above, managers clearly need to have a picture, permanently updated in a volatile and fast changing business environment, of some of the following:

1. Technical situation. This area includes, among others:
 - Production conditions and competitiveness
 - Facilities available for processing and plans for expansion, upgrading, closing, etc.
 - Investment rules, credit availability and its cost
 - Research and Development situation, pros and cons
 - Plant protection both legal and in practice (law enforcement)

2. The manager has to consider also key aspects that will influence the business such as:
 - Institutional stability
 - Law enforcement in general
 - International trade alliances and relationships in the country of production
 - Taxes, incentives and disincentives
 - Pro or anti business and profits atmosphere
 - Security and social situation
 - Trends in the economy

Impact of Weak Intellectual Property Right in Soybean Research and Development. Cases of Brazil and Argentina

It is crystal clear that weak intellectual property rights weaken Soybean Research and Development. It is also true that a situation like that, let say it for example in Argentina and Brazil, may hamper for sure local R&D as well as the access to foreign R&D and new technologies. But the question here is how much?, when will that happen with impact in production volumes?

1. Is there a true culture against property rights?
2. Is it a law problem or a law enforcement problem?
3. How crucial are the seed margins on autogamous plants?
4. How different is the situation in the US, for example?

Regarding question number one, the answer is clear. There is no culture against plant variety protection in the cases of Argentina and Brazil. In both cases there are laws and systems in place that recognize the rights of research, development and discovery. On the patent side, there are discrepancies, deep and somehow similar to some European countries. Patents on existing living organisms are, at its best, extremely difficult or impossible to be obtained.

About question two, it is clearly a law enforcement problem and the responsibility lies both in government and in the seed industry itself for several reasons, topic that exceeds these paragraphs.

In Argentina, with the current law and stronger will in the government (with the previous functioning of INASE) and a more cohesive attitude from the seed industry through ARPOV, figures shown in years before were near 50% of bags sold collecting royalties, 30% farm saved seed and 20% "brown bags". Now these figures have heavily deteriorated but the law is the same..

As another example, Brazil is heavily investing in R&D in soybeans and is interested in protecting those efforts mostly carried out by Embrapa. At the same time, except in the south, the climate and store conditions do not favor farmers, saved seeds and "brown bags".

In both countries there are clear trends in favor of strengthening plant variety protection and the search for easier ways to collect revenues for the various owners. In Argentina, advanced farmers groups are moving forward very aggressively in soybean research and investing in the development of new technologies. Actually, in this country, several top level companies, national and international, have announced different investments (800 US million) in port facilities, infrastructure, crushing, etc. for the soybean complex nearby Rosario and its area of influence alongside the Panama River.

Considering question number three, books can be written on the subject. However, it is very clear that seeds margins and profitability on non hybrid seeds are much lower than on hybrids, reason why many important commercial companies have abandoned those programs or reduced them, even in markets where, in theory, there is a strong plant variety protection and revenue collection.

Many companies continue with this research and development and their production and commercialization for reasons such as:

- Small mom and dad local companies
- Service to their customers that purchase hybrids and need the alternative product to rotate (ej. Soybean seed)
- Beat on a permanent new releases of superior varieties
- Vehicle (regardless its margins) for other products and services and customer loyalty
- Beat on new technologies and attributes that in the future will make this seed products hybrid alike
- Others like product generation for exporters.

So all in all, while it is very important to be profitable, in these type of products with so many reasons and stakeholders, I do not see variances in royalty collection as a single definitive factor to end up R&D in such a critical area for both consumption and industry.

On the fourth question, I do not see the situation in the US very different. The will, both public and private is to protect the varieties and patents. We have also witnessed an array of legal cases and disputes, companies against farmers and producers/ processors.

Nevertheless “brown bags” exist and tiny margins persist. The solution on these type of non hybrid products resides in technology, changes, new incorporated traits and a faster release of new varieties, helped by the modern techniques together with the chain of interests of the powerful stakeholders of the soybean industry.

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