

## Biotechnology in Argentine agriculture faces world-wide concentration

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**Abbreviations:** M and A: mergers and acquisitions  
R and D: research and development

**In the 1980s, the technical pattern of production in agriculture changed due to the increasing design of genetically modified plants. Modern biotechnology thrived on events requiring certain thresholds of scientific and technological skills as well as scale economies usually seen in developed countries. The mergers and acquisitions during the mid-1990s led to a world-wide oligopoly composed of very few agri-biotechnological mega-corporations and the literature discusses the impact of the mergers and acquisitions on the agriculture of developing countries with comparative advantages in agriculture. This paper analyzes the world-wide process of agri-biotechnological mega-corporation mergers and acquisitions as well as its impact and interrelationships with Argentine agriculture using information from primary and secondary sources. Conclusions refer to the set-backs of endogenous agri-biotechnological development due to world-wide concentration in developing countries with comparative advantage in agriculture.**

In the 1980s, the technical pattern of production in agriculture changed due to the design of genetically modified plants. This new agricultural model, which included direct sowing as a new production technique in the case of glyphosate-resistant transgenic soybean, led to new relationships in the schemes of knowledge and competence

generation. These changes also modified the agricultural network because they strengthened large seed-producing firms.

Now that seeds are "produced", science and, hence, laboratories have a crucial role to play in the new set-up because the production function, which was formerly determined by the agricultural producer, is now indirectly determined by the industrial supplier of inputs through a technological mix based on transgenic seeds.

One of the distinctive traits of the new model is the consolidation of several mega transnational firms that specialize in agricultural biotechnology. In effect, there has been a world-wide concentration of capital at the main stages of the industrial process (*i.e.* R and D, production and marketing). Even so, certain characteristics of agriculture and the pervasiveness of world-wide mega corporations lead the latter to articulate with local agents.

The aim of this paper is to analyze the M and A process of mega agri-biotechnological transnational corporations during the last decade measuring their global share in agriculture and inquiring about their impact on the agriculture of a developing country with comparative advantage in the production of natural resource-intensive goods with special reference to Argentina as a case study.

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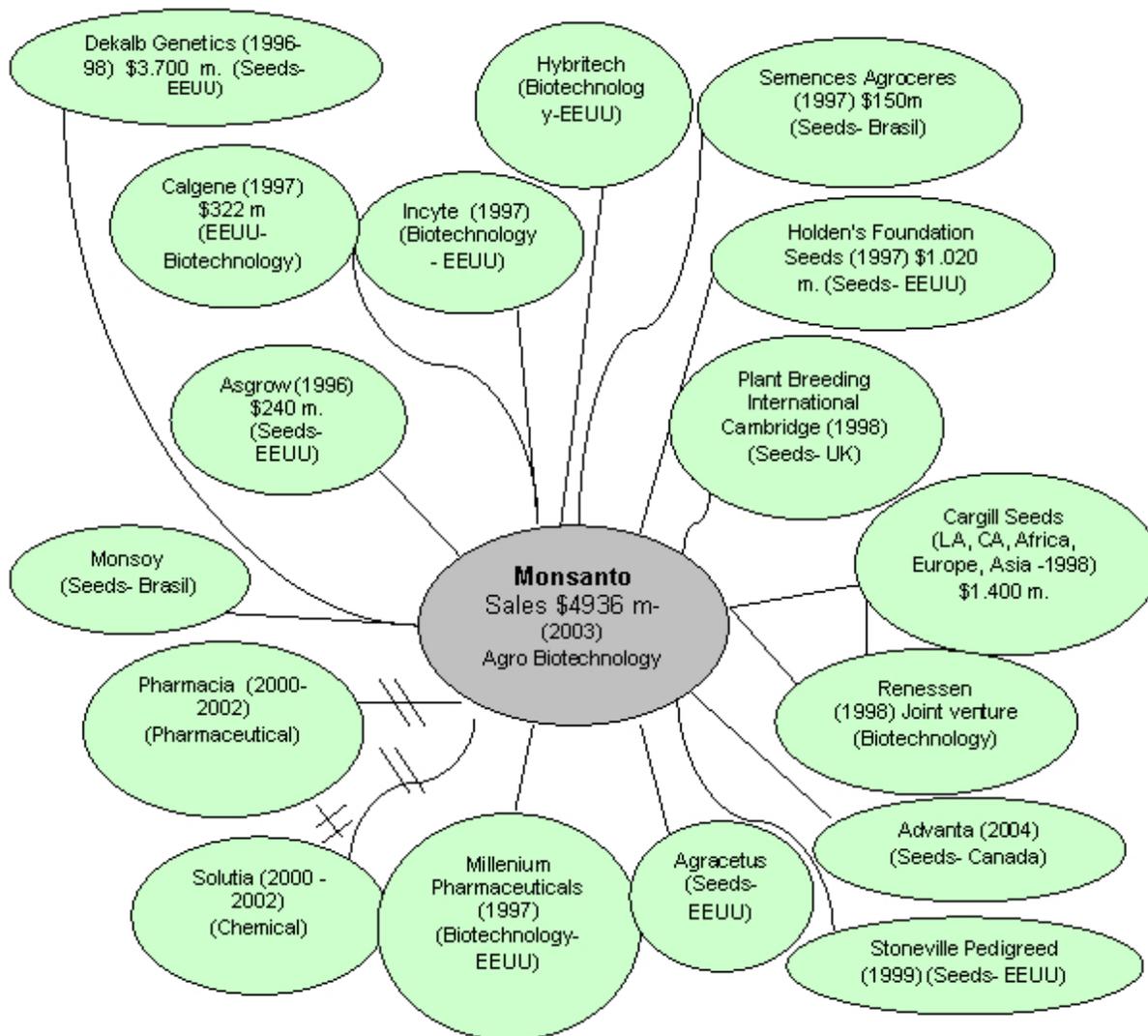


Figure 1. Monsanto. Main M and A. (1997-2004). US\$ million. Source: Project on "Economic Impacts of Biotechnology on Agriculture and the Food and Health Industries in Argentina", Project PICT 2002 - Code 02-13063.

**METHODOLOGY**

The analysis draws on two types of information sources. The first source provides quantitative information which is extracted from balance sheets, entrepreneurial reports prepared by specialized consultants, official statistics on innovation, own surveys and the database generated by the project "Economic Impact of Biotechnology on Agriculture and the Food and Health Industries in Argentina" (Project PICT 2002 – Code 02-13063) and the Instituto de Industria de la Universidad Nacional de General Sarmiento. The second source provides qualitative information through research carried out in books, revised articles and publications on the subject.

**RESULTS AND DISCUSSION**

Between 1995 and 2000, several agri-biotechnological

mega corporations (that started their business outside agriculture) became very strong players in the agrochemical and transgenic seed markets (Morales, 2001; European Commission, 2000). These mega firms increased their scale in terms of turnover, employment, R and D budget, etc. and, due to their vertical integration, also generate basic science (Zucker and Darby, 1995; Deeds and Hill, 1996; Ernst and Young, 2000; Cooke, 2001; Coriat and Orsi, 2002).

The annual turnovers of the six mega corporations concentrating agri-biotechnological generation (Monsanto, Syngenta, Dupont, Bayer Crop Science, Dow Agrosience and Basf) exceeds US\$ 5,000 million and their annual R and D budgets are around US\$ 600 million (Table 1). The total turnover of these six corporations exceeds the total value of Argentine agricultural production and some of these firms individual R and D investments exceed 50% of

total Argentine R and D investment (Table 2).

Mega agri-biotechnological firms consolidated through a series of M and As' which began in 1995 (James and Krattiger, 1996; Lesser, 1998; Oehmke and Wolf, 2003). According to Bisang and Varela (2005) these six firms acquired at least 50 seed and research firms between 1996 and 2004 so that in 2003 just five of them (Monsanto, Syngenta, Dupont, Bayer Crop Science and Basf) concentrated 70% of the world-wide agrochemical market, 20% of the seed market and, with Dow Agrosience, 100% of the transgenic seed market (Morales, 2001; James, 2003).

For example, Figure 1 shows the Monsanto M and A process during 1997-2004 and its constitution as an agri-biotechnological mega firm. Figure 2 shows the path of the firms that converged into Syngenta in 2000.

These world-wide production and innovation M and As' have a deep impact on the international competitiveness of local agriculture, particularly for developing countries with comparative advantage in agriculture. In Argentina, where biotechnology is not only used but is also adapted to local production, adopting the new scheme led to significant changes in agricultural organization and forms of competence. On one hand, in the 1990s significant correlation was observed between the effects of the M and As' on the operations of the main offices of mega corporations and of their local ancillaries. On the other, industrial producers of inputs were empowered within the agricultural network. The new phenomenon consists of adopting not-quite-closed technological bundles as well as an impressive presence of foreign capital at the main nodes (Lesser, 1998; Limpert and Kim, 2002; Niosi, 2003; Bisang and Varela, 2005).

The discussion on the future of biotechnology in developing countries with comparative advantage in agriculture pivots around the following issues. The first issue is the degree of technical and industrial integration to be achieved in the entire agricultural sector. The second is the role to be adopted by different scientific and

technological agents with respect to generating, transferring and adapting knowledge and how to articulate it with agricultural activities. The third issue is the local behaviour and integration of mega corporations, the profile to be adopted by local capital firms and the evolution of the forms of competence in world-wide markets. And, finally, the fourth is the evolution between world-wide biotechnological developments and the local technological gap. To summarize, local agricultural dynamics will depend on the ability of reaching the minimum threshold of technological and industrial capacity; on the articulation with the local system of innovation and on the way in which endogenous learning processes are generated.

## CONCLUDING REMARKS

The consolidation of the new agricultural technical and productive scheme was found to be related to a strong world-wide process of production and innovation centralization. Present agri-biotechnology develops new events as from certain thresholds of scale production as well as minimum scientific and technological thresholds.

The M and A process that started in the mid-1990s configured an oligopoly of mega transnational agri-biotechnological corporations that set their technical and productive strategies up on a world-wide basis as the main players in local agriculture.

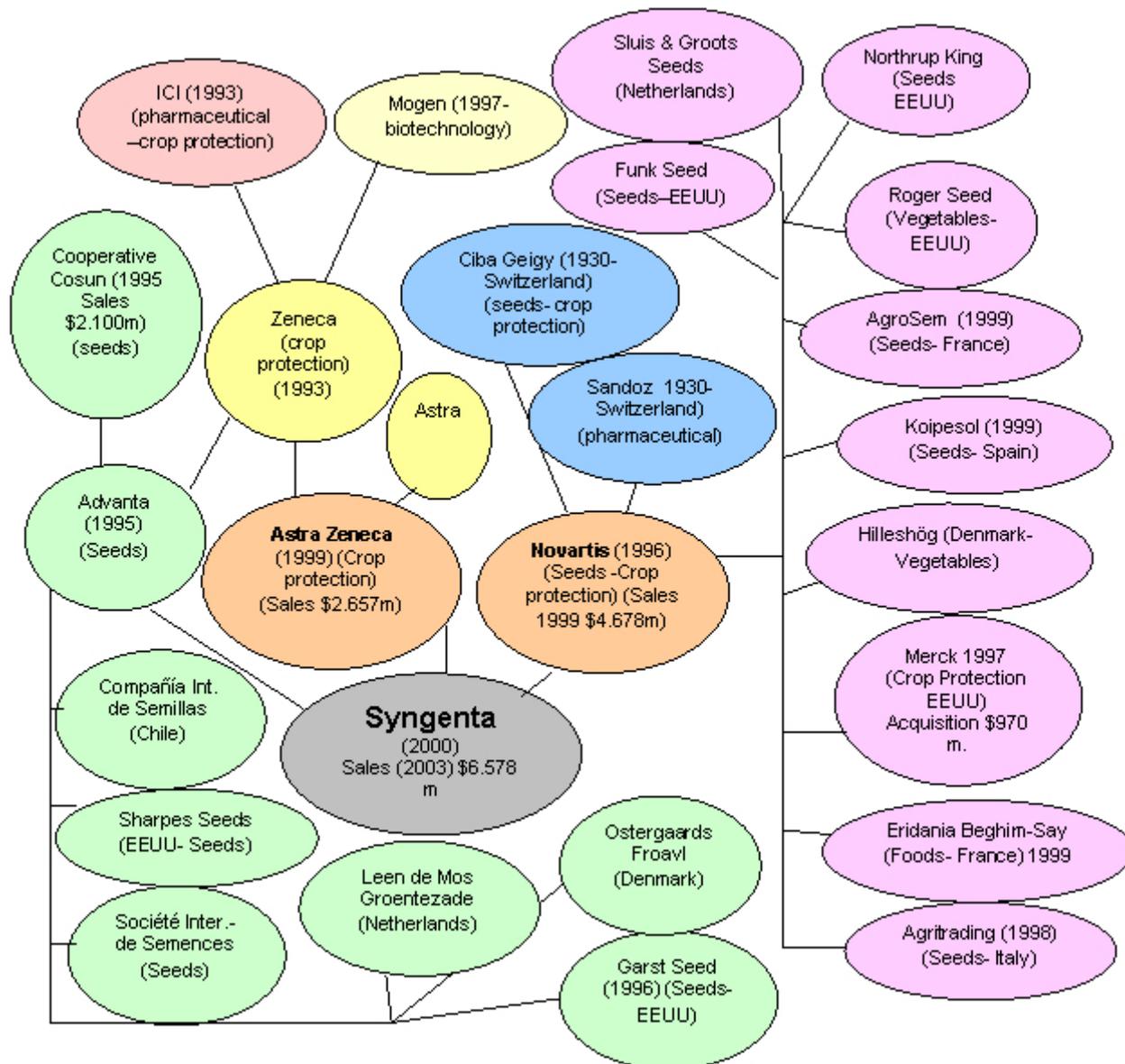
Argentine agri-biotechnology started up in the 1990s in the shade of mega transnational corporations and, fostered by public policies such as trade liberalization and market deregulation, the process of world-wide concentration spread to the rest of the local economy.

The scale reached by these mega corporations in local agriculture empowered them to the point of becoming the main nodes of the network in such a way that the Argentine economy – endowed with natural resources and comparative advantage in agriculture- plays the role of user and adaptor of the new technology.

Recent analysis reveals two opposing tensions in the world-

**Table 1. Overview of agri-biotechnological mega firms in 2003.** US\$ million, units and percentages.

	Sales	Employment	R&D investment	Share of local ancillaries in the total sales of the corporation
Monsanto	4,936	13,200	527	7%
Syngenta	6,578	19,000	727	1%
Dupont*	5,500	n/a	240	2%
Dow Agrosiences	3,008	5,700	n/a	4%
Bayer Crop Science	6,917	19,400	872	0%
Basf	4,001	n/a	301	n/a
<b>Total</b>	<b>30,940</b>	<b>57,300</b>	<b>2,667</b>	<b>3%</b>



**Figure 2. The path to Syngenta (1996-2000).** Main M and A. US\$ million. Source: Project on "Economic Impacts of Biotechnology on Agriculture and the Food and Health Industries in Argentina", Project PICT 2002 - Code 02-13063.

wide market. The first tension arises due to the high concentration of R and D, production and marketing as well as the constitution of not-quite-closed technological bundles which condition the development of firms, scientific and technical institutions as well as other agents operating in the local innovation system. And the second tension arises due to certain characteristics of agriculture and its present high growth rate that constitute incentives for mega firms to articulate with local actors thus facilitating the adaptation of state-of-the-art products. The dilemma facing Argentine agriculture and, particularly, local innovation players relates to the pros and cons of articulating with the technical and industrial strategies of mega agri-biotechnological corporations

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Table 2. Comparison of the mega firms with the Argentine economy in 2003. US\$ million.

Indicator	Selected firms (a)	Argentina (b)	Quotient a/b
Turnover – Total GDP	30,940	145,000	0.36
Turnover – Industrial GDP	30,940	23,392***	1.32
Turnover- Agricultural GDP	30,940	7,730****	4.00
R&D budget*, **	2,667	413	6.46

\* Source: Ricyt, 2002 for Argentina. \*\* The information refers to Monsanto, Syngenta, Dupont, Bayer Crop Science, Basf Agricultural, \*\*\*base 1997, \*\*\*\*base 1993.

Source: Project on "Economic Impact of Biotechnology on Agriculture and the Food and Health Industries in Argentina", Project PICT 2002 - Code 02-13063.

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