
Background

Important Changes in the Agricultural Input Industry

Issues

What are the major changes in the agricultural input industry? How has the application of biotechnology to agriculture been integrated within the input industry?

Context

Over the past several decades, the agricultural input industry has undergone many notable changes. These changes accelerated in the 1990's. Greater private-sector investments in agricultural research and development (R&D) have been accompanied by changes in investment composition and by recent consolidation of chemical, seed, and biotechnology companies into "life sciences" enterprises that work in areas not only related to food production but also to medicine and health.

Specific Changes

Increasing Private-Sector Investment in Agricultural and Food R&D

Private investments in agricultural and food R&D have nearly tripled in real terms (1992 dollars) from about \$1.2 billion in 1960 to \$3.4 billion in 1995 (Fuglie et al.). Furthermore, private-sector investments to agricultural research have outpaced public-sector agricultural research spending since the early 1980's. Public-sector expenditures in 1995 were \$2.8 billion, about 17 percent less than private-sector expenditures (fig.1).

Changes in the Composition of Private-Sector Agricultural R&D

The composition of private-sector research has also changed considerably. The share of agricultural R&D expenditures for biological and chemical inputs (plant breeding, agricultural chemicals, and veterinary pharmaceuticals) rose from 19 percent of total research

spending by private firms in 1960 to 58 percent in 1995 (fig. 2). Although absolute private-sector R&D spending also increased for agricultural machinery and processing, the relative expenditures in these areas have substantially decreased.

Consolidation in the Agricultural Input Industry

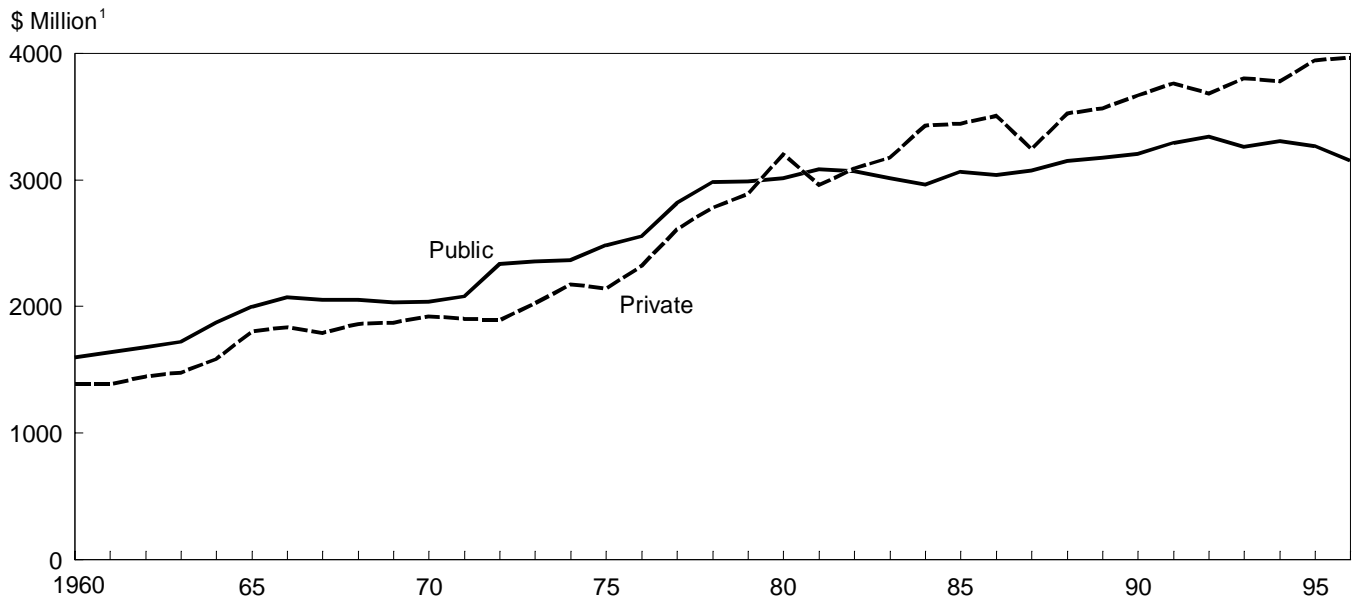
Mergers, acquisitions, and strategic alliances in the agricultural input industry have risen substantially in recent years. There were 167 mergers, acquisitions, and other strategic alliances in the agricultural biotechnology industry between 1981 and 1985. This number climbed to 801 during 1991-96. About 90 percent of these alliances were between larger, more established firms and technology startup companies (Kalaitzandonakes and Bjornson).

Major Players Today

Mergers and acquisitions by Monsanto in the 1990's highlight the trend toward consolidation. Between 1996 and 1998, Monsanto acquired Calgene, a biotechnology company, and numerous seed companies, including Asgrow, Corn States Hybrid, DeKalb Genetics, Holden's Foundation Seed, the Plant Breeding Institute Cambridge, Sementes Agrocere, and Cargill's foreign seed business. In 1998, Monsanto also announced plans to buy Delta & Pineland, the company with the largest share of the U.S. market for cottonseed—a deal that subsequently fell through. These acquisitions have increased Monsanto's market share for many major crop varieties. This acquisition activity is only the latest stage in Monsanto's transformation from a company largely concentrated in plastics and other petrochemicals in the 1970's to a major life sciences player today.

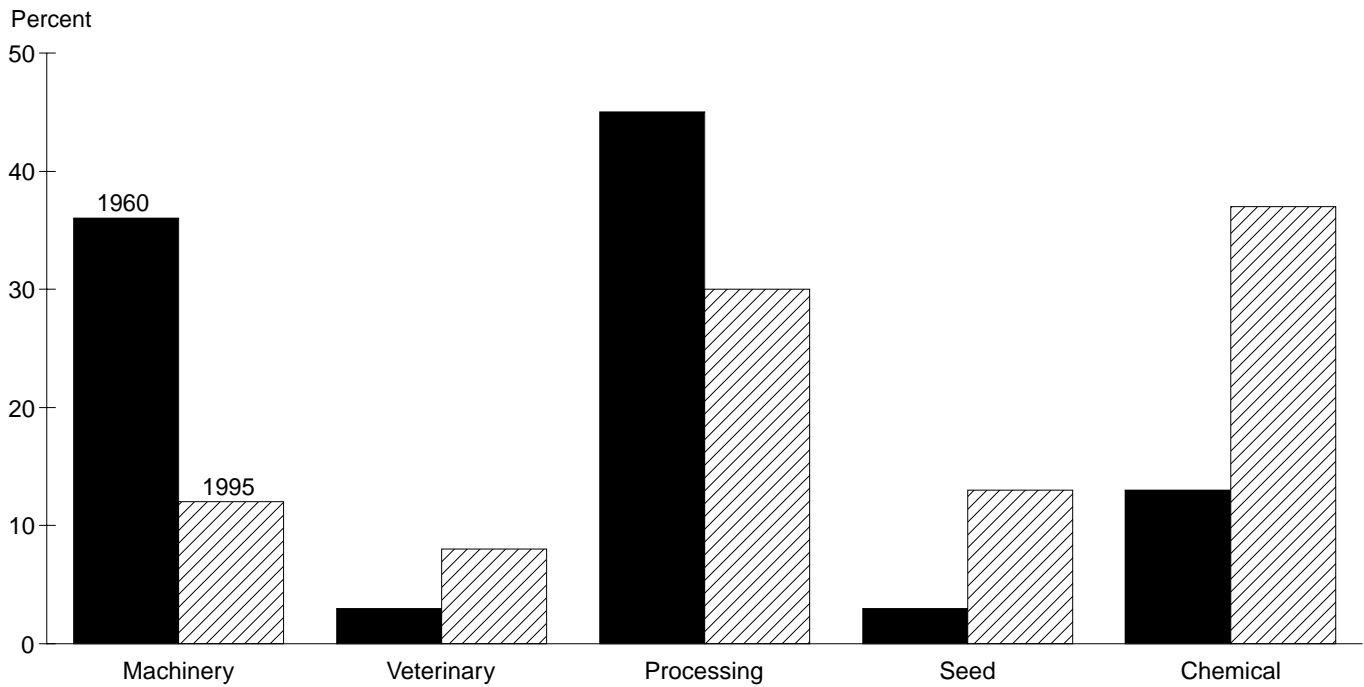
Monsanto is not the only agrochemical or pharmaceutical firm to stake out a claim in the rapidly changing world of agricultural biotechnology. Some of the fol-

Figure 1
Public and private agricultural research expenditures in the United States, 1960-96



¹In 1992 dollars.
 Source: Economic Research Service, USDA.

Figure 2
Allocation of private research and development spending, 1960 and 1995



lowing companies have sales volumes across all product lines that are considerably higher than Monsanto's.

- DuPont, which has bought Pioneer Hi-Bred International, the leading supplier of corn seed in the United States.
- Novartis, formed in 1996 from the merger of the Swiss pharmaceutical and agrochemical companies Ciba and Sandoz.
- Aventis, created in 1999 in a merger of Hoechst and Rhône-Poulenc.
- AstraZeneca, formed from a merger of Swedish pharmaceutical company Astra with British bio-science company Zeneca, also in 1999.

Empresas la Moderna, a Mexican company with smaller sales volume than some of the other giant firms, is nonetheless the world's leading supplier of vegetable and fruit seeds and a company with a growing investment in biotechnology.

In the second half of 1999, however, several developments suggested at least a temporary downturn in investment volume for the life sciences organizations. In early December, Novartis and AstraZeneca announced that they would merge and, at the same time, merge their agricultural units and spin them off from the parent pharmaceutical company into an independent firm dedicated to agribusiness. Later in December, after more than a year of merger rumors concerning Monsanto, Monsanto and pharmaceutical

manufacturer Pharmacia & Upjohn announced a merger. Early reports of the merger suggested the new company might try to sell or spin off its agribusiness unit. At the same time, Monsanto announced that it was abandoning its plan to purchase Delta & Pineland because of lengthy delays in the approval process.

Analytical Issues

A key question concerns the amount of resources that should be devoted to modeling industry structure in the agricultural inputs industry. In an extremely dynamic and fluid situation, how can this structure be characterized in a way that identifies major empirical regularities? How should changes in that structure be measured? How can a better understanding of industry structure assist in identifying important policy issues, such as those listed in subsequent sections of this report?

References

- Fuglie, K., N. Ballenger, K. Day, C. Klotz, M. Ollinger, J. Reilly, U. Vasavada, and J. Yee. *Agricultural Research and Development: Public and Private Investments Under Alternative Markets and Institutions*. AER-735. U.S. Department of Agriculture, Economic Research Service, May 1996.
- Kalaitzandonakes, N., and B. Bjornson. "Vertical and horizontal coordination in the agro-biotechnology industry: evidence and implications," *Journal of Agricultural and Applied Economics*, Vol. 29, No. 4, pp. 129-139, 1997.