The Proceedings of Economic and Policy Implications of Structural Realignments in Food and Ag Markets

A Case Study Approach
(Proceedings Include Revisions)

The Food and Agricultural Marketing Consortium Research Conference
Shadow Ridge Hotel, Park City, Utah
July 31-August 2, 1998

Transaction Costs, Trust and Property Rights as Determinants of

Organizational, Industrial and Technological Change:

A Case Study in the Life Sciences Sector

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ABSTRACT

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Substantial vertical and horizontal integrations have recently occurred in the agricultural life science sector. Old-line chemical companies DuPont and Monsanto have shed traditional operations while significantly increasing their presence in the life science sector. Although these two companies have much in common their efforts in the life science arena use different ownership structures. Using a case study approach these organizational and industrial and changes can be explained through traditional IO economics, property rights analysis and a trust-transaction costs analysis.

Two old-line chemical companies, Monsanto and DuPont, are undergoing major restructuring as they significantly expand their presence in the life science industries. Monsanto has spent over eight billion dollars during the past three years to acquire agricultural seed companies, biotech firms and processing interests while also spinning off to their stockholders Monsanto's chemical operations. DuPont, likewise, has spent over five billion dollars to acquire interests in seed and pharmaceutical companies while selling off its huge Conoco oil company. Although the two companies appear to be similar in their backgrounds and efforts there are significant differences between the two companies. DuPont's method of entry into the life sciences field has greater use of joint ventures and alliances than Monsanto, which tends to use more direct outright ownership.

Why did these two companies, from the old-line chemical industry, suddenly express an increased interest in the life sciences sector and why are they using different ownership structures in their efforts? What is it about the agricultural seed industry that has suddenly created an impetus for both vertical and horizontal consolidation? As these two companies buy up major seed companies and biotech firms what will be the implications for remaining biotech and seed companies within these industries? How might farmers be affected as they face a more integrated supply and distribution channel?

This paper will try to address these questions by looking at the actions of Monsanto and DuPont from three organizational-economics perspectives. First, a traditional industrial-organizational market forces analysis will answer the question as to why Monsanto and DuPont are changing their strategic focus. Second, intellectual property and trust-transaction cost analyses will explore answers to the questions of corporate and industry structure.

Old-line chemical industry

The chemical business that was the main focus of both Monsanto and DuPont just a few years ago would best be described as an "old-line" industry (Fritsch & Kilman, 1996; Palmer, 1998). DuPont's sales of $43,810,000,000 in 1996 was only 9.4% greater than its sales level six years earlier in 1990, similarly Monsanto's 1996 sales of $9,262,000,000 had increased by just 14.8% over the same six year period (Moody's, 1997). Prospects for growth in the chemical industry, other than through acquisitions, were minimal. DuPont was often cited as the world's largest chemical company, so growth options for DuPont were especially limited (Freedman, 1996).

Using Porter's (1980) model to examine the competitive forces driving the old-line chemical industry one must make some simplifications to account for the great variance in number of products sold and individual product sales volumes. Certain buyers and suppliers, for some products, have extremely strong positions but in general the market is extremely competitive. Although some of the chemicals that these companies sold were proprietary and commanded high margins, a good portion of their sales were in commodity type chemicals with many competitors and low margins. DuPont's profit as a percentage of sales in 1996 was 8.3% while Monsanto's was 4.2% (Moody's, 1997). Both companies could make efforts at reducing their expenses, DuPont notably so, but their prospects for substantially increased revenue were nil (Miller, 1995).

This is a fairly mature industry and substantial growth for these companies had to occur outside of the old-line chemical business. Neither company could reasonably expect sustained high rates of return above the competitive floor rate.

Life Science sector

The "Life Sciences" sector that Monsanto and DuPont are entering is comprised of several different types of vertically related entities in the agribusiness industry. These entities are the agrochemical companies, biotech firms, seed companies, farmers and processors.

At the top of the vertical chain are the agrochemical and biotech companies. The agrochemical companies produce chemicals related to farming such as fertilizers, herbicides and pesticides. Monsanto and DuPont have long been in this industry as part of their chemical operations. The agrochemical companies may sell directly to the farmers or through agents such as the seed companies. The biotech firms, often small start-up entrepreneurial firms, identify genetic sequences that can code for desirable traits in one organism and develop techniques in which to place these desirable genes into the plant seeds of another species. The biotech firms may also be part of one of the seed companies. It has only been during the past few years that the biotech firms have been successful in transferring these desirable genes to plants on a practical scale. The resulting seeds/crops from this process are known as *transgenics*.

The seed companies maintain stocks of seeds that have desirable agronomic traits; *i.e.* the seeds have been selected for optimum production for localized soil and climatic conditions. Agronomic characteristics can measurably change from county to county. The seed companies sell their seed directly to the farmers, while also contracting with some of the farmers to produce seed for the seed companies. The seed companies contractually (and sometimes genetically through sterile hybrids) prohibit the farmers from retaining a portion of their harvest as seed for a subsequent crop – the farmers must buy their seed from the seed companies for every planting cycle. The processors buy the harvested crop from the farmers and process the crop for further end use. The processors may own or control the grain elevators and silos needed to store the harvest, or the farmers individually or through cooperatives may control the elevators and silos. The processors may contract directly with the farmers, before planting, to produce a certain type of crop for the processors.

Up until the time that the biotech firms became successful in introducing transgenics the relationships between these players was fairly stable. The agrochemical firms created slightly better chemical compounds for the farmers. The seed companies were able, through selection, to offer slightly better seeds to the farmers. The processors received a fairly homogenous crop from the farmers, who were in the middle of all of this. There was competition at all levels for "commodity" type products, and the future was not too different from the recent past.

Farmers could buy *comparable* seeds and agrochemicals from several competitive sources while selling their harvest to competing processors. It was the "commodity" type of competition at all levels and the incremental nature of change throughout the system that gave stability to this sector's arrangement of players. It was the successful introduction of transgenics that disrupted this equilibrium.

The biotech firms created three different types of traits for transgenic seeds (Grooms, 1997; Thayer, 1997). One type of trait made the seed more desirable to the farmer in that it enabled the plant to grow more efficiently, *e.g.*, the plant was more insect resistant, required less fertilizer or produced more output. This type of trait would have the least impact on the existing market system relationship.

A second type of trait changed the qualitative nature of the harvested crop, *e.g.,* high oil or low phosphorous corn, that would specialize what previously had been a "commodity" type product so that it would now be of interest to fewer processors. This reduced both the number of potential producers *and* the number of potential buyers for these specialized crops. This reduction in both buyers and sellers created a decommoditized small numbers market that resulted in greater use of contractual arrangements between processors and farmers prior to harvest (Williamson, 1975 & 1996).

The third type of trait was the introduction of a genetic resistance to a proprietary herbicide. This changed the market relationship in that farmers using seed with this trait were effectively tied to using one particular herbicide. This, too, created a small numbers situation between the farmers and the seed companies/agrochemical concerns that reduced the competitive commodity nature of the market.

An industry analysis looking at the buyers, suppliers, substitutes, potential entrants and industry rivalry shows that the tied traits created a strong impetus for the agrochemical firms to coordinate with, or own, the seed companies (Porter, 1980). The agrochemical firms would fare best if a seed company offered only seeds that were compatible with their proprietary herbicides, *e.g.,* Monsanto would want the seed companies to include the genes that created a tolerance to their Roundup weedkiller. Contractual limitations between the chemical and seed companies that would limit the seed companies to only offering seed compatible with one agrochemical company's products could be illegal anti-competitive coordination mechanisms. However, if a chemical company bought a seed company *and* only included traits in the seeds that would complement its own products that would be legal market coordination mechanism.

Monsanto had, and has, the best selling herbicide, Roundup, which accounted for $1.5 billion or 17% of its sales and half of its earnings in 1995 (Fritsch, 1996). Monsanto has also been most aggressive in moving into the seed industry spending $2.5 billion to buy DeKalb, $1 billion for Holden's Foundation Seeds, $1.4 billion for Cargill's European seed business, $525 million for Unilever Group's wheat breeding business, and recently offering $1.9 billion for Delta & Pine Land Co and. (Kilman, & Fritsch, 1996; Kilman & Warren, 1998, Wall Street Journal, 1998). DuPont has also spent billions to enter into this market, $1.7 billion for a 20% stake in Pioneer Hi-Bred and $400 million for a joint venture (Optimum Quality Grains) with Pioneer (Gardner, 1997; Kilman & Warren, 1998). Monsanto and DuPont combined control roughly half of the U.S. seed market for soybeans and more than half of the U.S. seed market for corn - the nations two largest crops. If Monsanto's proposed purchase for Delta & Pine Land Co. receives regulatory approval Monsanto will control 80% of the U.S. cotton-seed market (Kilman & Warren, 1998).

Transgenic seeds, introduced to the market only three years ago, have quickly bridged the gap from young science to market acceptance. Estimates for 1998 are that nearly half of U.S. cotton fields, 40% of soybean fields and 20% of corn fields are genetically altered. Although Monsanto is considered to be far ahead in this "first wave of biotech crops designed to resist insects and powerful weedkillers…DuPont has more patents for the second – and potentially far more valuable wave, which involves changing plants' nutritional attributes" (Kilman & Warren, 1998).

The practical application of transgenic seeds disrupted the fairly competitive market equilibria that had existed in the life sciences sector. Seed companies could now offer seeds that had value added traits that were markedly distinct from those of their competitors. Agrochemical concerns now had a greater interest in coordinating products and sales with the seed companies. The new agrochemical/seed companies were eager to purchase promising biotech firms. And finally, seeds designed to create qualitative differences in final crop characteristics reduced both the supply and demand for these "de-commoditized" products, leading to increased use of contractual arrangements between farmers and processors to plant on "spec".

An interesting twist to this vertical penetration into the seed markets is that the remaining seed companies see Monsanto and DuPont as *suppliers* (of pesticides, herbicides and fertilizers) and also as *competitors* (seed). This creates real uncertainty for the remaining seed companies.

Beyond IO Economics

A brief IO analysis of the old-line chemical industry and the life sciences sector reveals why DuPont and Monsanto may wish to decrease their presence in the former while increasing their presence in the latter, yet it does not explain why they are following differing organizational forms or structures in their efforts. Chandler's (1962) study of strategy and the organizational forms of early 20th century American corporations came to the accepted conclusion that form follows function. However here we have two similarly situated old-line chemical companies pursuing similar strategies while adopting differing forms. Monsanto spins off its substantial chemical operations and tends to buy complete interests in life science firms while DuPont chose to keep its chemical operations and tended to use joint ventures and alliances in its efforts to structure its movement into the life science sector.

Two highly interrelated phenomena are occurring. The first is that the entire agricultural life sciences sector is undergoing greater vertical integration. The second is that the two main players in this ongoing integration, though starting from similar positions, are following different paths. The first phenomenon of greater integration can be explained, in part, through an examination of intellectual property rights in the life sciences sector. The second phenomenon may have an explanation using a transactions cost analysis of the two companies organizational structures.

Property rights

Edwards addresses the issue of property rights when he looked at the interaction between technology and institutions. He saw support from the writings of classical economists that technological change interacted with institutional change.

> Adam Smith referred to the limit of growth which is set by the "laws and institutions" of a country. He emphasized the importance of "**order** and good government" and noted that capitalistic institutions promoted technological advance.
>
> John Stuart Mill listed several institutional changes which he considered characteristic of economic progress: a continual increase of the **security** of person and **property**, adoption by the people of the qualities we call "industry" and "frugality", an improvement in the business capacities of humankind, and the capacity for **cooperation**. He also listed several good reasons why institutional intervention is needed to correct the social ills caused by the marketplace.
>
> Karl Marx noted the interplay between technological advance and institutional change. He was concerned with the unprecedented increase in productivity under capitalism, and he concluded that the capitalistic institution provided **strong incentives** for technological advance." (Edwards, 1983).

With Smith's "order", Mill's "security of …property" and "capacity for cooperation", and finally Marx's "strong incentives" all three economists address issues directly related to property rights and technological and institutional change. The latter two economists, Mill and Marx, also looked at the dark side of an unfettered marketplace.

Alchian and Cheung developed an *economic* definition of property rights that is essentially *the ability to enjoy a piece of property* (Alchian, 1965; Alchian, 1987; Cheung, 1969). This ties into Coase's theorem that when rights are well defined and the cost of transacting is zero, resource allocation is efficient and independent of the pattern of ownership (Coase, 1960). "Were rights well defined everywhere, much of economics…would be superfluous. Because the cost of transacting is positive, delineating and enforcing rights is costly – prohibitively so if done to perfection." (Barzel, 1996, p7).

The property rights associated with plants that we are interested in examining fall under the domain of intellectual property rights. There are five main categories of plant protection in the United States: (1) trade secrets, (2) contracts, (3) the Plant Patent Act (PPA), (4) the Plant Variety Protection Act (PVPA), and (5) utility patents (Jondle, 1989). Although the PPA and PVPA are specifically aimed at protecting proprietary rights associated with plants they bear little impact for our discussion in the life sciences sector when compared to the use of the other three methods of protection. The Plant Patent Act of 1930 protects only *asexually* reproduced plants – that is plants propagated through cuttings and not from seed. The Plant Variety

Protection Act of 1970 was designed to protect new *sexually* reproduced plants with an 18-year patent. Utility patents, with a 17 year protection period, are often preferred to PVPA patents because utility patents can protect seeds, whole plants, plant parts, genes or physical traits, cultivars, hybrids, methods of plant regeneration, and other biotechnology processes and products. PVPA patents protect the seed and plant of an inbred or cultivar. PVPA protection does not extend to hybrids, fungi, or bacteria while utility patents can protect plants, microbes and animal inventions. *Utility patent protection is the only patent protection available for hybrids, biotechnology, genes, recombinant DNA, and plant breeding methods and processes.* Another major difference between the PVPA and utility patents is that the PVPA has both farmer's and research exemptions that utility patents are not obligated to allow (Jondle, 1989).

The nature of property and property rights in the life sciences is becoming less well defined in several interrelated ways. First, property that had been public property is now becoming private property. The private capturing of property rights from the public domain is occurring because of the interplay between (1) governmental recognition and (2) pragmatic valuation. Prior to 1986 utility patents had not been recognized for genetically modified plants. A 1984 patent application for tryptophan enhanced production had to be appealed to the Patent and Trademark Office's Board of Appeals and Interferences before the first utility patent was issued in 1986 for a genetically modified plant (Hibberd, Anderson & Barker, 1986; Kleese, 1989). This governmental recognition, or creation, of a new property right created a policy where what had been held in the public domain, *i.e.* not amenable to private ownership, could now become private property. The potential billion-dollar market conjoined with this new property right created the large-scale implementation of transgenics just ten years later. Without a large profitable market and secure property rights the advances in transgenics would have happened at a different pace and different parties would have paid for and benefited from the different developmental paths transgenics would have taken.

Public property becoming private makes more salient the issues of valuation and control. Also, competitive pressures in the industry have shortened the time available to make decisions and act – leading to increased uncertainty and risk. An example of the interplay of the valuation and shortened time span is evident in Monsanto's purchase of Dekalb Genetics. Monsanto purchased a 40% stake in DeKalb during February 1996 for $158 million. This put the market capitalization of DeKalb at $395 million. Fourteen months later, April 1998, Monsanto purchased the remaining 60% of DeKalb for $2.3 billion, or a total market capitalization of $3.8 billion. This represents almost a ten-fold appreciation in the market value of DeKalb over a fourteen-month period.

A small biotech firm will have two main types of intellectual property. The first type of intellectual property is the patented genetic sequences and patented machinery and processes that the firm has created or bought. These patented properties have legal protection for a fixed period of time and the main problem with these patented properties is in determining their value. The second main kind of intellectual property that a biotech firm possesses is the tacit knowledge or "know-how" that resides within the firm. This tacit knowledge may be how to best use or create a piece of sophisticated equipment or how best to run a research program. This tacit knowledge is hard to define and difficult to protect legally. Additionally, a firm may choose to avoid using patent protection for certain processes when the patent protection afforded is illusory because the patent can be easily worked around.

The valuation problem applies to both patented and non-patented intellectual property. The protection problem is more applicable to trade secrets and other types of tacit knowledge. A biotech firm may have several uncertainties in how it deals with a seed company that may be dealing with several other biotech firms. If the worth of a biotech firm is tied up in its trade secrets and know how, it will reasonably fear that this knowledge will "leak" from the firm and into the market (competitors and customers) when intimately working with its customers. Likewise, the seed companies have parallel concerns.

Learning in an economic exchange can occur through exogenous and endogenous methods. Exogenous learning about the value of an uncertain investment occurs through sources that are external to the governance mechanism of the economic exchange. Endogenous learning occurs through the governance device that is put in place to manage an investment (Barney & Lee, 1998). A firm making governance decisions in times of high uncertainty has as a goal to maximize its ability to learn about the value of its uncertain investment at the lowest cost.

Kogut (1991) argues that under conditions of high uncertainty, firms should adopt intermediate forms of governance (*e.g.*, joint ventures) because they simultaneously allow a firm to remain flexible and to learn about the value of their uncertain investments. A purely market relationship between the biotech firms and the seed companies would rely solely on

exogenous learning to evaluate property. Joint ventures and direct ownership are progressively stronger methods of allowing endogenous learning to occur. If the evaluation of the property in question can only be evaluated through endogenous methods then either a joint venture or an ownership relationship is desired. The problem with direct ownership is that it limits flexibility, the problem with joint ventures is that it is prone to opportunism.

To best evaluate knowledge in the biotech area, firms should choose governance mechanisms that allow for endogenous learning – this includes joint ventures and direct ownership. However to guard against opportunism (the uncompensated usurpation of proprietary knowledge) firms must rely on efficient market transactions (not possible) or through ownership. The only organizational form that optimizes both of these concerns is a consolidation and direct ownership between seed companies and biotech firms.

What makes economic sense for individual firms may not make collective sense for the industry or society as a whole. In the past when the land grant universities did much of the research that the biotech firms and seed companies are currently doing this information was quickly and publicly available at a minimal cost (to the seed companies and farmers). Now that the generation and ownership of this intellectual property has moved from being a public good and into the private sector private firms are zealously guarding their property rights and structural changes to the industry are occurring (Frieberg, 1996; Seed & Crops Industry, 1996). The policy implications of this echo the concerns of Mill and Marx.

Transaction Costs Analysis and Trust

The make or buy decision is the seminal transaction costs analysis question (Williamson, 1975). Should a firm make certain goods and services that it desires or should the firm buy these goods and services from the market? Williamson's elaboration of transaction costs analysis now uses a continuum of governance structures between make (owning) and buy (market) that include such governance mechanisms as recurring contracts, joint ventures, and franchises (Williamson, 1996). However, even if the governance structures analyzed by transaction costs analysis have expanded in scope, the underlying assumptions behind the analysis – opportunism and bounded rationality – have stayed the same.

Because of opportunism joint ventures are hard to explain without using concepts of trust or game theoretical notions of calculative trust (Williamson, 1996). Sporleder (1993) uses the term *strategic fuzzy alliance* (SFA) to describe a relationship between two firms that involves cooperation and a trusting environment. Traditional business structures are based on competition and opportunism with strictly defined and distinct firm boundaries. Strategic fuzzy alliances are highly flexible with less clear boundaries (Sporleder, 1993). "The system is an open structure where knowledge flows easily between the two firms, as through a 'membrane' connecting two living organisms (Hamel, 1991). To allow firms to keep pace in a rapidly changing environment, innovation, learning and coomunication are encouraged. (Vyas, Shelburn & Rogers, 1995). A key feature of the fuzzy alliance is trust." (Adams & Goldsmith, 1998, p. 3).

Trust is defined as "…the expectation by one person, group or firm of ethically justifiable behavior…on the part of the other person, group, or firm in a joint endeavor or economic exchange" (Hosmer, 1995). DuPont successfully participates in numerous joint ventures (see Appendix A) and enjoys the flexibility of such relationships. The role of trust must enter into both (1) the decision by DuPont to enter into the relationship and (2) the complementary decision by DuPont's partners to enter into a relationship with DuPont. How can DuPont's demonstrate to its partners that DuPont is a trustworthy ally?

Barney and Hansen suggest the use of reputation as a signaling device of trustworthy intent. "Gaining a reputation as a strong form trustworthy exchange partner occurs, over time, as an exchange partner confronts situations where opportunistic behavior is possible, but chooses not to engage in opportunistic activities." (Barney & Hansen, 1994, p. 187). If two trustworthy individuals or firms are able to engage in trade, then these firms will gain at least a temporary competitive advantage over individuals or firms that are not trustworthy (Barney & Hansen, 1994).

DuPont has generated a reputation for being a viable and attractive joint venture partner. DuPont has at least 65 active subsidiaries and joint ventures. From 1995 through mid 1998 over ten percent of DuPont's press clippings concerned the formation or successes of DuPont joint ventures. During this period surveyed DuPont had 62 articles describing 22 different joint ventures. Three of these joint ventures (Dow, BASF and Pioneer) were in the billion-dollar range and several (Merck and Ford) were of relatively long standing. As a contrast during the same time period Monsanto had only seven articles mentioning joint ventures and the only two that were in the life sciences sector never came to fruition (See Appendix A). Another measure of reputation that showed that DuPont was a trustworthy partner was an examination of lawsuits. During

the 1995-1998 the press clippings showed that DuPont was involved in no lawsuits against business partners while Monsanto was involved in four different lawsuits related to product licensing and acquisitions (See Appendix A). A final public measure of trustworthiness was to examine the press clippings for examples of awards and industry leadership. Again, DuPont has a much broader display of award winning and leader behavior (See Appendix A).

Because DuPont was able to successful demonstrate a reputation for trustworthiness DuPont should have been able to create and participate in these acquisitions and joint ventures at a reduced transaction cost when compared to Monsanto. The two lawsuits against Monsanto related to the acquisition of Calgene and Pioneer demonstrate a strong reluctance on the part of some members of the life sciences sector to do business with Monsanto. Could Barney & Hansens (1994) article be correctly title "Trustworthiness as a source of competitive advantage"?

Summary

Industry analysis demonstrated that DuPont and Monsanto faced limited growth prospects in the old-line chemical industry. Both were active players in the agrochemical sector of the life sciences industry and technological advances in transgenic plants created factors leading to structural changes in the life sciences sector. Both companies invested heavily in the life sciences sector –particularly seed companies. Both companies divested major portions of their old operations – Monsanto spun off its chemical business, Solutia, Inc., while DuPont sold off its oil company subsidiary Conoco (See Appendix B). Both companies created greater vertical integration through the life sciences sector, Monsanto through direct ownership and DuPont through ownership and alliance. A property rights and trust-transaction costs analysis can explain why DuPont may have been able to maintain a position of greater flexibility through joint ventures and alliances than Monsanto. Policy implications exist for the interplay of intellectual property rights and development and the changing structure of the agricultural life sciences sector of the economy.

Questions:

To what extent are Monsanto and DuPont playing into a zero sum game where the number of acres dedicated to any one crop is relatively fixed? Any rents received from value added traits can be quickly eliminated through rounds of Schumpeterian creative destruction. While the fixed costs of creating these traits are relatively high, the variable costs of generating additional seeds are low. This creates an economic incentive to reduce price in the anticipation of making it up on volume. This could explain the apparent price war that existed this past planting season.

People look back to the "good old days" when the public land grant universities engaged in fundamental research and knowledge was openly and readily shared. Lately, private concerns have "usurped" this role of the public land grant institutions and knowledge is becoming more proprietary and less readily shared. What factors led to this situation? Are these factors reversible? What are the policy implications and who are the winners and losers of this transformation? Finally, if Monsanto and DuPont continue their courses of action and a heterogeneity of structure exists will this increase or decrease public access to knowledge?

Quantum breakthroughs in technology, huge markets, substantial research and development costs, and intellectual property – to what extent will the life sciences industry play out like the pharmaceutical or microcomputer industries? Will Monsanto become the Microsoft of the life sciences sector, or will DuPont and Monsanto become the Coke and Pepsi of the agricultural world?

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APPENDIX A

"Trust… tends to be somewhat like a combination of the weather and motherhood; it is widely talked about, and it is widely assumed to be good for organizations. When it comes to specifying just what it means in an organizational context, however, vagueness creeps in." (Porter, Lawler & Hackman, 1975: 497)

While reputation and a propensity for trustworthiness are inherently difficult to define and measure I have used news and trade journal articles concerning these two companies to generate rough measures of trustworthiness and a propensity to engage in cooperative behavior. Using the Wilson Business Abstracts database I searched for every article that concerned DuPont and Monsanto from 1995 through mid 1998. The database search revealed 477 articles concerning DuPont and 285 concerning Monsanto. The search results were then examined to look for such issues as (1) lawsuits, (2 & 3) awards and examples of industry leadership, (4) joint ventures and alliances, and (5) board composition

DuPont lawsuits mentioned in business and industrial journals, 1995 – 1998.

Type of Lawsuit	# of articles
Product liability lawsuit polybutylene pipe	5
Product liability lawsuit and hiding/misrepresenting evidence Benlate fungicide	13
Cleanroom employees of customers suing chemical suppliers	2
DuPont v Insurance company on pollution liability responsibility claims	1
Contract employee suing for full-time employee benefits	1

DuPont-Merck and a host of others involved in FTC civil price fixing pharmaceutical suit	2
NLRB says DuPont TQM safety committees are an unfair labor practice	1
Congress wants to change OSHA regulations to allow DuPont's TQM safety committees	1
Total (suits/articles)	8/26

Monsanto lawsuits mentioned in business and industrial journals, 1995 – 1998.

Type of Lawsuit	# of articles
Monsanto v Insurance company on pollution liability responsibility claims	1
Monsanto and a host of others involved in EPA Superfund lawsuit	1
Employee of a Monsanto takeover sues for discrimination	1
Pioneer Hi-bred sues breech of contract related to takeover	1
Calgene shareholders sue because of unfair activities during takeover	1
Monsanto sues licensee/competitor Mycogen over patent infringement	5
Total (suits/articles)	6/10

Both companies were involved in pollution liability lawsuits that are endemic to large chemical companies. However DuPont was involved in two different product liability lawsuits that accounted for over half of its press regarding lawsuits. DuPont was not the main defendant in the polybutylene pipe lawsuit and ended up settling by paying $120 million. The Benlate lawsuits portrayed DuPont in a very negative light, DuPont was found to hide and misrepresent evidence. Both companies were involved in labor lawsuits. DuPont's employee lawsuits provide mixed press. The lawsuit of the contract employee seeking full-time benefits is not uncommon today and the NLRB unfair labor practices ruling regarding DuPont's TQM safety team was quickly addressed by Congress to favor DuPont's actions. Monsanto's labor suit follow Monsanto's purchase of a Chevron chemical unit and the firing 43 employees. The fired employees who sued alleging age, race and disability discrimination received an $18.3 million settlement. The last two groups of Monsanto lawsuits show a resistance to Monsanto's takeover practices and a difficulty in dealing with licensees and licensed technology.

DuPont awards and industry leadership mentioned in business and industrial journals, 1995 – 1998.

Type of Activity	# of articles
DuPont and Monsanto pledge to early phase out of deepwelling hazardous waste disposal	1
DuPont's CEO receives International Palladium Award for industry contributions	1
DuPont's annual report receives top prize from *Financial Post* for readability	1

DuPont's Printing and Publishing operations receive Management Plus Hall of Fame Award	1
President Clinton gives DuPont one of five National Medals of Technology	1
DuPont/Ford collaboration wins Society of Plastics Engineers Grand Award for recycling	1
DuPont receives Optimas Award for creating an harassment free work environment	1
DuPont receives Perkin Medal for outstanding achievement in applied chemistry	1
DuPont employees receive American Chemical Society Awards	1
DuPont and others sponsor a special pharmaceutical care program	1
DuPont and Cargill sponsor program to increase school and workforce diversity	1
DuPont and others propose Government/Industry high risk product development collaboration	1
Total (awards-actions/articles)	11/11

Monsanto awards and industry leadership mentioned in business and industrial journals, 1995 – 1998.

Type of Activity	# of articles
Monsanto and DuPont pledge to early phase out of deepwelling hazardous waste disposal	1
Monsanto receives Excellence in Logistics award	1
Monsanto receives National Agri-Marketing Association awards	6
Monsanto gets Presidential/EPA "Green" Chemist award	4
Monsanto sponsors a waste recovery competition ($1 Million prize)	1
Total (awards-actions/articles)	5/13

Both companies are on the receiving end of good press however DuPont's meritorious actions appear to be somewhat broader in scope

DuPont joint ventures mentioned in business and industrial journals, 1995 – 1998.

Type of Activity	# of articles
DuPont buys interest in ($1.7B), and joint ventures with ($400M), Pioneer Hi-Bred International to create Optimum Quality Grains.	5

DuPont and Dow Chemical joint venture to sell elastomers ($100 M investment, $1B sales)	9
DuPont and BASF joint venture to sell nylon in Asia ($750M investment)	3
DuPont's oil company subsidiary Conoco participates in 4 separate joint ventures	4
DuPont has existing joint venture with Merck Pharmaceuticals	23
DuPont buys Merck's 50% stake in joint venture for $2.6 Billion (May 1998)	2
Other DuPont joint ventures ranging from $2M to $120M	14/16
Joint ventures/articles	22/62

Monsanto joint ventures mentioned in business and industrial journals, 1995 – 1998.

Type of Activity	# of articles
Monsanto and Cargill create a $100 million joint venture	1
Rumors exist that Monsanto and ADM will joint venture	1
Monsanto joint ventures (PT Monfori Nusantra) with plant biotech firm ForBio in Australia	1
Monsanto's subsidiary Searle has joint venture with France's Synthelabo	1
Monsanto has a joint venture with AKZO	2
Monsanto sells its interest in a joint venture in Thailand	1
Joint ventures/articles	5/7

The use of joint ventures is one of the biggest distinctions between DuPont and Monsanto. DuPont had 62 articles mentioning its 20 plus joint ventures, while Monsanto has less than a handful of joint ventures and only 7 articles. DuPont's is notable for its several large successful joint ventures (particularly with Dow and Merck) though DuPont also participated in many smaller specialized joint ventures. The joint venture with "scandal ridden" Archers Daniel Midland (Marcial, 1997) was merely a rumor and never came to pass.

Additional support for the notion that DuPont is viable joint venture partner comes from Moody's Industrial Manual. The 1997 Manual lists a total of 65 subsidiaries and joint ventures for DuPont, while reporting only five subsidiaries and four joint ventures for Monsanto. Although the information published in Moody's is supplied by the companies being described this does provide support for the notion that DuPont has a predilection for joint ventures and alliances while Monsanto prefers to exercise a more controlling interest in its operations.

APPENDIX B

Notable Investments by DuPont	Notable Investments by Monsanto
$1.7 billion for 20% stake in #1 seed company Pioneer Hi-Bred International, Inc. †	$158 million to buy 40% stake in #2 seed company DeKalb Genetics, February 1996
$400 million joint venture with Pioneer to create Optimum Quality Grains	$2.3 billion to buy remaining 60% of Dekalb, April 1998
$1.5 billion for soybean refiner Protein Technologies International	$1 billion to buy Holden's Foundation Seeds, Inc.
$2.6 billion for Merck's stake in DuPont Merck drug joint venture	$525 million to buy Unilever's wheat breeding business
	$1.4 billion to buy Cargill's foreign seed operations
	$30 million to buy 49.9% stake in Calgene††

† Pioneer Hi-Bred sues Monsanto for breech of contract related to the takeover.

†† Calgene shareholders sue Monsanto because of unfair practices during the takeover.