

ANNEX C13

PITA Project: Policy Influences on Technology for Agriculture:
Chemicals, Biotechnology and Seeds

Pioneer Hi-Bred International monograph

Annex C13

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Introduction to the PITA Project

Technological innovation in the agrochemical, biotechnology and seeds industries and in associated public sector research establishments (PSREs) has the potential to deliver more socially and environmentally sustainable farming systems and to improve the quality of life of citizens in Europe. This is particularly true of farms on the most fertile land. However, although policies developed in different areas may all aim to improve the quality of life, in practice, in their influence on company and PSRE strategies, they frequently counteract one another and so attenuate the desired effect.

Market-related factors also influence decision making in industry and PSREs, the most important for this project being the policies of food processors and distributors and also public attitudes and opinion, which often set more demanding standards than those of national governments and the EU.

The PITA project (see Project Structure) is developing an integrated analysis of policies and market-related factors relevant to the agrochemical, biotechnology and seeds sectors. The core of the project is an investigation of the impact of these factors on the strategies and decision making of companies and PSREs and the downstream implications of these decisions on employment, international competitiveness and environmental benefits. The final outcome will be feedback of our conclusions to policy makers and company managers.

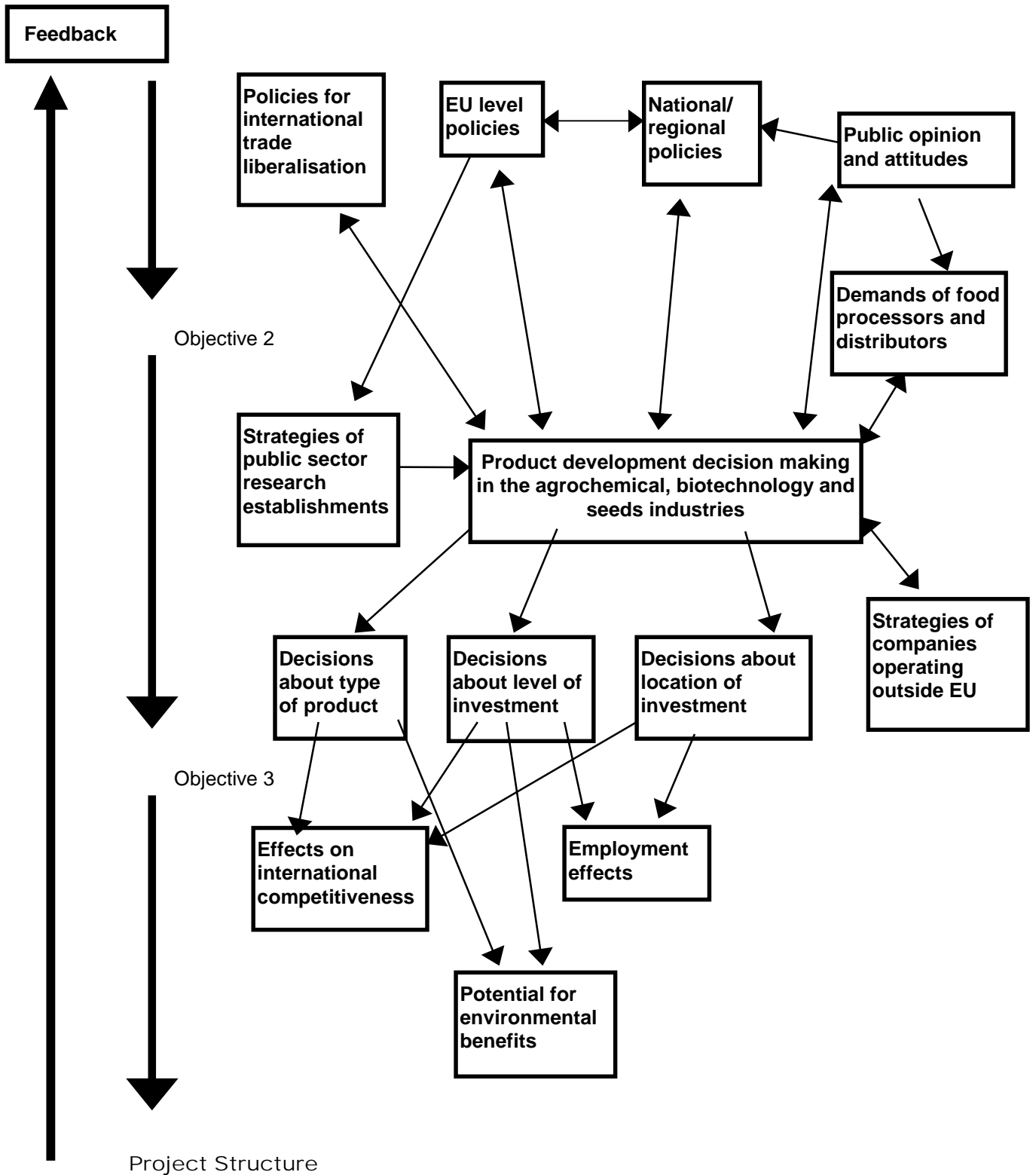
The range of policies and other influences studied includes:

- policies to stimulate innovation in the agrochemical, biotechnology and seeds industries;
- purchasing policies of food processors and distributors;
- policies for international trade liberalisation;
- policies for the regulation of industry and farming (for environmental protection and public health and safety, particularly for pesticides and biotechnology);
- agricultural and farming support policies, particularly for crop production;
- policies to promote environmental sustainability and wildlife biodiversity in arable farming areas;
- public opinion and attitudes.

The overall aim of the project is to contribute to the development of sustainable industrial and farming systems and an improved quality of life by encouraging the development and uptake of 'cleaner' technology for intensive agriculture. Its objectives are:

- to develop an integrated analysis of policies and market-related factors relevant to technological innovation in the agrochemical, biotechnology and seeds sectors, to study their interactions and to develop hypotheses about their impact on strategic decision making in industry and PSREs.
- to study the influence of policies and market-related factors on innovation strategies in the agrochemical, biotechnology and seeds industries and PSREs, and their impact on decisions about product development, levels of investment and location of investment.
- to study the outcomes of the industry decisions investigated under objective 2, in their effects on employment, on international competitiveness and on their potential to deliver environmental benefits.

Objective 1



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1. Introduction

1.1 History

Pioneer and hybrid maize

'Established in 1926 by Henry A. Wallace, Pioneer has been a major actor in the development of hybrid corn seeds in the US. The Wallace family has played also a major role in the political arena : Henry A. Wallace left Pioneer in 1933 to follow his father as Secretary of Agriculture, and later on was elected as Vice President of the US under Franklin D. Roosevelt (1941). Pioneer went public in 1973, but the Wallace family kept the majority until very recently. During 30 years Pioneer and DeKalb were the two major leaders and competitors on the hybrid corn seed market. At the beginning of the 70's each one held 22% of the US market (for hybrid corn seeds). Over the course of the 70's Pioneer and Dekalb applied divergent business strategy: DeKalb diversified in other industries (oil and gas exploration, mining, etc.); Pioneer focusing on the seed market with a slight diversification toward other crops (Soybean and Cereal mainly). Ten years later, Pioneer became the net leader [in the corn seed business] (34% for Pioneer and 14% for DeKalb at the end of the 80's)'.¹

Development in Europe

After the Second World War, Van der Have had an exclusive agreement for the distribution of Pioneer's varieties in Europe. From the 60's until the 70's Pioneer progressively increased its share of the European seed business with various strategies depending on the European country.

In France, this development was made in four stages: (i) in 1963, Pioneer made an exclusive agreement with a group of cooperatives, France Maïs, for the distribution of its varieties; (ii) in 1973, Pioneer set up a joint research unit with France Maïs; (iii) in the 1980's Pioneer and France Maïs built a joint venture (Pioneer-France Maïs) for the selection and the commercialization of varieties for French markets; (iv) in 1994 Pioneer bought all the shares in Pioneer-France Maïs which became its French subsidiary (renamed Pioneer France). Production in France is still managed by the French cooperative (France Maïs Union).

Even though this development is specific to France, expansion of Pioneer in Europe was also usually made on the basis of agreements with local distributors².

Acquisition by DuPont

For a very long time, Pioneer was considered as the untouchable giant of the seed business. From the 80's to the mid 90's, most of its competitors were acquired or themselves acquired others . But no company entered in Pioneer's capital, and Pioneer acquired no other seed or biotechnology companies, devoting all its investment to internal activities.

This situation changed in August 1997 with the announcement of the partnership with DuPont. DuPont acquired 20% of Pioneer's capital and a joint venture (50/50) was created: (Optimum Quality Grain) devoted to commercialize agricultural products with enhanced

¹ This summary of Pioneer history is extracted from April S. Dougal (unfortunately the precise reference is missing).

² On exception is Germany where Pioneer built its own subsidiary.

quality traits. In this agreement, there was a standstill provision that prohibits DuPont from increasing its ownership share in Pioneer for 16 years without the consent of Pioneer.

In March 1999, DuPont and Pioneer announced an agreement by which DuPont acquired 80% it did not already own for about \$8 billions US. This acquisition was fully completed in October 1999.

1.2 Key figures and product portfolio

Key financial figures

Table 1 The key financial figures of Pioneer (\$millions US, 1992-1998)

| | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Total sales | 1 262 | 1 343 | 1 479 | 1 532 | 1 721 | 1 784 | 1 835 |
| Sales in US | 1 015 | 1 092 | 1 270 | 1 271 | 1 435 | 1 626 | 1 818 |
| Sales in Europe | 235 | 259 | 228 | 349 | 287 | 391 | 349 |
| Inter-geographic sales | -181 | -214 | -230 | -277 | -323 | -473 | -582 |
| Sales of hybrid maize seeds | 1 013 | 1 077 | 1 185 | 1 227 | 1 377 | 1 385 | 1 393 |
| Sales of Soybean seeds | 109 | 117 | 127 | 145 | 164 | 208 | 232 |
| Other crops seeds and products | 140 | 150 | 165 | 160 | 180 | 191 | 210 |
| Operating income | 243 | 225 | 346 | 280 | 347 | 363 | 359 |
| Net Income | 152 | 120 | 213 | 183 | 223 | 243 | 270 |
| R&D Expenses | 92 | 105 | 114 | 130 | 136 | 146 | 155 |
| Number of employees | 5 016 | 4 807 | 4 847 | 4 924 | 4 700 | 5 000 | 5 000 |

Note :

- Fiscal year ends on August 31
- Sales in US and EU do not take into account the inter-geographical sales.

The distribution of the sales worldwide is: 70% in US, 20% in Europe, and 10% elsewhere. This distribution has been very stable during the 90's.

Product portfolio

Seed corn : Pioneer's product portfolio is essentially based on seed corn which represents now 75% of total sales . The list of varieties is large. Pioneer is the world leader in corn seed with 42% in North America (in 1998) and strong in Southern Europe³.

Other crop seeds: Sales of soybean seeds have been growing twofold since 1992, and this part of Pioneer's business is becoming major. Most of the Soybean seed is sold in the US. Pioneer is the leader in Soybean seed with between 16% and 18% of market share. The other seed products sold by Pioneer are Alfalfa, Sorghum, Wheat and Sunflowers. These four crops represent 8% of total sales in 1998.

Other products: At the end of the 1970's Pioneer acquired a small US company which was leader in microbial products. The interest for the company is that forage additives are complementary with the sale of corn seed for silage. Even though this activity represents only 2% of the total sales of the company, Pioneer is today the world's biggest supplier of forage additive. This activity includes also the sale of microorganisms for other purposes such as

³ In Europe, Pioneer is the leader in the south where American material is the most adapted; Pioneer is not the leader in northern Europe where the leaders are mainly European based seed companies (Limagrain, KWS).

soil, animal feed (see box 2 for an example of such a product for animal feeding). In 1997, vegetable seed activity was sold because it was not beneficial.

Distribution by type of trait. Most seeds are standard but since 1997, the business of specialty crops was enhanced, in particular with the creation of Optimum Quality Grain. Since the acquisition by DuPont, Optimum Quality Grain is a fully owned subsidiary, and has been renamed recently DuPont Speciality Grain.

GM products. From the end of the 1980's until 1999, Pioneer was responsible for 10% of all US field tests of transgenic crops⁴ (Ditner and Lemarié 1999). In 1999, one third of Pioneer's catalog was genetically modified varieties (Bt and/or Liberty Link). Pioneer also sells RoundUp ready soybean varieties. These transgenic events are licensed from other biotech companies. In 1997 Pioneer announced that it would not commercialise RoundUp Ready corn, because no possible licensing agreement could be made with Monsanto⁵.

The events currently in Pioneer varieties are not the property of Pioneer, but are obtained through license agreement. However, Pioneer will soon be able to release varieties with proprietary events, the main one in the short term (2001) being a GM corn resistant to rootworm (obtained from a collaboration with Dow Agrosience).

Acquisition

Pioneer has acquired relatively few assets, all of them in the biotech business:

- Allelix Crop Technologies : assets purchased in December 1990.
- Mycogen (1995) : Pioneer acquired a minor participation in Mycogen (3 million US\$) . The shares were sold to Dow Agrosiences in 1998.
- Acquisition of research programs : Plant Cell research Institute's RFLP program (3/91), the Native Plants Inc. RFLP program (4/91).

2. Corporate and research strategy

2.1 The original corporate strategy : high yielding maize (corn)

Pioneer was one of the first companies created at the very beginning of the diffusion of hybrid corn. Pioneer's strategy, from its creation to the end of the 80's, can be summarized in 5 main characteristics :

1. *A business centered on seed corn with only internal growth.* Pioneer growth in the seed business has been only internal (no acquisition). Its diversification into different crops has been very small, the recent sale of vegetable activity being a interesting indicator of this strong focus.
2. *The central role played by research.* Pioneer's success is first of all based on its ability to provide enhanced varieties. This strategy is based on high investment on research activity (about 8% of the total sales in the recent years). *"Pioneer has been driven by research for a very long time, and is still a company in which research plays a prominent role. It means that, compared to other departments such as the marketing, the research department has had the last word for a long time"*. For a long time also, Pioneer's CEO has had research background.

⁴ This figure is equivalent to all the tests made by the American Universities. The only firm which made more tests was Monsanto (including subsidiaries: Asgrow, Calgene and Dekalb), with 38% of the total number of tests.

⁵ Pioneer justified its position in a letter to the farmer, explaining that the agreement with Monsanto would not be in the interest of the farmers *"In our opinion Monsanto's demands would limit our customers' ability to access a complete package of product traits and technologies"*.

3. *A highly focussed and worldwide research strategy.* The research strategy has been highly focussed on agronomic traits for corn. Pioneer is famous for having one of the best collections of corn germplasm in the world. The research strategy is described in greater detail below.
4. *Close relationship with farmers.* The distribution system of Pioneer's seeds in US is an interesting indicator. In US, Pioneer distributes its seeds by representative farmers and not by distributors. This strategy enables the company to provide very accurate information on each new product. One of the interviewees underlines that this aspect has taken more importance in Pioneer's strategy during the last 10 years because it is no longer possible to be a leader by only saying "*my variety gives 3% more than the others*". In Europe, even though the distribution system of the seed is different, Pioneer discourse underlines the importance of having a direct link to the farmers. The objective is not only to be able to provide the seed *per se*, but also adequate information on the way to use these varieties (technical farming practices), and complementary product (other crop seeds, silage additive, etc.).
5. *A strong property right policy.* Pioneer devotes significant investment to protect its innovation and defends its property rights. In the US, since the beginning of 80's all the main lines of genetic material has been protected by patent. Pioneer has undertaken legal action against its main competitors (Holden, Dekalb, Asgrow, Cargill) with the claim of imitation. "*the investment in protection of our invention is very important because we can hardly afford to compete with ourselves*". In the same vein, Pioneer was one of the main defenders of the introduction of the notion of essential derived varieties in the Plant Breeders Right, through the revision of the UPOV convention at the beginning of the 90's.

2.2 Recent changes in corporate strategy

In the last decade, the original strategy described before has been slightly modified on three aspects:

- Functions other than research are now playing an important role in the elaboration of corporate strategy, leading to a less research driven picture. The three last CEOs (Thomas Urban, Charles Johnson and Jerry Chicoine) have not a research but a financial background. The matrix structure, in place since the beginning of the 90's, gives more weight to some functions which were previously split in different regions (see below).
- Since the beginning of the 90's research objectives have broadened to include not only agronomic traits but also quality traits. The first experience on this topic was the creation of "better life grain" trademark. The company also created an internal structure devoted to this topic : NIM (Nutrition & Industry Market) in a first stage (1995-1997), and then Optimum Quality Grain (joint venture with DuPont created in 1997). The focus on quality traits is viewed as very complementary to the focus on agronomic traits, because quality trait product has to have parity yield with the main variety in order to be adopted by farmers.
- The relative importance of Soybean compared to Corn has been increasing.

2.3 Research strategy

The objective of research strategy regarding traits reflects the objective of the research strategy mentioned before. For one of the interviewees [K]:

"The strategy now can be summarized by "increase productivity", which means :
(i) increase yield (and more precisely harvestable yield), (ii) diminish production cost (by improvement of input traits such as diminishing herbicide cost, introduce insect resistance in plants), and (iii) increase the value of grain."

The organization at the worldwide level leads to a leverage effect: investment in genetic progress is more profitable when the variety can be sold on a very large scale (different

countries). In other words, worldwide organisation enables capture of a larger part of the spillovers. Note that this leverage effect can hardly be captured by delegation (i.e. license agreement with a local seed company): the innovation in a given trait needs to be introduced in a variety adapted locally, and consequently, an investment in research is necessary to adapt the general innovation to local conditions.

The leverage effect is more important, the more the company invests in generic programmes. Three main generic programmes have been developed progressively:

- Central management of genetic resources. Pioneer is known for having one of the best collections of genetic resources for corn in the world. Because of its organization at the worldwide level, the company has been able to gather and evaluate precisely these resources. Moreover, Pioneer participates in several projects oriented toward the preservation and the evaluation of corn genetic resources (LAMP⁶ in Latin America with the CIMMYT, PPS⁷ in France with INRA).
- Investment in information technology. Since the 1980's Pioneer has progressively set up an international network of information, which enables a more intensive valorisation of genetic material (Harvard Business School 1993).
- Investment in Biotechnology. About 300 researchers are currently working in biotechnology research in Pioneer. Pioneer owns different key patents in this area, and is reputed for having key patents and competencies on the knowledge frontier. At the beginning of the 1990's Pioneer made several acquisitions of biotech assets : Allelix Crop Technologies; the Plant Cell research Institute's RFLP program, the Native Plants Inc. RFLP program. This leadership can also be seen through the series of research collaborations between Pioneer and biotech companies such as Affymetrix, Mycogen, Curagen, Oxford GlycoScience and Maxygen (see appendix A).

More precision on the organization of the research activity will be given below (section 3.2).

Each interviewee was asked to explain the specificity of the research in Europe compared to the US.

[L] "Pioneer has an aggressive research strategy in Europe, based on products developed elsewhere."

[P] "The US market is larger than the EU market. Consequently, many initial developments devoted to US are incorporated in EU late-maturity groups. I participate in a committee with representatives from research and marketing. The discussion can lead for example to underline the need to integrate a particular trait in earlier-maturing material. This is the case for example with the Bt Corn. The problems with European Corn Borer are more widespread in Europe compared to US (in term of maturity group)."

[M] "Products are developed in North America, but they are trialed for research in Europe. For Corn (the main product in Pioneer) the broad strategy is more North America oriented. But, for Sunflower and Wheat which are more European specific, the research is mostly oriented toward Europe. For these cases, research is EU biased."

These quotes can be interpreted as follows:

- (i.) Pioneer has been increasing its investment in research in Europe for the last decades. Starting from delegation of varieties during the 50's, Pioneer progressively created agreements, joint venture, and now owns entirely most of its representative companies in Europe. Pioneer investment in Biotech is

⁶ LAMP : Latin American Maize Project.

⁷ PPS : Programme Population Source.

concentrated exclusively in US, but the European proportion of the staff for the other research (product development, characterization and commercialization) is approximately 20%. Note that this proportion is approximately equivalent to the proportion of sales made in Europe (cf. table 1).

- (ii.) A US bias : Pioneer main products are corn and soybean which are the two main crops in US. For corn, which is a major crop both in US and in Europe, the strong emphasis on the US market is due to the major proportion of sales made there. Moreover, the main criteria for success of varieties are very similar compared to Europe. Such a situation gives rationale for the leverage effect under worldwide organization of research. Interestingly, it can be seen that Pioneer is the leader in Europe for late maturing species which has an equivalent in US. For the earlier maturities, Pioneer is behind European based companies such as Limagrain.

When analyzing the structure of corporate activities (cf. section 3.1. and appendix III for the list of vice-president), it can be observed that decision making is based in US (including the vice-president for Europe).

- (iii.) A series of cases shows however that Pioneer has devoted significant investment in research for products with more importance in Europe compared to northern America. These products correspond to crops such as Sunflowers and Wheat, or to specific quality traits such as High Oleic Sunflowers (about 50000 hectares in France) or the Low Phytate corn (in development, see box 1). These last cases of specific quality traits are interesting for two reasons: (i) they indicate the capacity of Pioneer to develop an Identity Preservation system with local partners in Europe, (ii) they correspond to the strong emphasis of the company on developing quality traits, as mentioned before.

2.4 The acquisition by DuPont : origin and consequences

The acquisition by DuPont can be explained by three main factors (from Mr Z interview):

- For the success of the orientation toward enhanced quality trait, it became crucial to establish partnerships, in particular for control of outlets.
- The R&D budget of Pioneer increased by 50% between 92 and 98, mainly because of the focus on biotechnology. Pioneer made the statement that it would not be able to continue alone. Several research agreements had been made to solve the problem, but the merger with DuPont biotech research presented much more interest to Pioneer.
- The third generation of shareholders were coming to the front with different visions compared to the preceding ones.

Moreover, the context for seeds businesses became more difficult, in particular since the acquisition of DeKalb and Holden by Monsanto.

Before the acquisition of Pioneer, DuPont was not in the seed business, and Pioneer becomes DuPont's subsidiary for this sector. In other words, DuPont will certainly base its strategy for seeds on Pioneer. The major change occurred at the research level with the merger of the two programs in biotechnology. Finally, the interviewee generally recognized that it was too soon to see if Pioneer's strategy in the seed business could be modified because of acquisition by DuPont. Two main conjectures were made. First research strategy on quality traits for certain crops would probably need to be made in collaboration with some subsidiaries of DuPont, such as PTI (Plant Technology International, a world leader in the extraction and processing of Soybean protein). Second, the discourse on the environment from Pioneer will probably be strengthened because of DuPont experience.

3. Organization and decision making

3.1 Organization at the corporate level

Since the beginning of the 90's, Pioneer's organization at corporate level is based on a matrix structure. The different activities are either part of an operating unit or in a corporate activity (figure 1):

- The *operating units* correspond to geographic areas: North America, Europe, South America, Asia. The units may be subdivided in sub-units, the Europe unit having 4 sub-units: Central EU, Southern EU, Northern EU and France. The operating units manage mainly two types of activity: sales and administration.
- *corporate activities* are organized on a worldwide basis, in order to benefit from a leverage effect. The main corporate activities are: R&D, Supply management (seed production), information technology, marketing and finance. In a corporate activity, the people in France, for example, report directly to the US.

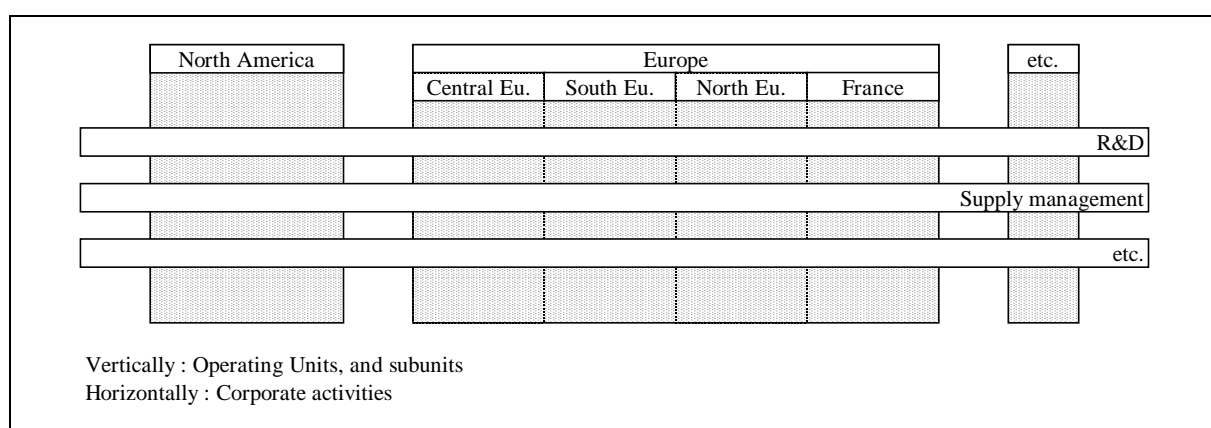


Figure 1 Organization at the corporate level in Pioneer

The director of each operating unit or corporate activity is the corresponding vice-president (see appendix III for the list of corporate officers). Interestingly, one of the interviewee noted that this structure attenuates the weight of research activity in corporate strategy. Corporate activities such as supply management or information technology gained relatively more power. The weight of business units is important because they represent large regions, and possibly regroup different subsidiaries in several countries. To summarize, this structure leads to the formation of large units with greater negotiating power, compared to the R&D.

Regulatory affairs activity is important for the purpose of PITA. Rod Townsend is director of this activity. The two main groups are based in Des Moines (for northern America) and Brussels (for Europe), and they work in close connection. The group for Europe (i.e. not only EU) includes 4 main managers (plus technical support) and covers three main activities:

- Biotechnology and non-biotechnology regulation related to the seed industry (market approval process).
- Policy issues related to innovation: intelligence activity, and analysis of policy formation.
- Communication (both internal and external).

More details concerning this activity will be presented in the next section (4.2. perception of public policy). Note that property rights activity is not managed by this group⁸, but issues concerning test and market approval of GMOs (90/220 part B and C) are managed by this group.

3.2 Organization of research activity

As mentioned before, research is a corporate activity and organized at the worldwide level, based on about 100 research and experimental stations. Pioneer R&D budget was \$155 million US in 1998.

It is divided in three main groups:

- Technology and Trait Development (TTD). This group works on gene discovery and the development of enabling technology. It is based mainly in Johnston (Des Moines area, USA). The TTD research is now part of BioSolution, and merged with the biotechnology group of DuPont based mainly in Wilmington (Delaware). The Pioneer biotechnology group represents about 300 persons, an equivalent size to that of DuPont. The joint biotechnology group will have an annual budget of about \$400 million US.
- Product Development (PD). This group works on plant breeding in order to develop new breeds⁹. The group gathers between 100 and 150 persons (20% of them are in Europe), and about 50 research station develop new breeds.
- Product Characterization and Commercialization (PCC). This group works on the development and the test of new hybrids (for corn) or new variety. About 600 persons work in this group, 20% of them based in Europe.

Pioneer being the only seed company in DuPont, the PD and PCC groups will continue to be managed at Pioneer.

The PD and PCC work jointly to create new varieties. Generally, a new variety results from six years of research: 3 years in the PD group and then 3 years in the PCC group. In some particular cases, coordination between the different groups is also made on a project level. Such projects are: insect resistance, herbicide resistance, enhancing grain quality. Such projects involve researchers from the three different groups (TTD, PC and PCC). The management of the project is based on regular meetings between representatives of each group, and there is no particular persons responsible for the project.

3.3 Organization within DuPont

The life science activities in DuPont have been divided into two main divisions since 1998: the Pharmaceutical division and the Agriculture and Nutrition division. These two activities are very independent in terms of research.

Agriculture and Nutrition was originally based on crop protection products. This division has been developed recently with a series of acquisitions :

- Pioneer HiBred acquired fully in 1999
- Optimum Quality Grain, a subsidiary (previously a joint venture between DuPont and Pioneer) dedicated to develop agricultural products with enhanced quality traits.
- Hybrinova, a French hybrid wheat seed company, purchased in 1998.

⁸ By property right activity, we mean day to day management and defence of the property right of the company. Conversely, the regulatory affair can be involved in the negotiation concerning evolution of property rights (for example, Rod Townsend was involved in the negotiations of the UPOV revision).

⁹ inbred lines are the parent of the hybrid.

- Protein Technology International (PTI), purchased in 1997. PTI is a global leader in the supply of soy protein and applied technology to the food and paper processing industries.
- Cereals Innovation Centre (CIC) purchased in 1997.
- Qualicon, a subsidiary dedicated to improving commercial diagnostics in food, pharmaceutical and personal care (created in 1997, after 8 years of incubation in DuPont).
- The strategy of the Nutrition and Health sub-division is defined by the term "BioSolution".

3.4 The committees

The major committees (for our purpose) at Pioneer level are¹⁰ :

- A Management Committee at the corporate level, with vice presidents (Jerry Chicoine, Franck Ross, John James, Peg Armstrong-Gustafson, Wayne Beck, Jim Miller, and Leon Shearer)
- A Management Committee linked to the Operating Units. In Europe, this committee is named EMC (Europe Management Committee). The members of the EMC core group are the regional management persons, and representatives from some of the corporate activities (finance, marketing and research). The EMC larger group include, among others, a representative from the Government and Public Affairs group.
- The biotechnology team is based in US, and deals with most of operations issues in Pioneer. The biotechnology team has a representative from Government and Regulatory Affairs.

At the DuPont level, two other major committees dedicated to biotechnology issues are also important for our purpose:

- Dupont Biotechnology Core Team deals with most of the strategic issues concerning Biotechnology. This team gathers functional people on the one hand, and government affairs and business people on the other hand (Yolande Peeters, Jeffrey S. Kelley, and Herve de Trogoff from Dupont, Yves Goemans from PTI, and Tim Stocker from Pioneer).
- Dupont Biotechnology Acceptance Team is organized at the European Level, and chaired by a member of the biotechnology core team.

Within the BioSolution division of DuPont, there is a BioBoard and a BioStrategy team. The BioStrategy team gathers the boss of each company within BioSolution.

4. Environment and public policy

4.1 Concept of clean technology and the discourse of GMO acceptance

The initiatives in Pioneer related to this issue are:

"Environment stewardship is a very important issue in Pioneer. The company is very sensitive to the effect of its product on the environment. For example, we organized several conferences on this issue for the staff of the company". [M]

At the beginning of the 1990's Pioneer was conscious that it did not have a corporate policy related to the environment like other major companies had by that time. The initiative had several forms:

- The creation of an Environment Task Force, involving some employees from Pioneer and external experts¹¹.

¹⁰ The list of vice presidents and their respective roles is detailed in the appendix III.

¹¹ See the Harvard Business School 1993 report for more details.

- The organisation of a series of conferences in the US. The first conference gathered 300 people, most of them from Pioneer (senior level audience). The issue of the environment was addressed both from Pioneer and the government perspectives. A series of regional conferences was then organized (in US) with a increasing proportion of people from the outside. Pioneer made efforts not to discriminate external participants. For one of the organisers of this initiative, who we interviewed, *"We saw the role of catalyst that our company could play, especially for a lot of local issues" [L].*
- The initiative ended with the elaboration of a corporate position adopted by the board of directors, and a large communication around this event.

No mention of environmental issues is made in the different annual reports. However, all the interviewees agreed on the importance of this issue.

Three main examples of innovation corresponding to cleaner technology were mentioned during the interviews:

- Any technology which leads to a decrease of pesticide load. This could be a chemical with less effect on the environment (for example with same efficacy at lower rate). It could also be a variety with better resistance to pest, or resistance to herbicide with less effect on the environment (e.g. Round Up Ready varieties). On this topic, one of the interviewees mentioned that *"the general discourse on the environment is generally biased because people do not take the total load into account" [K].*
- A product which facilitates the management of manure via animal feeding. One example of such a product is the Low Phytate case, currently developed by Pioneer (see box 1).
- A product which leads to better drought resistance. For one interviewee, *"Drought tolerance is less sexy, but it is a good example. Water consumption is very important in Spain and Central Europe. This need does drive the development of corn which is very sensitive to water availability" [P].*

The issue of environmental effect of GMO's was discussed in detail with one of the interviewees.

- Concerning Bt Corn. "I will never say that the resistance of ECB can't appear. Our concern is "how to prevent it from occurring?". And we have been investing to provide an answer to the question" [K]. Pioneer has been investing in the elaboration of protocols for Insect Resistance Management. The refuge system is applied in US (even if it is not mandatory), and will be in Europe.
- Concerning herbicide tolerant products and the risk of gene flow. *"We have an equivalent position: we assume it can happen. It's unlikely but I will never tell you "it would never occur"" [K].* He also underlines that most of the hybrid coming from that cross will be sterile. *"However our position is to propose diligent and responsible crop management programs based on two factors: crop rotation to make sure that farmers wouldn't grow Canola every year; and herbicide rotation" [K].*

The general discourse on the environmental friendly product and the GMO's

Several key elements were visible through the general discourse of the interviewees on the environmental issue. They can be summarized by four general ideas.

1. The need to have practices compatible with the economic context.

The need to maintain agricultural productivity was very important in the general discourse of most of the interviewees. On this question one interviewee underlines that *"the company is very agricultural oriented, and has a very good understanding of agricultural needs" [M].* In other words, even though it is accepted that stakeholders are not the only actors involved in the product production process, it is important to be conscious of consequences for those actors directly affected by the change. An interviewee also underlines the negative effect which some extreme measures might have on equilibrium at the macro level *"Some groups are proposing to have more pasture. The problem is*

that we will have less food, and it will have a major destabilizing effect, in particular on less developed countries" [L].

Finally the following quote provides a good summary of the definition of the environmental friendly product within Pioneer:

"It is a relative notion. An environmental friendly product means a product that has better effect on the environment than what it replaces. It leads to production, which needs less herbicide, less insecticide, less fertilizer, less water, less sunlight. Generally, it means that they use the same sources in a more efficient way (.../...) It is important to have more environment friendly practices, which means that we are moving in the right direction". [L]

2. The agreement on an increasing concern about the environmental issue

This aspect is particularly underlined by the interviewees involved in regulatory affairs. One of them considered that it is a big concern, and they regularly informed management about it.

The main trend commonly acknowledged by the interviewee concerned animal feeding and animal waste. Such an anticipation was made several years ago in Pioneer, and was linked with the stress put on projects like the low phytate corn (see box 1) or the PDFM (see box 2).

One of the interviewees underlines that this is not only an internal problem to Europe. It is also an issue for international trade : *"the days where the world trading is based on strict economic factors are gone". [M]*

3. This hysterical climate of discussion and the lack of common ground

During 1999, Pioneer and DuPont worked jointly on this issue.

"We are working with DuPont on this issue and have meetings with environmental advocates. It took place in EU and US within the last 6 months. The topic was specifically the new technology. It is a one to one talking with key environmental groups. There is discussion, but there has been no improvement until now. The goal is first to have a solid relation between Pioneer-DuPont and respected environmental groups. Then, we will look to other partners within the food chain." [L]

The same interviewee makes a series of statements:

"

There is no meeting of the mind between companies and the strong environmental movement.

- The green movements in EU focus on zero impact, and promote the old traditional ways.
- We would like to address the issue around the strict environment problem. If the problem is to produce food with reduced environmental effect, we are ready to speak. If the problem is to stop modern technology, there is no way to have a dialog.
- Our company has much more in common than what we are observing." [L]

The disagreement lies on three main factors:

- The lack of clear (or at least predictable) agenda. One of the interviewee involved in Government affairs ironically started his answer by saying :

"The environment issue: something I am not sure I know what does it means precisely!" [M].

- In some cases, the feeling that decisions are driven by political motives and have a low scientific or economic basis :

"The issue concerning animal feeding will evolve rapidly because of the establishment of David Byrne in Brussels. He has a lot of concern for feed and food, sometimes putting science on the side, because public relations plays a key role" [Y].

When talking about the EU position on marker genes in transgenic varieties: "This is not a science based decision, but a political decision. This decision has impacted years of research, but we have accepted it. Our main problem is "what is next?" " [L].

" More broadly, on the use of GMO, I am very critical about government responsibilities. Everything happens as if there were no concern (no encouragement) of having an efficient industry. Long term questions seem not to have a great importance in the current political decisions." [M]

- The effect on the economic context. As mentioned before, interviewees underline the need to have compatible practices with the economic context, and consider that the environmentalist movements are not conscious of the complete effect of what they are suggesting.

4. The different perspectives linked to the environment in Europe, compared to the US

Generally, the interviewees explained that a series of historical and geographic arguments explain the different perceptions in Europe compared to the US.

"My colleagues in US are sensitive to the problem but the issues are different. The scale of agriculture and landscape are so different. In US, there are broad areas dedicated to agriculture, while in EU, agriculture is more included in the landscape" [M]

"Environment is not a marginal question in the US. When there is a need to move away from farming the slopes, or to take care of the river basins, it is enforced. These are actual measures and not only declaration of intention". [Z]

In general, the issues related to the environment in the US are more related to soil erosion, pesticide residues, while the issues related to the nitrates are more important in Europe.

4.2 Perception of public policy

The discussion here is limited to European public policies.

The approval for innovations

The European system for approval of innovations is seen as complex, leading to important time delays, and is unpredictable. There was a general agreement among the interviewees to say first that this aspect of the public policy is the most critical one for the company, and second that policy evolution concerning this question will have an important impact on the corporate and research strategy.

According to one of the interviewees, the time delays are already too long for conventional varieties (two years of testing are required before registration on the official catalog). In his view, it leads to a competitive disadvantage of EU farmers.

But the most important criticism concerns market approval of GMO's. The position of some governments such as France is considered as unacceptable because of its total opposition to transgenic crops, and the absence of concern for long term economic issues.

As mentioned before, policy evolution is seen as very unpredictable.

Concerning this aspect of policy, the interviewee generally considers that a company like Pioneer has a role to play in the elaboration of policy. Such a role is illustrated in the non-controversial case of the PDFM (see box 2). To a large extent, this role is played by people from the Government and Regulatory Affairs, through their policy formation activity.

"Before lobbying we need to define what the company policy is, and to do so, we need to define it in the context of a policy framework. For example, in the present European situation, there would be no interest to have a position such as 'There should not be labeling'. We know that we have to address this issue, leading to a solution such as 'The labeling should be in such a way'. ". [M]

Other public policies

The effect of the Common Agricultural Policy is presented with two perspectives: the effect on product profiles and the effect on crop acreage.

The experience of the CAP reform at the beginning of the 90's leads to the observation that CAP has no dramatic influence on product profiles (i.e. the type of trait which make the variety successful).

The effect on crop acreage cannot affect innovation in the short run, because they are already defined. In other words, the precise evolution of level of subsidy is hardly predictable, and the company can only adapt its research strategy through a reallocation of programs in the experimental station, or even change in the geographic position of the experimental stations. This is not considered as having a major influence on research strategy. The effects of Agenda 2000 are the following: a slight downward pressure on corn in the EU, but probably compensated by expansions in central Europe; an increase of wheat acreage; and a decrease of oilseed (sunflower and oilseed rape).

One of the interviewees mentioned other long term changes in the European agricultural landscape which will probably be more important than the short term effect on crop acreages:

- A continuing trend toward farm consolidation because of decreasing subsidies. This does not happen quickly because it is generally linked with generations.
- An evolution in the distribution system for the farm inputs. The general trend is increasing concentration and increase in trans-border activities, because of diminishing subsidies and the Euro.
- EU enlargement. The price harmonisation and the reduction of the trade barrier between the two regions (eastern and western countries) will have an impact on crop production planning in Europe.

Questions concerning STI policies were asked, but the interviewees considered that it has no significant effect.

5. Conclusion

Pioneer is recognized as the worldwide leader in plant breeding for Corn and Soybean. Such a success can be explained by two main reasons: (i) a very focused corporate strategy, since its creation in 1926, on innovation through plant breeding (mainly for corn); (ii) a worldwide organization which enables a leverage effect of research activity.

During the last 20 years, Pioneer has been able to keep this technological leadership in the seed business through a series of adaptations such as the integration of information technologies, and integration of molecular marker techniques. Pioneer has also been able to maintain a good understanding of agricultural needs, through several main adaptations: the ability to provide not only a bag of elite seed, but also a set of information to enhance its use;

the ability to promote not only input trait but also output trait innovation; and (to a lesser extent) the ability to create environmental friendly innovations.

The focus put on biotechnology and value added traits, on the one hand, and the consolidation of the sector, on the other hand, explain why the company recently accepted the acquisition by DuPont. The interviewees recognized that the event is too recent to have a clear idea of the effect of this acquisition on Pioneer's organization and strategy.

The environment issue is recognized as important, with an increasing trend worldwide. The problem of the diffusion of GMO's in Europe is seen as a critical issue. The quote below provides an interesting synthesis

"Companies have a long term interest in the success of the technology. The central problem is a problem of timing and tempos: there is a need for local testing and understanding. With the current policy framework, it is not clear who will bear the cost of a system which is non receptive to the technology." [P]

- Timing and tempos. Because of the important time delay, the company has to be able to make relevant anticipation of the evolution of public policies, especially for innovation approval. In other words, the coordination of the agendas of the different stakeholders appears critical. Two cases of innovation in a non-controversial area shows that relevant anticipations could lead to interesting innovations in the environment issue.
- A need for a predictable long term evolution. The current political position is seen as not driven by clear economic or scientific arguments. The role of policy makers in Europe are criticized. Pioneer and DuPont are currently making efforts to find common ground for a discussion with environmental advocates, but without any success until now.

Box 1. The low Phytate corn

This case is one of two early innovations developed by the NIM (Nutrition and Industry Market) Group, partially replaced by Optimum Quality Grain. The group identified Phosphorus as a key element in the management of pollution due to animal waste. The anticipation was that this element would drive most of the EU regulation.

Phosphorus has different forms, with different levels of digestibility. The Phytic acid (or Phytate) is especially non digestible, and consequently the more phytic acid is present in animal nutriments, the more Phosphorus is present in animal waste. One of the strategies used for solving the problem of Phosphorus in animal waste was to find plants with reduced phytic acid. One of the main technical problems was the role of the Phosphorus in the development of the plant, especially at early stages (seed germination, early growth). The solution was to find or breed plant. By screening the collection of genetic material, the researchers found a natural mutant with equivalent level of Phosphorus, but reduced level of non-digestible forms such as Phytic acid. This mutant was then breed with elite material, and about 5 hybrids have been developed and tested for productivity and animal feeding.

This innovation is protected by breeder's rights. Pioneer is currently going through the testing system, in order to check the values concerning agronomic traits, and ensuring that the low phytate trait is in a germplasm with parity yield. Pioneer also made a series of marketing tests which revealed a significant interest from farmers. Even though parity yield is obtained, success of this innovation is difficult to value (in direct economic terms) for several reasons. First, the higher proportion of digestible form of Phosphorus enable the farmer to decrease the level of extra-Phosphorus in the ration, but the cost saving is very low. Second, the diffusion needs to set up an Identity Preservation (IP) system. The major area of pig production in Europe (Catalogna in Spain, Netherlands, Denmark, and UK) imports Corn. It means, that the production of corn on the farm is not enough for the feeding of pigs. Consequently, the low phytate corn exported to these region needs to be segregated. Nowadays, the farmers have no real incentives to pay the extra cost linked to this IP system, because the low phytate corn will not increase their productivity. The main solution for the diffusion of this innovation is twofold : to sell

the product in some region (e.g. Italy) with sufficient production of Corn, with no need to set up a IP system (the production of Corn for pig feeding is made on the farm); to have an evolving regulation which recognizes less pollution when using low Phytate corn, and which allows higher density of pigs.

Box 2. The PDFM

The Pioneer Brand PDFM (Protected Direct Fed Microbial) feed granules are used for poultry feeding in replacement of antibiotic additives, for the stimulation of animal growth. This product was created by the branch of Pioneer which works on microorganisms (mainly for soil and forage). At the origin, Pioneer forecast a change in regulations concerning animal feeding. However, 10 years ago, it was not possible to register such a product in the EU. Pioneer approached a member state (UK) on this issue, and participated to the elaboration of a text for changing the regulation. This registration process took three years and a half. The product is currently commercialized.

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Appendix I

Research alliances of Pioneer

| Partner | Date | Object | Source |
|-------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Plant Genetics Systems NV | | Genetically engineered vegetable seeds, licensing agreement | Bioscan |
| Monsanto Co. | | Licensing agreement for the use of Round-Up ready gene in Soybean | Bioscan |
| Ecogen Inc | 04/91 | Seed corn containing Ecogen's Bt genes, licensing agreement | Bioscan |
| Zeneca Mogen | 02/94 | fungal resistance technology, collaborative research and licensing agreement | Bioscan |
| Monsanto Co. | 12/95 | YieldGard insect-protected Bt corn, licensing agreement | Bioscan |
| Mycogen Corp. | 12/95 | Agricultural seeds for corn, soybean, sunflower, canola, sorghum, and other crops with Bt-based insect resistance, joint development agreement (51 M.US\$) | Bioscan |
| USDA/ARS | ≤96 | Introduction of a low-phytic-acid trait in Pioneer inbred line | Agnet (12/96) |
| Human Genome Sciences, Inc. | 01/96 | Corn genome, collaboration agreement | Bioscan Agnet (02/97) |
| Ridgetown College | 96 | Use of low-linolenic soybean variety worldwide (except Canada) | Agnet (01/97) |
| Japan Tobacco Inc. | <97 | Research license agreement concerning the application of the Agrobacterium Super Binary Vector (SBV) and related technologies to the transformation maize and sorghum. | Agnet (09/97) |
| Kimeragen Inc | 03/97 | Agricultural applications of Kimeragen's gene enhancement technology, licensing agreement | Bioscan Agnet (03/97) |
| DuPont | 03/97 | Research agreement permitting Pioneer to test and potentially market seed capable of producing DuPont Optimum High Oil Corn | Agnet (03/97) |
| Affymetrix, Inc | 04/97 | Agricultural research, feasibility collaboration | Bioscan |
| Case Corporation DowElanco | 06/97 | Collaboration on learning and determining how the interactions of various farming practices, inputs and environmental conditions can be collected, processed, and turned into information to help farmers make better crop production decisions. | Agnet (06/97) |
| USDA/ARS | 06/97 | Research agreement to discover the functions of certain corn genes recently found and cloned by researchers with ARS and the University of California at Berkeley. | Agnet (06/97) |
| CuraGen Corp | 06/97 | - Seed and agricultural products, \$25M research collaboration-- Pioneer made \$7.5M equity investment and commitment to fund research for 5 years - Expanded (4/98) Pioneer will double annual funding of CuraGen from \$2.5M to at least \$5M | Bioscan Agnet (06/97) Agnet (04/98) |
| E. I. Du Pont | 08/97 | Genomics and enabling technologies, research alliance, joint venture and equity stake | Bioscan |
| Monsanto Co. | 06/98 | Licensing agreement for the use of Round-Up ready gene in Canola hybrids | Agnet (06/98) |

ANNEX C13

| | | | |
|------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Oxford, Glyco Sciences | 09/98 | Proteomics, research collaboration, proteomics technology, for improving agricultural seed products | Bioscan Aget (09/98) |
| Maxygen, Inc. | 01/99 | Five-year strategic research collaboration. Exclusive application of Maxygen DNA shuffling technology to generate novel gene in the development of specific crop protection and quality grain traits in corn, soybeans, and other crops. | Aget (01/99) |
| Forage Genetics | 04/99 | Agreement to create a new organization (Alfalfa Technology Consortium ATC) focused on promoting, supporting and accessing public sector research on alfalfa technologies | Aget (04/99) |
| American Cyanamid | ≤07/99 | Licensing agreement for the use of ClearField production technology (resistance to the Patriot herbicide) | Aget (07/99) |



APPENDIX II

List of interviews

- Gérard Faure (Contact Person), Directeur Technique, Pioneer Semences (French Subsidiary)
- Ian Grant, Research Director for Corn (EU, South American, Africa, Asia)
- Tim Stocker, Director of Government and Public Affairs group for Europe
- Michael H. Coon, European Marketing Manager, Corn Team Leader
- Peter Hooper, Director, Nutritional Business Support, European Operations
- Steven J. Daugherty, Director of Environment and Industry Relations (US)

All interviews were made face to face, except S. Daugherty made by phone.

5 interviews out of 6 were made in english.

APPENDIX III

Corporate officers (mid 2000)

CEO Jerry L. Chicoine (President)

Corporate activities

⇒ R&D : Richard L. McConnel (Senior Vice-President)

⇒ TTD : Anthony J. Cavalieri

⇒ PD : James E. Miller

⇒ PCC : Jack A. Cavanah

⇒ Supply Management : Wayne L. Beck

⇒ Marketing : Peg Armstrong-Gustafson

⇒ Information Management : Thomas M. Hanigan

⇒ Finance : Frank Ross

Operating Units

⇒ North American Sales : Jerry Armstrong; Robert Wichamnn

⇒ European operations : James R. Houser

⇒ Latin America operations : Paul E. Schickler

⇒ Africa, Middle East, Asia, and Pacific operations : Dean Oestreich

⇒ CIS, Oceania, and Turkey operations : John T. Watson

Other vice-presidents

John D. James (Senior Vice President)

Carrol D. Bolen (Government Affairs and Iso 9000)

Dwight G. Dollison (Finance, Safety, and Risk Management)

Herbert H. Jervis (Intellectual Property Counsel)

Leon R. Shearer (General Counsel)

Karen Pedersen (Human Resources)