

ANNEX C10

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

Limagrain group monograph

Annex C10

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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.

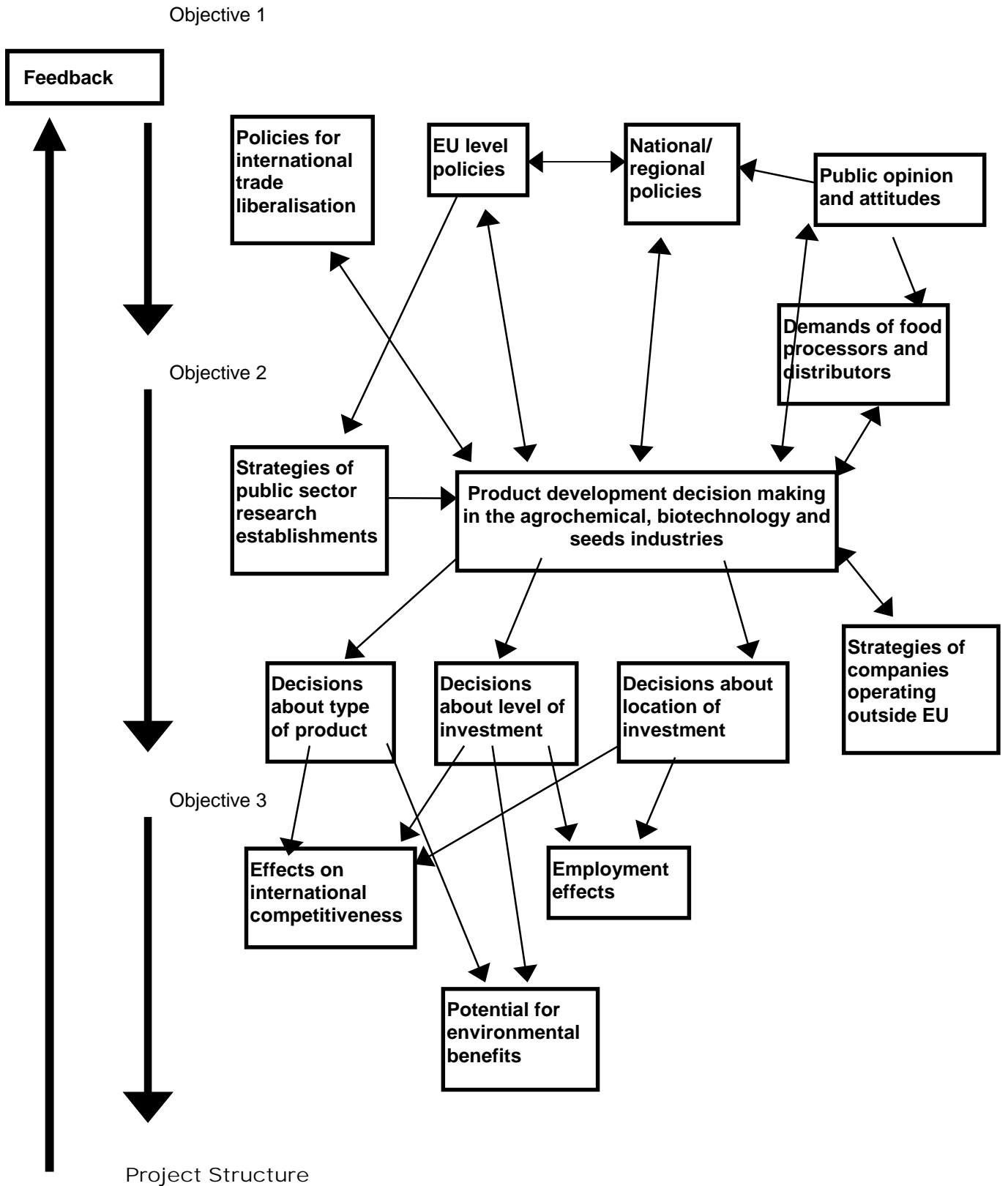
The PITA project (see Project Structure) is developing an integrated analysis of policies and market-related factors relevant to the agrochemical, biotechnology and seeds sectors. The core of the project is an investigation of the impact of these factors on the strategies and decision making of companies 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.



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1. Introduction

1.1 Presentation of Limagrain

Top managers of the company define Limagrain both as an agricultural co-operative from Auvergne and as the first independent seed company. These two characteristics provide a good definition of the particular identity of the organisation.

As a co-operative, the structure is particular in that it is a reversed pyramid¹, with a turnover of 6 billion French francs and 5000 employees serving 500 farmers. The structure is the result of a collective history which saw the sudden development of the co-operative of Chappes from 1971 onwards. Indeed, the development of the LG 11 variety enabled this co-operative of farmers specialised in seed multiplication to take the lead in the maize seed market which was then in a phase of rapid growth. The products of a two-digit growth were then reinvested in R&D and the buying up of seed companies, particularly in the vegetable sector and then abroad, allowing the co-operative to become a leader in the seed industry.

Considering this situation and the complexity of the sectors, it could be thought that the farmers have lost the power of decision making which is mainly in the hands of the managers. In fact, this is not the case:

- Firstly, the history of the group. On two occasions (in 1984 and 1994), the disagreement between the governing board and the general management over significant strategic decisions led to a renewal of general management, this event being sufficiently rare in the agricultural field to mention it.
- Secondly, the present organisation gives the members of the governing board a significant role. Not only do they follow the general affairs of the governing board, but they also share between them the responsibility for the different channels and main subsidiaries of the group. In order to improve its competence and knowledge of the subject, the governing board regularly organises training sessions and forecasting exercises.
- Thirdly, the role of the chairman of the group who is the true representative of Limagrain and plays an active role in significant strategic initiatives such as the Genoplante project.

Thus, the identity of the group is seen as a synthesis of these attributes. This is a key to the outlook necessary to understand general strategies and the role of innovation within these.

Between 1993 and 1998, the turnover has doubled, which expresses a strategy of internal and external growth. Meanwhile, the R&D budget has increased from 50%. Thus the R&D intensity has diminished from 8% to 6%.

Limagrain operates mainly in Europe (81% of the sales) where approximately 80% of its employees are located. It specialises in seeds for field crops and horticulture. These two business segments represent respectively 39% and 31% of the turnover. Accordingly, the co-operative has two main division, one for each business segment.

¹ For comparison, the Pau Euralis group has 2000 employees for 25 000 members and a consolidated turnover of 4 billion French francs (1997/98 data).

Table 1 General data on the Limagrain group (consolidated in MF)

	92/93	93/94	94/95	95/96	96/97	97/98
Turnover	3094	3649	4139	5227	6022	6147
Turnover in Europe* (in %)	2351 (76%)	3029 (83%)	3394 (82%)	4443 (85%)	4938 (82%)	4980 (81%)
Operating Profit (before exceptional items)	242	245	298	338	408	471
Net profit	16	29	45.2	41.2	83	164
R&D expenses	247	253	252	277	350	369

* including France

Table 2 Main products. In MF and % of the total ()

Time period	Sales		
	95/96	96/97	97/98
Field crops	1906 (30)	2186 (38)	2397 (39)
Horticultural (vegetables and flowers)	1307 (25)	1626 (27)	1906 (31)
Agro-industry	1150 (22)	1024 (17)	1106 (18)
Bio-Health	575 (11)	602 (10)	307 (5)
Other products	314 (6)	361 (6)	430 (7)

1.2 Methodology

The PITA project concentrates on field crops, the Limagrain case study is, therefore, limited to the agro-food division of the group as this division deals with agro-food and agro-genetic activities. Within this branch, it was decided to concentrate the analysis on the European maize channel. In collaboration with the scientific director of the group, around ten respondents were thus selected, each representing one aspect of the channel: from the chairman and the general manager of the group to the maize selection expert (See the list of interviewees in appendix 1).

The respondents:

The interviews took place between April and June 1999. Respondents were met individually and the interviews followed an interview plan.

We met eleven management staff and presented our approach the different decision levels involved in the creation and implementation of innovation strategies for field crop seeds. As a result, the respondents represent very different levels of the hierarchy, from the manager of a selection programme to the chairman of the group. Each interview was entirely transcribed and sent to the respondents for possible corrections and validation.

First of all, we present the analysis of the general innovation strategies of the companies. Secondly, the aspects relating to the organisation and decision processes are considered. It is then possible to consider more specifically the impact of public policies coming out of the analysis of different interviews. Finally, we concentrate more specifically on opinions on the environment. We show that the managerial position allows links between the different opinions identified. The true challenge of the environmental issue is thus the valuation of investments on the market which implies clear political signals, but particularly also the implementation of the development strategy of specialised production areas.

2. The innovation strategy

2.1 Recent evolution of the company

In the last decade, different events have marked the history of the group. Recalling these events allows a better understanding of the factors determining the present strategy:

- The prospect of the CAP reform in 1992 is perceived as a significant threat for the future of the group. Like many companies upstream from the agricultural sector, the Limagrain group then thought that a change in agricultural support (decrease in market prices, fixed compensation subsidies, set-aside) would result in a drop in its activities. In order to restore growth, two possible strategies were explored:
 - (i.) diversification to pharmaceuticals, based on the group's knowledge of life sciences, which was put in place through the purchase of the Dolisos laboratories in 1992;
 - (ii.) the conception of a strategy for the development of specific products, put in place through the purchase of 'Pain Jacquet' in 1995 (the first French enterprise in industrial bread production), the creation of an agro-industry branch and the creation of a subsidiary, Ulice, in charge of the implementation of industrial methods to select and develop varieties adapted to specific needs.
- In 1994, the Limagrain group takes over the seed production assets of Rhône Poulenc Agro (RPA) and the two groups exchange shares, creating Limagrain Genetics International (83% Limagrain, 17% RPA). In addition, the two companies develop common research programmes in crop biotechnology within an economic interest group 'Crop biotechnology', shared 50/50;
- On the 1/7/97, Limagrain creates the Biogemma company, in collaboration with the Coop de Pau (25%), Sofiprotéol and Unigrain. The objective is to merge the research potential of the two companies, in order to resist the attacks of large crop biotechnology corporations, particularly with regards to industrial property. Biogemma thus answers a double objective: to create a purchasing group to best negotiate gene use licensing contracts, and to be a source of industrial property in order to participate in the exchange of technologies amongst large actors in the field. The agreement with RPA on crop biotechnology still holds: Rhobio, a common subsidiary of Biogemma and RPA was formed in April 1998. Rhobio was put in charge of research on crop resistance to illnesses, the identification of new genes of interest and the improvement of genetic engineering techniques.
- At the same time, Limagrain decides to terminate its diversification strategy and sells Dolisos to the P. Fabre Laboratories. Considering the resources required to keep up with the crop biotechnology race, the group decides to concentrate on biotechnology and agro-industrial activities.
- On the 23/2/99, public research institutes, RPA, Biogemma and BioPlante announce the creation of the Genoplante programme: this is an ambitious research effort on plant genomes, associating important French actors, both public and private. This work represents a research effort of one billion francs over 5 years (400 MF for basic technologies and 600 for specific programmes).

Today, the Limagrain group is confronted with a major challenge: to stay in the biotechnology race. The large agrochemistry corporations (Monsanto, Du Pont, Novartis) presently concentrate their research efforts on plant genomes. It is estimated that they invest between 60 and 70 million US\$ in this field. A major issue is the resulting patents (Joly, OCL).

The difficulty for Limagrain is its low investment capacity. 60 million US\$ represents the equivalent of its total R&D budget. In 1997, C. Lescoffit, chairman of the Executive Committee of Biogemma explained:

« there is a relation of 1 to 10 between the budget that the seed producers dedicate to biotechnologies and that of the most active agrochemists» (Joly, Biofutur)

From 1996 onwards, the issue of biotechnology becomes one of the central themes of the companies position (see table 3). Mastering these technologies is indeed necessary for the group to keep its independence with regards to strategies. The issue is then to:

« Develop biotechnology while keeping identity and independence » (P. Pagesse, Annual report, 1995/96)

This dilemma is behind the establishment of closer links with Pau Euralis and the creation of Biogemma. Indeed, in the context of the agrochemical corporations offensive, the association with Rhône-Poulenc is a source of danger from a strategic point of view, as well as from an image point of view. The creation of Biogemma allows the development of a technological service for farmers. However, it quickly appears that Biogemma has limited financial and technological resources (R&D budget of 60 MF). Therefore, it must be used as a basis to negotiate a large French initiative. This was the beginning of the Genoplante project which also includes RPA as a participant.

As long as RPA keeps to the initial deal – no direct investments in seed production – the projects are compatible. Limagrain confirms its speciality as a seed producer and develops a strategy of specific channels. RPA adapts its activities in crop protection by renewing its knowledge base. Any modification in these strategic directions is a threat to the stability of the deal. From this point of view, the creation of Aventis represents a serious threat in that, considering the history of the two groups, Agrevo is the stronger partner with regard to crop biotechnology compared to Rhône-Poulenc. Agrevo also appears to want to integrate seed production in its activities, as shown by its recent investments.

The following table (table 3) presents the position of the management and chairmanship of the group, as presented in the annual reports since 1990. It provides thus a picture of the strategic priorities of the company.

Table 3 Strategic priorities of the group (analysis of the chairman's presentation of the annual report) (1990:97)

Year	Management and chairmanship	Motto	Opinion about the political context	Strategy	Purchase/alliances
1990/91	Chairman: Jean-Marie Crochet General manager: Dominique Vial	'Face the storm'	Anticipation of the CAP reform 'times will be difficult', criticism of the public authorities who do not defend 'a strategic agriculture' enough.		
1991/92	Chairman: Jean-Marie Crochet GM: Dominique Vial	'Nature has all talents'	Opinion on rural life: farmer is not a landscape designer, he should receive support to maintain himself as a producer: maintain income and markets.	Seed production developed by answering upstream to the needs of the 'food, chemistry and health industries'.	
1992/93	Change of Chairman Chairman: Pierre Pagesse GM: Dominique Vial deputy GM: Alain Catala	The two challenges of agriculture today are: the reduction in government aid and the protection of the environment (conclusion). ⇒ anticipate the consequences of the CAP.	Justification of the low financial returns: – direct effects of the CAP (↘ in the volume of sales, decrease in the price of maize);	Slowness of Ferry-Morses recovery, financial difficulties of Flora-Fray ⇒ decrease in the turnover. Despite the CAP, sales of maize are stable (Maïs Angevin + Nickerson). Internationalisation of risks (USA) and diversification (health + vegetables): 60% of the LG result is protected from the CAP; – end of the borrowing policy.	Nov 1992: Dolisos group
1993/94	Chairman: Pierre Pagesse GM: Dominique Vial deputy GM: Alain Catala	A 'daring and innovative' group	The economic context is still unequal	– strategic alliance with R-P (agrochemistry and plant genetics); – entry of Vilmorin&Co in the 2nd market; – strengthening (through purchase) of the north-American distribution network; – production of proteins for therapeutic use (3 research agreements); – statement on the recovery of Dolisos. Increase in self-financing and turnover.	

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1994/95	Chairman: Pierre PAGESSE GM: Dominique VIAL deputy GM: Alain Catala	'Ideas translated into reality'	CAP reform and development of agriculture impose a capacity for innovation. With a similar level of competition, agriculture does not require any support other than 'consideration and esteem from the rest of the nation'.	Renewal of the structure into 5 branches: seed production and markets (reinforces the strategy carried out since 1985) ⇒ specific channel logic, 1 unity: the plant. Strengthening of the companies purchased.	LG Genetics International: RPA partnership.
1995/96	Change of GM Chairman: Pierre PAGESSE GM: Alain Catala	Develop biotechnology, while preserving identity and independence	Development of biotechnology: the purchase of several biotechnology companies validates the direction chosen by the group (since 1986)	Traditional seed production: leader for maize in Northern Europe, 7 vegetable seeds (Clause). Biotechnology: – grab the opportunities (food and health). – limitations: convince the public (biotechnology = simple tool, capacity to feed the planet); – prepare alliances with agrochemical-agro-food-seed producers.	Purchase of the Clause Group.
1996/97	Chairman: Pierre PAGESSE GM: Alain Catala	Biotechnology = technological jump, preserving the 'identity and independence of the group	Impacts of biotechnology on the market: – the whole market is concerned, each component is indispensable.	Success for maize and vegetables = genetic success of LG; Biotechnology: – 'laboratory channel': i.e. Jacquet as 'essential component'; – traceability: natural in seed production. For the market, costly but feasible; – 2 opposite requirements: rapid protection of inventions /slowness of the agricultural cycles; – need for alliances.	

2.3 Innovation strategies: the cognitive map

Thus, the identity of the international seed producer and farmers co-operative is essential to understand Limagrain's project and innovation strategy.

The present motto, '**an agriculture of the future for the benefit of mankind**' (1)² summarises this project well. It concerns agriculture (not life sciences), an agriculture of the future (not a 'farmers agriculture') taking advantage of technological progress. The reference to 'the benefit of mankind' is equally important in defining the group's identity. It is inscribed in a humanistic world view in which profit is only a means at the service of human development. For Limagrain, this is even more adequate as the shareholders (farmers) are not in search for dividends but expect the co-operative to participate in the development of their own activities.

These characteristics largely determine **innovation strategies for biotechnology**:

- biotechnology should allow the development of dedicated products because it is, in the long term, a means to *bring added value to agriculture* and thus increase its resources and promote its capacities for development. This first consideration is the basis for a strategy of development of channels for specific products (2);
- the active participation of Limagrain in the *development of biotechnology* must allow farmers to remain major actors in the chain of agro-industrial activities. Indeed, the leaders of Limagrain are concerned with the progressive decrease in farmers freedom of action, restricted by strong agricultural suppliers on one side and on the other, mass marketing which places a strong pressure on production channels. This is confirmed by the observation of the 'gene leasing contracts' system implemented by Monsanto in the US.

Hence the idea of Biogemma which is a business based on farmers grouping their resources to fund R&D (6). With Biogemma, farmers can fund upstream R&D, which should allow them to participate in the decisions on the direction of projects and influence development methods. It is thus a strategic tool allowing farmers to play a role as major actors (11).

However, the independence of France in terms of plant genomics (7) cannot only rely on Biogemma. Hence the idea to create the Genoplante programme (8), a project bringing together all the different actors in France, both public and private.

The implementation of this innovation strategy is subject to **two major constraints** of a different nature:

- Firstly, the constraint of *financial resources*:

The substantial funding requirements for biotechnology R&D and the development of specific channels. Sharing R&D costs partially answers this problem but it is not enough. The objective of the group is to increase returns on traditional activities (5). This should be possible by strengthening the position on the seed market (3). The challenge is therefore to concentrate on seed production which will have a growing strategic importance, particularly with the development of dedicated products(4).

Apart from strengthening the position of traditional activities³ and the development of dedicated products, it appears necessary to *invest in Asia* as strong potentials for growth are found in this area.

² The numbers between brackets refer to the different elements of figure 1. See also figures 4 and 5.

³ The contribution of vegetable and maize seeds to the groups results is essential: these two activities respectively contribute 100 and 80 million Francs to the net income (which represent 160 million in total, taking into account losses in other fields of activity). The difficulties of Limagrain and its return to a position of leader on the market of maize seeds are significant factors in the strong belief that the groups competence is in seed production: 'our job is to always be aware of the evolution of varieties, to have good ideas before others and know how to implement them.'

The leaders of the group are also aware that the future of seed producers will be dependent on the *evolution of industrial property rights*. Indeed, patents represent a threat in that they question the principals of free access to plant varieties as a source of genetic variability in the selection process.

- Secondly, the constraint of *innovations acceptability* – particularly GMOs – (12):

A key to the acceptability of GMOs is the perception of their usefulness. The development of dedicated products with improved qualitative characteristics should contribute to solving this problem but it is not sufficient. Today, the problem lies in the *lack of any project for the future in agriculture*. There is no clear public will to develop agriculture as an activity of production nor in any case any sufficiently strong declaration from public authorities. For example, what about the maintenance and development of the capacity to export or self-sufficiency in terms of proteins? What is the future of the agricultural sector if there is no strong will to develop production? At present, a new project for agriculture is missing. In this context and considering that the public does not see the use of increasing production, the usefulness of the technical progress brought by GMOs is not valued.

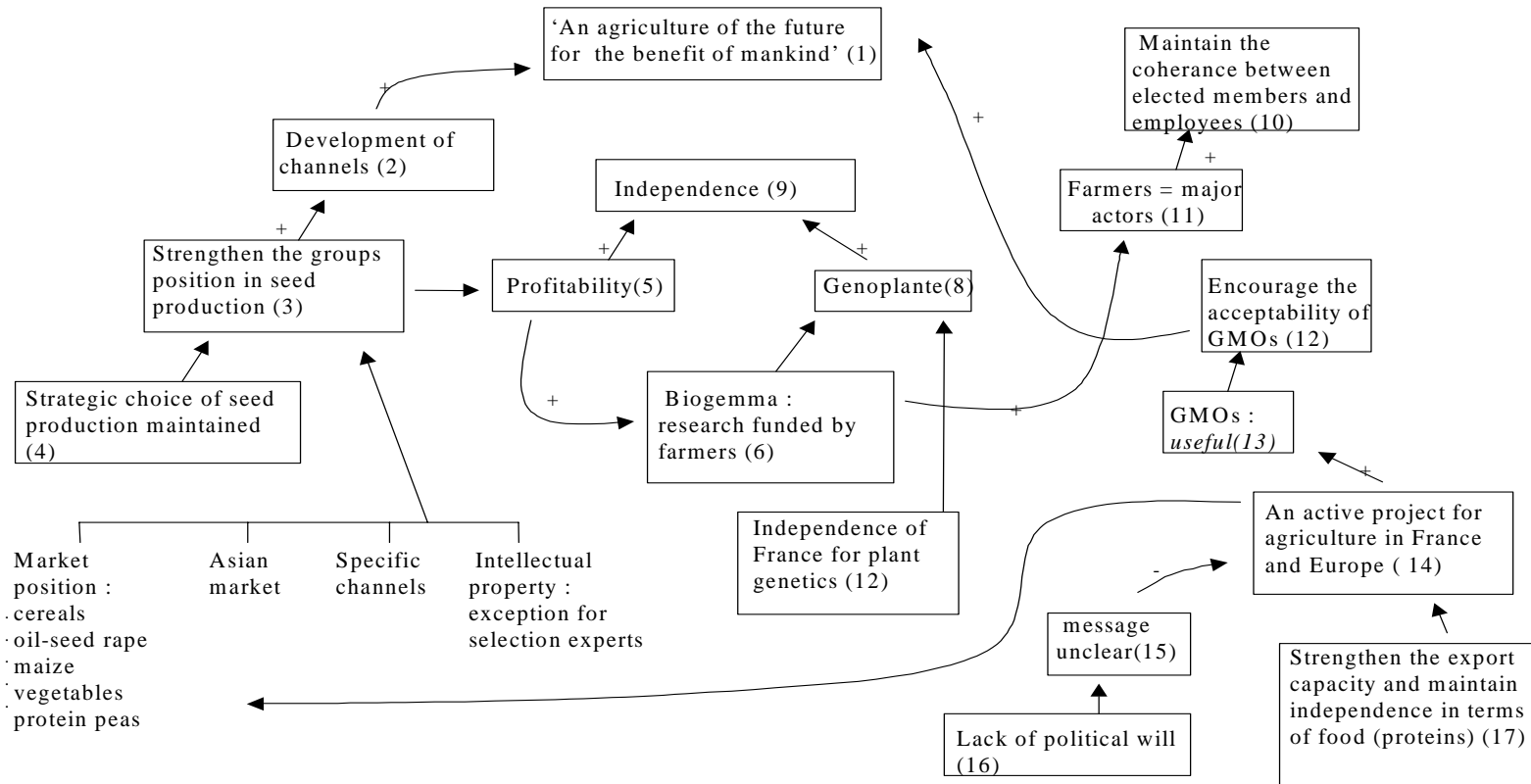


Figure 1. Group's identity project

3. Organisation of R&D and decision-making

3.1 General organisation

Having established itself through the purchase of numerous companies year after year, the group has generally maintained the different elements purchased. The companies keep a relatively large autonomy in management decisions.

From the legal point of view, the structure manages participation in the different subsidiaries of the group. From a functional point of view, it is organised in a relatively conventional way (see corporate structure diagram below):

- a recent restructuring has simplified the corporate structure of the group: the activities of four operational branches have been grouped into two large divisions, '**agrogenetics**' and '**horticulture**' (vegetables and flowers)⁴. Each division will include all the activities of one field (including research) at the international level.
- the **general management** is a relatively light structure. The General Manager (GM) has two deputy GMs, each in charge of one division. These division managers play a major role in the organisation.

For field crops, M.Chéron is in charge of the Limagrain Agro-Industry division which includes the LG Agro-Genetics (field crop seeds) and LG Agro-Food branches. Being responsible for the Agro-Industry division gives him a global vision to encourage the development of specialised channels. The GM also heads 6 functional departments across the organisation, including the scientific department. The **management committee** meets once a month. Depending on the theme, it can bring together only the general management or also include the branch managers.

⁴ The Agro-production Division is devoted to the various activities directly connected to the local agricultural production (in the "Plaine de la Limagne").

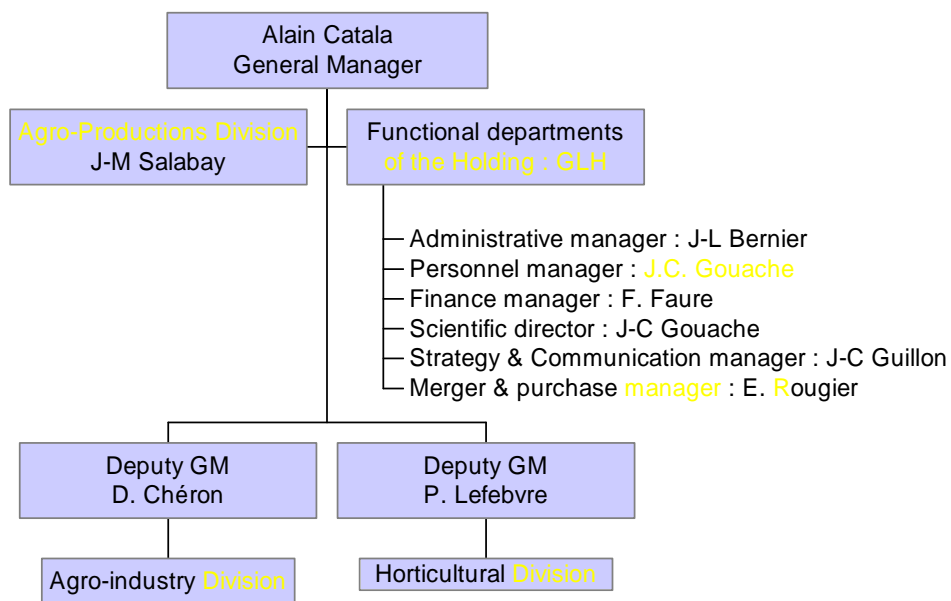


Figure 2. Corporate structure of Limagrain

3.2 Organisation of R&D

The **Scientific department** of the group does not have any direct responsibility in the guidance and management of research programmes. Its main objective is to provide guidance on the general direction of the group in terms of research and balance between upstream and downstream research. In addition, it is in charge, from an operational point of view, of the direct management of:

- *scientific monitoring*: identifying new technologies and their possible impact, identifying potential partners;
- the *intellectual property* policy (defensive and offensive) with a centralised management;
- the *promotion and communication of innovation*, internally (organisation of seminars, training...) and externally (representation of the group in the scientific world).
- following the *regulatory business* on scientific and research matters.

The Scientific department is in charge of co-ordination, the general secretariat of the group's Scientific Committee being managed by a deputy GM (see infra).

In the **Agro-Industry Division**, research does not take place in the commercial subsidiaries (Maïs Angevin, Force LG, Nickerson). It is grouped in specialised subsidiaries: LMGC (maize and sunflower Europe), Nickerson (wheat, oil-seed rape), LG Corp (maize and soy North America) and Biogemma for R&D in biotechnology. The managers of these subsidiaries are also the directors of research in these fields.

This form of organisation is particular: the R&D function is not centralised, but it is also not localised in the commercial subsidiaries. This characteristic, which is the result of history, allows the general management of the group to get involved in the R&D decisions concerning specific elements of the market. The general management – via the deputy GMs in charge of the divisions – participates in the debate on directions in the Research Orientation Committees (ROC– see frame 1) and validates decisions in the budget balancing procedures. Thus the division management can play a role as referee and control tensions between short-term market forces and the development of R&D projects far from a clear vision of the users.

The position of **biotechnology R&D** is complex:

- internally, Biogemma is part of the Agro-Industry division but in fact, carries out research which can be of interest for the whole group. In this case, it is the group's holding which will fund generic research. When the research deals with a particular crop, the sector concerned is the funder (eg. Nickerson funding research on wheat). On the other hand, Biogemma's research director co-ordinates R&D in the Agro-Industry division and, as such, chairs the 'Comité Animation Recherche Agro-Industrie' (CARAI), co-ordination committee for research in agro-industry;
- externally, Biogemma also has other shareholders, in particular Pau Euralis contributing its Toulouse laboratories in the plan of action. Within Biogemma, decisions deal with specific projects (each programme takes the shape of a joint-venture company). Each partner then provides funding in various proportions, depending on its interest. The sharing and exploitation of results depend on these agreements.

Biotechnology R&D is thus carried out as projects, some of which –the applied projects – are the subject of an agreement between 'producers' (Biogemma laboratories) and 'clients', the subsidiaries of Biogemma's different partners.

3.3 Organisation and decision procedures: committees and networks

In this section, special emphasis will be given to the analysis of committees, their composition, role and operation. Indeed, in all organisations, committees are a forum for

exchange and confrontation which play a central role in shaping a collective representation. Thus, they have a significant role in co-ordination, upstream from decisions. The fact that a permanent committee is dedicated to a particular type of problem (for example the analysis of agricultural policy) and the hierarchical level of the members of the committee are good indicators of the importance given to the problem in the organisation.

Concerning R&D activities, different types of decisions can be seen:

- *decisions concerning the optimisation of means and adjustment* of the system, while keeping the same structure (operational decisions). The preparation for such decisions takes place by crop type⁵ within the Research Orientation Committee, ROC. They are validated by the GM in the budgetary selection procedures ;
- the *strategic decisions* which affect the R&D potential and innovation strategies: creation of Ulice, creation of Biogemma, investment in Genoplante. Such decisions are the product of strategic thinking within the group and validated by the GM.

Such decisions can come from different sources. Concerning research and innovation specifically, they can be initiated by the monitoring groups of the Scientific department (discussions in **Scientific Committees**).

The **Scientific Committee Group** has a co-ordinating function for all research in crop biotechnology. The Scientific director is also the chairman of the Scientific Committee of Biogemma, Biogemma's arm in the field. In addition, the Scientific Committee participates in the selection of research programmes:

- for 'generic'⁶ research, the Scientific Committee Group funds the programmes directly, using a special budget, the research contribution which comes from a deduction on the budget of the subsidiaries;
- the applied projects, funded directly by the subsidiaries, are submitted to it for comment.

As regards innovations in the agro-food strategy of the group, the deputy general manager of the division has formed a brainstorming taskforce: the '**Comité de Prospective et d'Innovation**' (**CPI**) for forecasting and innovation. The CPI plays a significant role in the discussion of new ideas and new projects specifically linked to the development of channel products. It is thus a place for the elaboration of projects whose operational implementation can then be discussed in the ROC. Let us note that although these committees do not have a direct role in decisions, their meetings are however regularly attended by members of the general management which shows the importance given to them.

The position of these committees relative to the companies structure is described in the following diagram.

⁵ For convenience, ROC is used in the singular but there is one ROC per crop type.

⁶ For Limagrain, a generic programme is a programme which could interest different subsidiaries of the group. These generic programmes have allowed the exploration of new research paths. This mechanism plays a significant role in the first phases of Limagrain's investment in biotechnology. Subjects which were originally considered as generic are today considered as applied and should therefore be funded by the R&D budget of subsidiaries, whether they are carried out by Biogemma or within the Genoplante programme. The recent creation of Genoplante has required an increase in the research contribution.

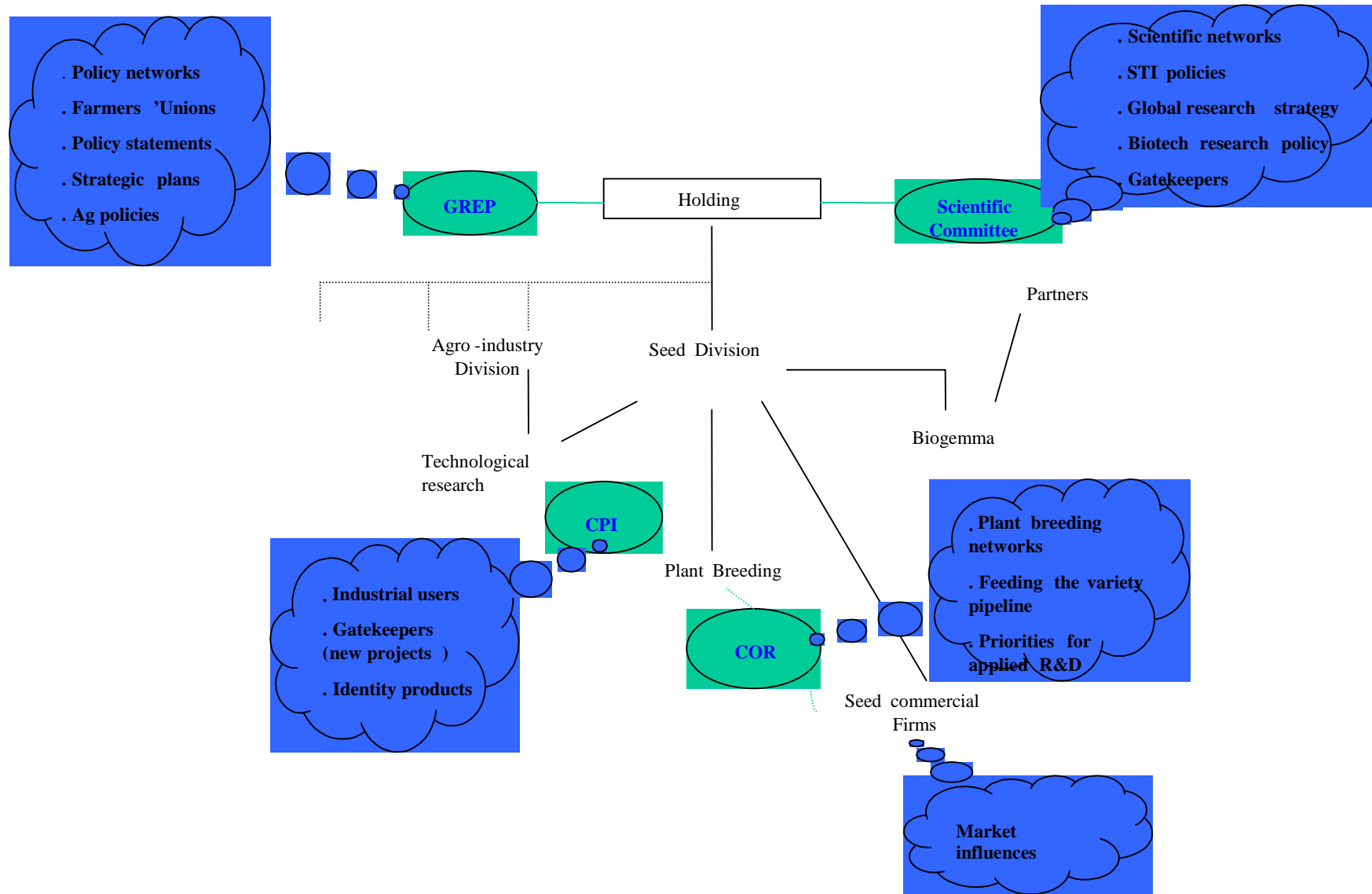


Figure 2 Role of the committees in the group structure

All these committees are not only different from the point of view of their role. They are also connecting points to external networks (see Figure 3). They differ through their integration in professional networks which carry different outlooks:

- the **Scientific Committee** of the group is integrated in **scientific networks**, its outlook will be structured by debates on the state of research, the possibilities and problems associated with life sciences. It is truly a place for discussion on important options in the long term, depending on the state of knowledge and of scientific and technical competition;
- **ROC**: being in charge of the linkage between different commercial functions and research on crops, the main concern of ROC is to manage the existing system for the best in order to produce a sufficient potential of commercial varieties with the group's resources. ROC is also integrated in two significant networks: the **network for crop improvement** (with all the professional extensions: CTPS, SEPROMA, GEVES,...) and the **market** (via participation in commercial companies). It is the interface between the market forces and the long cycles of crop improvement. By definition, it is a place marked by the permanent balancing between these two visions: for example, there was a strong market pressure three or four years ago to accelerate programmes on the production of transgenic varieties (resistant to the European corn-borer (Bt) or to herbicides (Liberty, Round Up)). Today, selection experts observe a U-turn of commercial forces and no longer demand these varieties in view of the opposition to GMOs in Europe. The task of a ROC is to see and control demands which may be contradictory, and to pilot programmes with a long-term vision at a time when there are many short-term demands⁷. Similarly, the outlook of those concerned with crop improvement, is also marked by a refusal of patents and a certain scepticism towards the immediate application of biotechnology (*'our selection experts are St Thomas'*);
- **CPI**: despite a more informal role and organisation, the CPI plays a significant role as noted above. It is linked to industrial networks. The outlook therefore is that of the users of the raw material. This aspect is integrated in the company through Pain Jacquet and Ulice. Within this framework, innovations on products are prepared and tested, for example the nutritional improvement of industrial bread (fibre-rich bread, Omega 3) or the possibility to replace food additives in wheat products by genetic characteristics incorporated in the variety. CPI can be a forum for the discussion of these ideas at an early stage. It also aims to integrate other concerns and other projects in the Limagrain group. The function is both one of technological monitoring and one of precise knowledge of potential users behaviour.

In the diagram, another committee was mentioned, **GREP**, which has no specific role in terms of research and innovation. However, it is an important body for taking public policies into account. GREP deals with both forecasting and agricultural policy. It is mainly connected to public policy networks, but not only in the field of agriculture (it can also discuss the evolution of international trade, general economic forecasting, public acceptance of biotechnology, the group policy with regards to the environment...). It is also closely connected to agricultural trade unions. It is above all, the forum for the analysis of public policies and the preparation of public statements on the group's position.

Although such a picture is incomplete, this analysis of the connections between committees and external networks brings us to the following comments on how public policies are taken into account:

- the agricultural policies have a key influence on short-term decisions through ROC and in long-term decisions through GREP. These two committees are forums for exchange and the development of a common representation within the company;
- policies relating to science, technology and innovation are mainly taken into consideration by the Scientific Committee. However, let us note that the internal networks of the latter are less developed than those of ROC (see figure 5).

⁷ There are two ROCs per year.

On the other hand, aspects relating to **environmental policies** are not treated in the same way. There is no committee in the group specifically in charge of those questions, although they are touched upon within GREP. Such a situation is not fortuitous. On the contrary, it marks the will not to treat environmental concerns as a specific type of problem, but truly as issues integrated in the agricultural system.

The following parts assess in more detail the impact of public policies on the organisation we have described. The whole analysis is based on the contents of nine interviews carried out in the group (in total eleven respondents met)

4. Public policies and innovation

Introduction

The following public policies were mentioned (in decreasing frequency) in the interviews:

- agricultural policy (CAP and GATT),
- environmental policy
- GMOs,
- science and technology policy under three aspects:
- the protection of innovation,
- research in biotechnology,
- public research.

See Figure 6 for a cognitive map on these issues.

4.1 The public policies taken into account

4.1.1. *The agricultural policy*

The most common answer to the question *what public policies have an impact on your activity?* was the agricultural policy, as guided by the CAP and international negotiations (GATT).

Two types of answers can be identified here:

- some mention the CAP including its most recent changes. From these statements, it is possible to see how the group anticipates the development of some crops relative to others and the consequences in terms of investment;
- other answers relate more to the impact of the agricultural policy on the general strategy of the group. At this level, it concerns the impacts of the 1992 reform of the agricultural policy.

In both cases, the agricultural policy is the subject of a consistent position within the group. One can therefore suggest already that the agricultural policy is a clear and well identified policy and that, on the other hand, the organisation is well aware of this environmental factor.

Impact of the agricultural policy on the different crops:

The following table was obtained by comparing the different interviews. It reflects, by crop type, the analysis made of the agricultural policy (CAP and WTO) within the company and its consequences in terms of investment.

Table 4. Impacts of the Agricultural Policy on different crops

Maize	<ul style="list-style-type: none"> • Generally, the maize market will change: <ul style="list-style-type: none"> – it will probably decline (in particular, in favour of wheat), – it will concentrate on late maize, – and on Eastern Europe, – most of all, the ensilage maize will remain (early growing maize will disappear). <p>For the company, this leads to a shift in research efforts towards these objectives. At present, their strength is based on ensilage and early seed maize, and the aim will be to concentrate on semi-late and late maize, in order to be stronger and become more present on Eastern European markets.</p> <ul style="list-style-type: none"> • The subsidy for irrigated maize could have some consequences: if it is not maintained and there are restrictive rules on the use of water, irrigated areas may disappear. This may upset the market and the type of the strains sought (strains which would resist water stress in certain regions). <p>For ensilage maize, there is a minimum surface area in any case as it is used in the intensification of cattle breeding.</p>
Wheat	<p>One effect of GATT has been the strong increase in the wheat area. At Limagrain, the analysis is presently as follows :</p> <ul style="list-style-type: none"> – in western Europe, the relative importance of maize is decreasing and wheat will replace it for a variety of reasons, particularly the compared production costs in Europe and the USA. – the yield of wheat per ha in Europe clearly exceeds that of the USA so that even if farms are smaller, they can be competitive if there are no distortion measures in the USA. Hence significant investments in wheat research (conventional and biotechnology).
Oil-seed rape	<p>As regards biotechnology programmes, Agenda 2000 has had an automatic effect on oil-seed rape: considering the future of the crop, shareholders funding biotechnology programmes have requested a restructuring of the programmes along agricultural rather than qualitative (oil quality) lines.</p> <p>It is thought that for oil-seed rape to compete with other crops, the problem is one of productivity, hence the restructuring of programmes to concentrate on oil-seed rape yields.</p>
Sunflower	<p>The group has not perceived a sufficiently strong political stability regarding oleaginous crops and sunflower in particular: the uncertainty over the maintenance of subsidies jeopardises the return on 10-15 year research programmes. It has therefore had an impact on sunflower in that there has been a relative decrease in investments (creation of a joint-venture with Pau Euralis).</p>
Protein pea	<p>For a crop such as the protein pea, the group would only be ready to invest if there was a stable and clear political will. A private, perhaps European, research programme could be considered if it was certain that the CAP focus will not change for 10-15 years. The EU dependence as regards proteins is very significant (80%) and, in the long term, breeding will suffer from the fact that no means are provided for achieving independence.</p>

These prospects will condition, more or less directly, the research priorities and the launch of selection programmes on different crops. Finally, it appears that the general directions of research are still determined by the perceived future of one crop type relative to another.

Impact of the agricultural policy on the general strategy of the company:

While changes in the agricultural policy influence research choices, they also have a strong impact on the group's general strategy. Looking back, it appears that important strategic choices are directly linked to the 1992 reform of the CAP and the context of GATT negotiations at that time. In particular, the expectations of that period led to a diversification of the group's activities.

Thus, several respondents underline the fact that the decision to make significant investments in work on quality was taken in 1991-92. At that time, the GATT negotiations and expectations about a decrease in agricultural prices led to the belief that the only way for the co-operating farmers of Limagrain to maintain their income was to produce crops with a high added value. Hence the work on starch quality and the development of particular marketing channels in some fields.

The following extract from an interview shows the spirit of the time and the significant impact of the agricultural policy on the formation of the group strategy:

“Very early, we believed in the agricultural world moving closer to industry (from 1988). In particular, the development of the CAP encouraged us not to get locked in the thinking of traditional seed producers following narrow agricultural objectives (we had a bleak view on cultivated areas, the evolution of added value ... that could have brought us to a dead-end). So, how could one give added value to agriculture again? How could agriculture find a new chance? Thanks to our know-how in crop improvement and the know-how of farmers: this combination provided some tracks (it was a bit unclear at the beginning, objectives were not yet well defined). In 1992 we created Ulice [R&D subsidiary for cereal development] while telling ourselves that, after having seen large, we had to stick to the major crops which are maize and wheat”.

Since that period, the question for the group is still – under pressure from members – to create value for crops cultivated by the members of the co-operative (mainly wheat and maize), in the context of a decrease in prices. For the group, the future of farmers as seen through the CAP chapter remains bleak. The specific channel strategy was then conceived to add value to group genetics and to keep part of this value. We find here again the group’s logic, but it is important to underline that this shift largely came from the analysis of the agricultural policy.

Let us note that this development, based on the anticipation of a less favourable agricultural context (decrease in prices), can however be seen as something positive by the employees. From the selection expert’s point of view, there may be a decrease in the maize market but this adds value to his work: it is up to him to bring a qualitative advantage so that the variety can remain longer on the market. The decline in the maize market encourages, therefore, the search for new markets to maintain the present surface areas. These new markets imply new needs, giving even more significance to the selection experts work.

‘Lessons from 1992’

The CAP reform in 1992 and the pessimistic vision that arose from it at the time have influenced the history of the company. The situation today has evolved towards a relative optimism and a widening of opportunities (history justifies a continuation of the present strategic directions).

“We don’t react spontaneously, lessons have been learnt from 1992 when everything seemed bleak and finally it wasn’t so disastrous... but for reasons linked to the international situation: two bad harvests in the USA made the prices go up, masking the consequences of the 1992 reform. Today, the dramatic decrease in prices shows that our analysis was right. And all the consequences of Marrakech are not yet visible (exports, subsidies). In research, we are all the same, in large projects which takes time. To stop a programme and start again some time later can have devastating effects.

We can note the apparent contrast between the way in which the 1992 reform -since 1988- has been discussed within the group, causing major strategic changes, and the relative silence around the present agricultural reforms. However, given that the Berlin agreement follows what was started in 1992, it is not really surprising. The new political deal linked to Agenda 2000 and the new trade negotiations, sets indeed a significant stake: on the one

hand, it reinforces the strategic choices of the group (specific channels, speciality products...) but on the other hand, it increases pressure on price competitiveness.

4.1.2. *The environmental policy*

Environmental issues are also quoted as having an impact on the group's activities. In terms of public policy, it generally appears from the interviews that the environmental policy is not clearly identified and even unclear. It is identified as the work of the Ministry of Environment and some particular actions strike out: eco-taxes, the 'Contrats Territoriaux d'Exploitation' (CTE) or area management contracts and the regulatory incentives for reducing inputs. However, specific measures remain unclear for example, eco-taxes are not perceived as a serious threat although their implementation methods are not yet defined precisely.

At the management level, the views on these measures are rather negative. Thus, environmental standards are considered as a risk because they often lead to inconsistencies: the environment requires local action, taking local specificity into account. This is often not compatible with the laws!

In the same way, many subjects seem to be badly dealt with because they are a response to 'media hype' (the problem of nitrate water pollution, for example). Finally, although the pressure of environmentalists appears credible because it reflects a true demand from citizens, the company does not trust 'the effects of fashion', believing problems are often treated in a reductionist and not a global way.

The group's approach is based on a search for effective solutions. As an illustration for this approach, one project has been mentioned several times as an example of the group's orientation: a programme aiming to reduce the consumption of water in maize production. Set up to answer a real problem, it is also a consequence of environmentalist pressure on this particular crop type (possible regulations to come):

"For maize, we have developed an important programme on water stress because it is clear that this crop type will remain competitive only if we can reduce inputs. Maize has quite a bad reputation (water consumption, pollution etc.) and this has had an influence on the perception of the crop by the authorities, the European Community and even the public."

We will come back in more detail on the way the environment is approached in the group and its impact in terms of innovation and development of new products in part 5.

4.1.3. *GMOs*

The question of the environmental policy is often associated with that of GMOs and their regulation. The group being concerned first-hand by the controversy around GMOs, a number of people in the group deal with that issue.

The problem is seen from different aspects which affect the group's activities. Thus, we can mention amongst the people directly linked to GMOs, those in charge of lobbying the professional circles; implementing a traceability chart; ensuring a scientific watch in relation to gene providers; following up cases within organisations such as CGB; monitoring intellectual property in the field. There is also a working group on the introduction of these new products on the market.

It is worth noting that the present situation in Europe is identified as a problem of public opinion and not of public policy as such (shift of the problem from the political sphere to a larger public debate). On the other hand, the public policy is seen as reflecting the reluctance and rejection of GMOs by the European public: the unlocking of regulations will only be possible once the mistrust of the public is dealt with.

In day to day business, the regulation on GMOs is perceived negatively because its lack of precision makes implementation difficult for selection experts. The lack of definition of a threshold above which a product is considered as a GMO has direct consequences on the

selection experts activity. For example, it requires the implementation of special procedures to isolate trial plots in fields in order to avoid any 'pollen contamination' of other crops, which must, moreover, fulfil 'zero-GMO' criteria requested by industrialists.

The regulation on GMOs is nevertheless crucial for technologies which will be used to transform crops. But the problem today goes beyond technical decisions such as the banning of antibiotic markers: we are faced with the substantive issue of public opinion where uncertainty dominates.

"For maize (1989-90), we used these antibiotic markers like anyone else, we did not know how to do otherwise. But considering what is happening at present, I wonder if it is sufficient to eliminate antibiotic markers. In the end the problem isn't there (antibiotic markers or not) but there is indeed a substantive issue which is cultural, about the acceptance of transgenesis (we can make every possible effort, there will always be an additional technical barrier, someone to ask for more precautionary measures)".

While public policies on the matter reflect this concern, there are significant differences between the position of a Ministry of Research supporting transgenesis '*with no qualms*' and a Ministry of Agriculture '*giving the impression of having doubts about it*' and a Ministry of the Environment which '*almost systematically takes a negative position*'.

On the larger debate around GMOs, the group find itself involved in the controversy. After ten years of increasing investment in biotechnology, consumer rejection challenges the strategy of the company.

On the subject of GMOs, the position of the group and its management about the relevance of using transgenesis as a tool for crop improvement has not changed. Consequently, the group has stated that it carries out its research programmes consistently and continuously.

However, as with all social entities, opinions can vary depending on the position of the person: the salespeople, whose horizon is often limited to the current commercial campaign, are subject to the present media pressure and translate it directly into messages sent to the research teams. Discussions in the ROC, which are forums particularly adapted for communication between commercial management and researchers, reflect this change:

"What is happening about GMOs is interesting: 2-3 years ago, our salespeople were telling us, under the pressure of competitors 'you aren't going fast enough'. And today, at the last ROC meeting, considering everything that is happening at the regulatory, distribution levels, etc., they are almost telling us 'stop, the market isn't ready!'".

The salespeople, but also the selection experts, find that the benefits of biotechnology are slow to come considering that the group has heavily invested. This delay, added to the public controversy, can encourage in the short term some scepticism within the group.

However, for the management and the declared strategy, the GMO controversy does not go as far as causing a challenging the group's investment in biotechnology. The belief that any strategy in the crop industry will involve genomics in the future justifies a strong speech:

"We will continue to invest substantially in biotechnology: the strategy will not be questioned. We will continue to participate in genomics programmes for understanding the genome: this goes further than GMOs. Tomorrow, it will be required from any strategy regarding crops. Even if we were only to do conventional selection, the understanding of the genome is essential. So in our laboratories, we continue as if nothing was happening. Of course, one shouldn't have to wait 10 years before the first return on investments, but in our jobs we have to know how to be stubborn!

I am convinced that, sooner or later, things will go forwards, maybe not as we predicted, but it is unthinkable that Europe should ignore this revolution. No country can say 'there is an entire scientific revolution which I don't want to hear about !'. That would be the same as considering that Europe didn't exist anymore! I am absolutely convinced that Europe will ignore such a development!"

4.1.4 *Science and technology policy*

Unlike the CAP, science and technology policy is not the subject of common thinking within the group. What is perceived of this policy and the judgement on it depends on the function occupied within the group.

The protection regime for innovation:

In terms of science and technology, one of the group's most favoured issues is that of the law on intellectual property. The patenting of life forms and the challenging of selection experts' right to exemption are seen as significant threats to the sustainability of the selection experts work. This problem is presented as a key element which goes further than the sole private interests of the group and concerns the whole of Europe:

"Access to biodiversity must be preserved... we will eventually have a political problem because it would not be acceptable that the genetic variability of the 2-3 main cultivated crops be concentrated in the hands of three entities. We think that the selection experts exemption is a factor of progress. However, we are aware that we could lose at the WTO: that in the end, we would have Europe line up with the USA but in the middle term, it is unacceptable".

As regards this subject and, more generally, the issue of the technological independence of Europe, the group is attempting to defend its position to the public authorities. This question, which has not been consistently mentioned in the interviews, can be considered as emerging from the activities of the group. Beyond speeches, the impact of the issue on research activities remains unclear or a subject of concern about freedom of action for the future.

Biotechnology research:

Generally, when the subject is raised, the impact of the scientific policy and specifically, support for biotechnology research is perceived as positive at the national as well as at the European level:

"In terms of scientific policy, we are concerned at the European level: Europe strongly supports research in biotechnology. We do participate in a number of European research programmes: the strength of Europe lies in the quality of its research in biotechnology (many networks have been formed and developed through these programmes)".

However, the opinion on scientific policy at the national level is more balanced. Although the Ministry of Research is clearly identified as supporting biotechnology research, the Ministry of Agriculture is perceived as having a more ambiguous position, the latter adopting an overcautious attitude towards biotechnology which is also consistent with the caution demonstrated by agricultural organisations.

The group has a pro-active strategy regarding the science and technology policy, as shown by the example of the establishment of the Genoplante programme⁸. From a private research project supported by four/five agricultural leaders, this has become a large programme of fundamental research in genomics, associating public and private research. It is the result of lobbying authorities (Ministries of Research and Agriculture). For this project, the common

⁸ On this subject, see also 2.1

ground which justified the pooling of public and private funds was the defence of national independence:

“Agriculture remains a national wealth and if all the keys of added value are concentrated in the hands of the agro-chemical industry, it means that they will be able to tap all the added value. Farmers will lose out inevitably and the consumer will also lose out ultimately”.

Public research:

Together with scientific policy, the role of public research has been mentioned in some interviews. For the seed producer group, INRA is an obvious partner and several scientific partnerships have been established. A perfect illustration of this is the role of the INRA-Limagrain partnership in the creation of Genoplante. However, there is a more balanced view about the position of the Institute on biotechnology.

On the one hand, there is no doubt about investments in this field. For some people, these are made at the expense of the more traditional activities of the Institute. The amount of resources dedicated to molecular biology, at the expense of classical selection methods, has had an impact on the quality of the Institute’s genetic material. On the other hand, the perception of the Institute’s position in the GMO debate is still ambiguous:

“The position of INRA is not clear enough and this is a problem for us: while the Institute is involved in biotechnology, some researchers publish their views in journals: it is detrimental that they should express themselves on behalf of INRA as afterwards, when you talk with anti-GMO activists, they refer to such and such article which shows that INRA is also opposed to them.

We are expecting INRA to carry out research work on GMOs that demonstrate whether what is said is right or wrong. Public research has a role to play towards the public in terms of expertise, information and education because as industrialists, we have no credibility”.

4.2 Analysis of environmental policy and organisation

The public policies mentioned in the interviews include those which are the subject of a consistent position within the group (e.g. CAP), those for which the views expressed depend on the function of the respondent (scientific policy) and those which are not the subject of a common position (environmental policy).

In this section, we intend to analyse the basis of these different approaches. We can then identify the mechanisms which condition opinions and the interpretation of public policies within the company.

CAP: a consistent position

At the management and governing board levels, the GREP, as noted above, is a forum for interaction and reflection on public policy issues. This taskforce is part of the strategy and communications department and it is designed as a group for political reflection, for the analysis of the regulatory and political environment (CAP, effects of WTO). This structure also supports the work for issuing public statements (for example on the reform of subsidies).

Conceptual work within working groups helps to define common positions, the search for consensus being often mentioned as a working method favoured by the group. On the other hand, it is important to note that, with respect to public decisions, management and the governing board are also informed ‘at the source’ as the leadership keeps in regular contact with decision-makers in agriculture.

At other levels within the company, the general shifts in the CAP are well known, whatever the level in the hierarchy [see 4.1.1]. Concerning those interviewed, this knowledge came from:

- the individual follow-up of news in documents and press reviews prepared by the group's information and documentation service (this service was mentioned spontaneously at least three times);
- participation in professional working groups (SEPROMA type);
- more or less direct transmission of the management's position to the base.

More specifically, the transformation of basic information, as found in the press, into an analysis of CAP consequences on the group's activities, is clearly identified as the responsibility of people designated in the group, i.e. all the monitoring teams in a broad sense. Their task is to analyse the competition, regulatory, political and technological environment continuously. These analyses are then distributed through different channels, particularly through management staff meetings. For example, not only the analytical work of the holding's departments but also information passed on by the sales people, structure the group's view on the maize market.

The position on the CAP and its impacts on the group are consistent because the issue is crucial to the group. This policy affects the whole company and there is a consistent position of top management on the subject. This is more of a top-down mechanism directly linked to the method of organisation described earlier, i.e. a systematic distribution of information through the information service channels and, more specifically, from the holding's services to the base through committees and meetings. The different cases are not discussed directly any further –in ROC for example – but they affect major R&D decisions.

The environmental issue: diversity of positions

It is worth noting that no one could be identified as specifically responsible for the environmental issues and that there is a variety of positions in that respect. We will see in more detail later how this issue is integrated in the group.

5. The Environmental issue at Limagrain Field Crops

5.1 Classification of different approaches

In the interviews, the main questions about the environment were as follows:

- How is the environmental issue integrated into the group and into your activity in particular?
- Which projects are linked to environmental concerns?

A first comment on the answers is that there is no consistent view about the way in which the environment is integrated in the group's activities. Unlike the CAP for which all respondents have similar opinions, the approach to this issue depends on the position occupied in the company. Each person is more or less aware of the issue in their activity. Although there is ultimately some agreement about the environmentally oriented projects of the group, the dominant logic in the group, i.e. the place given to the environmental issue in decisions and the R&D projects selection process, appears only by comparing all the interviews.

From the answers received, a kind of classification of the different approaches can be established (See Figure 7):

- the political approach;
- the scientific approach ;
- the management approach;
- These approaches are all found within the company and they are complementary rather than conflicting.

5.1.1 *The political approach*

In France, the issue of the relationship between environment and agriculture is characterised by the opposition between the 'productivist agriculture' and the 'sustainable agriculture' models. The supporters of the latter –originally promoted by environmentalists– condemn the deficiencies of intensive agriculture trapped in the race for international competitiveness and supported by large agricultural organisations.

The leaders of the group being directly involved in this debate –the Chairman is one of the major agricultural leaders– the answer to the group's awareness of the environmental issue is a political one at the management level. In that sense, the environmental question cannot be separated from the larger debate on the future of French agriculture. Now as noted above, the CAP and WTO offer a bleak future for agricultural incomes, from the group's point of view. In this context, the co-operative's priority is to recover enough room for manoeuvre through innovation and the creation of added value. Massive investment in biotechnology and the setting up of specific channels are some of the means to that end.

In this broad context, the environment is not publicised as a priority in the design of the companies development strategy, even if the subject is not left out. Besides, talking about the environment is legitimate for the group as it works for its members – the farmers – and as the chairman himself is a farmer. As farmers, they express similar views about the environment because 'their economic survival is dependent on the maintenance of their ecosystem'. There is no conflict between farmers and the environment. On the contrary, the farmer is in the best position to act locally because he takes into account the specific features of his land, the climatic conditions etc.

In that sense, the environmental policy is seen as a set of constraints ill-suited to local production conditions. It is an unavoidable constraint but leaders remain very critical as to the effectiveness of associated measures. On the other hand, the group with its own capacities can offer innovations which are substantive solutions:

"Our solutions to these issues are not direct answers: there is no rush as regards the environmental issues in fashion. Because very often, these problems are only approached in a reductionist and not a global way. We look for substantive solutions which go the right way.

[...] Our motivations remain to provide real solutions to farmers and not partial answers to the media hype".

5.1.2 *The scientific approach*

A second approach can be found in the position of the group's scientists who manage the selection programmes daily, some of which are directly linked to environmental concerns. The main feature of this scientific approach, particularly in relation to the political approach, is a higher awareness of the environmental problems at stake. These are not challenged, but considered as more or less important constraints to be taken into account. At this level, they are included in the crop research strategy and innovative solutions are searched for. Thus, the strong criticism of the environmental problems at the political level (atrazine pollution is not a real problem but the result of media hype) is, therefore, no barrier to their consideration in research programmes. Thus, the group has developed a major maize programme on water stress, directly linked to the view that the crop, with its '*ill-founded reputation of polluter*', will not remain competitive unless it is possible to reduce inputs and improve its image.

The environmental issue has also become increasingly important for biotechnology research in the last 15 years, to the extent of being today one of the criteria in the selection of projects. For example, there was some questioning within the group about introducing animal genes in a selection programme. It is worth noting here that the concern is linked to public perception rather than to the environment itself. Generally, many classical or biotechnology selection projects aim to reduce inputs (research on disease resistance) and select the most genetically resistant varieties (maize resistance to water stress for example).

Furthermore, some respondents noted the paradox in the present situation of biotechnology: the public opinion and the rejection of GMOs are leading to the emergence of solutions which are more-environmentally friendly than conventional technologies. For example, research in herbicide-resistant crops aims to find substitute herbicides which are less strong, particularly in relation to the problem of atrazine. France is one of the only European countries where atrazine – a product which is easy to trace and persistent– can still be used although there are total herbicides which are biodegradable (Round Up, Basta...), breaking down very rapidly.

The idea that many 'environmentally-friendly' innovations could come from biotechnology and genomics is found in the scientific approach. Besides, most R&D programmes which meet an environmental concern are carried out in the subsidiary responsible for field crop biotechnology research. The 'scientific approach' on the environment is thus characterised by the search for innovative technical solutions to the problems submitted. Therefore, it has to be determined *how and when will an environmental concern lead to a research programme with a budget?* The management approach to the question provides an understanding of the selection criteria for group projects.

5.1.3. *The management approach*

Within the group, another type of position is found which could be called 'management approach' because it sets the problem in relation to the market. In some aspects, it is close to the political approach, but it enables the company to go further in the understanding of the group's general attitude towards the environment.

Here again, it is difficult to distinguish the environmental issue from the wider farmer's background. For the farmer, there is a direct link between the environment and agriculture as his income comes from the land. The environment should be seen as a component of his work. It would be a mistake to consider it as an objective and to forget that the real aim of the farmer is to meet market demand. The following quote illustrates this point, explaining why the group is concerned with the environment:

"We discuss ecology which is unavoidable: it is impossible not to discuss such issues! But it doesn't mean that the environment should cover everything else. For us, the environment must remain in its place: agriculture has to pursue an objective, the environment is one of the components in the construction of agriculture but it is not the main one. Agriculture should not be seen under the light of 'land-use planning' or 'farmer, the manager of the French landscape'. The debate isn't there: farmers will be farmers with their main function being production but they need to integrate their environment into their approach. When the farmer grows maize, he will think about the nitrate balance, it is part of his job. However, it would be ridiculous to say that the farmer's objective is to avoid such inputs in his field. We have to think in terms of balance. The objective of any farmer is to provide a satisfactory answer to his market, while managing his land for the best. Thus, the environment is a significant component because the farmer does not produce only for one year, he must think about the long term. This is a part of his job: the sustainability of his farm is one of his concerns. But it cannot be his main objective. His job is agriculture and the environment is one aspect to be taken into account".

While the group's objective is to meet the needs of its members who are farmers, it is also concerned about meeting the needs of the market. Therefore, environmental issues can and must be integrated in the group through the market.

The following diagram shows the way in which the environment is included in the group's general strategy, represented as a cognitive pattern diagram.

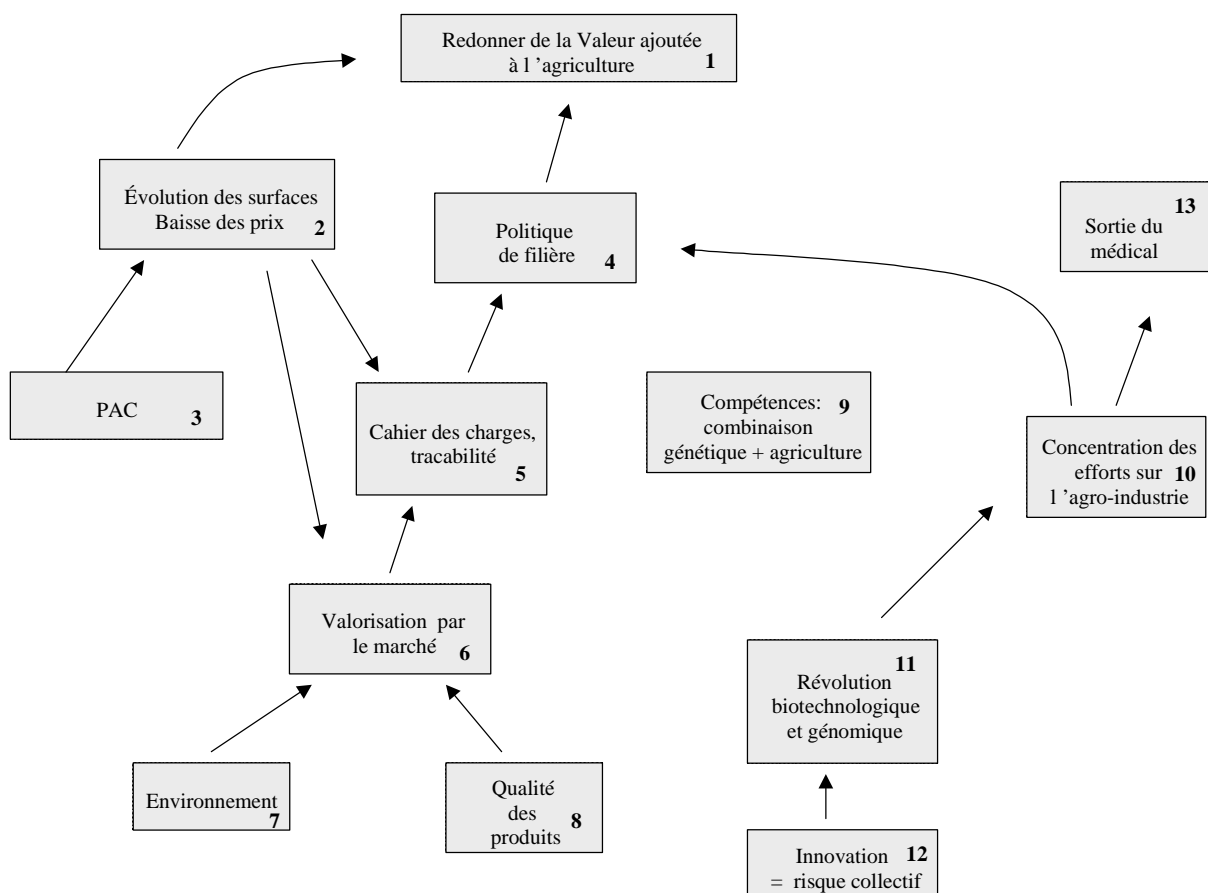


Figure 3. Cognitive pattern: 'the environment must remain in its place'

In the managers thinking, the most important is to achieve the group's objectives, i.e. to restore added value to agriculture (1). The strategy adopted by the group has been to make the work of the seed producer evolve towards work in specific channels: the genetic analysis is not only carried out from an agricultural but also an agro-industrial point of view. Crop improvement is seen in the light of advantages aimed at the industrialist or the consumers, and which can enhance the value of the product through specialised marketing channels (4). Valuation is a problem with respect to providing information for the consumer, who does not always see the added value of the product. The solution considered is then for the actors of the channel to work on a definition of specifications (6).

These specifications would allow the different actors in the channel, including the regulatory authorities, to discuss its characteristics. In the end, the consumer is provided with a quality product with information on the specifications as determined by those actors. Under such a scheme, what would be the place ultimately given to the environment? This component would also have to be seen in terms of information: the environmental aspect has to be integrated in the specifications determined by the market

5.2 At the company level

As we have seen, there are several points of view on the environmental issue within the organisation. While anyone can assess how ecology is integrated at their particular level, the way in which it is integrated in the organisations' general strategy is less clear. Some find that its integration is rather ambiguous and that this criteria is not taken into account in particular

selection programmes. Others underline that while the environment is in the general background, it is not a theme as such. There is no one in the organisation who could be seen as responsible for environmental issues in relation to a particular field and ultimately, *'everyone does a little bit'*.

Thus, environmental considerations are not an issue as such. We have seen, through the manager's position, why the organisation is reluctant to give the environment a specific place but integrates it as a component of a more global approach (it is part of the marketing channel approach: the environment will only be taken into account if it enhances value in the supply chain).

The aim of the following section is to identify, from the interviews, the means provided by the organisation to deal with environmental issues. These means are not clearly visible and the lack of certain elements also reveals the general policy carried out.

Lack of an environmental management department

A major consequence of the policy carried out is the lack of an environmental management department or programme. This is mostly due to opposition from the management: *'There is no environmental department and it is not on the agenda.'* It reflects the concern not to make it an objective as such. However, there are some people in the organisation who are more specifically in charge of environmental issues.

The 'Environment and Public Policy' representative

Two respondents have mentioned a person in the group more specifically in charge of environmental issues. However, his role is to approach the subject from the point of view of the agricultural policy: he is in charge of following up cases in general policy, agricultural policy, regulations, etc. He is now also responsible for environmental questions which are increasingly becoming a political and regulatory subject. He is part of the 'strategy and communication' department.

His task is also related to the preparation of the organisation's public statements on subjects such as 'sustainable agriculture' and 'integrated agriculture'. The approach here is to consider the environment from a political point of view. The aim is to communicate but it is difficult to assess the effects in terms of research programmes.

Monitoring staff:

As we have seen in the 'scientific' approach, several research programmes aim to answer environmental concerns. Two persons seem to play a significant role in the identification and implementation of these projects. They are two monitoring staff working for the holding (department in charge of the 'scientific, technological, technical and marketing' monitoring). This is a description of their role in the company:

"Their task is to study what is happening in the environment, to be on the look-out, to listen to people, make them talk, try to feel the general trends of the market, consumption, etc. They monitor constantly, follow the state of knowledge, but they also act (for example, by setting up research contracts with the INRA)".

Their role is therefore to monitor the environment and also to help develop projects. The latter is important in our study because it is in this way that 'environmental' projects can emerge. The following quote shows the process through which a given subject can become the basis for a research programme:

"The idea [of a project] can come from different backgrounds but at some point, it will be taken into account by these people who think about the evolution of needs (**the monitoring staff**). They will start by taking over the project, start working on it, see what is technically feasible; they will find the selection experts (before the ROC) to see what exist.[...] their performance can be measured according to their capacity to transform an idea into a project. Their objective is to find amongst all the ideas they consider, some which will first become research projects and then

development projects. They will work with the selection experts, the R&D production representatives in service and manufactured food companies, collect data, make economic simulations etc., build a project in fact. Then it is included in the ROC agenda”.

These two people were mentioned several times as having the capacity to attract attention and set up projects with an environmental component. Besides, they seem to have initiated several projects.

5.3 Environment and innovations

5.3.1. *‘Environmentally-friendly products’ and ‘clean technology’*

During the interviews, one of the last questions covered the company’s definition of ‘environmentally friendly technology’ and ‘clean products’. Different answers were given and referred to what is done in the company.

In the general orientation of the research programmes (biotechnology and conventional selection), the environmental issue is a component: as part of the conventional selection and biotechnology work, the objective is often the reduction of inputs and selection of genetically more resistant varieties. For maize, the idea is to reduce inputs and find stress-resistant varieties.

In the work of the selection experts:

- for biotechnology, the organisation avoids, as far as possible, the use of animal genes; noting that this choice is linked to a question of perception at present, but that there are no reasons to be constrained in this field from a scientific and safety point of view.
- in the daily work of selection experts, the present regulations on GMOs are strictly complied with. This is a source of considerable constraints in the specifications.

Upstream, ‘clean technology’ is defined at three levels :

From the farmer’s level to the industrial process, the term of ‘clean technology’ can be considered under three aspects according to some of the respondents:

- At the **agricultural** level, we can try to better manage inputs. This doesn’t necessarily mean trying to reduce inputs but attempting to optimise them (given the decline in prices, farmers are concerned that a reduction in inputs could lead to lower yields);
- For **raw materials**: the aim is to produce raw materials which reduce the environmental costs for industrialists. For example, a starch producer using large quantities of water will be interested by corn which is more easily transformed (he will use less water and produce less wastewater). In this way he will be subject to less pressure, which is an advantage.
- Promoting the development of new products to **replace non-renewable by renewable material**. For example in packaging: plastic is replaced by plant-based material and the combustion is under study to determine whether more energy can be produced while reducing emissions or waste products (e.g. Polystyrene emitting chlorine).

5.3.2. *Market position of innovations and barriers*

At this level, one can see the logic behind the design of environmentally oriented projects. Enhancing market value is a precondition for developing ‘clean technologies’: the fact that the product is ‘environmentally-friendly’ is not sufficient in itself. A series of minor factors will thus influence the interest taken in and selection of an environmental programme.

The following quote give a good synthesis of this logic which affects the general attitude of the organisation towards ‘clean products’:

“To act on an ecological level is not a primary objective [...] The environmental issue must be taken into account because it is a constraint applying to all citizens. It is a constraint for producers in their working methods and for us, the idea is to give solutions to farmers so that tomorrow, even with higher environmental constraints (eco-taxes, input reduction, etc.) they will be able to get an adequate income from wheat or corn. An adequate income means an agricultural yield and a product meeting a clearly identified market demand, so that the value of the product is the highest possible. Our main concerns are agricultural and technical innovation”.

Creating added value

However, market development does not necessarily mean an increase in the added value. Developing environmentally-friendly products is above all, a way of staying on the market. Thus, one respondent explained the following about a project related to an environmental issue:

“For this project, we did a thorough study and we know it won’t make any money, it will only allow us to keep our shares on the market: it is an environmental factor so it will not be earn anything (Who would pay for this?). We will provide a solution but there won’t be any change on the selling price (only the maintenance or a larger market share).

As regards all these environmental issues, we work on them because we have to, more than anything else, in order to keep our share on the market. We know that, generally, it isn’t a way to create added value for our products.

It is not a market as such, it is a way to deal with constraints which will appear sooner or later and for which we have to get ready in advance”.

Regulatory incentives

Another important component which will condition the development of environmentally related research programmes is an existing or expected restrictive regulation on a given issue.

Regulatory constraints can promote programmes relating to an environmental concern. Measures such as eco-taxes give a market value to cleaner products by creating market opportunities: *‘These ideas aren’t new but today, industrialists pay more attention to this type of programme, under the pressure of eco-tax type measures which they will have to pay.’*

Substitute products

Finally, in addition to regulatory criteria, another factor can have an impact on the implementation of an environmentally related research programme, i.e. the existence of substitute products.

Some programmes have not only been set up because of a regulatory threat, but also because there were substitute products on the market. An initiative was needed because the product could be replaced by another if it was not changed.

6. The organisation’s position on political and environmental policies

We have examined in detail which policies have an greater or lesser impact on this particular company. However, some critical comments about public policies which were expressed during the interviews are not specific to a given field. They relate to more general aspects of the methods of action adopted by the authorities and give important indications on the company’s perception of public policies generally.

The defence of European agriculture in international negotiations: a major uncertainty

When supporting the independence of European agriculture, the organisation takes very forceful approach. It warns against North-American hegemony from the scientific point of view [see 4.1.4] as well as relating to self-sufficiency in the field of soy proteins, and regrets the lack of political will. This criticism is accompanied by a recognition that there is no clear and shared vision of the role of agriculture in France. Any project in this field would involve opening a real debate with the public.

Beyond the CAP, the organisation recalls thus that the future of agriculture in France is strongly dependent on the power game between Europe and the USA in international negotiations. There is a deep concern about the political will required to maintain a clear community preference: the commercial risks linked to the gradual removal of tariff barriers are therefore a source of major uncertainty. These could undermine most of the expectations about different crops on which the group's strategy is based (for example, the work on wheat or maize quality could be jeopardised by the removal of tariff barriers).

The gap between the design of public policies and their implementation:

The organisation's management also notes a gap between the design of public policies and their implementation. Significant measures determined at the WTO level eventually have to be implemented by local authorities, often unaware of these international negotiations. The lack of communication between the different implementation levels of agricultural policy and the importance given to the local level often become a source of inconsistency. This situation can be compared to the uncertainties about public opinion on the issue of French agriculture and its role in society.

Promoting a participative process to set standards:

Public policies on environmental matters often raise the question of the setting of environmental standards. In response to a question on the possibility of a tightening of some standards, as in the Netherlands or Denmark where the governments have set up plans for a compulsory reduction of inputs, one respondent stated:

“That's where I'm very worried for the competitiveness of European agriculture. I think farmers can take this type of problem into account but that the market is the law. For example, integrated agriculture is no problem for me: to meet the demands of a consumer, a marketing channel seems to be real objective for agriculture. Tomorrow, it will be necessary to ensure that agro-food quality satisfies market demand: if integrated agriculture contributes to it, I won't question it. However if integrated agriculture is used to set standards which make no sense from the point of view of agro-food quality, we cannot agree”.

In this respect, we are close to the manager's approach which prevails in the organisation on environmental matters. But what should be remembered here in terms of public policy is the rejection of standards as an instrument of public policy. In any case, if a standard has to be set, it should be based on market needs and take into account the production constraints to overcome.

'As regards this concept of standards, I am very worried about who will set them: the market or the policy-makers?

Is it not up to the actors of the marketing channel to determine specifications and then have an information policy towards the consumer?'

In terms of public policy, the organisation campaigns thus for the participative setting of standards through the market. Besides, it considers its efforts to set up special marketing channels as a way to move the debate forwards:

'At Limagrain, we took the decision to create our own channels: for wheat, we followed it all the way up to Pain Jacquet. We started marketing 'channel products' where the origin of the wheat, the soil, the genetic characteristics (a specific

variety with a specific flavour or health quality) are indicated. It can serve as an example for the market, we do not boast about it but it shows that it's possible.'

7. Conclusion

To conclude, we will summarise the main results of this case study and indicate possible problem areas.

1. Limagrain's innovation strategies are deeply rooted in the companies identity. Being both a co-operative and a seed production group, its strategy closely combines investment in biotechnology and agriculture with a high added value.
2. The co-operative identity has considerable consequences in terms of company culture and the decision-making process. Farmers are both shareholders and stakeholders⁹. Their support to the project is not only based on the expectation of possible returns on investments. It involves a consensus on general directions and an approach to innovation strategies which is consistent with the proposals of agrochemical corporations. This is particularly important at present, given the agricultural sector's concerns about mergers. Although the initiatives of the technostructure are essential, strategies and technological projects must be discussed at different levels. Joint action is crucial and farmers play a central role in it. This leads to a slowness in reactions which could be attributed to inertia or stability depending on the point of view. Reactions are possible but the time factor is important and changes in orientation require a 'maturation' period. The disinvestment from Dolisos is an example of the difficulties of withdrawing from a joint project but also shows that it is possible. In this decision-making process based on discussion, the consistency of the project is given a greater place, perhaps at the expense of its adaptability.
3. The internal working of the group is close to the relationship between the co-operative and farmers which have just been described. Committees play an important co-ordinating role, upstream from decision-making. We have seen that, in all the fields where committees are involved, the respondents had a similar perception. Thus, this operating method, through committees, favours decision-making by consensus. While new ideas may be developed (such as participation in Genoplante or investment in Jacquet), it might be difficult to give shape to those which, at a given moment, run contrary to the common perceptions rooted in the company.
4. The ability to invest in biotechnology is one of the critical areas for Limagrain. Considering its size, the group can only be part of the big game if it associates with other actors. Here, two points can be made:
 - 4.1 While the Biogemma project (in which Limagrain is the main actor) is consistent with the company's project, the alliance with RPA is a source of risk. It can hold as long as RPA does not have any seed production strategy, a situation which could change with the creation of Aventis;
 - 4.2. Investment in biotechnology is only possible with a complex set-up. This is a time-consuming process for management and can lead to some constraints in the implementation of research strategies. These limitations are likely to be offset by a more flexible management of the research projects, based on direct relations between the producers and the users of innovations. However, the organisation of such an internal market may create problems. We have not studied these problems in detail but it is easy to understand that the ability to reduce opportunism on the part of different actors will be important. Attention should

⁹ The company stakeholders here are individuals or groups which contribute significantly to the recognition of the company project internally (employees...), but also in society (consumers, citizen groups...). A company must defend its legitimacy vis-à-vis stakeholders as well as shareholders.

therefore be given to the contents of the contract, to controls and penalties, as well as to joint training possibilities.

5. The agricultural policy has an obvious impact on Limagrain's markets. It is therefore important in different decision-making processes. However, the following comment has to be made. Looking back, it can be seen that the CAP 1992 reform triggered a strategic shift towards specific product channels. The debate about agricultural policies has given little attention to the current changes: indeed, the management considers that Agenda 2000 and the Berlin agreements only help to strengthen the decisions taken in anticipation of the 1992 CAP reform. It considers that environmental components and the CTE (area management contracts) confirm the urgent need to develop dynamic agricultural channels.
6. Environmental concerns do have a place in the company. Indeed, the latter is deeply rooted in the agricultural sector. The members of the Governing Board, all farmers, aim to ensure the sustainability of their environment, which guarantees the sustainability of their production tool. Here, it must also be noted that, within the group, sustainable agriculture is perceived in a similar way: 'The real answers in terms of sustainable agriculture (controlling water use, inputs etc.) will be high tech solutions which require more knowledge'. Sustainable agriculture (in all its aspects, including economic) will be a high tech agriculture (which implies a 'control on actions and technical decisions') and not a return to the past as has been suggested. This explains the will to not deal specifically with environmental issues but to take them into account as a factor among others. This has significant consequences: in any event, it can reduce effectiveness with regards to environmental objectives in as much as this choice cannot lead to the broad vision necessary for the serious consideration of environmental problems. The decision not to deal with environmental problems as such restricts the implementation of measures (ecobalance), measuring instruments and standards which would allow the company to have a pro-active approach in the field. Furthermore, this state of affairs reveals the weakness of the political processes in this matter. Indeed, the refusal to define an environmental strategy for the company is the result of a management decision on the one hand and on the other, of resistance to policies based on compulsory standards and an authoritarian enforcement.

ANNEX C10

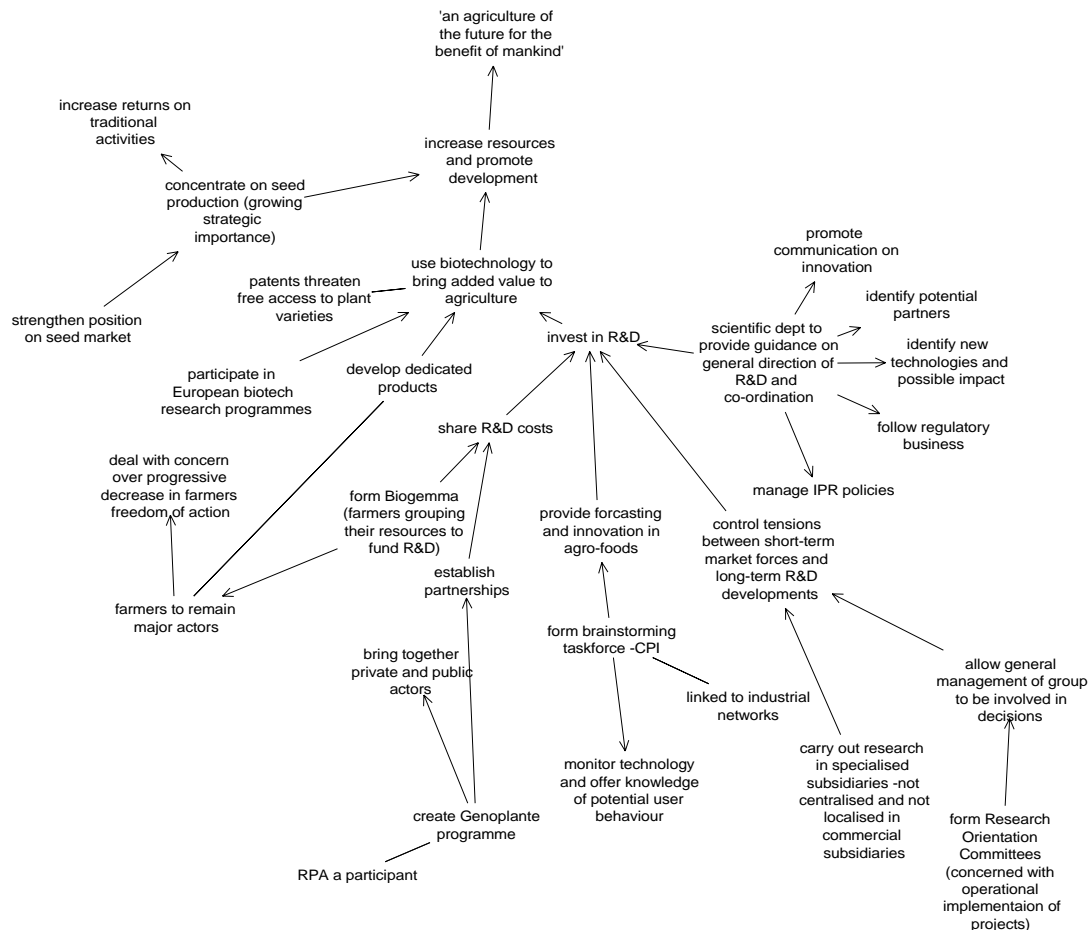


Figure 5 Map Showing Limagrain's Innovation Strategy

ANNEX C10

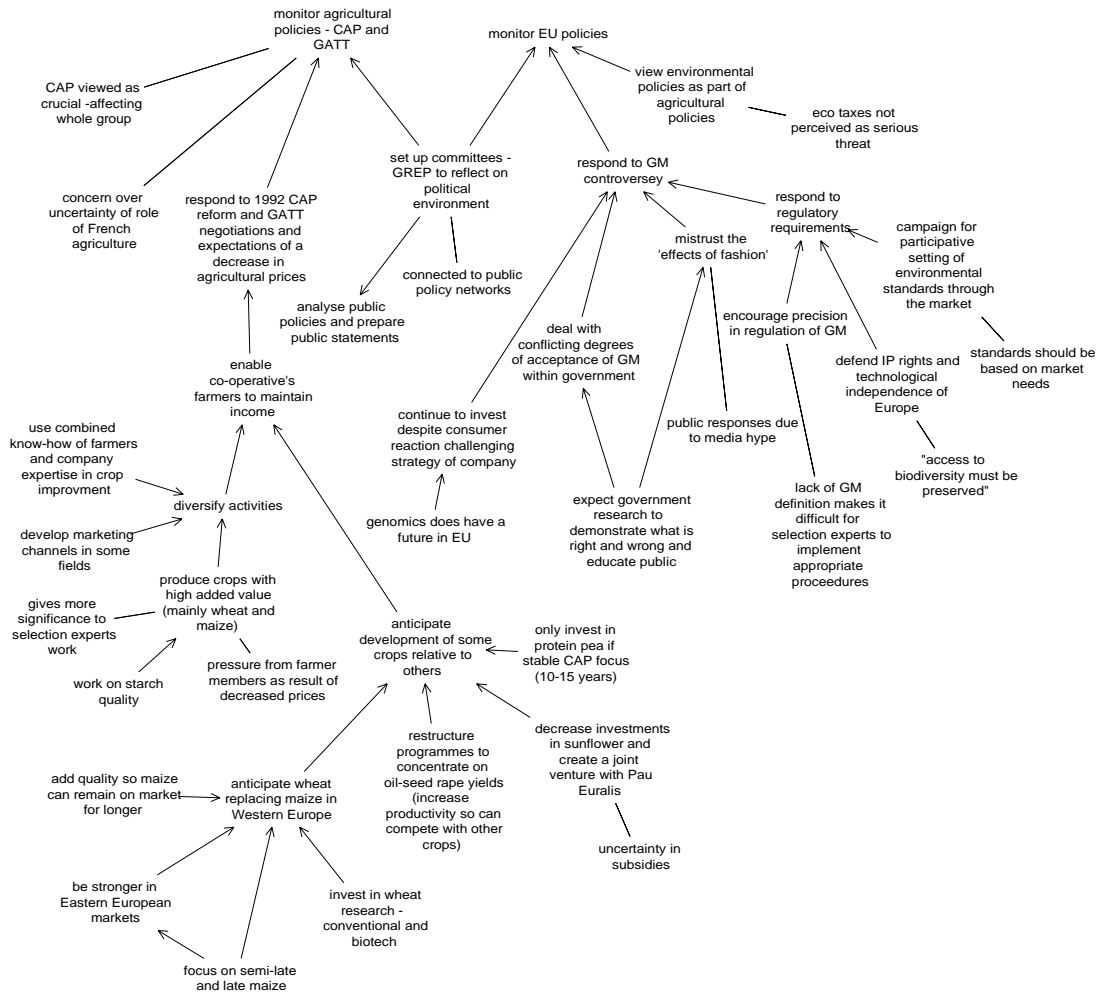


Figure 6 Limagrain Policy Map

ANNEX C10



Figure 7 Map showing Limagrian's thinking on environmental issues



Appendix : List of Interviewees

- P. Pagesse, Chairman of the Board
- A. Catala, CEO
- D. Chéron, Director, Limagrain Agro-Industrie
- J.C. Gouache, Scientific Director
- A. Messenger, Director, Ulice
- M. Debrand, Director, Biogemma
- C. Camisan, Head, Industrial use of Maize in Europe
- B. Debray, Development, Maize Varieties
- S. Crouzier, Director, Industrial use of agricultural products
- P. Bertaux, Director, Maize Research
- O. Vimont, Maize Plant Breeder