

ANNEX C14

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

Rhone Poulenc Agro monograph

Annex C14

TSER Programme
European Commission - DG XII
Project No. PL 97/1280
Contract No. SOE1-CT97-1068

Gérald Assouline

**QAP Decision
France**

September 2000

Introduction to the PITA Project

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

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

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

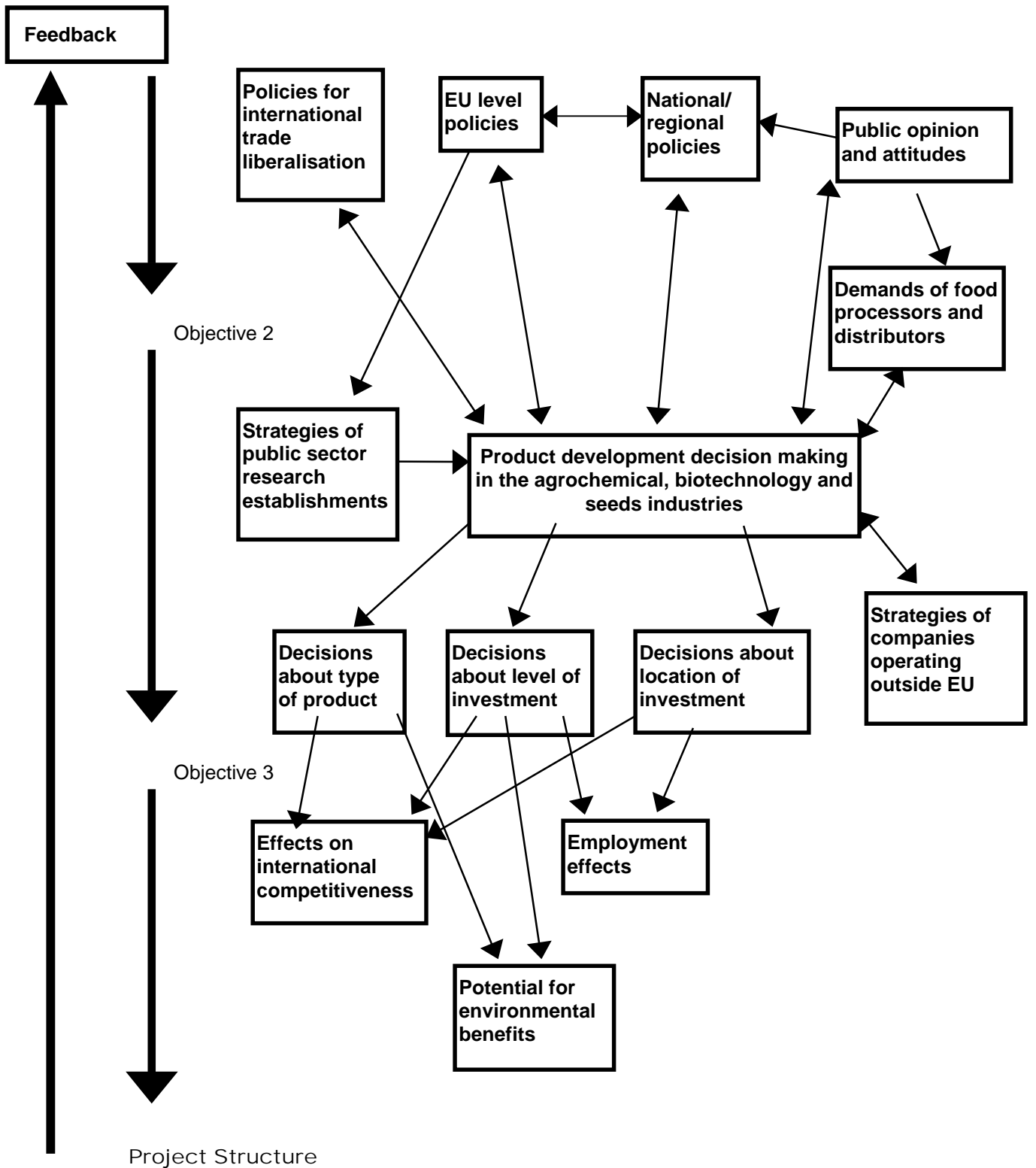
The range of policies and other influences studied includes:

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

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

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

Objective 1



Contents

1	INTRODUCTION	5
1.1	THE PREPARATION OF RHONE POULENC AGRO MONOGRAPH	5
2	KEY FIGURES ON RP AND RPA	5
2.1	RHÔNE-POULENC GROUP	5
2.2	RHÔNE POULENC AGRO	6
3.	INNOVATION STRATEGIES	8
3.1	MAIN RPA PRIORITIES	8
3.2	THE CHEMICAL INNOVATION DYNAMIC	9
3.3	STRATEGY TOWARD BIOTECHNOLOGIES	10
4.	R&D DECISION MAKING : ORGANISATION AND STRUCTURE	13
4.1	THE TOP MANAGEMENT DISCOURSE ON THE BENEFITS OF DECENTRALISATION	13
4.2	THE ORGANISATION AND DECISION MAKING PROCESS IN RPA FOR CHEMICAL R&D	13
4.3	CLUBBING AND NETWORKING	15
4.4	CORPORATE SYNERGY	15
5.	PUBLIC POLICY INFLUENCES ON INNOVATION STRATEGY	16
5.1	INTRODUCTION: THE IMPORTANCE OF EUROPE FOR RPA	16
5.2	DISCOURSES ON ENVIRONMENTALLY FRIENDLY PRODUCTS WITHIN THE COMPANY	16
5.3	REGULATORY AND ENVIRONMENTAL POLICIES	19
5.3	AGRICULTURAL POLICY	23
6	CONCLUSIONS	24
7.	EPILOGUE	25
7.1	AVENTIS CROP SCIENCE ACCORDING TO RPA MANAGERS	25
7.2	NEW ORIENTATIONS	26

1 Introduction

1.1 The preparation of Rhone Poulenc Agro monograph

During our investigation, our concern has been to find answers to key questions characterising the PITA project:

- What are industry's main innovation strategies and factors influencing them?
- How to analyse the R&D decision making processes?
- How do public policies influence the decisional processes?
- How industry decision makers pay attention at the environment question?
- Which kind of environmentally friendly products and technologies may the industry innovate and market?

The answers to these questions for RPA are quite similar to those from other agri-chemical companies, such as the way they look at public policies and public opinion. However, the monograph presents interesting particularities. The discourses on environmental issues are not monolithic and vary according to the position of the interviewee within the organisation. RPA reflects a flexible and quite decentralised organisation which is very engaged in chemical innovation but cannot be considered as a pioneer in plant biotechnologies.

Five interviews have been carried out within RPA mainly during Summer 1999:

- J. P. Decor, RPA R&D Director.
- J.B. Unsworth, RPA La Dargoire Research Centre Director.
- C. Guyot, RPA La Dargoire Research Centre, Environment Scientific Adviser.
- G. Maréchal, RPA Europe Zone, Technical Development and Regulatory Affairs Director.
- E. Zirakparvar, RPA Active Ingredients, Products, Projects Vice General Director.
- P. Housset, Aventis CropScience Strategy Manager

2 Key figures on RP and RPA

2.1 Rhône-Poulenc Group

Rhône-Poulenc Agro is part of the Group Rhône-Poulenc. Rhône-Poulenc is now divided into two main divisions:

- **Life sciences** which include *Human Health* (pharmaceuticals, vaccines) and *Plant & Animal Health (PAH)*
- **Rhodia** for chemical specialities.

Table 1 Corporate data from 1993 to 1998

In billions of Euros*	1993	1994	1995	1996	1997	1998
Turnover	12,28	13,15	12,92	13,08	13,70	13,23
Turnover in Europe (%)			53.2%			46.5%
Operating Profit (before exceptional items)	0,90	1,05	0,94	1,05	1,21	1,20
Net profit	0,14	0,29	0,32	0,41	0,52	0,64
R&D expenses	0,97	1,02	1,08	1,23	1,29	1,29

* 1 Euro = 6,56 FFr

When observing those data, several remarks have to be done:

- the corporate sales amount fluctuates, throughout the recent period, but profitability is increasing;
- Europe share in the total turnover is decreasing, but is still quite important (46,5%);
- Corporate R&D remained stable in the last two years, after a significant increase between 1993 to 1997.

In June 1998, Rhône-Poulenc floated 32.6% of its Rhodia subsidiary' capital on Paris stock market, a significant step in its strategy of refocusing on life sciences. In August 1999, RP put on the market all its shares in Rhodia. A major reason for this divestiture is financial: the high level of debt of RP which can be a hurdle for further investment in pharma and agro activities, has to be reduced.

As a major company of the sector, Rhône-Poulenc is now presenting itself as a Life sciences Company with two main business sectors :

- **Pharma**, built around Pasteur Merieux Connaught, Rhône-Poulenc Rorer and Centeon (a JV with Hoechst) ;
- **Plant and Animal Health (PAH)**, which includes three companies :
 - (i.) Rhône-Poulenc Agro
 - (ii.) Rhône-Poulenc Animal Nutrition
 - (iii.) Merial (a JV 50/50 with Merck & Co Inc).

See Figure 1 Sales by business sectors (page 28)

2.2 Rhône Poulenc Agro

The turnover fluctuates in recent years, but profitability is improving. From 1995 to 1998, R&D investment share has been decreasing, from 6,85% to 6,39% between 1995 and 1998.

ANNEX C14

Table 2 RPA Plant and Animal Health Sales and R&D investment (billions Euros)

Years	1995	1996	1997	1998*
Turnover	2,66	2,97	2,97	2,62
Operating profit	0,29	0,38	0,47	0,54
R&D	0,18	0,20	0,20	0,16
% of sales	6,85 %	6,66 %	6,66 %	6,39 %

* excluding Merial, the Animal Health joint venture with Merck & Co, created mid-1997 (1,58 B. Euros)
Source : Annual reports

RPA product portfolio is a mix made with quite old (20 to 30 years old) products and more recent ones: Sales amount of the older products increases much slower (+ 8%, between 1997 and 1998) than the newest ones (+ 73%), which are still in a launching stage.

Table 3 RPA key plant protection products sales outlined in RP annual report (1998) in Millions Euros

Products	1997	1998	1998/1997 (%)
Temik (I)	170,1	178,3	
HBN (H)	137,0	159,7	
Iprodione (F)	121,0	126,0	
Sub-total	428,1	464,0	+ 8 %
Regent * (I)	76,2	121,8	
Fosetyl (F)	83,0	100,6	
Isoxaflutole (H)	5,6	62,8	
Sub-total	164,8	285,2	+ 73 %

* fipronil based Insecticide

43,1 % of RPA's turnover is done in Europe while 30 % is in the USA. The last 25% is in the rest of the world.

Table 4 RPA Plant protection products geographical presence (in % of sales)

Europe	43,1
North America	29,9
Latin America	11
Asia Pacific	10,4
Rest of the world	5,4

In terms of ranking by kind of products, we could say that RPA is an intermediate company. RPA is a leader only on the growth regulators markets. On the most important market, the herbicide one, its position (n° 9) is quite far from the leaders. On the insecticide market, RPA is in the 3rd position, and it could improve it with its new product (fipronil). Its position on the fungicide market is quite stable (n°4).

Table 5 RPA plant protection products per category of products (in % of sales)

Type of product	1994	1998	World ranking
Herbicides	41,6	39,5	N° 9
Insecticides	25,7	31,5	N° 3
Fungicides	20,8	20,9	N° 4
Growth regulators	11,9	8,1	N° 1

3. Innovation strategies

3.1 Main RPA priorities

Priorities highlighted through the institutional communication

Alain Godard, President of Rhone Poulenc Plant and Animal Health¹:

...The future of crop protection passes through the combination of an innovative chemistry with biotechnologies...Rhone Poulenc's strategy consists in focusing on innovation and investing in the development of genes which provide a clear competitive advantage...

In the RP 1998 annual report, R&D is presented under the Life Sciences chapter, with quite a lot of details on the pharma and drugs R&D (1,5 pages) and few details for the plant and animal health R&D activities (less than half page).

- Accelerating the discovery process:

...In plant protection, RPA has devoted more than 15% of its innovation resources to develop plant biotechnologies. This strategy should enable RPA to use new genes to develop plants with significantly improved agronomic and quality characteristics (p. 16).

- Reinforcing research capabilities:

...The life science sector is in a state of fast and ongoing change. For this reason, it is vital to have access to the most advanced technologies. RP has therefore strengthened its potential to innovate through partnerships and alliances with public institutions and private laboratories that are recognized for their cutting-edge technologies and innovative capacity. RP's goal is:

- to enhance its scientific knowledge, particularly on emerging technologies,
- to accelerate the development process through the acquisition or pooling of techniques.

In addition, strategy and innovation working groups have been organised by the Scientific Affairs Department. These groups, which include RP researchers and outside consultants, have identified the usefulness of a common life science platforms for:

- access to a diverse range of compounds, the development of combinatorial chemistry methods and primary screening to detect in vitro activity.

¹ Quoted in *Rhone Poulenc Agro : A major partner in the field of plant biotechnologies*. RPA Lyon, March 1999

- The discovery of new biological targets with co-ordination of functional genomics and bioinformatics technologies (p.17)

Source: RP annual report, 1998

- While continuing to enlarge its product line, RPA is developing new research methods. The « New Approaches » and « High Throughput Screening » projects became operational in 1998. These programs enable increased screening capacities in research centres while targeting molecules that have positive plant-health action at very low concentrations. RPA is also developing a predictive methodology for the early assessment of molecules toxicological and ecotoxicological profiles.

- In addition, RPA is developing new products that will be launched between 2001 and 2006: two new fungicides (including fenamidone for grapevines and vegetable crops), two new insecticides (acetamiprid and ethiprole, which will enable RPA to extend its products a large number of crops and a large number of insects), one herbicide and three herbicide tolerance genes.

- Two new products have entered the pre-development phase: a new insecticide of the fipronil family and a fungicide for treating cereals.

Source: www.rhone-poulenc.com 11/09/99

Those declarations show clearly that RPA structures its strategy around crop protection, showing how it orientates its efforts to strengthen its research capacities through accessing to/combining new technologies and investing in biotechnologies (genomics).

3.2 The chemical innovation dynamic

Mr D presents what could be a good product:

A good product is for large markets: fungicides for cereals, herbicides for maize. We can't develop a product for strawberries or raspberries, it is too costly. We need a profitable market for pay back of the development cost (about 50 M \$). The R&D project has to be cheap, the product should not be remanent in soil and very efficient...

Mr E says:

In terms of crop profile, the major changes within 5 years will happen on corn, soybean and cereals, where we still have gaps. We are not as strong as we would like: a new product is to be launched in the US corn market. In terms of products portfolio, we have a quite diversified one. Our market share will grow on herbicides (1 new compound) and insecticide (1 new compound) and decrease on fungicides. In the seed business, GMOs will take place in Europe beyond 5 years.

As those quotations indicate, the company innovation priorities are fully focused on the major industrial crops and chemical products for which the market share needs to be higher i.e. on herbicides and insecticides. Minor crops are not at all a target for RPA.

Rhône-Poulenc Agro Research Centres in Europe

1. Lyon – La Dargoire (France):
fungicides, food residue analysis, product chemistry, biotech (specialised on herbicide tolerance genes), formulation (attached to Europe zone), bioavailability.
2. Antibes – Sophia Antipolis (France): human and environment safety.
3. Ongar (UK): research on herbicides and environmental fate of pesticides.

Non European Rhône-Poulenc Agro Research Centres:

4. Research Triangle Park (USA): insecticides, water monitoring, regulatory studies and formulations for North America.
5. Akeno-Ami (Japan): expertise on rice, regulatory studies, formulations for Asia.

Breakthrough active ingredients

In research, more than 100 000 molecules are screened per year and only some have an interesting activity. The screened molecule goes from the research stage to the evaluation stage (2 years) in field experimental farms to define the profile, efficacy, safety, leaching and early tox and ecotox assessment. For development, the average investment is approx. 50 M\$, under the responsibility of a project manager to get the dossier (tox and ecotox) for registration. This decision of investing such an amount is taken by the Executive Committee (see below).

Two products are considered by RPA as blockbusters: Regent (fipronil) and Balance (isoxaflutole). They are estimated to contribute together approx. \$1 billion in sales by the year 2003. In the pipeline (2001-2006) are 5 new crop protection products based upon innovative compounds.

The association of existing molecules

Another important source of innovation is the regeneration of the product portfolio by association of existing active ingredients from the company or other companies. This option answers to the request from country representatives to regenerate the range and optimise the use of new compounds by associating them with existing products. It gives a much quicker answer, the registration procedure is national and it is also an alternative when breakthrough molecules have been missing. Uncertainty of the marketing schedule of some GM varieties may also inhibit the development of new active ingredients, and the association of existing active ingredients may represent a technical and commercial solution to stay on the chemical market.

Formulation and packaging innovations

In this area there are two very different concerns:

- The first is very marketing oriented. It concerns finding new packaging presentations that are innovative and attractive, as a *plus*: As one of our interviewees says, *there is a relative disappointment on that point because there is no great revolution in terms of product presentation.*
- The second one is related to the type of formulation and package, it does not differentiate very much from one competitor to the other. New formulations look for different objectives:
 - to be close to the target price, by reducing the doses,
 - to fit with the evolving regulation on water contamination for instance, or on user protection.

A major trend is on developing wettable granules or soluble sachets where an influencing factor is the recycling of packaging.

The difficulty of protecting intellectual property of packaging innovation is quoted as a serious problem as it would inhibit real packaging innovations which could easily be copied.

3.3 Strategy toward biotechnologies

In 1998, 15% of RPA R&D budget is devoted to agbiotech, i.e. approx. 25 M Euros, while in 1996, it was 20,5 M Euros, i.e. a 25% increase between the two years.. RPA works mainly on

the valorisation of agronomic genes. This commitment in the field of quality genes is a reality of all RP activities, plant and animal health, pharma.

The company presents itself as a pioneer in the field of herbicide tolerance, with the first GMO being approved in France (bromoxynil resistant tobacco in 1994) and the first large industrial crop being herbicide tolerant in the USA (bromoxynil tolerant cotton in 1995). The transgenic cotton covered 500 000 ha in 1998, i.e. 10 % of the total cotton planted acreage.

RPA set up its first molecular and cellular plant biology laboratory in Lyon in 1984, reinforced by a joint laboratory RPA/CNRS in 1986, and by the creation a joint economic structure (*Groupement d'Intérêt Economique*, *GIE*) specialised in plant biotechnology with Limagrain in 1994. This GIE is now enlarged to other French seed companies inside Rhobio.

RPA built a patent portfolio of more than 40 patents mainly in the field of herbicide tolerance (to oxynils, isoxazoles, asulam, glyphosate...) and plant disease resistance genes, quality genes (fatty acid composition) and genetic engineering technologies.

In its communication², RPA comments on its alliance strategy as a key element of its success in the field of biotechnology:

...Based on technological innovation, RPA strategy in this field follows a logic of alliances. Only in 1998, RP has signed several major agreements of partnership for being present in all the stages of the creation of a genetically modified variety, from genome study till the delivery to the seed producer, through the "mother-plant".

...This strategy should allow RPA to have in 2006 15% (400 M \$) of its sales based on products derived from biotechnologies....

This hypothesis is built upon taking into account existing patent portfolio on herbicide tolerance, the programmes currently developed with Biogemma into Rhobio on disease resistance and the possible access to insect (Bt) resistance genes, through third parties.

This hypothetical amount of 400 M\$ biotechnology derived product sales has to be compared with RPA's own estimation of the future world market for biotechnology derived crop protection in 2005, i.e. approx. 5 000 M\$, on a total crop protection market of 35 000 M\$.

Rhobio

The main biotechnology research activities on industrial crops (maïze, wheat, sunflower, rape seed) are shared between RPA and Biogemma, a biotechnology platform of French seed companies³, within a joint venture (50/50) called Rhobio.

The joint research programme is based on several priorities:

- disease plant resistance
- development of genetic engineering technologies
- development of industrial crop genome analysis technologies (gene expression, plant transformation).

100 researchers, paid by each partner, are mainly located in the two shareholders research labs: They work on generic technologies to be applied on plant resistance to diseases and plant genomics (22 persons, in the only Rhobio lab, Evry near Paris).

² Rhone Poulenc Agro : A major partner in the field of plant biotechnologies. RPA Lyon, March 1999

³ Biogemma (capital of 300 M FFr, 45 M Euros) is a Limagrain (55%), Pau Euralis (25%), Sofiproteol (10%) and Unigrains (10%) joint venture dedicated to research programmes on plant biotechnologies, with a 26 MFFr (4 M Euros) R&D budget. The main Biogemma objective is to avoid Limagrain to be alone in front of Monsanto, Pioneer or Zeneca. So Pau Euralis and Limagrain decided to join their industrial crop R&D capacities (cf Limagrain PITA monograph).

ANNEX C14

Rhobio has signed an agreement in March 1998 with the US company Celera Aggen to discover corn genes associated with agronomic interest and quality traits. In the short term, RPA is waiting for the benefits of the introduction of an insect resistance gene and 3 new genes for herbicide tolerance in several crops.

Genoplante

Genoplante is a national programme, opened to European partners, oriented towards plant genomics, involving public research actors (INRA, CNRS, CIRAD, IRD...) and private companies (Rhone poulenc Plant and Animal Health, Biogemma, BioPlante...). Its goal is to accumulate new knowledge on the main cultivated crops in Europe and to discover agronomic and quality genes. Genoplante is supposed to allow France and then Europe, to preserve its independence in relation to the big US and Japanese genomic programmes.

Table 6 Some 1998 research agreements in the field of plant biotechnologies

Title	Name of partners	Type of agreement
Rhobio	Biogemma (Limagrain + Coop de Pau)	JV 50/50 for Research
07/98	Mycogen Corp, subs. of Dow (US)	Pooling of plant biotechnologies assets to develop & market GM plants and seed products containing multiple traits (sugar cane, cotton → Bt & tolerance to glyphosate, bromoxynil and isoxazoles). The agreement also provides for future expansion insect/herbicide-resistances for corn, canola, soybean, sunflower and additional traits such as oil and protein output enhancement. (Plant Biotechnology Institute at the University of Saskatchewan, Ca)
09/98 Genoplante	Biogemma/sigma/ Serasem/Florimond Desprez INRA//Cirad/IRD/CNRS	Joint research programme in plant genomics (Mainly at Evry technological platform)
09/98	EMBRAPA-SOJA, National Agricultural Centre for Soya Research in Brazil	Research agreement in the field of genetically modified soya varieties suited to tropical markets: resistance insect and disease resistance, tolerance to Rhône-Poulenc Agro's new herbicides
10/98	Dow Agrosiences (US)	Unknown
02/99	Agritope (US)	RP forms with Agritope a plant genomics joint venture
03/99	Perkin Elmer's Celera AgGen unit (US)	Genomics deal with Rhobio
04/99	Singapour Institute of Molecular Agrobiology	RP enters into a rice research agreement
10/99	CSIRO (Australia)	Rhobio enters into a plant biotech research agreement with the Australian CSIRO
10/99	ICAgen (US)	RP enters into an agrochemical screening agreement with US pharmaceutical company ICAgen

Source: Agrow, annual reports

4. R&D decision making : organisation and structure

4.1 The top management discourse on the benefits of decentralisation

In 1993, A. Godard, RPA Chairman, set up a new philosophy, inspired by a Tom Peters book summer reading⁴, for managing the company: SDM - « simplify, decentralise, manage ». During 6 months, 8 working groups joining 300 people worked on how to simplify, decentralise and manage. Unionists are integrated in the process.. In June 1994, the 80 managers become truly company managers with a broad autonomy for recruiting, deciding on product selling prices and even making competing internal services with external ones. The headquarters staff has been reduced to 30 persons. And central services (accountability, communication, legal support...) became units charging for their services. The economic added value (EVA or VEC in French) is used now as an indicator of the decentralisation and optimal use of resources. 4 years later, this change has been considered as a success within the company: the operational profit grew up till 183 M Euros in 1995, 235 M Euros in 1996, i.e. a ratio of 12% on sales amount.

As we shall see below, the decision feeding process is quite decentralised, while the decision making process is centralised: Information goes up, decision goes down.

In a way it is a bottom up process, because the elaboration of the R&D programmes starts from the analysis of the market need. Decisions are fed from information provided by those with field responsibilities. i.e. product managers, country representatives and zone representatives. Then propositions go to the EC, which takes the decisions on their implementation.

4.2 The organisation and decision making process in RPA for chemical R&D

There are two kinds of decisions and decision-making structures:

- Strategic orientations and decisions: such as group positioning, long term strategic planning, research main objectives and resource allocation. These are in the hands of the Executive Committee.
- Decisions related to the selection, implementation and follow up of research programmes (in the hands of the Research Development Marketing Committee) and product development initiatives (in the hands of the Research Committee).

Executive committee (EC)

The members are:

- the Chairman,
- the R&D Director, RPA,
- the active ingredient, product and project Director,
- the Financial control Director
- + 5 zone Directors

They may meet once a year.

Activity: The Committee elaborates the overall strategy for RPA, sets the objectives, analyses the research needs and other needs, defines the resource allocation (50 M \$ for developing a molecule till the registration)

⁴ In Le Monde, 26th March 1998

ANNEX C14

R&D Marketing Committee (RMC)

The members are:

- R & D Director
- Business Managers (herbicide, fungicide, insecticide)
- Country Representatives
- Toxicology Director
- Process, Chemistry Director
- Environmental fate Director
- Patent Director
- Zone Directors or representatives for North America, Latin America, Asia Pacific, Europe, rest of the world

Activities: It presents the EC propositions of research programmes to be launched and assesses projects (which are the components of the programmes) in development.

10 to 15 members of this committee meet twice a year.

- Objective setting meeting to analyse market needs;
- Then R & D programmes are defined

This committee re-assesses every two years the long term strategic plan.

Research Committee (RC)

The participants are:

- The R&D Director, RPA,
- Research centres directors,
- Business managers (herbicides, fungicides, insecticides)
- Approx. 10 Experts to solve question on patenting, marketing, tox, ecotox, process, environmental fate...

Activity: Management of projects. This committee is empowered to take decisions on product development projects. Sometimes decisions are easy to take.

Mr D says: When a patent expert says we can't follow with this project because there is a competitor's patent, then it's clear. If we look at the market where we need a 100 FFr product and it will cost 200 FFr. Then we can have a debate on if we can reduce the product volume. If we have a more than 6 months half life in soil, we can't get the allowance. The problem is when we have a good product (in marketing terms) and a 6 months and half life in soil: here we have a debate on how to find a way to get the allowance. We have to find a solution. May be we can improve the product. If we propose a hedge at 20 meters from water, marketing people may tell us it is not interesting we shall lose market share...

R & D decisions for agro-biotechnology

The main strategic decisions are taken at the Executive Committee and RPA biotech management levels. The main research activities are centralised in Rhobio, the RPA-Biogemma industrial crops biotechnology joint venture. The RPA Biotech manager has his words to say on Rhobio decisions. And Rhobio may sub-contract RPA research units, from La Dargoire for instance.

See Figure 2 RPA R & D decision making processes (page 29)

Gatekeepers are written in italic. They are in charge of anticipating, preventing, implementing new predictive methods in relation with the evolutions of regulation systems and environmental concerns all over the world; they have also to feed the decisions taking into account competitors' projects (through patent).

4.3 Clubbing and networking

In RPA there are 4 to 6 clubs. A club is a transversal network, mobilising competencies through out the company. It seems to us that those transversal links could be compared to quality circles: valorising skills and expertise in the company to feed top management goals and concerns with new ideas. In this networking strategy, there is a strong emphasis on markets needs and signals, from country and zones.

There is a regulatory club (set up two years ago with 10 persons, among them top managers, toxicology and ecotoxicology experts...), crop networks (like banana...), product networks.

The first club was created 4 years ago, was a product launching one with the Fipronil club. The Executive Committee organised a club on supply chain and value chain, as a working group for making recommendations to the EC.

Simultaneously, committee members have their own information and idea networks to feed the decision making process within the committees. According to one interviewee: *Each of us has his own network and agenda: committee meetings are done for getting a consensus. My network is external and internal, based on the lowest level within the company (trans-hierarchical links).*

4.4 Corporate synergy

In RP there is a corporate research co-ordination within RP Direction. Participants are research directors from Rhodia, Pharma and RPA and externally recognised scientists (some are Nobel prize winners) who work part time in the group as scientific advisers. Within the company these scientists have their correspondent. So it is a small group with its own budget for long term research programmes.

It is the place to test new research concepts, long term orientations and to identify, around the company, potential research partners to collaborate with on new research programmes of common interest for several businesses.

One interviewee was asked how the company is facing the growing concern on endocrine disrupters:

It is a transversal problem of interest from fine chemicals to pharmaceuticals.. If we suspect that there are products which are endocrine disrupters, we need to have very soon a diagnostic tool for detecting them. So three years ago we launched a corporate research programme, a part is done in Sophia Antipolis and another part in Alforville. RPA toxicologists and pharma *toxicologists* work together, along with PhD students from public university labs. It is a programme initiated by the Group's scientific direction. The idea is really to have a predictive test on endocrine disrupter.

See Figure 3 RPA clubbing and networking (page 30)

5. Public Policy influences on innovation strategy

5.1 Introduction: The importance of Europe for RPA

RPA geographical implementation is related to the strong impact of European markets on its business. The European market share is more than 43 % of its turnover. This means that RPA follows very carefully the policy signals having influence on European markets; agricultural, regulatory, environmental ones, at national and European levels. It means also that more than half of the activity is related to non European markets. In Lyon, at the headquarters, a majority of managers are French, but a significant proportion of the managers are from the US or from UK⁵.

Europe Zone at RPA covers the European Union, and other countries like Norway, Switzerland and Eastern Countries including Baltic Republics, Poland, Check Republic, Slovaquia, but not Russia. All the non EU countries are followed from Germany by dedicated persons within the German unit. In the Central European countries, regulatory standards are such that the company does not consider as essential to invest a lot of effort as either the registration files are similar to Western Europe ones or they are much more simple.

The content of the interviews and the answers to our question on whether those policies are influential in the innovation decision making of the company show that our interlocutors are mainly concerned by the regulatory processes. The agricultural policy is taken into account but more indirectly by conditioning agricultural areas and incomes.

There is a multiple level of responsibilities for interacting with regulatory and registration processes:

- Europe Zone is responsible for EU active ingredient registration process;
- Europe Zone also has a small team (two or three persons around the Europe marketing manager) to follow up what's going on on GMOs within the major markets. This information is then centralised and integrated at RPA top management level;
- Country representation is responsible for the national registration of commercial products;
- RPA R&D for preparing new active ingredients, getting a conditional green light for their ecotoxicological and toxicological profiles;
- The environment scientific adviser, working as an expert, for answering questions and problems from R&D and regulation units and interacting with external expert and regulatory networks.

5.2 Discourses on environmentally friendly products within the company

We could identify two kinds of discourses within the company on how RPA should deal with environment: environmentally friendly products and public risk perception

- **A political discourse on risk**

This political discourse expressed by a R&D top manager is in fact quite close to the industry institutional discourse on:

- the role of the pesticide industry for feeding the earth,
- the irrational risk perception of the public who wants zero residue in food and environment,

⁵ On the 6 persons we met in the company, 4 are French, one is from the US and another one is from UK.

ANNEX C14

- the recognition that pesticides may contaminate environment,
- GMOs as the more environmentally friendly solution industry can provide in answer to public concerns on pesticides,
- the decadence of our civilisation that is too averse to risk taking.

Zero risk means to be against progress:

...I don't believe in a zero risk product. It is like the protein you put in GMOs: I don't believe zero risk could be scientifically proven. People want zero risk, absolute safety, pets replace children. Europe could be a decadent civilisation. Living means taking risk !! And I am glad that GMOs are developed in other parts of the world like China or in America. We will see the benefit and in Europe I hope we can react if it is not too late...

A second part of this kind of discourse is more technical. Pesticides may contaminate the environment (more before than now), but zero risk pesticides are difficult to create so the solution to environment problems related to crop protection is GMOs:

...We have products, discovered 40 years ago, used in millions of hectares with impacts on the environment; we can see them because we have very sophisticated diagnostic tools. It's mainly pollution consequences. Products have been used to avoid risk, to maximise their crops. The new products of today can't have the same consequences as existing old ones. In the US, to get the « reduced risk » registration label procedure, you have to justify how you position your product in relation with its three main existing competitors on the markets. You have to prove that for instance, your maize herbicide is better than atrazine on toxicological or environmental aspects (solubility, life time, presence in underground water, tumours...).

For the research it is important to anticipate on next thresholds: the next threshold will be zero residue...And zero residue could mean GMOs. I conceive that people don't want residues, because we can't say that residues even at ppm level have no impacts, when you believe in homeopathy...

It is worth to note that in one way public risk aversion is considered negatively by our interviewee, but in another way he accepts that residues may exist and it may concern people. The acceptance of a legitimate concern on pesticide residues justifies the GMOs solution as an alternative.

- **A technical discourse on sustainable agriculture**

This discourse is not in contradiction with the former one. The perspective is different. It focuses on sustainable agriculture and the necessary preservation of natural resources.

As a pesticide fully safe for the environment is quite illusory, the risks related to pesticides has to be minimised by the way pesticide is used and by accompanying measures aimed at reducing environmental risk such as land planning, natural and artificial pollution filters to avoid water contamination.

...We have to improve things at several levels:

- *For new products, we have to modify the cashier des charges, which is not exactly the registration, but the conditions of use. We have no more direct interface with farmers.*
- *There is a filter which is the retailing system and agronomic advice. 70 % of the agronomic advice is done by retailers who are interested by their margins and do not see « beyond their nose »*

- *I want a lot from land planning, from landscape conservation, from landscape re-habilitation. If we don't have a minimal distance between field and river, we have pollution. It is as simple as this...In land planning, natural or artificial devices (grass belt, hedges...) are necessary to protect aquatic ecosystem, which is the most sensitive environmental component. The experimental small river basin is the right territorial unit to control practices and to take all planning, rehabilitation accompanying measures. Otherwise, there is no environment protection.*

Once again, social concern or demand on environment is recognised as a reality to which the company has to adjust. The adjustment can't be through the respect of regulatory standards and through « green pesticides ». The answer is by making the different components of the environment compatible for urban expectations to leisure and landscape and for farming activity.

...Sustainable agriculture has to preserve its resources. There is a social demand, more or less manipulated, which imposes on us objectives which are not in the regulation framework. Regulation does not answer society objectives. Environment for me is a whole set of components. It is a territory with different components; when you develop agricultural activity, you use some of those components for production and yields. Outside those plots, the components are components of leisure, well fare: Among those components there is landscape diversity. Today landscape is essential for urban citizen demand for preserved environment. For me, environment preservation becomes reality, when we manage the components of the environment taking into account the double aspect of agricultural production and quality of life...

Media and press are invoked to justify public concerns: the public is not an object of irrational perception, but is an object of manipulation non scientifically based on risk assessment.

...Today, when you read the media, you can see that 90% of Brittany's rivers are contaminated...This is the kind of message we can see, we talk only in the press, media, of exposure, concentrations, detection levels...It is a discourse for the public. It is not a discourse on risk and risk control...

- **Green pesticides?**

For Mr A, a zero residue product cannot exist and according to such a diagnosis, GMOs are the answer to agriculture pressure on the environment.

A zero residue product should be a product:

- being systemic,
- with degradability after action,
- non curative,
- available in soil to be pumped by roots,
- not leaching to water,
- not soluble...

These are characteristics that industry does not know how to do, because they are contradictory.

For Mr B, environmentally friendly pesticides do not exist per se. Now molecules (low volume, non detectable in water) may be more ecotoxic and harmful for environment. The answer in this case is in good practices and landscape planning, i.e. accompanying measures to pesticide use:

...the green pesticide is a dream for the R&D director and a nightmare for researchers: it is absurd.

Pesticides have the right to exist only because they provide benefits for farmers and because we are able to control the risk for environment, there is a regulation for that. I don't believe in a registration which will be efficient without good practices and landscape measures. Let's take a new product, a furtive one, difficult to detect in water. The risk for aquatic organisms could be the same as that from older products. It may be much more ecotoxic for some species. We have this problem with new products, they are very interesting because of their low dose but they are very harmful for aquatic organisms. The ideal would be to get a 25g/ha product and much less ecotoxic.

From those declarations we could expect a strong and decisive involvement on GMOs, but RPA is not an undisputed leader in that domain; RPA should orientate its innovation strategy to focus on the importance of using existing molecules rather than investing in really new active ingredients; this has been partly the case. RPA should also invest in accompanying measures related to pesticide use. Its participation in the FARRE experimental farm network may be understandable in that sense. FARRE is a « forum de agriculture raisonnée et respectueuse de l'environnement ». It is mainly a communication action plan based on a network of experimented farms receiving an agreement for three years. Launched in 1993, the plan is mainly funded by the pesticide industry (70%) and joins 100 experimental farms communicating on « agriculture de précision ». It is conceived as modern agriculture, using the most modern techniques and inputs, avoiding overuse of inputs and as being environmentally friendly⁶.

See Figures 4 Mapping of Mr A's discourse and 5 Mapping of Mr B's discourse (pages 31 and 32)

5.3 Regulatory and environmental policies

The pesticide regulatory dynamic

- According to RPA, there has been a shift of internal power within the European Commission. This opinion is based on a shift of resources from DG VI to DG XXIV. In fact, as we saw in part 1, what has changed really is the transfer of scientific assessment and committees from DG VI to DG XXIV, i.e. the separation between scientific risk assessment and approval decisions. The day to day institutional pace is not faster. We had been given an example of an old active ingredient being proposed by the scientific committee of DG XXIV to be excluded from the positive list of allowed pesticides (according to the directive 91/414). Two years after, DG VI had not taken the decision to exclude it, so the molecule was still on the market. In fact, industry has to deal with more actors in the regulatory process than before when all the regulatory stages were concentrated in DG VI.

Mr C says:

... For two years now, the influence of DG XXIV has been growing and since last year, DG XXIV took the lead in the process. So now DG VI is responsible for the process and DG XXIV has the last word. So DG VI is a little bit under DG XXIV control. In our pesticide field, DG VI has always had very few resources. DG XXIV has more resources, staff from DG VI went to DG XXIV and play an important role. The other stage, which is the registration of commercial products in the member states, is more a co-ordination job. It is the responsibility of each national team to

⁶ Assouline G. et al., 1999 : Bilan des actions de conseil mises en œuvre par la profession agricole concernant les pollutions diffuses liées à la fertilisation minérale et aux traitements phytosanitaires. Ministry of Agriculture, Ministry of Environment. Qap Decision, Theys.

interact with national authorities to get the allowance of each formulation of each product in the country.

The regulatory process is too slow

The European regulatory process, organised by the Directive 91/414, is considered by industry as very slow. From 1993, approx. 700 active ingredients had to be reviewed, with a first list of 90 molecules. Until now, only one molecule (fungicide) has been fully reviewed and its file completed. Because of that, some national authorities do not wait for EU registration, but do the registration according to EU standards, sometimes completed by specific national standards. This is the case in countries like UK, Germany, The Netherlands.

It is also incoherent

The logic of the main pesticide directive (91/414) is to define common (uniform) standards for assessment. RPA's main criticisms are towards:

- the uniformity which does not take into account the diversity of agri-climatic conditions and pesticide use conditions,
- the incompleteness of the directive which remains without precise guidelines for assessing risk for atmosphere.

Mr B says:

We think regulation is important, it has to live, but we can't ask regulation more than we can give to it.. An European registration procedure has a great interest. But as it is a harmonisation of assessment principles, i.e. annex VI uniform principles, product assessment principles are harmonised between member states, and this is an aberration. Why an aberration? Because between North and South, there is a difference of use conditions, culture, practices which partly predetermine risk and risk control. In the registration directive, the member state stage safeguards the old commercial product system. And this is a good thing. Since 1994, the directive is transposed into the French legislation. But we still don't have risk assessment guidelines for risk in atmosphere. For soil, water and environment, it is more or less stable for air it is not done. Then you are asked to do the risk assessment without guidelines.

- A moving process

As products are conceived for more than one Zone, particular attention is given within the company to regulatory national initiatives and dynamics. Germany and the US are mentioned as examples on the evolution of regulation towards non targeted species of insects or plants. If the non targeted insect standard is considered as a less constraining one, the growing concern is with the non targeted plant impact of herbicides. Regulation is in its emerging process on this point. In those countries, tests must be done to show that herbicides have no negative impacts on non targeted plants, including weeds. In the US, industry can only get provisional registration after completing non targeted plant and weed tests.

In Germany, regulatory authorities have implemented a new test for evaluating endocrine disrupting impacts of existing and new pesticides. This new test is only valid in Germany, but the objective would be to broaden its use to the EU. In Germany, the test protocol does not seem very stabilised, there are still expert discussions on how long a toad has to be exposed to the substance.

Mr C comments:

We have the perception that today we shall not obtain allowance for our substance in the registering process if we don't pass favourably the test according to a protocol accepted by public authorities. There are still expert discussions at EU

level to agree on the protocol, but sooner or later there will be an agreement. This endocrine disrupter test will be the first one in the set of tests for registration in Germany and also at EU level.

An example presented by Mr C

Recently, the EU Commission⁷ asked an independent expert to establish a list of 500 chemical substances with a potential risk as endocrine disrupter. In this list there are pesticides. Then the list has been reduced to 115 substances. In this new list, there is one RPA important product. This substance has been reviewed by the US EPA and is finishing its reviewing at EU level. The product has been accepted. At the time of those reviewing processes, endocrine disrupter tests were not used but today there are apparent elements which may induce the question on its impact, then an in-depth study allows to say that it is not an endocrine disrupter.

Then Mr C adds:

We continue with that product, because we got the green light. This leads us to question the role of predictive tests. Today a product with such a profile, should we develop it? may be, may be not. In that predictive stage and before having in-depth studies to be done later on, the test would work as an alert signal.

Regulatory authorities simply assess according to this alert. And then, we say, this is not the right process. Before doing predictive tests, just look carefully at the existing studies to conclude that it is or it is not an endocrine disrupter.

Mr E says:

The regulatory process takes into account the technology improvement and public pressure: we look for a without residue product, and the research is done in terms of g/ha.

In fact, this process implies for RPA:

- Working on predictive tests to improve the pre-selection (*guillotine* internal effect) of the new molecules and avoid late and costly problems of registration: This is carried out at RPA level when questions and further problems are already identified.
- The Group scientific co-ordination may also participate, through the anticipation of long term concerns (like endocrine disrupting effect of pesticides). It has to take into account specificities like the US EPA influence on toxicity standards, the European one on ecotoxicity and volume, or Japanese concern on aqua-toxicity.
- Waiting and seeing the re-registration process for existing molecules;
- Influencing the elaboration of the official registration tests and protocols. This is outlined as a strategic issue. Permanent direct contacts with national and EU officials are presented as crucial for the company. Experts working for the EU are member state experts and as such are known by industry. They may also be indirect through professional organisations like ECPA⁸ or IUPAC⁹. The drinking water 0,1 µg/l standard is very criticised, and the ECPA is also criticised for not having done its job and *for running behind the train* (Mr A).

⁷ Probably DG XI

⁸ European Crop Protection Association

⁹ International association joining university and industry researchers working in the field of agrochemicals and environment

Major uncertainties related to GMOs

- **Postponing GMOs marketing: safety as a competitive advantage**

A first level of uncertainty is related to the regulatory process concerning the marketing of new transgenic seed varieties. We heard different visions of that question:

- One discourse criticises mainly the irrationality of the public and decadence of our civilisation. The vector of decadence is the information, media, political power which do not want to take their responsibilities (Mr A).
- Another kind of discourse insists on the failures committed by industry from the beginning of the 90's for having under-estimated the resistance of the public, in France and other countries. Monsanto and Novartis counter-productive strategies in Europe were mentioned.
- A third connected discourse explains that RPA has to differentiate from competitors by investing on safety with more time and money. A common conclusion is that if GMOs are ever marketed in Europe it will be beyond the next five years.

Mr E says:

5 years ago and today, decisions are different on GMOs, the situation is OK in the US but not in Europe. There are more questions, more emotions. We need more work, more resources on GMOs to get leadership on GMOs, in RPA it is more than a wish or a project. Product safety policy is a competitive asset. One of the lessons of the Citizen conference on GMOs is that we need more time and money to put GM products on the market.

- **GMOs impacts on pesticide R&D strategy**

A second level of major uncertainty concerns the impacts of GM crop possible evolutions on plant protection product markets in Europe. The European uncertainty on the future of GM crops makes it quite difficult for the company to build projections on the « traditional pesticide market » (sic).

The example of sugar beet has been quoted during the interviews.

The hypothesis of evolution of sugar beet acreage is very stable, within the next 5 to 10 years. The marketing allowance of GM sugar beet varieties resistant to non selective herbicides would provoke drastic changes in the sugar beet herbicide market. RPA was in contact with an external company for a new sugar beet herbicide. In the discussion between the two companies, the potential impact of GM sugar beet resistant to broad spectrum herbicide was a major issue and uncertainty element. A punctual study has been carried out and the conclusion was that due to the development delay for a new herbicide, it was not desirable to develop a selective herbicide. The hypothesis of the study was a marketing date in 2002/2003 for this GM sugarbeet.

This means that for the most questioned crops like sugar beet and rape seed, chemical innovation on developing new active ingredients is more or less suspended. As an alternative, a second option is systematically explored and developed by RPA: the valorisation or re-valorisation of the existing active ingredients portfolio. This policy has been developed as a « wait and see solution » while waiting for breakthrough products for Europe but also to optimise the potential of an active ingredient by extending its life cycle. This option generates an important number of commercial product development projects managed mainly at the Europe Zone level. They are based upon the combination of existing molecules from RPA or from other companies. Those projects follow the same selection process at the Zone and country levels with similar criteria. The pressure from country representatives is quite high for renewing the commercial product portfolio. This process of creating new commercial products has a major advantage, the delay of development and registration is much shorter.

Mr D says:

Five years ago, it was possible to develop soybean products in the US, which was a very profitable market. Now the market has almost disappeared, except for Roundup. And we can imagine a nightmare scenario as Roundup begins to be attacked for its harmful environmental effects. And Monsanto has put all its eggs in the same basket. Today it is Monsanto, tomorrow it can be RPA or Agrevo.

5.3 Agricultural policy

At RPA high management level, we heard those words on the specific role of Europe within the company:

We should not forget that we are a global company, we are now more global than 10 years ago so we see beyond Europe. We have to give a global meaning to the decision, you can't ignore North America, Asia, they are realities of the company. All countries are at the same level. 10 years ago, in Europe decisions were based on some market information, potential for price and acreage. Today, prices decrease, acreage decreases, subsidies decrease, CAP weights less. European price is a global price for the whole area. (*according to Mr E*).

Limited uncertainty

At the Europe Zone level, when planification and decision making processes are presented, the discourse is a little bit more *nuancé*.

The ad hoc level of interface with the European agricultural policy is the strategic marketing unit of the Europe Zone. When the strategic plan is elaborated, scenario are built by this unit. So the policy impulsion comes within the company through a quite decentralised level. No big changes and ruptures are expected from the evolution of the crops, for instance cereals versus oil seed rape, or maize, in Northern and Southern Europe. The evolution of crop acreage is not considered as a factor of uncertainty for the company.

Mr C says:

The plan intends to integrate evolutions of acreage, levels of profitability of the different crops, possible expenses on those crops. All those elements are combined with environmental and regulatory factors. Within the next 5 to 10 years, what are the active ingredients which will stay on the market or will disappear, because of the effects of the European reviewing process. Cheap active ingredients may disappear and this will modify the cost of herbicide use in the crop and the target price for each crop and use.

The example of a new cereal fungicide development quoted by Mr C

At the end of 1999, the development of a new cereal fungicide will be decided. In the major European agricultural countries, teams have worked on hypotheses for acreage, price, expenses. The Europe Zone communicated its information on sales, profitability and marketing schedule to the global project manager. Those hypotheses have been based upon projections on cereal acreage to be treated within the next 5 to 10 years, expenses farmers will ready to do for protecting the crop, and possible major competing products on that market and with that market price. At this stage of the decision making

process, all lights are not green. But there are enough green ones to say a « let's go », even if for instance the price is not adjusted to the target price¹⁰.

One of the major difficulty is to foresee this target price, which depends largely on existing and further competing products. When defined, another difficulty is to reach it; the reduction of the volume may be a contribution from industrial process units to this goal.

Mr C adds:

Today, it 's true that in this active ingredient selection process for further development investment , the ecotoxicological and toxicological profiles, environment and residues factors are really taken into account in such a way that when we get the green lights for selecting the molecule, we can think that the selected molecule can get the approval in Europe.

6 Conclusions

The monograph shows a company profile characterised by:

- its strong crop protection innovation, marketing and industrial strategies;
- its modest engagement in biotechnology, through external tools which are Biogemma and Rhobio;
- its medium ranking position among the top ten agrochemical companies, with a major weakness on the most important world market, the herbicide market;
- its strong position in Europe and the US on the pesticide markets.

Significant organisational initiatives have been carried out to make the company more flexible more decentralised and transversal in terms of market knowledge and decision feeding processes. The strongly decentralised style of the company structure is considered as an internal protection system for facing the interrogations to be solved all along the decision making processes. Nevertheless, the decision making process remains quite centralised and the decisions go top down.

The policy signals taken into account by the company work mainly in terms of crop protection regulation (pesticides and GMOs) rather than in economic terms through CAP reforms. We could say that policy signals work as green/red lights for the company, for example:

- A conditional green light for transforming a research project into a product development decision, to get the product allowed, is its regulatory profile: ecotoxicological and toxicological characteristics. If at this stage of the decision this profile induces a high risk, the product is not accepted for being developed.
- The other necessary green lights are related to the economic and market factors, enabling the product to be profitable in the major agricultural European countries. We have said that no big changes and ruptures are expected from the evolution of the crops, for instance cereals versus oil seed rape or maize, in Northern and Southern Europe. The evolution of crop acreage is therefore not considered as a factor of uncertainty for the company.

According to different interviewees at RPA, the green pesticide is an illusion - it can't exist. Firstly, the pesticide industry does not know how to do it. Secondly, recent low volume molecules, which are less detectable in water, are considered as sometimes more ecotoxic than older ones. The proposed answers are:

¹⁰ target price could be defined as the competition price, the price over which the company should not be competitive. This price is the result of several factors like intensity of the competition, farms' income, subsidies.

GMOs are a solution to concerns on agriculture pressure on environment.

- A more global and ecosystemic vision of the way pesticides interact with environment leading to a strong focus on good agricultural practices (use conditions of pesticides) and landscape planning to multiply pollution filters.
- The answer to the chemical pressure on environment should not be not a chemical one. This position is worth mentioning for a very crop protection oriented company.

See Figure 6 RPA public policies – R&D strategy interactions (page 33)

In the interviews carried out in the company, our interlocutors tended to separate clearly policies and directives on one side and society concerns and pressures on the other. The interactions between these two dimensions are considered as a source of high uncertainty on the future of products, chemicals and transgenes.

The strategic uncertainty concerning the medium and long term R&D decisions is induced by several types of unforeseeable interactions or influences:

- How public concerns weight upon public policies.
- How industry can participate in the elaboration of public policies. Is the current context propitious to such relations between policy and industry?
- What kind of reactions may be expected from the major competing stakeholders, may be provoked by rising public concerns, or moving policy processes.

Another level of major uncertainty concerns the impacts of GM crop possible evolutions on plant protection product markets in Europe. The European uncertainty on the future of GM crops makes it difficult for the company to build projections on the « traditional pesticide market » (sic).

7. Epilogue

7.1 Aventis Crop Science according to RPA managers

The new organigramme

Formally and according to RPA managers we interviewed, there are not so many differences between RPA and Aventis organigrammes:

- In Aventis, a seed structure (CINT) appears under the responsibility of Crop Sciences, parallel to the Crop Protection one. This novelty is logically related to the integration of Agrevo seed activities.
- With RPA, the Zones were positioned in the organigramme at the same level as the key functions. This was giving the organigramme a quite horizontal profile. With Aventis, the zones are under the Crop Protection and CINT responsibilities. This contributes to « verticalize » somehow the profile of the new organigramme.
- Within the next three years, three business lines should be developed: crop protection, seeds and environmental science, including non agricultural products and services.
- A lobby internal network: a PGA (public and government affairs) network is being implemented. The components of this network are in the business lines (with full time representatives in the zones) and connected to one of the Executive Committee members: this network has an expert status, and is co-ordinated by one of the seed managers. It will be used as a lobby instrument.

See Figures 7 RPA organigramme [page (vi)] and 8 Aventis organigramme (pages 34 and 35)

The new decisional structures

- **The Executive Committee (EC)**

In relation with RPA EC, Aventis is very business line oriented, reflecting the broader spectrum of activities. The second major change is the elimination of the zone responsables from the EC.

Executive committee (EC)

RPA	Aventis
The 9 members: - the Chairman, - the R&D Director, RPA, - the Active Ingredient, Product and Project Director, - the Financial Control Director - + 5 Zone Directors	The 10 members: - CEO, - Deputy CEO - Crop Protection Business Line - Crop Protection Portfolio Management - Seed/Crop Improvement Business Line - Environmental Science Business Line / Strategy - R&D Technology - Finance & Admin - Supply Chain, EHS Manufacturing - Human resource Communication

- **Aventis Product Development Committees substitute RPA Research Committees**

Instead of having two committees RDMC (R&D Marketing Committee) and RD Committee, the new company is settling a Product Development Committee (PDC) per Business Line (Crop Protection and Seed). These two PDC are directly connected to the EC. They propose the Executive Committee research and product development projects to be approved and funded.

A consultative structure should be created, called Strategic Forum, joining 50 to 60 managers from R&D, Corporate Statelty, Product Portfolio, country representatives, Crop Protection B.L., Seed B.L., Environmental Sciences B.L. Its role is still not very clear.

See Figure 9 Hypothetical new decisional configuration (page 36)

7.2 New orientations

Research

- The R&D resource allocation should not be drastically modified: biotechnology which receives 16% of the R&D budget today should receive 26% within 3 years;
- New alliances would be built for getting outputs to be valorised in non food markets.
- Existing alliances between RPA and research partners with Limagrain Genoplante should be maintained. Nevertheless, the new profile of Aventis on seed and GMOs may change the way partners like Limagrain treat and consider the new company. While Limagrain was treating RPA as a complementary interest company, Aventis could be considered as a Limagrain competitor on the seed market. According to one interviewee, the success or failure of Genoplante, the presence of Aventis in Genoplante, could depend on public researchers commitment (INRA especially) to protect inventions.

ANNEX C14

Employment and sites

Aventis staff will be lower (3000 to 4000 jobs less) than RPA + Agrevo staff. This job cutting process will be operated through the closing of several sites:

- R&D sites: one in the US (Goldsborough) and one in UK (Chesteredfordpark: 300 persons)

Manufacturing sites: active ingredients production sites are maintained, but formulation sites are partially closed (one over two) in France, a factory in Marseille