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

SMEs in the Netherlands Agrochemicals, Seeds and Plant Biotechnology Industries

Annex D 5

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

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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.

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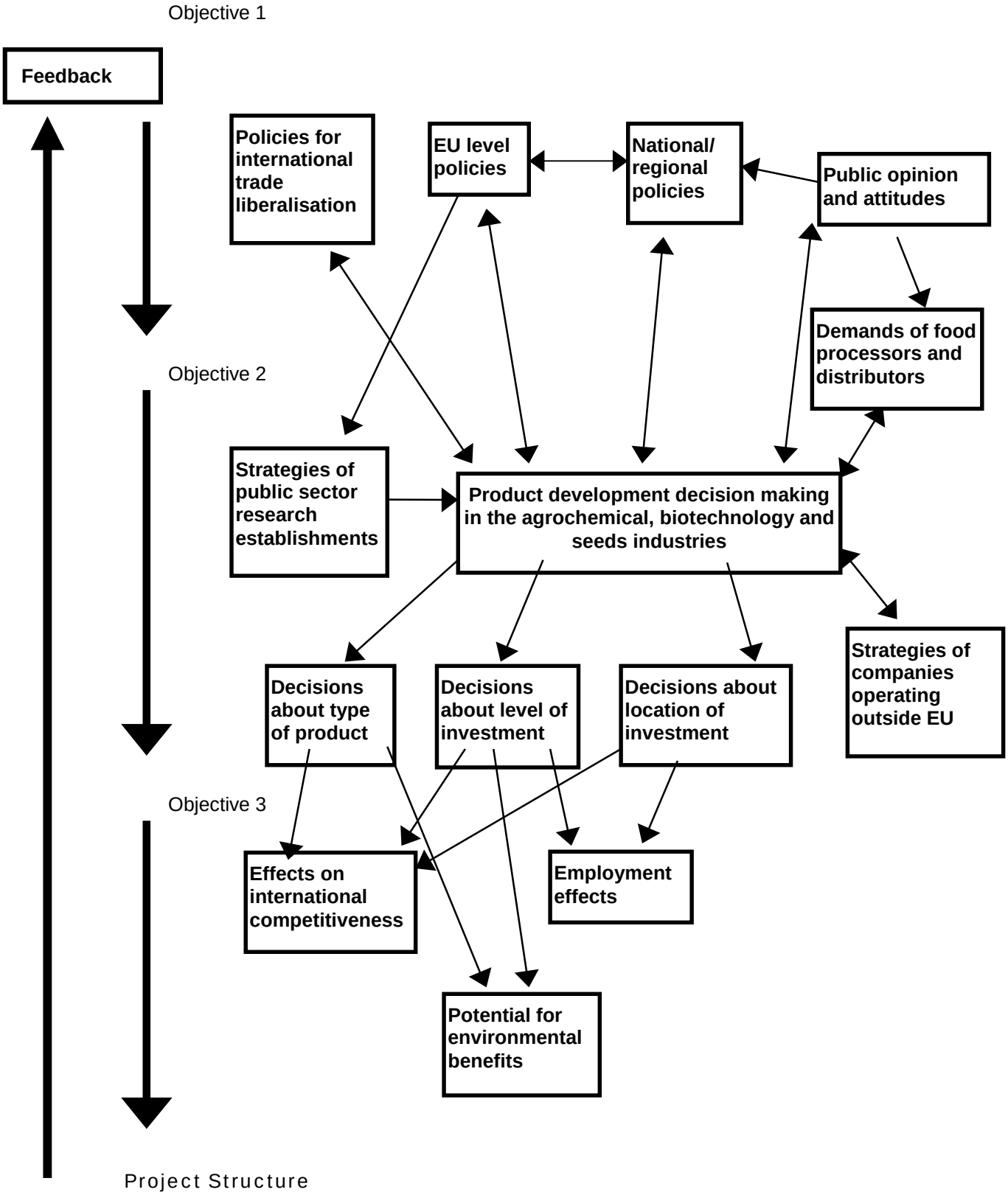
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1. Introduction

The PITA project (Policy Influences on Technology for Agriculture) studies the influences of public policies on innovation strategies of firms in the agrochemical, seed and biotechnology industries. The overall aim of the PITA 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.

One objective is to assess how SMEs can be supported to develop innovations which ensure a better environmental performance. For this assessment information is needed on how the innovation activities of SMEs are influenced (positively of negatively) by the economic and societal environment. This report seeks to answer the following question: What is the influence of policies and market-related factors on innovation strategies of SMEs in the agrochemical, biotech and seed industries?

Small and medium sized enterprises (SMEs) play a major role in the Dutch economy. Not only do 99 percent of all private firms in the Netherlands belong to the SME category (all firms with 1 to 250 employees), but also SMEs account for two-thirds of employment growth.

A large number of firms in the agrochemicals, biotechnology and seeds industries belong to the SME category. However, large differences exist between these industries. While in agrochemicals – a relatively mature industry – almost all companies are subsidiaries of foreign multinationals, in the seed industry the distribution of firms over SME and non-SME categories is more even. As no official figures exist on the presence of SMEs in these industries, the information in this report will focus on SMEs where possible and will cover the whole industry where no specific SME information is available.

This report is structured as follows. Section 2 presents an overview of the role and position of SMEs in the three industries under study. Section 3 presents innovation strategies of the relevant SMEs. Section 4 discusses how these firms deal with environmental issues. In section 5 the influence of public policies on the innovation activities of these firms is assessed. In section 6, finally, some conclusions are drawn in the influence of public policy and market developments on innovation by SMEs in the agrochemical, seeds and biotechnology industries.

Biotechnology is a fast-developing technological field; the agrochemical, biotechnology and seed industries are undergoing rapid structural change. So it is emphasised that this report presents only the situation at a particular point in time. The manuscript was closed in March 2000 and reports on no later changes in the industries.

2. Overview of SMEs in agrochemicals, biotechnology and seeds

Although the focus of this report is on SMEs, this chapter describes the whole Dutch agrochemical, biotechnology and seed industries. As no official figures exist on the presence of SMEs (i.e. firms with fewer than 250 employees) in these industries, most of the information presented here covers the three industries in total. In the PITA project, employment is a major element of study. When available, employment figures for the three industries are presented.

2.1 Agrochemicals

Agrochemicals or crop protection products are the largest but not the only part of the pesticide industry. Other products supplied by the pesticides industry are household pesticides and wood preservatives. Producers of agrochemicals are represented by Nefyto, the Dutch organisation for phytopharmacy. In December 1999, Nefyto had 19 members (see Table 1) together accounting for 95 percent of domestic sales of plant protection products. Most of these companies are subsidiaries of foreign multinationals.

Table 1 Pesticides companies in the Netherlands (members of Nefyto, as of Dec. 1999)

Company	Location	Parent company
AgrEvo Nederland BV [1)]	Haren	AgrEvo (Germany)
Asepta BV	Delft	Asepta (Netherlands)
BASF Nederland BV	Arnhem	BASF (Germany)
Bayer BV	Mijdrecht	Bayer (Germany)
Cyanamid Benelux BV [2)]	Breda	American Home Products (USA)
Dow AgroSciences	Wilrijk (B)	Dow (USA)
Du Pont de Nemours BV	Dordrecht	Du Pont de Nemours (USA)
Elf Atochem BV	Vondelingenplaat	Elf (France)
Luxan BV	Elst	Cebeco (Netherlands)
Makhteshim Agan Holland BV	Leusden	Makhteshim (Israel)
Monsanto Europe S.A.	Brussels (B)	Monsanto (USA)
Novartis Agro Benelux BV [3)]	Roosendaal	Novartis (Switzerland)
Nufarm BV	Botlek-Rotterdam	Nufarm (Australia)
ProAgro BV	Maarssen	Mitsui (Japan)
Rohm and Haas France S.A.	Parijs (Fr)	Rohm and Haas (USA)
Rhône-Poulenc Agro BV [1)]	Etten-Leur	Rhône-Poulenc (France)
Stefes Nederland BV [1)]	Esch	AgrEvo (Germany)
Uniroyal Chemical BV	Amsterdam	CKWitco (USA)
Zeneca Agro [3)]	Ridderkerk	AstraZeneca (UK)

Source: Nefyto Bulletin, December 1999.

1. Due to the merger (in December 1999) between Hoechst and Rhône-Poulenc into Aventis, the marked companies will be renamed into Aventis CropScience Benelux.
2. In 2000, BASF (Germany) has taken over the crop protection business of American Home Products.
3. In 2000, Novartis and AstraZeneca will merge there agribusiness activities into a new company named Syngenta.

Detailed figures on employment in the Dutch agrochemical industry are available, but Nefyto has recently collected employment figures from there members (Nefyto Bulletin, June 2000). The total employment in the Dutch pesticides industry account to a little more than 1000 persons. About half of these people are working in production and logistics. Although the multinational crop protection companies do not have large research centres in the Netherlands, still about 150 people work in R&D (including technical support and advisory services). Luxan, with 140 employees, is most likely the largest agrochemical company in the Netherlands. Wholesalers of crop protection products are represented by the trade organisation RODIS. In 1999, RODIS had 94 members. However, data from the Central Bureau of Statistics (Statline) count 220 companies as wholesalers of pesticides and fertilisers. This number probably included many local or regional co-operatives supplying farmers with various inputs, among them pesticides.

2.2 Biotechnology

Given the importance of the agricultural sector in the Dutch economy, it is not surprising that a significant part of biotechnology research focuses on plant and animal applications. Still, the number of dedicated ag-biotech companies has always been quite small. According to a publication of the Ministry of Economic Affairs, in 1995 the Netherlands counted more than 40 companies with activities in agricultural biotechnology, of which 22 focussed on field and

horticultural crops, 6 on floriculture and 5 on animal production. Of the 22 companies working on plant biotechnology (excluding floriculture) only a few were new dedicated biotechnology firms. Most of the companies working on plant biotechnology (in 1995) were established seed companies, like Avebe, VanderHave (now Advanta) Royal Sluis (now Seminis Vegetable Seeds) Zaadunie (now Novartis Seeds) Nunhems Seeds (owned by AgrEvo). New plant biotechnology firms were Mogen (now Zeneca Mogen) Keygene, Florigene (now Florigene Europe) and RZ Research (no longer existing). Four other seed companies - Cebeco Seeds, Rijk Zwaan, De Ruiter Seeds and Enza Seeds - had direct access to plant biotechnology research, as they were shareholders of Keygene.

Of the members of the Dutch Industrial and Agricultural Biotechnology Association (NIABA) the main interest organisation for biotechnology firms, only seven work on agricultural biotechnology and seeds (see Appendix 1). However, this number does not give a good representation of the (small) seed companies doing biotechnology research, as they are represented in NIABA by the Dutch Seed Trade Association (NVZP) or by the National Co-operative Council for Agriculture and Horticulture (NCR). Still, there is only one company – Keygene – that fits in the category of plant biotechnology SMEs (i.e. not seed companies). Below we will describe the history and activities of Keygene in more detail. Before that, we will spend a few words on Mogen and Florigene, as they also used to belong to the category of plant biotechnology SMEs until they were acquired by a large foreign company.

Mogen

When Mogen started in 1985, it was a typical biotechnology start up firm rising out of academic excellence. It was founded by the American biotechnology company Molecular Genetics together with the Dutch investment company MIP, with the purpose of exploiting the (patented) transformation technology developed by Prof. Schilperoort of the University of Leiden. For this reason, Leiden was chosen as the location for the company. Besides the biotechnology expertise at the University of Leiden, also biology (plant breeding) expertise from the Free University in Amsterdam was set to work in Mogen. When Molecular Genetics made the strategic decision no longer to be involved in plant biotechnology, in 1987, Mogen went public and became listed at the Amsterdam stock market. It operated as an independent company until it was acquired by Zeneca, the UK pharmaceutical and agrochemical company.

In June 1997, Zeneca acquired Mogen for the total amount of 65 million Euro. At that time, Mogen had a turnover of only 2 million Euro, and had about 45 employees. The year before it had made the first profit in its existence. When Plant Genetic Systems was acquired by AgrEvo for 436 million Euro, in 1996, investors of Mogen also wanted to cash in on their expected wealth, and went looking for a take-over candidate. Zeneca was particularly interested in the Mogen's expertise on fungal and nematode resistance, and in its patent portfolio. After the acquisition by Zeneca, Mogen's research was integrated with that of Zeneca Plant Sciences, the biotechnology research unit of Zeneca Agrochemicals. The company is now called Zeneca Mogen, but is still located in Leiden. The number of employees has doubled since the take-over.

Right from the start, Mogen focussed on the transformation of crop plants. It had three main research programmes: improving plant resistance, developing plants that can be used as a producer of special compounds like enzymes, and further developing the transformation technology (Bijman, 1993). In the crop protection programme, Mogen's main focus was on fungal resistance. But it also worked on virus resistance, bacterial resistance and nematode resistance. In its early years, potato was an important crop in Mogen's research, not only because potato had proven to be a good model crop, but also because potato is an important commercial crop in the Netherlands. By focussing on plant protection and potatoes, Mogen was responding to projected government policies to reduce pesticide use. Although exact figures are not available, it is safe to state that Mogen has profited substantially from (bio)technology subsidies made available by the Dutch government. Until its acquisition by Zeneca, Mogen had multiple research collaboration with companies in the Dutch agrifood sector, like Gist Brocades (now DSM) Avebe, and Bruinsma Seeds (now Seminis Vegetable Seeds).

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Florigene

Florigene was established in 1989 as a joint venture among DNA Plant Technology (a biotechnology firm from the USA) Zaadunie (a Dutch horticultural seed company, owned by Sandoz, Switzerland) and Rabobank Biotech Venture Fund (Bijman, 1994). Florigene was and is located in Rijnsburg, the Netherlands. Florigene is specialised in the development of novel colour cut flowers using genetic engineering. Soon after its start, Florigene obtained an alteration of flower colour by genetic engineering. Working together with chrysanthemum breeder Fides, Florigene transformed the pink chrysanthemum variety 'Moneymaker' into a white flower. The newly developed variety, called Flori-ant, was meant as a test case for genetic engineering of flowers, as well as for the approval procedure of the Dutch government.

In 1993, Florigene was acquired by its Australian competitor Calgene Pacific. This company had been established in 1986, in Melbourne, Australia. Calgene Pacific had a strategic alliance with Suntory, a Japanese brewer also engaged in flower biotechnology research, and it had a collaboration with Mogen for the application of fungal resistance to carnations. After the acquisition, the name of the new company became Florigene, while the Dutch subsidiary obtained the name Florigene Europe. Most of the research is located in Melbourne, Australia, while the product development and commercial activities are centred in the Netherlands. In 1996, Florigene commercialised its first genetically engineered flower, a mauve-blue carnation.[1] It is marketed in Australia, Japan and the USA. In the EU, Florigene Europe has an approval (under 90/220/EEC, part C) to market transgenic carnation varieties. However, by March 2000 the company has not yet put any transgenic carnations on the European market. According to a Dutch newspaper, this may have been due to protests from German environmental organisations (AgD, 28/10/99).

In 1999, Florigene had 80 employees in total, out of which 25 worked in the Netherlands, at Florigene Europe (source: Dun & Bradstreet).

In March 2000, Nufarm limited acquired a majority stake in Florigene. Nufarm Ltd. is an Australian manufacturer of agricultural and industrial chemicals (until January 2000 the company was known under the name Fernz Corporation, and was originally located in New Zealand). The acquisition price was only 2 million Australian dollar. According to Nufarm, the acquisition represented an important element in the company's biotechnology strategy.[2]

Keygene[3]

Keygene was founded in 1989, in Wageningen, by five plant breeding companies, with financial support from the Rabobank Biotech Venture Fund. These seed companies wanted to have direct access to biotechnology knowledge, without having to invest large amounts themselves in a high risk R&D activity. The company started with five employees doing research on the AFLP technique (i.e., a DNA finger printing technique). Currently it employs about 80 people, and has a turnover of 7 million Euro. Managing director, since 1996, is dr. Hans Dons, who used to be deputy director of the Center for Plant Breeding and Reproduction Research (CPRO-DLO).[4]

The original founders were potato breeders Ropta-ZPC and Cebeco, and vegetable breeders Royal Sluis, De Ruiter Seeds and Enza Seeds (Bijman, 1993: 67). After a few years Ropta-ZPC and Royal Sluis sold their shares. Ropta-ZPC started its own biotechnology firm (RZ Research) and Royal Sluis left when it was acquired by Seminis. VanderHave joined the

[1]. Source: http://www.florigene.com.au/ceo.htm (visited on 30/6/99)

[2]. Source: http://www.nufarm.com/html/news/media03.htm (visited on 30/3/00)

[3]. The main source of this section is an interview with dr. J.J.M. (Hans) Dons, managing director of Keygene, held at 3 September 1999.

[4]. Until 1999, CPRO-DLO was part of the Ministry of Agriculture. Now it is named Plant Research International, and it is part of the Wageningen University and Research Center.

club, and the Cebeco share was split into one for Cebeco Seeds (field crops, including potatoes) and one for Rijk Zwaan (vegetable seeds). When VanderHave merged with Zeneca Seeds into Advanta in 1996, there has been some discussion about the Advanta's relationship with Keygene, because it also has access to biotechnology expertise at Zeneca Plant Sciences (including Zeneca Mogen). As of March 2000, Advanta is still a share holder of Keygene.

Keygene's core competences lie in DNA finger printing technology. For the AFLP marker technique, used for molecular selection process in all kinds of organisms, Keygene has a world-wide patent. Keygene focuses on application of marker technology in plant breeding, although it also has animal breeding companies as client. The application of DNA finger printing in human health research was done by Genscope, an American subsidiary of Keygene. In 1997, Genscope was sold to Perkin-Elmer, a major producer of genetic analysis systems. The sale included an agreement that Perkin-Elmer only applies the AFLP technique to human health research, while Keygene covers all applications in agriculture and food production (as the AFLP technique can be used to identify any trait). Nowadays, Keygene's the core activities have been broadened from molecular marker technology into genomics and bio-informatics. While Keygene has the expertise to develop transgenic plants, the transformation technique is not part of it core competences.

Keygene carries out contract research for its shareholders, who have preferential access to newly developed knowledge. It also does contract research for other Dutch and foreign clients, among them seed companies. Another source of income is the licensing of its proprietary technique to private and public research institutes. Finally it also receives income from molecular marker services, i.e. applying the DNA finger printing technology as a service to other companies.

2.3 Seeds

The Dutch seed industry can be divided in three branches: agricultural seeds (for field crops) horticultural seeds and seed potatoes. In seed potatoes the Netherlands occupies a unique position, as it is the largest exporter of seed potatoes in the World. Also in horticulture, and particularly vegetable seeds, Dutch companies play a major role. However, the largest vegetable seeds companies in the Netherlands are now subsidiaries of foreign multinationals. In agricultural seeds the Netherlands is a small country, although one company belongs to the top five of seeds companies in the world (Advanta) and one company is a global player in just the grass seed business (Barenbrug).

The seed industry in the Netherlands is a relatively large industry compared to other countries, and has a strong international orientation. It is difficult to give an exact number of companies in the seed industry, as official statistics are lacking or incomplete. The number of members of the Dutch Seed Trade Association (NVZP) is 305, but this includes seed wholesalers. Official employment figures are not available. The NVZP uses a figure of 4000 employees (interview Van den Bergh, 1998).

For 1995 it was estimated that the total employment in plant breeding companies was between 3500 and 4000 (Hietbrink, 1997). Of this total, about 2100 persons were working in vegetable breeding, 500 in ornamentals breeding, 750 in field crop breeding and 100 in potato breeding. In addition, about 200 farmers are engaged in potato selection, mostly under contract with a potato breeding company. Employment in research centres and biotechnology firms directly related to plant breeding was estimated at 500. Moreover, the number of people working in tissue culture firms, seed treatment firms, quality control agencies, and interest representation is about 400. If we add the number of farmers growing plantlets, seed potatoes and agricultural seeds[5], then the total employment (in full time equivalents) in the Dutch plant starting material is more than 10.000.

[5]. In 1999, 624 Dutch farms produced vegetable seeds, 2785 farms produced grass seed, and 3314 farms produced seed potatoes (LEI-CBS, 2000). Many farms produce both seed potatoes and grass seed

Field crops

In 1995 there were about 15 plant breeding companies for field crops (Hietbrink, 1997). Some of these companies have a broad product portfolio, other specialise in only one crop (particularly grasses). The largest Dutch agricultural seed companies are Advanta (formerly D.J. van der Have) Cebeco Seeds and Barenbrug (see Table 2).

Table 2 Main agricultural seed companies in the Netherlands (1998)

Name	Turn over (million Euro)	Ownership structure	Number of employees (total / NL)	Main products
Advanta (incl. Mommersteeg)	374	50% Cosun, 50% AstraZeneca	2300 / 400	maize, grasses, sugar beet, sunflower, soybeans, canola, wheat, sorghum, onions, rice
Barenbrug	146	family owned	540 / 120	grasses, maize
Cebeco Seeds	103	100% Cebeco Group	400 / 225	cereals, maize, peas, grasses, flax, sugar beet (for Advanta)
Zelder	n.a.	25% Cebeco Group	55	maize, grasses
Force Limagrain	n.a.	100% Limagrain (Fr)	10	maize, grasses
Pioneer Hi-bred	n.a.	100% Pioneer (USA)	10	maize
Novartis Seeds	n.a.	100% Novartis (SW)	n.a.	maize, sugar beet
KWS Benelux	n.a.	100% KWS Saat (G)	n.a.	maize
Swalöf Weibull	n.a.	100% Swalöf Weibull (Sweden)	n.a.	cereals, oilseeds, forage crops
Joordens	n.a.	100% RAGT (Fr)	n.a.	maize, oilseeds, sugar beet (for KWS)
Van de Bilt	n.a.	family owned	35	flax

sources : various.
n.a. : not available

Advanta offers a broad range of field crops, and sells world wide. Advanta VanderHave, the Dutch subsidiary of Advanta, is a major supplier of seeds for maize, sugar beet, grasses and several other field crops. Cebeco also has many crops in its portfolio, but focuses on the European market. In the Netherlands, its main crops are maize, cereals, peas, grasses and flax. Barenbrug is specialised in grass seed, both forage and turf grasses, and sells its products world wide.[6] Some firms have relatively small breeding programmes for crops like flax, peas, oilseed, forage crops, manure crops, etc. Most of other firms do not develop their own varieties, but are sales offices for foreign seed companies. For instance, for sugar beet, Advanta VanderHave has a major breeding programme in the Netherlands, while the other main sugar beet seed companies – Hilleshög/Novartis and KWS (represented by Joordens) – sell seeds that have been developed in other European countries.

[6]. In the Netherlands, Barenbrug also sells seeds for maize and cereals. These are varieties developed by other companies.

Horticultural crops

The large horticultural sector in the Netherlands justifies an extensive horticultural seeds industry. There are 66 horticultural seeds companies member of the NVZP (NVZP website, 31/3/00). In the horticultural seeds industry, too, there is a large variation in firm size (see Table 3). Novartis Seeds and Seminis Vegetable Seeds (SVS) are among the largest seed companies in the world. Their Dutch subsidiaries consist of old Dutch seed firms, that have been acquired in the 1980s or 1990. The Dutch part of Novartis Seeds, for instance, was built on the seed companies Sluis & Groot and Zaadunie (NTZ, 1992). Already in the 1970s these companies merged, and they were sold by the owning family to Sandoz, a Swiss manufacturer of pharmaceuticals and agrochemicals. Later, Sandoz merged with Ciba Geigy to form Novartis. SVS Europe consists of the old Dutch vegetable seed companies Royal Sluis and Bruinsma (Massieu, 1998).

Major foreign owned vegetable seed companies in the Netherlands are Novartis (Swiss) SVS (American/Mexican) Nunhems and Leen de Mos (both owned by Aventis, German/French) Nickerson-Zwaan (owned by Limagrain, French) Sakata Seed Europe (Japanese) and Takii (Japanese). Dutch owned vegetable seed companies are Rijk Zwaan (owned by Cebeco Group) De Ruiter, Enza, Bejo, Pieterpikzonen, and Meo Voto. Besides these companies with their own breeding activities, there are many wholesale companies selling domestic and foreign vegetable crop varieties to professional farmers.

Once again, there are no official statistics on the seed industry, so it is difficult to find out how many companies belong to the SME category, and what the number of employees is in that segment of the industry. Hietbrink et al.(1997) estimated that in 1995 about 1650 employees were working for large international firms, while only 450 people were working for Dutch companies, most of them SMEs.

The Dutch seed industry is a major supplier of new horticultural seeds to the international farming sector. The distribution of employment in the seed sector is rather skewed, with some really large companies, working on a global scale, and several small companies selling mainly in the Netherlands and the neighbouring countries. The subsidiaries of the large vegetable seed companies, like Novartis and Seminis, continue to have their European headquarters in the Netherlands. The large domestic market and the well developed knowledge infrastructure are reasons to remain located in the Netherlands while the market is becoming global.

Table 3 Main horticultural seed companies in the Netherlands (1999)

Name of the company	Products	Ownership	Number of employees total / NL
Novartis Seeds (formerly S&G Seeds)	Vegetable and flower seeds	Novartis (Sandoz since 1980)	???/560
SVS Europe	Vegetable seeds	Savia (US/Mex)	4000/365
Rijk Zwaan	Vegetable seeds	Cebeco Group (since 1989)	900/600
Nunhems	Vegetable seeds	Aventis (AgrEvo since 1997, Hoechst since 1986)	300
Bejo Seeds	Vegetable seeds	Family	190
Enza Seeds	Vegetable seeds	Family	160
Nickerson-Zwaan	Vegetable seeds	Limagrain (since 1990)	150
De Ruiter Seeds	Vegetable seeds	Family	300/50

Pieterpikzonen	Vegetable and flower seeds	Family	50
Leen de Mos	Vegetable seeds	Aventis (since 1998)	35
Dutch American Plant Breeders Corp.	Vegetable seeds	Alfa Pure Seeds	n.a.
Meo Voto Seeds	Vegetable seeds	Family	n.a.
Bakker Brothers	Vegetable seeds	Family	115
De Groot en Slot Allium	Onions, shallots, garlic	Family	25
Huizer Seeds Holland	Flower seeds	Family	15
Sakata Seed Europe	Flower seeds	Sakata Seed Corp (Japan)	15
Goldsmith Seeds Europe	Flower seeds	Goldsmith Seeds (USA)	10
Bolier Seeds	Flower seeds	n.a.	n.a.
Hem Seeds	Flower seeds	Family	n.a.
K. Sahin Seeds	Flower seeds	n.a.	n.a.
Takii Europe	Flower seeds	Takii Co. (Japan)	n.a.

* sources: company web sites, trade journals, SeedQuest, Dun & Bradstreet.
n.a. : not available.

Seed potatoes

As potato is the most important crop in Dutch arable farming, potato breeding is well developed in the Netherlands. Breeding of new potato varieties is a combined effort by some farmers and breeding companies. Developing a new potato variety takes 10 to 12 years. Farmers do most of the selection work during this period. The breeding companies do the research, the original crossings, the testing of a new variety, the application for variety registration and breeders rights and the marketing of the new variety. Once the variety has been registered and breeders rights have been granted the owner of the variety has the exclusive right (for 30 years) to trade seed potatoes of this variety. For this reason variety breeding and seed potato trade is combined in the same company.

In 1998, the seed potato-breeding sector consisted of 11 firms (Table 4). Hietbrink (1997: 19) has estimated the 1995 employment in potato breeding/trading companies at about 1000 persons. The four largest companies, Agrico, Hettema, Meijer and ZPC, accounted for about 60% of total employment.

Table 4 Seed potato breeders/traders in the Netherlands (1998)

Company	Location	Ownership structure	Number of farmer-breeders engaged [2)]	Number of employees [3)]	Turnover in seed potato trade [4)]
Agrico	Emmeloord	farmer co-operative (1500 members)	40 (5 of them professional breeders)	475 (20 in breeding)	400.000 tons

Agrofex	Medemblik	family-owned	6		n.a.
Den Hartigh	Espel (NOP)	family-owned	6	n.a.	n.a.
De Nijs	Warmenhuizen	family-owned	collaboration with Fobek-breeders		n.a
Fobek	Beetgumer-molen	farmer co-operative (50 members)	50		no trade
Hettema [1)]	Emmeloord	family owned	100	65	200.000 tons
KARNA	Valthermond	100% owned by AVEBE	collaboration with Hettema and ZPC		no trade out-side of coop.
Meijer	Kruiningen	family-owned	15	80	100.000 tons
Stet Holland	Emmeloord	majority owned by ZPC	12	15	40.000 tons
Van Rijn	's Gravezande	family-owned	12	200	n.a.
ZPC [1)]	Leeuwarden	farmer co-operative (700 members)	30	n.a.	250.000 tons

1) In July 1999, Hettema and ZPC have merged into HZPC; the new company has a 40% share of the Dutch seed potato market. 2) source: Delleman, 1998. 3) sources: Dun & Bradstreet. 4) estimates.
n.a. : not available

The total Dutch production of seed potatoes is about 1 million tonnes. Trade in seed potatoes is carried out by quite a large number of companies. In 1997 still 333 firms were registered as seed potato traders, most of them retailers (BGA, 1997: 56). Most of these firms are very small. In 1980 there were still 727 and in 1990 still 559 wholesalers and retailers in seed potatoes. Rademakers and McKnight (1998) have found that over the period 1974-1996 the number of seed potato merchants (i.e. wholesalers) declined by 73 percent. The concentration in seed potato wholesale is most visible if we look at the combined market share of the two largest potato traders. After the 1999 merger between Hettema and ZPC into HZPC, the two largest companies have a combined market share between 80 and 85 percent (AgD, 7/8/99).

Of the total production of seed potatoes about 70 percent is exported. Also in exporting there is strong concentration: six companies carry out almost 90% of the export trade (BGA, 1997: 56). The Netherlands is the largest producer of certified seed potatoes. Major export markets are Italy, France, Germany, Belgium and North Africa. The value of seed potato export has grown from 250 million guilders in 1980 tot 560 million in 1995.

3. Innovation strategies of SMEs

3.1 Agrochemicals

As there is hardly any independent Dutch producers of plant protection products, it is not easy to assess innovation strategies of SMEs in the agrochemical industry. From the 19 companies in Table 1, only Asepta BV is truly an independent SME. However, Asepta does not develop plant protection products itself. It only registers, tests and sells pesticides developed by other (mostly foreign) companies. Still, two companies could be partly considered an SME: ProAgro and Luxan. Both companies are fully owned by a larger

company (respectively Mitsui and Cebeco) but operate as independent firms. Although they may be influenced by decisions taken by the parent company, particularly concerning acquisitions and other major investments, they do follow their own strategy.

As far as innovation takes place within the Dutch agrochemical industry, and that is mostly in formulation of plant protection products, there is a relatively strong focus on application in small crops, and on integrated pest management (IPM). Nefyto, the interest organisation for the Dutch agrochemical industry, favours the introduction of integrated crop management (ICM) of which IPM is a part (Nefyto Bulletin, June 1999). For instance, advise on application of agrochemicals can be combine knowledge of both chemical and non-chemical methods of pest control. If new application methods are needed, the agrochemical industry will adjust its application instruction as written on the label. Examples of more general innovation in the crop protection industry are the development of seed coating, pesticides based on natural ingredients, and a new generation of fungicides (Nefyto Bulletin, June 1999).

Case Study: Luxan[7]

Luxan is a producer and distributor of plant protection products. It has about 140 employees and is fully owned by the Cebeco Group, a farmer-owned co-operative holding company. Luxan has a 8-10 percent market share of the Dutch pesticide market (Agrow No. 348). Its main activities used to be the formulation and wholesale of pesticides with active ingredients supplied by foreign producers like BASF, Rhône-Poulenc and Ciba-Geigy. Due to the concentration among the major pesticides producers and the stagnant market for pesticides, fewer and fewer business opportunities remained for Luxan. Also, for generic products like glyphosate Luxan has become too expensive as a manufacturer.

In reaction to changing market conditions, Luxan shifted its strategy from formulating and wholesaling to developing and producing its own products. Also, it is shifting from primarily servicing the Dutch market with a broad range of products, to focussing on the European market with a small number of (proprietary) products. The company's profile has changed considerably in the last decade, as it is now less concerned with generic products and more with innovative products. Luxan is investing more in new products, and has an R&D budget of 5% of its turnover of app. 45 million Euro. The company believes it can better complement the multinationals by concentrating on smaller markets and niche products.

Another reason to focus on a small number of products for a large European market are the Dutch and EU registration policies. As environmental policies become more and more tight, fewer products will receive or maintain approval, while registration itself is becoming more and more expensive. According to Agrow (No. 345) pesticide registration fees in the Netherlands are among the highest in Europe. The cost of supporting older registrations and registering new products has led Luxan to withdraw several products and abandon the development of others.

One of Luxan's main target markets is sprout inhibitors for potato storage. It has two such products in its portfolio. One is a chemical product, the other is a natural product. Luxan started to develop the chemical sprout inhibitor when one of the main producers of anti-sprout compounds, Bayer, decided to no longer supply this market as it considered it too small. Thus, Luxan now services a niche market that is left open by the large multinationals. Luxan has also developed a natural sprout inhibitor, called Talent. The active ingredient, carvone, is extracted from caraway seed oil. This natural product can be used in those countries and for those potato processing companies that do not allow the use of chemical sprout inhibitors in potato storage. It can also be used for storing organic potatoes. Luxan is marketing this product in the Netherlands and Switzerland since 1995, and has registered the active ingredient in Brussels. The good contact with the Dutch potato processing industry (partly within the Cebeco Group) has helped Luxan to make the strategic decision to develop sprout inhibitors.

[7]. Sources for this section on Luxan's innovation strategy are Agrow (several issues) and an interview with L. de Regt, managing director of Luxan, on 12 November 1999.

The natural sprout inhibitor has been developed in collaboration with the Agrotechnological Institute (ATO) in Wageningen. At the time it was working on this product, the ATO was still part of the Ministry of Agriculture. This development project has also profited from government subsidies available for sustainable technological innovation.

3.2 Biotechnology

The innovation strategies of the Dutch plant biotechnology SMEs have developed in close collaboration with Dutch (potato) seed companies. This is the case for Keygene, whose shareholders are five seed companies, but also for Mogen until it was acquired by Zeneca. Both with Keygene and Mogen, initial innovation decisions were influenced by technological expertise developed by universities. Mogen was located near the University of Leiden and Keygene was located near the Wageningen Agricultural University. In reaction to demands from the seed companies, methods to improve pest resistance in crop plants, both for agriculture and horticulture, has been an important target of the biotechnology research. At the same time, these firms put a large emphasis on developing technologies that could be commercialised in a broader market, particularly by licensing patented knowledge.

As biotechnology research requires large investments while the market continued to be uncertain, many biotechnology SMEs world wide have been acquired by large agrochemical or seed companies. This is also the case for Mogen en Florigene. Through such a take-over, the companies have a better perspective of continuing their biotechnology research. The case of Mogen shows that employment can even substantially increase after a take-over.

3.3 Seeds

Innovation strategies of SMEs in the Dutch seed industry do not substantially differ from innovation strategies of the large seed companies. Innovation in general is a strong asset of the Dutch seed industry, both in developing new varieties, in breeding and multiplication techniques and in seed treatment (Kleijn et al., 1992). The following factors have stimulated the innovativeness of the Dutch seed industry:

- support in technology development from the public research institutes;
- continuous efforts to improve quality, for instance by compulsory quality control for export markets;
- protection of innovations through plant breeders rights; domestic clients demanding high quality products; and
- the use of variety lists providing farmers with unbiased information about the characteristics of all available varieties.

One of the main factors in the innovation strategies of Dutch seed SMEs is the international character of the seed market. Most of the Dutch seed companies, whether they are supplying arable crop farmers or vegetable farmers, develop varieties for the international market. There are several reasons for this strong international scope. First, the Netherlands has a long tradition of exporting horticultural seeds. Second, even though the Netherlands has a large horticultural sector, the size of the domestic market is relatively small, particularly for specialty crops. Third, all seed companies already have international activities because part of their development work and part of the multiplication of the seed is located in other parts of the world (for climate and seasonal cycle reasons). Fourth, firms developing seeds for greenhouse crops can sell their products world wide, as greenhouse growing conditions can be made similar in many parts of the world. Fifth, competition is tough in the market for seeds, and market shares can vary substantially over the years. Thus, scale of marketing is important in the seed industry. In horticulture, most seed varieties only last a few years, before a new and better variety takes the market.

4. Environmental Issues

The Netherlands has an intensive agricultural production sector, leading to high environmental pressures. This fact, together with the greater awareness of the general public of environmental problems, have resulted, since the 1980s, in stricter environmental policies. Farmers and supplying industries have had to adjust their activities to the restrictions put upon them by governmental regulation on pesticide use, on water use, on waste disposal, on energy use, etc. In recent years, the agricultural community in the Netherlands has been faced with additional pressures to lower the environmental impact of farming methods. These additional pressures are coming from the food industry and the retail industry. In response to consumer concern about environmental pollution as well as food safety issues (for instance pesticide residues) food processors and retailers are increasingly demanding their suppliers of agricultural products to use cultivation practices that are more friendly to the natural environment and result in more healthy products (Brouwer and Bijman, 2000). For instance, the initiative of several large European retailers, united in Eurep, to design Good Agricultural Practice (GAP) guidelines and to demand their suppliers to apply these GAP recommendations may in the end lead to lower and/or different pesticide use. The Eurep GAP guidelines go beyond the regulatory requirements, or perhaps anticipate future ones.

In reaction to societal concerns over the environmental food safety impact of pesticide use, Nefyto is focussing on two activities (Nefyto Bulletin, March 2000). One is the use of a Product Stewardship, the other is a more open communication between industry and society. The Product Stewardship is a declaration with eleven principles saying that the signatories will take care of the environment, of safety and of health, and will communicate about this with society. The Product Stewardship can be used by society to evaluate the activities of the pesticide industry. So far, it is a voluntary declaration, but it is Nefyto's goal to make it a standard guideline for all activities of its members. In reaction to consumer concerns over pesticides (for instance expressed in a large 1999 public opinion poll by the Consumer Union) Nefyto seeks to improve its communication about innovation in the crop protection industry. One of the instruments that will be used in this communication effort is an environmental information system developed by Nefyto itself.

Information systems that collect and present data on the environmental impact of individual pesticides are a useful tool in innovation in the agrochemical industry (OECD, 1997). Such a system provides transparency in the market place, and helps farmers making a better choice for plant protection products. If sufficient farmers use such an information system (or are forced to do so by food processors and retailers) this may generate a pressure on manufacturers of pesticides to develop new products with improved environmental characteristics and/or to discontinue the registration of highly polluting products. The Centre for Agriculture and Environment (CLM) has developed such an information system, a so-called 'environmental yardstick' (e.g. CLM, 1999).

The Nefyto has developed its own 'environmental yardstick' because it considered the CLM system too narrow. Thus, the Nefyto information system provides indicators on a much broader set of criteria. However, the use of such a yardstick is not without risk for the pesticide industry, particularly for those producer that sell pesticides that receive a bad score on the yardstick. Therefore, companies are reluctant to use such a system. A representative of the agrochemical industry has remarked that "in general, the agrochemical industry is not running ahead to introduce an information system that could lead to negative assessment of products currently supplied."

Slowly but gradually, more and more pressure from the food industry and the retail industry is building up for farmers to apply environmentally sound production methods. The use of pesticides is getting explicit attention from those companies, in response to consumer concerns. An example of pressures from the food industry on the agrochemical industry to come up with products with a better environmental profile is the natural sprout inhibitor Talent developed by Luxan. In response to consumer concerns or even legal bans (in some Scandinavian countries) the potato processing industry started to look for an alternative for

the commonly used chemical sprout inhibitor. Talent has proven to be a good, though expensive alternative.

As far as the plant biotechnology industry is concerned, its focus on developing techniques to enhance the pest resistance in crops plants has even become more important over the years. Improved pest resistance leads to lower pesticide use, and thus to lower environmental pressure of pesticides.The protests of environmental organisations like Greenpeace and others against field trials with transgenic crop plants – physical protests in the field, judicial protests against the granting of approval by the government – have made doing these test quite expensive. As a result, only the largest companies can afford to do (or to continue doing) these field trials. SMEs in the seed industry cannot afford to do this kind of risky R&D activities. In general seed companies selling horticultural crop varieties are much more reluctant to engage in the development of GM crops than seed companies developing field crops. As vegetable crops are eaten fresh, public acceptance is expected to be even lower for these crops than for crops whose products are being processed before they reach the consumer.

5. Policy influences

5.1 Agrochemicals

According to Luxan, shifting legislative approval of active ingredients (AIs) from the Member States to Brussels has made the registration process much more expensive. Until the harmonisation of pesticide policies in the EU and the adoption of Directive 91/414/EEC, pesticides registration was fully a national responsibility. Now, all new AIs have to go through an European evaluation and registration scheme. Authorisation of the plant protection product still is the responsibility of the Member States. Once a product (a formulation) containing an ai approved by the EU (i.e. included in the Annex I of the Directive) has been authorised by one Member State, other Member States have to recognise this authorisation (but have some discretion over setting conditions of use). The harmonisation of pesticide registration policies the EU has forced Luxan to broaden its scale of operation, from the Dutch domestic market to the European market.

Directive 91/414/EEC requires a re-examination of all active ingredients within 12 years from adoption (in 1991). Thus, in 2003 some 800 AIs, that were registered before 1993, have to be re-approved; if not, the products based on these AIs will have to be withdrawn from the market. In the Netherlands, more strict environmental criteria were introduced in 1995, in the *Besluit bestrijdingsmiddelen* (as the national implementation of Directive 91/414/EEC). For existing products based on 42 AIs that were known to have harmful environmental effects but were considered indispensable for agriculture a temporary registration until the year 2000 was granted. The products in this so-called “canalisation” process would be prohibited or limited in application by 2000, unless the registration holder could provide information proving that the environmental impact is within the limits set in the 1995 registration criteria. As of March 2000, 18 of these canalisation products have lost their registration, another 18 have been limited in their application, while the rest has been re-approved as they comply with the more strict environment requirements.[8]

The Dutch government’s exacting environmental requirements in its review of pesticide approvals has also affected Luxan. Out of the total number of 110 registrations, Luxan expects to loose about 30 products. In response to this, the company is paring down its range to concentrate on core products, to expand the registration of these products to other countries, and to strengthen its own innovation activities.

[8]. Situation as of March 23, 2000; source: CTB website: http://www.agralin.nl/ctb.

5.2 Biotechnology

In 2000, The Ministry of Economic Affairs has initiated a 45 million Euro subsidy programme for helping biotechnology start up firms. The goal of this so-called Life Sciences Action Programme is to have 75 new biotechnology companies in the Netherlands in five years. This programme was set up in reaction to complaints from the biotechnology sector that the Netherlands was running behind in European perspective. In the early 1990, the Netherlands had a good score on biotechnology start ups. The Netherlands was second in Europe, after the United Kingdom. Now, it is only seventh (NRC Handelsblad, 22/3/00). After several biotechnology stimulation programmes in the 1980s and early 1990s, the Netherlands for several years had no explicit subsidy programme for biotechnology companies. At the same time, other European countries enhanced their promotion programme of biotechnology activities, particularly in Germany, Belgium, Switzerland and Sweden.

Another complaint of the biotechnology industry is the incoherent governmental policy on biotechnology. The Ministry of Economic Affairs is subsidising biotechnology research, while the Ministry of Agriculture is prohibiting research on transgenic animals. Moreover, the Ministry of Environment is rather slow and reluctant to give approval for field tests with genetically modified plants. Approval of GM crops is mainly a EU responsibility, but Member States use the uncertainties in the European decision making process or the conflicting views on the safety of GM crops to make their own decisions on approving these crops.

A survey among SME biotechnology firms, held in 1999 by the NIABA, showed that these companies expect an increase in employment of more than 200 percent in 4 years (NIABA, Biotechnologie Nieuws, November 1999). It should be stressed that this figure is for all sub-fields of biotechnology, like pharma, agriculture, food, environment, diagnostics, equipment, etc). For agricultural biotechnology, an increase of employment depends on the acceptance of GM crops in Europe. If the acceptance continues to be low, it could even lead to lower employment in the agricultural biotechnology industry. Also, promoting agbiotech start up firms is of no use as long as their is no clear regulation on the market introduction of GM products.

A company like Keygene has used Dutch and EU technology subsidies, for instance by participating in R&D projects funded as part of the EUREKA and EU R&D (4^{th} and 5^{th} Framework) programmes. In the Netherlands, the BTS programme is a relevant source of subsidies. However, subsidies are never crucial, and participating in European R&D programmes is not done primarily for the funds but for networking and exchanging knowledge. Keygene receives many requests to participate in research programmes initiated by academic institutes, because of the opportunity to apply research outcome and because it is an SME.

The impact of government policies on Keygene's innovation strategy is not only through the availability (or lack) of subsidies, but also indirectly through the (non) approval of GM products. If transgenic varieties are not accepted in the European market, it will mean that seed companies will not develop these varieties, and that would probably mean less work for Keygene (interview Dons, 1999).

5.3 Seeds

The Dutch Seed Trade Association has the following concerns about government policies. First, the role governments play in approving genetically modified crop varieties. There seem to be no consistent policy, neither at the European level nor at the Netherlands level. Within the Netherlands, differences in approach exist between various ministries. The Ministry of Economic Affairs is a strong supporter of biotechnology, showing from the subsidy programme for R&D it had in the past, and the subsidy programme for biotech start-up firms it has initiated in 2000. The Ministry of Environment (VROM) is responsible for granting approval for field trials and market introduction (under 90/220/EEC). However, this Ministry is currently rather reluctant to grant approval, partly as a result of pressures from environmental organisations and the concern of the general public, partly as a result of ambiguous European decision making processes. Also the Ministry of Agriculture is involved. In recent

years it has intensified its attention for consumer issues (so-called 'consumer concerns') also in response to political pressure and complaints that it was to too much protecting farmers' interests.

Second, if the renewal of European Directive 90/220/EEC leads to time-limited approval of transgenic varieties, this would contradict the long term perspective in plant breeding. Developing a new variety really requires a long term investment, which does no go together with temporary approval for commercialisation.

A third issue is the availability of plant protection products for small crops. As the registration of crop protection products becomes more and more tight, with stricter environmental criteria (both nationally and European wide) fewer and fewer plant protection products will become available (or will remain registered). For the producers and their agents it becomes too expensive to uphold a registration for a product that is only used on a small crop area. Thus, for the small crops fewer and fewer plant protection products are available, leading to serious pest control problems or economic problems if only more expensive control methods – like hand weeding – have to be used.

6. Conclusions

This report assesses the influences of public and private actors on innovation by SMEs in the Dutch agrochemical, biotechnology and seeds industries. As no official figures exist on the presence of SMEs (< 250 employees) in these industries, and trade organisations do not make an explicit distinction between SMEs and large companies, this report focuses on the total agrochemical, biotechnology and seed industries.

Most of the companies in the Dutch agrochemical industry are subsidiaries of foreign multinationals. They do not develop new pesticides, although some of them do formulate products for the Dutch market. A small company that does develop new plant protection products is Luxan. Although Luxan is fully owned by the Cebeco Group, it operates like an independent company. In chapter 3 a small case study of innovation by Luxan was presented.

In the plant biotechnology sector of the Netherlands there are two kinds of companies: seed companies and dedicated biotechnology firms. The Netherlands has only three dedicated plant biotechnology firms, two of them owned by a foreign agrochemical multinational, and one collectively owned by five Dutch seed companies. The latter, Keygene, can be considered as a SME, and is therefore studied in more detail (see chapter 2). Still, Keygene's innovation strategy is strongly related to the demands from its shareholders. The genetic marker technology developed by Keygene is of great value to the seed companies. It is not only made available to Keygene's shareholders (five Dutch seed companies) but it is also licensed to other domestic and foreign seed and biotechnology companies.

Innovation by SMEs in the agrochemical, biotech and seed industries is primarily influenced by demands from the primary clients, i.e. Dutch farmers. In response to more strict environmental policies, farmers demand crop varieties with improved pest resistance, so that they can reduce the amount of agrochemicals needed. While large companies are in a better position to develop new active ingredients for crop protection products and new varieties for the major agricultural crops, Dutch companies focus on niche market and smaller-scale crops (particularly horticultural crops). Other innovation targets are seed treatment, biopesticides and transgenic crops with enhanced pest resistance (particularly nematode and fungus resistance).

Increasingly innovation in the seed and agrochemical industries is influenced by demands from firms further down the production chain, i.e. from food processors and food retailers. Thus, regulatory requirements for reduction of environmental impacts is complemented by market requirements for environmentally friendly products. In response to growing consumer concern over the quality of product and process, food processors and retailers pressure their suppliers (i.e. farmers) to apply environmentally benign production methods. This, in turn,

influences innovation in the pesticide industry, not only in developing new active ingredients, but also in making new formulations and in combining agrochemicals with other methods of pest control (within IPM/ICM).

Public policies have a direct impact on innovation in the agrochemical, biotechnology and seeds industries through the pesticide registration policies and the GM-crop approval policies. European harmonisation of pesticide registration (Directive 91/414/EEC) creates opportunities for a Europe-wide market. However, more stringent criteria and expensive registration procedures may pose obstacles for present or prospective products which have only a small specialty market. The latter problem has already appeared in the Netherlands, where the commission for registration of plant protection products (CTB) is already applying the new European criteria. As a result, several products have been withdrawn from the market. This, in turn has led to farmers complaining: for some products, no (or only expensive) alternatives are available. In response to these protests, some of these products have received a temporary extension of registration. For others, the market has been closed.

GM-crop approval policies meet a lot of complaints from biotechnology, seed and agrochemical companies. Particularly the small dedicated plant biotechnology companies, like Keygene, and the seed companies with a large biotechnology research programme, like Advanta, have been faced with long delays and many uncertainties in approval policies. GM-crop approval policies are primarily a EU responsibility, and EU decision making continues to be uncertain due to a rather politicised decision making structure, so companies have difficulty in planning their GM-crop innovation strategies. However, it seems that SME seed companies with no GM crops in their R&D portfolio are benefiting from these delays, as they have not made heavy investments in biotechnology research.

In the past, STI policies have promoted biotechnology research both by dedicated biotech start-up firms and by seed companies doing their own biotechnology research. Nowadays fewer subsidies exist, although the ministry of Economic Affairs has just started a new subsidy programme to promote the establishment of biotechnology start-up firms in the Netherlands. This programme came in response to other countries granting similar financial and supporting services to newly founded biotech companies.

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ir. N. van de Bergh, deputy director of the Dutch Seed Trade Association (NVZP) on 18 December 1998;

ir. L. de Regt, managing director of Luxan, on 12 November 1999.

Appendix

NIABA

Members of NIABA from the agrochemicals, agbiotech and seeds industries:
(total number of NIABA members in March 2000: 56)

	Agrochemicals	Agbiotech	Seeds
- Agrevo Nederland	x	x	x
- Avebe		x	x
- Florigene Europe		x	x
- Keygene		x	x
- Novartis Seeds		x	x
- Seminis Vegetable Seeds		x	x
- Zeneca Mogen		x	x

The Dutch trade organisation for the seed industry, the NVZP, is also member of NIABA. Also the National Council for Cooperatives in Agriculture and Horticulture (NCR) is a member. This way, most seed companies are indirectly represented in the NIABA.