5 The VEL and VANLA Environmental Co-Operatives as a Niche for Sustainable Development

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Introduction: the birth of the environmental co-operatives

The modernisation paradigm has, for many years, dominated the shape and direction of Dutch agriculture. This resulted in the prevalence of the agro-industrial model, characterised by industrialisation, productivism and economies of scale (see Marsden 2003; van Huylenbroeck and Durand 2003; Wilson 2001). In the last decade an alternative competing rural development paradigm has emerged. These two different paradigms co-exist, compete and evolve at different levels: in farming practices as well as in policies and sciences. The emerging rural development paradigm not only entails a new approach to agricultural and rural development practices but also calls for a new approach to scientific practices and policy making, steering and control. Key elements of this approach include regional diversification of rural policies and citizens' and stakeholders' participation in science and policy making. The emergence of the rural development paradigm was induced by a growing societal concern over the negative side effects of the modernisation paradigm. Examples of these side effects include environmental pollution through the excessive use of chemical fertilisers and pesticides and increasing dis-connections between agriculture and its social and ecological environment.[1]

Environmental co-operatives in the Netherlands are part and parcel of this new rural development paradigm. In this chapter two environmental co-operatives are examined: Vereniging Eastermar's Lânsdouwe (VEL) and Vereniging Agrarisch Natuur en Landschapsbeheer Achtkarspelen (VANLA). These are located in the Friese Wouden (the Friesian Woodlands)[2] and were founded in 1992 being among the first environmental co-operatives in the Netherlands.[3]
An environmental co-operative is a regional organisation of agricultural entrepreneurs, often working in close collaboration with other rural stakeholders (e.g. environmental organisations, local authorities, animal welfare groups and citizens). They aim to integrate environmental,

conservation and landscape objectives into their farming practices. This is done in a pro-active way and from a specifically regional perspective. Environmental co-operatives are both a symbol and an expression of a new contract between local, regional and national authorities and farmers. As such, they are a promising example of new rural development practices and new forms of rural governance (van Huylenbroeck and Durand 2003).

The emergence of the environmental co-operatives was closely linked with the emerging tensions between the Friesian farms and the prevailing agro-industrial model. Intensification and scale enlargement seemed to be the only possible routes for development. The farmers in the Friesian Woodlands worried whether they could maintain their small-scale farms in the unique landscape if they did not follow this path of intensification of production and scale enlargement.

> *'Many dairy farmers in our area used to farm relatively extensive and on a small scale, which fitted with the landscape. Farming in a small-scale landscape is labour intensive, which means that production costs are high. As there is a growing pressure for us to farm with low production costs, the space we can give to landscape and nature gets smaller'* (Local farmer quoted in Renting 1995).

Furthermore, they experienced the growing tension between agricultural production on the one hand and nature conservation on the other hand. From the 1980s onwards, the Dutch government issued a series of environmental rules and regulations designed to reduce the environmental impact of agriculture. The farmers found the regulations on environment and nature conservation both inadequate and inappropriate. Through the establishment of the environmental co-operatives the farmers hoped to be able to create more room for self-regulation in order to develop locally effective measures to reach environmental objectives:

> *'The new rules for sustainability were seen as difficult to implement, badly balanced and contradicting each other'* (Renting 1995).

> *'The environmental co-operatives see the governance of nature, landscape and environment as their responsibility. They can fulfil this role by negotiating with the land users and by co-ordinating the tasks that need to be done. External control by government organisations or nature organisations can, in this way, be limited to formulating clear aims. Farmers retain choice of the methods through which nature, landscape and environment objectives are met'* (Renting and de Bruin 1992).

In this chapter we discuss how the environmental co-operatives and their members have integrated agricultural production, nature conservation and landscape maintenance. However, in order to emergence of environmental co-operatives, we discuss the institutional context of Dutch

agricultural and environmental policy-making.[4] Next, we describe the nutrient management programme of the VEL and VANLA in more detail. We conclude this chapter by synthesising our findings. We propose that the activities of the VEL and VANLA can be seen as an example of a so-called niche in which the transition towards sustainable agriculture has been able to develop.

Agro-environmental policies and policy-making in the Netherlands

Introduction

In this section we outline the environmental crisis in Dutch dairy farming and the policies that emerged as a response to this crisis. We will argue that for a long time the development of environmental policies was hindered by the corporate structure of relations between politics and farmers' organisations (see Box 1). The rules that were developed by the government were mostly focused on means, and not on targets, and were perceived by farmers as being inconsistent. When a move was finally made towards integral policy making (through the introduction of the Minerals Accounting system – MINAS) the government also maintained the other rules. Thus the government prescribed both the rules on targets as well as the means that farmers had to use to meet these targets.

The environmental impact of livestock production

In the second half of the twentieth century the environmental problems associated with the large number of livestock in the Netherlands have increased tremendously. Between 1950 and 1990 the number of cows doubled, the number of chickens quadrupled and the number of pigs increased sevenfold. Intensive animal husbandry, with its high use of fertilisers, manure and animal feeds has caused severe environmental side effects. Emissions of nitrogen (N), phosphate (P) and potassium (K) have created environmental burdens that have taken several different forms. Excessive Nitrogen use can lead to accumulation of nitrates in the groundwater, creating health risks. In almost 40 per cent of the agricultural area, the nitrate content of the upper ground water exceeds the 50 mg/l specified in Directive 91/676 (van der Bijl and Oosterveld 1996). Nitrogen is also an element of ammonia, one of the causes of 'acid' rain, which damages forests and ecosystems. In the Netherlands Ammonia is the main element of acidifying deposition: since 1980 it has contributed 45-50 per cent of total acid depositions. In 1995, some 34 million Euro were being spent annually to combat the effects of acidification and eutrophication of nature reserves (Anon. 1995a). Phosphates accumulate in the soil, and when the soil is saturated, can leach into ground- and surface water. About 400.000 ha of the sandy soils (50%) in the Netherlands are considered saturated with phosphates In

1990, agricultural emissions contributed between 21 per cent and 67 per cent (average 29 per cent) of the phosphate burden of surface waters in the different regions of the Netherlands. Acceptable surface water concentrations of phosphorus were exceeded at 75 per cent of test locations (Anon. 1995b). Leaching of nitrogen and phosphate results in eutrophication of surface water and pollution of ground water and has severe consequences for drinking water catchment areas. Overall, agriculture is estimated to be responsible for around 32 per cent of the acid depositions in the Netherlands. In 1995 the total direct costs of eutrophication and acidification caused by agricultural emissions were, if policies remained unchanged, predicted to run to 220 to 290 million Euro per year by the year 2000, rising to 500 million Euro per year by 2015 (Anon. 1995a).

On denial and obstruction

From the 1970s onwards, societal pressure to reduce environmental problems in dairy farming has increased. As early as the 1970s, research reports from the National Institute of Soil and Fertiliser Research and the Institute for Soil Fertility indicated the negative side effects of the excessive use of manure on agricultural soils (Bloemendaal 1995). From the mid-1980s onwards the Agricultural Policy Community could no longer ignore these signs (see Box 1; see also Frouws 1993; Proost 1994; van der Bijl and Oosterveld 1996). The first restrictions on production growth were introduced for environmental reasons in the 1980s after years of denial of the problems, obstruction of research and political struggles by the members of the Agricultural Policy Community (Bloemendaal 1995).

Frouws (1993) argues that the lack of anticipation of these environmental problems by the Agricultural Policy Community can be traced back to the corporate structure of the agricultural sector. The mutual interests of the APC created a status quo among its members. Furthermore, the closed character of this agricultural 'bastion' led to an attitude of denial of environmental problems. The ruling modernisation paradigm created a 'blindness' to the negative side effects of agricultural policies, especially amongst farmers:

> *'For a long time, environmental problems were experienced by farmers as a problem of the government. Both the government and farmers' organisations failed to clarify the consequences of individual farmer's practices for the environment. As a result, environmental problems were never internalised as being the consequence of one's actions. Creating awareness has been ignored in the policy development process'* (Oerlemans and Wiskerke 2000).

Box 1 The Dutch Agricultural Policy Community

The concept of 'Agricultural Policy Community' (hereafter referred to as the APC) is used as a shorthand for the complex of stakeholders, relationships, policy processes, roles and objectives in the agricultural arena. In the Netherlands a corporate organisational structure has dominated the agricultural policy process for almost forty years. Some authors refer to the APC as the 'Green Front' (Frouws 1993; de Bruin 1997). According to Frouws (1997) members of the APC were leading farmers' representatives, experts from the Ministry of Agriculture, Nature Management and Fisheries (hereafter referred to as Ministry of Agriculture), the Agricultural Board and other corporate bodies in agriculture as well as members of the Parliamentary Committee on Agriculture. Members of the APC shared a common and firm belief in technical progress and modernisation. While contacts between the members of the APC were very close, liaison with the 'outside world' was rare. For instance, it was not until the 1980s that the APC came to consider regular contacts with the Ministry of Public Housing, Spatial Planning and Environment (hereafter referred to as Ministry of Environment) to be useful.

The corporate organisational structure was based on the 'Landbouwschap' (Agricultural Board), which was established in 1954. In this board, the three national farmers unions and unions of farm labourers were represented. Until 1995, the Agricultural Board was both a platform for negotiation and a legislative body. In the latter function the Board was entitled to levy taxes and to implement rules and regulations. The Agricultural Board was the major negotiation partner of the Ministry of Agriculture. The organisations participating in the APC were granted the privilege of influencing public policy-making in exchange for their co-operation, the legitimisation of negotiated policies and maintaining discipline within their constituencies. Frouws (1997) states: *'This neo-corporatist exchange was 'ruled' by a permanent search for consensus, élitist decision-making, membership passivity and isolation vis-à-vis non-agricultural 'outsiders'. The APC was like a state within a state and the 'Landbouwschap' functioned as the 'farmers' parliament.'* The corporate structure worked effectively when the Ministry of Agriculture and the agricultural sector shared the same modernistic view of agricultural development: based upon a highly productive, efficient, export oriented agriculture, requiring farm enlargement, specialisation and intensification.

Frouws and van Tatenhove (1993), Termeer (1993) and Bloemendaal (1995) all conclude that this denial and lack of anticipation of environmental problems was maintained for a long time because of the limited interaction between the APC and other outside actors. In addition, relevant actors outside the APC (i.e. environmental groups) were less organised (Frouws 1997).

When the Dutch government began to develop agro-environmental policies in the early 1980s to prevent a further expansion of livestock production, farmers found it difficult to understand the change in the attitude of the government. Oerlemans and Wiskerke (2000), quoting a

representative of the Dutch Agricultural and Horticultural Organisation illustrate this:

> *'For years, the government was investing millions of guilders in developing the agricultural sector to internationally competitive production levels by stimulating growth and expansion. And now they turned their back to the sector by stating 'you have got a problem'. It is hard to explain this change of attitude to our farmers. (...) It is common knowledge that people pass several phases when being confronted with a problem. First, they deny the problem, after some time they accept that there actually is a problem and it's only some time later that they change their attitude and take action to solve the problem. The whole agricultural sector has been living in the phase of denial for a long time. Now it's slowly changing towards the acceptance phase.'*

A never-ending story? The development of manure and nutrient policies

The introduction of the Milk Quota System in 1984 became a turning point in the intensification of Dutch agriculture and was followed by the introduction of the Interim Pig and Poultry Holdings Act. This act tried to restrict the rapid growth of intensive pig rearing and poultry farms. The Minister of Agriculture prepared and implemented this act without prior consultation with the Agricultural Policy Community. Though this act never achieved its aims of putting a hold on the growth of pig holdings, it opened up the discussion on the negative consequences of intensification and production growth processes during the former decades. The Act also led to joint actions between the Ministry of Agriculture and the Ministry of Environment. They co-operated with each other in the design of the Fertilisers Act (which was initially the responsibility of the Ministry of Agriculture) and the Soil Protection Act (which was the primary responsibility of the Ministry of Environment). Environmental issues thus gained a new importance on the political agenda, partly due to a stronger environmental lobby and a higher profile in public opinion (de Bruin 1997). As a result the influence of the Ministry of Environment on agro-environmental policy increased.

From the 1980s onwards, a new series of agro-environmental policy measures was introduced. The main reason for new and additional policy measures was the growing anxiety, both nationally and internationally, about the dangers of groundwater pollution (de Walle and Sevenster 1998). A phased approach was adopted in order to give room to the agricultural sector to adjust their practices and for the Ministries of Agriculture and Environment to develop and fine-tune their policies. There were three phases, each of which had a distinct objective:

1 Stabilisation of manure production at a level where all manure produced could be utilised nationally, to prevent a national manure surplus (1987-1990);

2 A steady reduction of the nutrient surplus through the gradual tightening of standards for the application of manure and fertilisers, to avoid further accumulation of nitrate in soil and water (1991-1994);
3 Achieving equilibrium between inputs and outputs of nutrients (1995-2000).

According to Henkens and van Keulen (2001) the phased approach was built upon two lines of government intervention: application policies and volume policies.

1 The application policies. The Decree on the Use of Animal Manure, which was based on the Soil Protection Act, regulated the application of manure between 1987 and 1998. It specified restrictions on the annual dose of animal manure (i.e. the application standards) as well as the timing and methods of application (such as the obligatory slit injection of manure, see below). The application rates, calculated on the phosphorus content of manure[5] were decreased through time in order to diminish the environmental impact of phosphorus and nitrogen
2 The volume policies. Regulations regarding manure production initially aimed to halt the expansion of the livestock sector and thereby the increase of manure surpluses at national level. This started, as mentioned before, with the introduction of the Interim Pig and Poultry Holdings Act in 1984. In 1987 this Act was replaced with the prohibition of expansion and disposal of manure production. Since 1994, new conditions for the disposal of manure were specified as part of the Disposal of Manure Production Act. This provides a set of rules and regulations referred to as the System of Manure Production Rights. Thus in the early 1990s, the rules regulating manure production aimed to achieve a national balance between production and disposal possibilities of manure.

In the course of the 1990s, it became evident that stabilising the volume of manure production could not guarantee a national balance between production and disposal. Furthermore the tighter manure application standards, issued as a result of the application policies, made it even harder to achieve a balance as the amount of manure produced exceeded the amount of manure that could be applied. The poor integration between the manure application policies and the volume policies coupled with the need to comply with the EU Nitrate Directive meant that additional policy measures became necessary. According to Henkens and van Keulen (2001) it became increasingly clear that an effective manure policy required a system that took into account the large differences in manure surpluses, between different sectors and different regions.

In 1998 the Minerals Accounting System (MINAS) was introduced as a *'central instrument for restricting emissions of nutrients to the environment' (ibid.)*. MINAS implied a completely new approach to manure policy (Siemes 2001):

- The policy no longer focused on phosphate alone, but explicitly included nitrogen.
- The policy addressed nutrient surpluses, instead of manure surpluses, as the true problem and the measures were equally applied to chemical fertilisers, animal manure and other organic fertilisers, such as compost.
- The focus of policy shifted from specifying measures to setting targets to reduce the nutrient surplus, giving farmers (at least in theory) the freedom to decide which measures to use to reach this target.

The last change was only partially true as the restrictions on the permitted times[6] and methods (e.g. obligatory slit injection of manure) remained in force alongside MINAS. Compliance with MINAS implies that all farmers are obliged to register the annual inputs of nutrients in livestock manure, organic manure, chemical fertiliser, roughage, concentrates and nitrogen fixation as well as the outputs of nutrients in agricultural products (milk, meat, crops, roughage) and in animal manure. These figures provide the basis for calculating nutrient losses per hectare (at the level of the individual farm). In order to comply with the EU Nitrate Directive, MINAS sets standards for losses (see Table 1). Farmers who exceed the maximum allowable loss standards have to pay a levy (see Table 2).

Table 1 Loss standards for phosphate and nitrogen in kg per ha per year (source: Siemes 2001)

Year	*Phosphate loss standard*		*Nitrogen loss standard*					
	arable land	*grass-land*	*arable land*	*arable land (clay/peat)*	*arable land (sand)*	*grass-land*	*grassland (clay/peat)*	*grassland (sand)*
2001	35	35	150	125	125	250	250	250
2002	30	25	150	100	110	220	190	220
2003>	20	20	100	60	100	180	140	180

Table 2 Levies on surpluses exceeding the loss standards in Euro per kg (source: Siemes 2001)

Surplus exceeding loss standard	*2000/2001*	*2002*	*from 2003*
Phosphate			
0 – 10 kg/ha	€2.30	€9.00	€9.00
> 10 kg/ha	€9.00	€9.00	€9.00
Nitrogen			
0 – 40 kg/ha	€0.70	€1.15	€2.30
> 40 kg/ha	€0.70	€2.30	€2.30

On the first of January 2002 an additional measure was introduced to ensure that the national production of animal manure did not exceed the quantity that could be applied on the total area of arable land and grassland. To achieve this, the government opted for an integral approach, based on the system of Manure Transfer Contracts for all livestock sectors (Henkens and van Keulen 2001; Siemes 2001). Farmers are obliged to enter into a manure contract and as part of this process must calculate how much nitrogen their farm produces. This calculation is based on the number of animals and a statutory fixed rate of nitrogen production per animal species. (These rates are laid out in the regulation that came into force on the first of January 2002). The farmer then needs to calculate how much manure can be deposited on his own land and how much he must sell to third parties. Some of the surplus manure might be applied on a neighbouring arable farmer's land, but contracts may also be signed with authorised manure processing plants. Farmers who are not able to dispose of their manure through any of these means will have to reduce their livestock numbers.

The combination of MINAS, manure application measures and the system of manure transfer contracts promised to be effective in terms of reducing nutrient and manure surpluses at both the farm and national level. Yet, these measures have resulted in a tremendous administrative burden for farmers and civil servants. In addition, a growing number of farmers are having difficulty with the combination of target-oriented policies (the MINAS loss standards) and means-oriented policies (the obligatory manure application measures). They have the opinion that the obligatory means are an obstacle to effectively meeting the MINAS goals. Despite difficulties in implementing the manure and nutrient policies, the Dutch government and the agricultural sector finally seemed to be on the right track for reducing the environmental impact of manure and fertilisers. However, in early October 2003 the European Court of Justice, in a case bought against the Netherlands by the European Commission, ruled that the Dutch system of rules and regulations (in particular MINAS) does not guarantee an adequate or timely realisation of the requirements of the EU Nitrate Directive.[7]

The development of VEL and VANLA in three trajectories

Introduction

This section focuses on the development of three trajectories[8] that the environmental co-operatives have pursued since their beginning in 1992. The first trajectory involved the re-integration of environment, nature and landscape into the farming system (see Atsma *et al.* 2000). The second trajectory entails the emergence of the environmental co-operatives as

possible authorities for effectuating rural policies in their locale (Renting and van der Ploeg 2001). The third trajectory concerns the role that the environmental co-operatives have played as field laboratories, with a potential for re-orienting Dutch farming towards economic and environmental sustainability (Stuiver *et al.* 2003). These three trajectories represent an unfolding pathway of possibilities, frustrations, success and failures.

Integrating environment, nature and landscape into farming.

Nature and landscape

Besides the environmental legislation described above, the Dutch government also introduced several legal measures to counter the detrimental effects of ammonia deposition (acid rain) on ecologically valuable landscapes in the early 1990s. The governments' programme of nature development (known as the ecological guideline) declared that the hedges and belts of alder trees (so characteristic for the Friesian Woodlands) were sensitive to acid rain. This designation implied substantial restrictions on animal husbandry in the immediate surroundings and was seen by farmers as a threat to future development of their farms.

The members of the environmental co-operatives argued that in order to maintain the landscape, active management of these hedges and belts of alder trees was more important than acid deposition. The farmers were prepared to commit themselves to more active management of these features in exchange for a policy-decision that these features would not be designated as acid-sensitive. In practice this implied that the ecological guideline would not be applied to the area. After a period of negotiation involving local, provincial and national governments the deal proposed by the farmers was accepted in the mid nineties.

Since then, the environmental co-operatives have restored a total of 240 kilometres of alder belts and hedges – generally containing trees between 30 and 50 years old. Restoration involves pruning the trees and providing fences to protect the trees from cows. Ditches have been cleaned and new trees planted. Besides this, a new plan for landscape management has been drawn up for the whole area with a transparent formal structure for subsidies and regulation. This was drawn up by seven environmental co-operatives (including VEL and VANLA), which between them, cover the whole of the area of the Friesian Woodlands.

Environment

As discussed in the previous section, high ammonia emissions led to legislation that required manure application by the slit injection method. As a consequence farmers in the Friesian Woodlands were obliged to use specialised machinery required for this operation. However, farmers found that this machinery created problems, especially on lower-lying

land and in the open meadows. First of all they found it very difficult to work with these machines within small fields. Second, because of high water levels in spring, using the heavy machines had damaging effects on the structure of the soil. This meant that the farmers had to use more fertiliser to achieve the same results (which was bad for their nutrient balances). Soil compaction also had a serious effect on earthworm populations, which play an invaluable role in recycling (de Goede *et al.* 2003).

The farmers became concerned that farming in harmony with the landscape would no longer be possible, as the only viable way of using the machinery would be to enlarge the fields, thereby damaging the landscape. The farmers negotiated exemptions with the Ministry of Agriculture concerning methods of manure application. The result was that 20 farmers received permission for surface application of manure. Agreements that manure could be applied fourteen days later than the national norm of 15 September were also achieved.[9] In return the farmers committed themselves to meeting the nitrogen loss standards (see Table 1) more quickly than the government required.

The farmers committed themselves to active participation in a number of different projects designed to reduce their nitrogen losses in a variety of ways:

- Since 1995 the members of the co-operatives have documented their MINAS results. This is an important tool for farmers to better understand the measures used to improve the nutrient management and to check the effectiveness of these measures. The farmers use the nutrient balances as an important tool to monitor whether the targets are reached.
- Some of the farmers use a manure additive called Euromanure.[10] The farmers believe that this treatment reduces ammonia volatilisation and improves the condition of the soil. Farmers are convinced that surface application of manure is necessary in order to let this treated manure work properly.
- In order to overcome the problems with the heavy machines, the farmers have developed a lighter, 'area friendly' machine for manure applications. This machine is supposed to overcome the problems of soil compaction.

Integrated approach to regional solutions ('governance experiment')

In 1995 the Dutch Ministry of Agriculture started with a 'governance experiment' in which five environmental co-operatives (including VEL and VANLA) were given incentives to take responsibility for preserving nature, landscapes and environment within their areas:

> *'The request of the Ministry entails proposals for experiments concerning policymaking within the areas. The ministry considers our 'plan of action' as*

> *a first 'governance experiment' that the Ministry wants to support. So our plan of action is an attempt to construct a new relation between governments and farmers, in which government give more space to farmers to solve their own problems within the farm and within the area. The environmental co-operative takes responsibility to solve these problems'.* (Co-operative member quoted in Renting 1995)

The activities of the farmers within this governance experiment were intended to be as practical as possible, addressing the themes of nature, landscape, environment, as well as water management and recreation. Therefore close relations were maintained with the relevant authorities and organisations. Working groups were built around the different themes and all the stakeholders contributed to developing the action plan. (Renting 1995).

Through this governance experiment, (and also, as we saw, with the exemptions on manure application), the farmers of the environmental co-operatives, together with local, regional and national authorities, have been involved in building new institutional relations between the state and the farming population, based on new relations of trust. Farmers in the environmental co-operatives certainly question the heavy burden of state regulations that interfere with management at the farm level (Wiskerke *et al.* 2003). However they do accept and endorse the policy objectives set by state agencies. These new governance structures have enabled the farmers to generate substantial reforms and greater flexibility in their implementation. Legally conditioned forms of self-regulation (Glasbergen 2000) seemed to replace the centralised prescription of how policy goals are to be implemented at the local level. In this respect these governance experiments emerge as new institutional arenas for negotiation and co-operation on policy issues relevant to specific farming practices (Renting and van der Ploeg 2001).

However, the co-operation between the environmental co-operatives and the national governments remained problematic after 1995. The environmental co-operatives had the status of 'governance experiment', but this position did not give enough long tem security for the future. For instance, the practice of surface application of manure had to be re-negotiated every year and approved by the ministries and parliament. In 1998 the Minister of Agriculture describes the conditions attached to continuation in one specific year:

> *'My plans concerning the 'governance experiment' are contained within this letter. [...]. Concerning the quality aspects for the maintenance of the alder trees I will ask the Province of Friesland to develop this as an experiment within the national programme of landscape maintenance. [....] The request to be able to apply manure after 15th of September can be given under specific conditions. I will support your experiment in reducing mineral losses. I ask you to make a research proposal for 1998 till 2000, together with the scientific*

institutions of the Agricultural University of Wageningen and the research station on dairy farming. Your research on (manure) additives will be part of this research. Under these conditions surface application of manure can continue.' (van Aartsen 1998).

However, the evaluation of the governance experiment in 1999 put an end to the shift towards local governance. This was not due a failure of the environmental co-operatives to meet their part of the deal. On the contrary, various positive evaluations produced evidence of the feasibility of the approach (Anon. 1998; Hees 2000). And although the Minister of Agriculture assured the parliament that the governance experiment was to be continued, it was decided at the same time that the environmental co-operatives would not receive an official governance status.

The negotiations between the stakeholders took another direction when, in 1998, the VEL and VANLA nutrient management project was set up (see next section). Exemptions to the rules became permissible only as part of scientific research. The report of a visit to the Friesian Woodlands from the Ministry illustrates this point:

'Annemarie Burger[11] *is convinced that leaders in dealing with sustainability, like the VEL and VANLA environmental co-operatives should be protected. At the same time we know that it is difficult for governments to deviate from generic regulations. That is why this is formulated carefully in the policies concerning agricultural nature groups. The exemption from the obligation to slit injection of manure is only legitimate and defendable for scientific purposes'* (Bargerbos 2001)

Laboratories in the field

The diverse manure and nutrient management practices of the farmers became 'bundled' in the 'nutrient management project' that started in 1998. In this project 60 farmers (farming approx. 2800 hectares of land) aimed to achieve a substantial reduction of their nutrient (in particular nitrogen) losses. The nutrient management project was established for three main reasons. First it aimed at improving the understanding about the inter-dependence between the different elements of farming systems, as we can see in the following;

'The environmental cow does not exist. In Wageningen we thought for a long time that we could solve our environmental problems by improving parts of the farming system, like the cow. Now we know better, we have to think more about improving systems' (Koopman 1998).

This quote reflects the influence of Egbert Lantinga, a key member of the project team on developing mixed farming systems at the Minderhoudhoeve in Swifterbant. This shift towards a farming systems approach marks an important shift within science and politics towards seeking insights into farming systems and farming systems development,

as opposed to focusing on individual component parts of these systems (Anon. 2000).

Second, the nutrient management project also aimed to open some of the 'black boxes' of agricultural sciences, such as manure and soil. The research agenda therefore can be seen as a reaction to the dominance of one particular mode of knowledge production. The modernisation model favoured certain types of knowledge, such as milk production per cow, while neglecting others, such as sustainability. The same model also favoured certain scientific methods, often based within research stations and without any 'lay' involvement.

Third, the nutrient management project differs from conventional research concerning the influence of 'lay' people. Knowledge production departs from the active involvement of farmers and their expertise within the project. Their knowledge influences the design and methodology of the project. Furthermore the project proceeds on the basis of hypotheses generated by farmers. One main reason behind this is that the scientists involved considered the practices of the farmers (as they have evolved over time) to be a sequence of novelties that merited further consideration and research. For the scientists the project became a field laboratory generating relevant research questions and delivering interesting new hypothesis (Stuiver *et al.* 2003).

The three trajectories of VEL and VANLA as different promises and associated practices (or novelties)

Figure 1 shows the simultaneous development of the practices and promises throughout the three trajectories of the environmental co-operatives. At the beginning, the practices of the farmers aimed to re-integrate dairy farming with nature, landscape and the environment (promise 1: integration of landscape). Simultaneously new options for the future were developed (like promise 2: increase nutrient efficiency). This second promise was the 'glue' of the nutrient management project that investigated the practices and associated novelties (see the next section). Finally this developed into the exploration of the possibilities for farming with fewer external inputs and the practices that need to be developed for this to be viable (promise 3: low external input farming). Others have called this simultaneous development of promises and practices the process of 'unfolding novelties' (Roep *et al.* 2003)

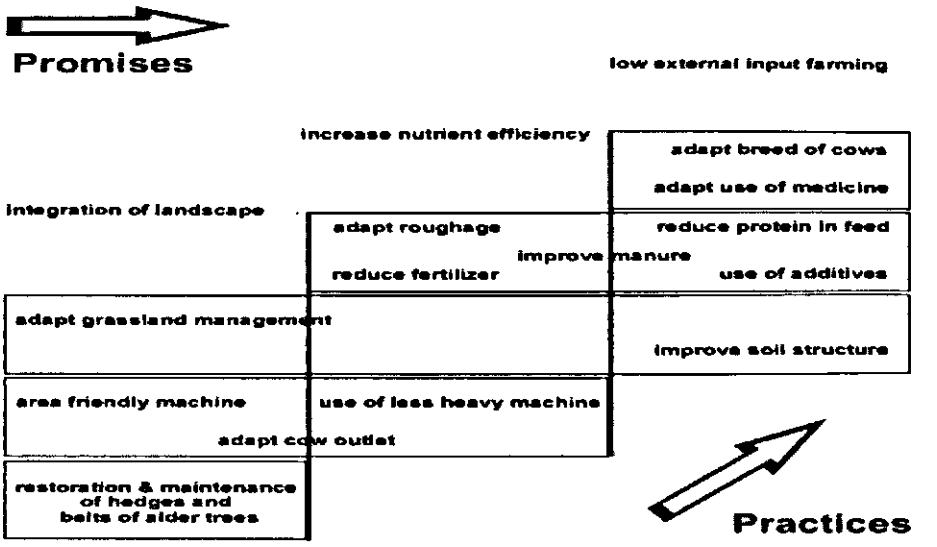
The VEL and VANLA nutrient management project

Introduction

The goal of the VEL and VANLA nutrient management project has been to find cost-effective solutions for environmental problems, through developing environmental practices that are appropriate to the local

context (i.e. the local farming systems, agro-ecological environment and social environment).

Figure 1 The simultaneous development of promises and practices



The project focuses on different aspects of the farming system (such as nutrient management) with a particular emphasis on decreasing fertiliser use, improving manure quality, adapting appropriate techniques for the application of manure and improving soil quality. The members of the project claim that the project has developed many innovations (or novelties) that have a potential for enhancing sustainability. In this chapter we present these novelties as the simultaneous co-evolution of three targets and associated practices (see Figure 1). This is illustrated by a quote from (one of the founding fathers of the project) Jan Douwe van der Ploeg;

> *'With the nutrient management project the VEL and VANLA environmental co-operatives aim to develop an innovative sustainable trajectory. First, the approach is specific for the region and embedded in the locality. Their farming systems are developed within and adapted to a unique landscape of small-scale parcels with hedges and belts of elder trees. Second, the approach is to increase co-operation among different stakeholders, farmers among themselves, farmers and scientists and farmers and politicians. Third, their approach is to gain more insight in the interaction between the different elements of the farming system (or the soil-plant-animal system) instead of optimising one element of the farming system'* (Jan Douwe van der Ploeg in Verhoeven 2000).

In this section we analyse key elements of the nutrient management project and their relevance to the research activities that have taken place.

First, we describe the actors that were enrolled in the project, forming a social network that was needed to develop the research activities. Second, we describe the approaches to research that were performed within the project, which represented a departure from conventional approaches. Finally, we describe some examples of alignment practices designed to ensure that these promising novelties could mature and sustain themselves.

The creation of a social network for research

The nutrient management project involved 60 farmers with differing farming-styles, education levels, milk production levels and environmental achievements.[12] These farmers are in charge of the project. This is formally laid down in the organisational structure. Two project-leaders are responsible for day-to-day project management: an agronomist from Wageningen University and an employee of the farmers' union (the LTO). Various other scientists participate in the project including agronomists from The Research Institute for Animal Husbandry and Wageningen University, as well as soil scientists and social scientists from Wageningen University. Farmers' organisations and governmental bodies are also engaged in the project through funding.

At the beginning of the project, in 1998, a research council was established to design, govern and monitor the nutrient management project. The research council was composed of both farmers and scientists, representing those involved in the work of the project. Due to the prominent position of the farmers in the research council, the formulation and monitoring of the research process was farmer driven from the very beginning. The knowledge, experiences and insights of farmers were central to the development of the project. The farmers started with the project because they wanted to increase their knowledge about nutrient management. The ideas of the animal scientists visiting the area seemed attractive to them, as the next quote shows:

> *'We could not continue with farming within the prevailing policies of the government. The ideas of Jaap van Bruchem about the importance of the nutrient cycle within the farming system made a lot of sense to us at the time and we decided to work on the soil-plant animal system together with the researchers.'* (Farmer during the VEL and VANLA evaluation 2003).

The scientists of Wageningen University that became involved in the project were searching for ways to develop knowledge that would contribute solutions for the environmental problems being encountered by agriculture. The social scientists already had extensive contacts with the farmers from previous work that they had done, identifying the challenges for the environmental co-operatives. This resulted in a plan of action (de Bruin and van der Ploeg 1990). The animal scientists were developing a farming systems approach in the Netherlands and found

striking similarities between the aim of their approach and the aims of the environmental co-operatives (van Bruchem *et al.* 2000):

> *'We have gone too far in intensifying our farming systems and this is having a negative effect on the soil, says van Bruchem. He proposes an introduction of the tropical approach where farmers return to more natural farming systems. [...] He is viewed with some suspicion in Wageningen but this year 2000 farmers have visited the Minderhoudhoeve research station where they experiment with his ideas'* (Horst 1999).

Researchers of the Research Institute of Animal Husbandry (Praktijkonderzoek Veehouderij) were also involved. The Ministry of Agriculture made the participation of this Research Institute a prerequisite for financing the first phase of the nutrient management project, as the finances had to be taken from funds that had already been credited to the Research Institute. Regional representatives of the Ministry of Agriculture and the Regional Province were appointed to keep a close eye on this new initiative. The Farmers' Organisation NLTO was involved from the beginning. It provided one of the project leaders and in the second phase of the project it became the body responsible for spreading the novelties among farmers in the rest of the country.

The first phase of the nutrient management project ended in 2000. Promising results in terms of achieving environmental objectives (see Reijs *et al*, this volume) and fruitful collaboration between farmers and researchers, encouraged the research council to apply for funding for a second phase. After a long period of negotiation between farmers, researchers and the Ministry of Agriculture, the environmental co-operatives got sufficient funding to implement an ambitious second phase of the project, which started in September 2001 and lasted till the end of 2003 (Verhoeven 2001). During this second phase more researchers with additional research activities became involved in the project, as we can see in the following table.

Table 3 Research activities of the VEL and VANLA nutrient management project (1998-2003)

Research activities 1998-2003	*Additional research activities 2000-2003*
• Data base on mineral management of 60 farms	• Social analysis on technico-institutional design
• Experiments with additives	• Monitoring farmers' learning processes
• Experiments with soil biology, grassland management and land use on 12 farms	• Monitoring relationships between fodder and manure quality on 8 farms
• Experimentation with manure practices, additives and grassland production on 2 on-farm plots	• Measurements of nitrate levels
	• On-farm experiments with Ammonia emissions and manure quality
	• Monitoring Animal Health

Conducting research about nutrient management

> *'It is up to the scientists to translate our ways of farming into science and politics. We as farmers are convinced it works, because we see evidence in the results of the farm. Now scientists have to translate it into scientific results, but not in a reductionistic way as they are used to. They have to look at the farm as a system'.*

Eshuis and Stuiver (2004) argue that 'agricultural research and extension systems have historically been focused on the issue of high yields and have neglected the issue of sustainability. This lack of knowledge about environmental friendly production has often been criticised. In a sense this ignorance has been created by this system' (Hobart 1993; van der Ploeg and van Dijk 1995). Furthermore they state that 'this knowledge, which claims to be universally valid, is always socially constructed within a specific locality, for example a laboratory or a test plot' (see Callon 1986; Knorr-Cetina 1981; Latour 1987). In their article they show that the nutrient management project endeavoured to meet the need of relating knowledge to specific socio-spatial environments, and in so doing generate sustainable solutions. The participants intentionally engaged in dialogue and co-operated with each other in order to create appropriate and applicable knowledge (see Chambers 1983; Clark and Murdoch 1997; Kloppenburg 1991). The nutrient management project aimed to reconnect conventional research under controlled circumstances with farming systems research and on-farm experimentation. This approach held different promises for all the participants: the farmers would benefit from the project through having practical tools and methods, the scientists with scientific outcomes and policymakers with regional specific solutions. In the following two sections different ways of doing research within the project are described.

On-farm experiments

The aim of the on-farm experiments was to modify natural science experiments to local circumstances. The form and scope of the experiments took different forms. One kind of experimentation focused on one component within the farming system (for instance the establishment of two research plots on manure, additives and grassland production). Another kind of experimentation concerned the development of the farming system as a whole (for instance the research on eight farms that monitored the relation between feeding strategies and manure quality). The on-farm experiments differ considerably from conventional scientific experiments. First, there was no random sample of farmers (only the members of the co-operatives participated). Second, one cannot speak of strictly controlled conditions (because every farm is different). Third, in practice there tended to be several independent variables at the same time (as alternative farming practices usually involve several variables simultaneously). This last factor was explicitly

recognised and used as strength, rather than that an attempt was made to minimise or standardise these differences.

It was not only the scientists who benefited from on-farm experimentation. The farmers learnt about the development of the soil-plant-animal system on their farm through on-farm experimentation:

> *'What a lot of farmers learnt was that by doing things in your own farm, you can solve environmental problems yourself. All the technical solutions were making us too dependent and costed us too much money. We wanted to take responsibility ourselves and find our autonomy instead.'*

Lower protein and higher fibre diets were considered important in improving manure quality. The cows reacted to these dietary changes in different ways, and the farmers monitored these reactions and evaluated their effects. During this monitoring and evaluation the farmer adjusts the diet to what he believes (on the basis of his observations and interpretations) to be best for the cows. The adjustments are never ending: they continually lead to other adjustments. This process is a spiral, the farmers constantly adjusts, monitors, evaluates and then adjusts again. Often the farmers discovered that they lacked knowledge, and have to deal with the changes on the basis of their available knowledge. In this way farmers learn by doing and do through learning (for a detailed discussion of this see Chapter 4 on farmers' knowledge, in this volume).

Exchange of information

The project provided several platforms where the data, hypotheses and outcomes could be discussed and compared by the (wider) network of involved actors. These platforms allowed farmers and scientists to get together and learn and exchange information about the ins and outs of nutrient management, soil-plant-animal system interactions and required socio-technologies and infrastructure.

A farmer explains how exchange of information made the project more interesting to the farming community:

> *'The social cohesion; increasing curiosity; farmers learning from farmers, these are all very interesting elements of the project. There is a lot of knowledge in Wageningen, but the farmers do not know what to do with it. But through encouraging farmers to learn together, the results become clearer for the farmers.'*

Group meetings were an important way of enhancing the exchange of information. During these group meetings farmers' findings were discussed, compared and contrasted. A specific topic related to nutrient management was discussed, based on the experiences of the farmers (Eshuis and Stuiver 2004). Every farmer would recount his experiences on the topic at hand, thus sharing his knowledge on the subject. The project-leaders would facilitate the narration and discussion by asking questions, bringing in the experiences of other farmers they knew or drawing on

knowledge developed in scientific institutes (*ibid.*). Farmers saw a clear value in this process:

> *'I learn most from the stories of others. I prefer if people say that I do it wrong, then I can learn from that. I also expect the project to provide an analysis of the data, for instance why one farm has a better economic performance than another farm.'*

It was possible to make farm comparisons as the project had invested in data collection and a central database. Both the farmers and scientists had, to a certain degree, free access to this database. The group meetings were used to help farmers and scientists discuss their interpretation of the results, overcome biases and to create mutual understanding. Visually aided forms of dialogue (videos, excursions, field visits) were used to stimulate these learning processes.

Another platform was the research council where the scientists, leaders of the environmental co-operatives, and regional ministries made crucial decisions for the development of the project. The researchers and farmers who participated in the research council advocated different ideas on relevant knowledge (or epistemologies). This meant that, the value of different categories of knowledge was continuously renegotiated at these meetings. One example of these negotiations between different epistemologies shows this process at work (see also Eshuis *et al.* 2001). Some of the farmers were experimenting with additives, such as Effective Microorganisms and Euromanure mixture in order to improve the farming system. These farmers strongly believe in the effects of these additives although their value is strongly contested by other farmers, scientists and government officials. These farmers claimed that the use of Euromanure mixture decreases ammonia volatilisation in the manure, improves its consistency and makes it easier to apply.

In 1996 the Research Institute of Animal Husbandry analysed the effects of manure treated with Euromanure mixture. They concluded that there was no difference in emissions between treated and non-treated manure. The farmers using the Euromanure mixture were sceptical about the findings of this experiment. They argued that the experiments had not been done in the context of a working farm and that the 'control' (untreated) manure that was used had a far lower N content than conventional manure (3.6 against 4.8 kg N/m^3 manure). In the following quote the truth of the farmers is expressed:

> *'We cannot really prove that what we are doing is right. Many people think it only costs money. I can only say that there are changes that I see, which maybe cannot be put into official statistics, but they are relevant to me. We can however measure some of the outcomes; the farmers of the nutrient*

management project who use Euromanure mixture have a higher C/N ratio in the manure'.

On the basis of their own observations of the manure and other relevant indicators, the farmers have drawn hypotheses upon which they can work. But until now these have not been 'scientifically' proven. This example can be interpreted as a struggle between farmers and scientists about what is true, or what data can be considered the truth. Epistemological differences about the issue of additives were not the only visible difference between scientists and farmers. There was also a struggle between competing groups of scientists on the research council – between those who strongly believe in on-farm research and a holistic approach as an engine of progress, and those who prefer a more reductionistic mode of investigation.

Eshuis and Stuiver (2004) argue that projects such as VEL and VANLA 'have triggered a growing discussion amongst scientists and farmers about scientific research methods and the suitability of existing agricultural models and guidelines. The members of the nutrient management project have attempted to develop an alternative pathway to promote sustainable farming. But they do not always agree on the types of research needed to reach this aim. In the following section we will describe some of the alignment practices that occurred between the different actors and institutions.

Alignment practices

The novelties developed by the farmers and scientists need to be aligned with the techno-institutional environment in order to sustain and mature. Here we will present several cases illustrating how these alignment processes occurred.

Alignment among farmers to deal with sustainability

At the end of the 80s, at the start of the environmental co-operatives, farming was often perceived as separate from nature, landscape and the environment. As we mentioned in a previous section this separateness was not only part of people's mindsets, but also embodied in the rules and regulations of the modernisation paradigm. Farmers' organisations and individual farmers in the area were often not convinced that the novelties proposed by the environmental co-operatives were the right track to follow). As one of the initiators of the VEL recalls:

'In 1990 farmers could apply for subsidies for nature conservation. None of the farmers' organisations were interested. They said that they did not want farmers to become nature protectors. So we worked without them to apply for subsidies. We had a meeting in 1991 but still none of them wanted to co-operate. Then we said, all right, you are not obliged to participate but let us be part of the deal. This was before the start of the environmental co-operatives.

Later on when it became more interesting to apply for subsidies the farmers' organisations also wanted to join us.'

Since 1990 the integration of farming with nature, environment and landscape has become increasingly accepted among farmers and their organisations. In a previous section we discussed this in the broader context of the emerging rural development paradigm. Organisations like VEL and VANLA came to the fore in the debate, providing continuous news, excursions, meetings and lectures about their activities. As a result, more and more stakeholders (including farmers and farmers' organisations from all over the country) became curious. One result was that the farmers' organisations became willing to invest more time and money in the project and, in the second phase of the project they co-ordinated their activities for promoting awareness of the ideas of the nutrient management project nationally:

'We feel that the farmers' organisations acknowledge the value of our activities more. But we need to push this development further still. One way is to train farmers to train other farmers in our methods.'

New feeding strategies and alignment with the industries

The nutrient management project considered lower protein and high fibre diets to be important in improving manure quality. They believed that such a diet would result in a more efficient nutrient use by the cows and less protein losses through manure and urea. This meant that farmers needed to feed less additional protein to their cows, but as a consequence they needed to find other forms of concentrate to supplement the fodder. One farmer states:

'I use the ACM concentrate. I do so because it fits the criteria of the project.'

Many farmers in the project experienced a difference between the proposals being made by the project leaders and the advice they were used to receive from their suppliers, who used to advise high levels of protein intake. The interest shown by advisors in these novelties started to become influential in farmers' decisions about which suppliers to use:

'I am with ACM because the advisor believes in the system. I asked him and he said that he liked it.'

Furthermore, farmers needed to know what nutrients are inside the concentrates they buy in order to make their own decisions about the cows' rations. Often, however, this information was unavailable. It simply did not come with the order they received. This knowledge was not important when the farmers used high protein food but the change meant it became important again. The industries therefore had to develop both new products and better information for farmers. One farmer says:

'The fodder industries have realised that if they want to keep selling their products they have to listen to the needs of the farmers. They have learned from the project about the possibilities of reducing Nitrogen surpluses. We co-

operate well together at a local level and there are positive reactions from the national.'

Application of manure and government regulations

As we discussed in the second section of this chapter, the Dutch government imposed a package of technological innovations and legislation to overcome the environmental problems stemming from intensive agricultural production. These regulations were the same for every farmer. One example was the law on manure application technologies, which stipulated that manure should be applied by slit injection. As we demonstrated in the third section the farmers of VEL and VANLA thought of different ways to reach the environmental aims themselves. They wanted to use surface application of manure, because they were convinced that their manure does not smell, has lower ammonia levels and does not pollute the groundwater.

The farmers of VEL and VANLA were not the only farmers to experiment with other types of manure application. They were also not the only ones in the Netherlands who were convinced that surface application is better for the soil than slit injection. In 2002 and 2003 there were several court cases in the Netherlands dealing with this issue, in which the judge found farmers guilty of breaking the law but did not give them a fine, as this judgement illustrates:

'Loss of manure to ground water, does not occur at Theo Spruits farm. He knows that by looking at the high quality of water, which supports plant-life and fish. He considers slit injection of manure as damaging to the soil and unnecessary. In 1995 he was fined for surface application of manure. In 2002 he was convicted without punishment. He asked for an exemption to the rule but was not granted this' (van Zomeren 2003).

As we have seen in the previous sections, the farmers of VEL and VANLA were eventually permitted to experiment with surface manure application technologies but only in the context of the research project and after a lengthy period of negotiation with the government:

'You have to create space all the time to gain exemption from the rules, to claim space to achieve your goals. That game in The Hague appeared to be difficult. Some of the civil servants agree with us, but others do not agree or are afraid of the consequences.'

In May 2003 several scientists and representatives of civil organisations sent a letter to the Minister of Agriculture to explain that other ways of applying manure have to be made possible for these farmers to enhance their farming system.

'There is a total mixture of means and ends. Some farmers meet the ends, but do not agree with the means of the government. Give them space to meet the ends on their terms and do not punish them for meeting the ends. Of course

these farmers need to prove that their methods are sufficient' (WB 15 May 2003).[13]

A continuous process of political alignment was taking place during the project. Different groups of stakeholders were involved. The farmers and scientists within the nutrient management project who believe in the necessity of reaching a reduction of pollution with own means are faced with legislation that describes certain rules and regulations. In order to overcome these (in their eyes) restrictions, a lot of work is involved to protect the space that the farmers need in order to develop their farming systems in their own ways. This work is done not only by the farmers themselves but also by scientists and other agents like politicians who are sympathetic to the ideas of the farmers. The work is also done in different contexts like meetings in political arenas, during the research council and through discussions in newspapers (*ibid.*).

Synthesis: the characteristics of VEL and VANLA as a niche

Following the conceptual framework (Moors *et al.* this volume) and summarising the stories of this chapter, the VEL and VANLA environmental co-operatives clearly show the characteristics of a specific niche. In general terms, these include the following:

- New institutional relations between state agencies and the agricultural community;
- The re-embedding of farming in its local (social and ecological) context;
- New social networks of trust at local level;

New institutional relations between state agencies and the agricultural community

The VEL and VANLA environmental co-operatives represent an attempt to build new institutional relations between the state and the farming population. In so doing they endeavour to go beyond the generalised distrust that has permeated Dutch state-farm relations for some time. Environmental co-operatives certainly challenge the burden of state regulations that have been imposed on farmers and often intervene with farm management (Frouws 1997). While they generally accept and endorse the policy objectives set by state agencies, they question the rationality of centrally guided and prescribed policy-implementation and have asked for more (legal) space for self-regulation (Glasbergen 2000). In doing so they have constructed new institutional arenas for negotiation and co-operation on the policy issues relevant to their daily work and lives (Renting and van der Ploeg 2001).

The emerging institutional relations between the environmental co-operatives and the state are based on a number of principles of exchange. State agencies define clear and quantifiable policy goals with respect to

the environment (e.g. a maximum amount of mineral losses), landscape, nature, etc. for the area covered by the environmental co-operatives. The co-operative members promise to realise these goals effectively. In exchange the state grants more flexibility over the means of implementation. Farmers are allowed to develop and implement those measures and instruments that they consider to be most effective ways of realising the policy-goals within their own specific circumstances.

The re-embedding of farming in its local social and ecological context

The environmental co-operatives aim to give farmers the (institutional) room for manoeuvre to re-embed farming in its local cultural and ecological context. There are various ways of realigning farming, ecology and society, although the exact lines along which this can be done may vary significantly (de Bruin and van der Ploeg 1990). Yet, realising the potential to do this necessarily involves loosening the strong external pressures of highly prescriptive policy frameworks. In this respect, the environmental co-operatives are an attempt to restore the wholeness, contextuality and specificity of farming through reinforcing the craftsmanship of farmers and their capacity to produce tailor-made innovations that are fine-tuned to the particularities of localised settings (Roep *et al.* 2003; Eshuis *et al.* 2001).

Environmental co-operatives do not call for, or promote a simple deregulation of agricultural production; rather, they envisage a re-regulation of farming in line with the needs of their specific localities. Just as the modernisation model flourished because of the existence of a favourable institutional environment of policy incentives, research and extension, the renewed embedding of farming into the local area requires a responsive institutional back up (Wiskerke *et al.* 2003). Environmental co-operatives are pioneers experimenting with new codes and rules that might help to build new governance frameworks for regionally embedded farming systems. Nature management plans, nutrient balance systems, codes of conduct and farm certification schemes are some of the building blocks for these frameworks. Through such means the locus of control of farming and rural development is shifted back to local co-ordinators developing locally specific mechanisms and solutions. In other words, they contribute to the development of self-regulation as a new mode of rural governance (*ibid.*)

New social networks of trust at the local level

The environmental co-operatives are a means to overcome confrontations between stakeholders at different levels and develop trust between them. They promote the integrated development of land use and socio-economic activities in their region. By building bridges between different rural stakeholders (like suppliers of inputs and members of the tourist board and nature organisations) and different rural activities,

environmental co-operatives attempt to increase trust and to build new alliances (Renting *et al.* 1994). They consolidate and reinforce social networks that facilitate the co-operation of local actors. In doing so they create social capital (Putnam 1993) and, thus, the resource base for joint projects both in the present and the future. For instance, at the local level the governance experiment has had the effect of creating new social networks including farmers and other rural stakeholders. In doing so, it challenges the conventional perception of growing and inevitable conflicts of interests between farming, nature conservation, tourism and infrastructural development for living, industries and transport and offers a new way of reconciling conflicting interests over these issues.

Concluding remarks

This chapter illustrates the multi-actor, multi-level and multi-aspect characteristics of novelty creation. The focus of this chapter has been on the innovation journey of unfolding novelties within two environmental co-operatives and their confrontations with the patchwork of regimes within the Dutch dairy sector. We described the process that took place since '70's to control environmental problems within the dairy sector. New sustainability demands started to arise and affect the technological regimes that structured the dairy practices in the Netherlands until then. These changes involved the societal functions of the sector, the emergence of new actors and the subsequent changes of relations between actors in the regimes, and finally new technological approaches and regulations to come to grips with the environmental problems.

Furthermore we described the emergence of a niche starting with the rise of the environmental co-operatives. The environmental co-operatives were established with the aim to be a system of governance to implement the societal demands for sustainability. Around the co-operatives a network evolved. We have seen the formation and stabilisation of this network of actors that get involved in the identification and development of the novelties. There are different processes of learning and ways of doing research visible among these actors. We described the formation and stabilisation of strategies and expectations among the actors through the identification of novelties and the research to develop insights in these novelties.

The novelties that are researched and developed are an interconnected set of technological and farming systems innovations to downgrade the growth factors within the farming practice connected with the adjustment of other growth factors. Novelty creation involves several underlying processes: reflexivity in practices; making the practices discursive among the actors in the network; adjustment of expectations and strategies and; learning about the different practices.

We have analysed the internal and external dynamics of niche development. First of all the dynamics within the niche were reviewed: 1) the role of the different actors within the network: scientists, farmers and government officials, 2) the content and quality of learning processes and ways of doing research and 3) the process of alignment of expectations. Second the external dynamics of niche development were analysed: the hidden novelties are rediscovered and get meaning because of the changes within the regime. At the same time the niche provides a protected space to mature the novelties because the existing regimes conflict with these novelties.

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Notes

1 Recent crises such as swine fever, BSE and Foot and Mouth Disease have given an additional impetus to this shift.

2 The Friesian Woodlands cover 12.500 hectares of land. They are a combination of small-scale and enclosed landscapes on the higher sandy soils and relatively open areas on the lower peat-clay soils. The small-scale landscapes are formed by hedges and belts of alder trees surrounding the plots of land, resulting in a unique mosaic of fields. In agricultural terms the province of Friesland is characterised mostly by dairy and arable crop production. Arable agriculture takes place on the northern clay soils near the seashore and dairy production on clay, peat and sandy soils in the rest of the province (De Bruin 1997).

3 The VEL has 65 members who manage 1,600 hectares. The VANLA has 144 members who manage 3,550 hectares.

4 This is not only relevant for this chapter but also serves as a background for the next chapter of this volume.

5 This is due to the (more or less) stable phosphorus/nitrogen ratio in animal manure.

6 There is a ban on application between 1 September and 1 February on grassland soils susceptible to nitrate leaching. Between 15 September and 1 February there is a ban on application on other grassland soils.

7 It was unclear at the time of writing what the implications of this rule will be for these policy measures and regulations.

8 We have purposely opted for the term trajectories as opposed to phases as the latter would imply that one stage followed another, whereas the three trajectories have co-existed for the last 10 years.

9 The farmers are convinced that the period available to apply manure, was too short to achieve an optimal spread of animal manure. Normally the farmers improve their grassland by sowing seeds and spreading manure in September. At present they are convinced that spreading manure after September results in excessive levels of nitrogen loss.

10 Euromanure mixture is added to manure twice a week, so that it can ripen the manure.

11 She was the Director of the Ministry of Agriculture at that time.

12 Sixty farmers participated in the project. They are divided in three groups of 20 farmers:
1. 20 farmers who use the Euromanure mixture and are allowed to application of manure on the surface: 'the Euromanure group'.
2. 20 farmers who spread the EM (Effective Micro-organisms) on the grassland: 'the EM-group'
3. 20 farmers who do not use any additives: 'the Control-group'.

13 At the time of writing, this discussion is still continuing.