



SOLINSA
Support of Learning and Innovation
Networks for Sustainable Agriculture

Agricultural Knowledge Systems In Transition:
Towards a more effective and efficient support of Learning
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SUSTAINABLE DAIRY FARMING LINSA: DUURZAAM BOER BLIJVEN (DRENTHE)

LINSA Case Study Report: Netherlands

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Executive summary

Managing and closing nutrient cycles can be an important mechanism for dairy farmers to improve the environmental impacts of their operations. The concept of low external input agriculture (in Dutch ‘kringlooplandbouw’) has become a catchphrase that has attracted the interest of farmers, researchers, consultants and politicians as a means to work on the sustainability of the dairy sector. The innovative idea is to optimise (and not maximise) the flows on the farm, improving environmental performance and economic performance at the same time. We have chosen the regional low external input farming network formed in the Dutch province of Drenthe as our LINSA. Over a period of 10 years different projects were organised that applied the concept of low external input farming using farmer study clubs. Data gathering involved a mix of participatory observation and in-depth interviews with some of the most important people involved in the low external input farming practice, not only in Drenthe but outside of Drenthe as well.

The results show how the practice of low external input farming is heavily influenced by discussions and developments at the national level. We have distinguished two somewhat archetypical Communities of Practice that implement the idea of low external input farming differently. These two communities have their roots in the environmental cooperatives of the Northern Frisian Woodlands, but over time have developed in two separate directions. These two approaches are adopted by different farmers in different regions and thus connect farmers across provincial boundaries.

Consultants play an important role in connecting the different groups and different regions together. They have been able to cater to all groups and have established themselves as reliable and expert partners on the different aspects of low external input farming. The study club method facilitated by these expert consultants in Drenthe has proved to be a very good way to get farmers involved, transfer knowledge and facilitate learning processes among dairy farmers. The provincial LINSA was fairly centralised in its governance and communication structure. This made it easy to manage information flows within the province and promote learning on the level of the whole provincial network, beyond the individual participants. As a result the water quality around participating farms has increased measurably according to the provincial water quality monitor. Furthermore the level of trust between farmers, government and environmental movement has increased and in recent years the provincial network has broadened with the involvement of veterinarians and the feeding industry. However, the study club method proved to be relatively expensive for the small share of dairy farmers reached.

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Abbreviations and explanation of some Dutch terms

AKIS	Agricultural Knowledge and Innovation System
BBD	Bedreven Bedrijven Drenthe ('capable companies Drenthe', the initial name of the project. Later this was renamed to Duurzaam Boer Blijven)
DBB	Duurzaam Boer Blijven ('sustainable dairy farming')
DMS	Dirksen Management Consult
LINSA	Learning Innovation Network for Sustainable Agriculture
LTO	Land en Tuinbouw Organisatie (Dutch Farmer Union)
NMI	Netherlands Measuring Institute (advise and consultancy firm)
PMOV	Platform Minderhoudshoeve, Ossenkampen en Vel/Vanla (network of two experimental/ pilot farms of WUR and the VEL/Vanla cooperatives)
VBBM	Vereniging tot Behoud van Boer en Milieu (association for the conservation of farmers and the environment)
VEL/ Vanla:	Vereniging Eastermars Lansdouwe (landscape association of Eastermar) / Vereniging Agrarisch Natuur en Landschapsbeheer Achtkarspelen (Nature and Landscape Association of Achtkarspelen) : the first two environmental farmer cooperatives of the Netherlands
WUR	Wageningen University and Research Centre

1 INTRODUCTION

Managing and closing nutrient cycles is an important mechanism for dairy farmers to improve the environmental impacts of their operations. The Dutch phrase ‘kringlooplandbouw’¹ is more or less comparable with the concept of ‘low external input agriculture’ and it has become a catchphrase that has attracted the interest of farmers, researchers and politicians as a means to work on the sustainability of the dairy sector. The concept of low external input farming is rooted in a holistic systems perspective. The innovative idea is not to focus on one specific element, to maximise the production of meat and milk, nor to minimise the flow or manure, but instead try to optimise the flows on the farm as a the whole, improving environmental performance and economic performance of the farms at the same time (Reijs et al., 2007, Groot et al., 2006). Figure 1 gives an overview of the type of system thinking behind this approach.

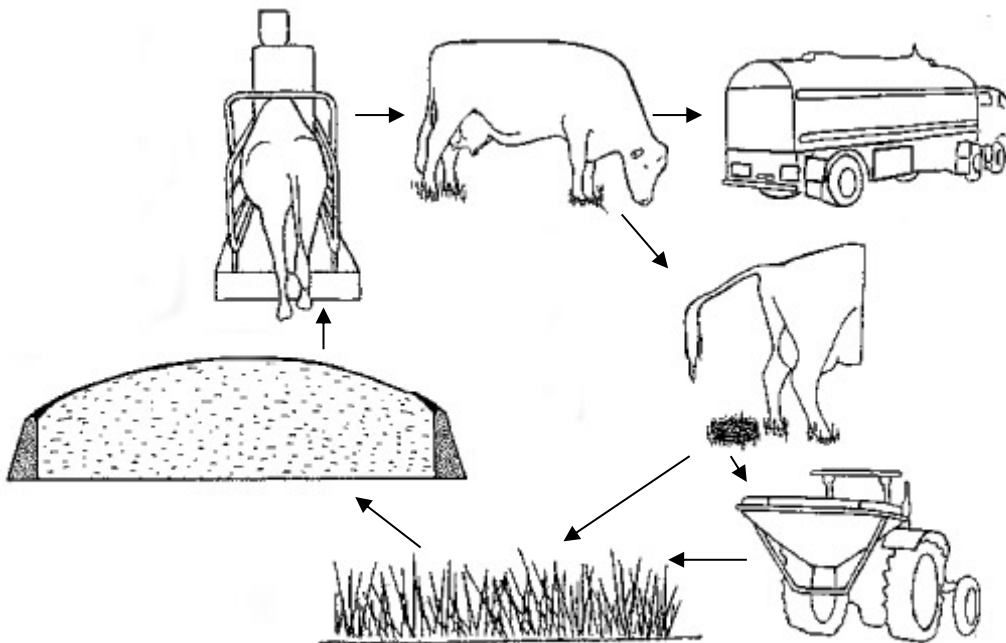


Figure 1: example of the soil-plant-animal system in dairy farming

The practice of low external input farming got its start with the environmental farmers cooperatives of VEL and Vanla in the early 1990s in the province of Friesland where a local network of farmers, scientists, NGOs and government officials started working an experimenting with the new approach (Eshuis, 2006, Stuiver and Wiskerke, 2004, Hermans et al., 2013a, Hermans et al., 2013b,

¹ The Dutch word ‘kringlooplandbouw’ is difficult to translate. Closest translation would be ‘cycle farming’ or ‘closing loops farming’. CLM compares it with the internationally more accepted terms of “low external input agriculture” and “conservation agriculture” (Hees, et al. 2009). In this report we will use low external input farming (or LEIA for short).

Renting and Van Der Ploeg, 2001). Since that time the practice of low external input farming has been taken up by more and more farmers and the practice has spread over the whole of the Netherlands. In different regions different networks are active who work with the principles of low external input farming. Both these regional networks and the aggregated national network can be defined as a LINSAs: a Learning Innovation Network for Sustainable Agriculture. A LINSAs can be defined as: “a network of producers, customers, experts, NGOs, SMEs, local administrations, as well as official researchers and extensionists, that are mutually engaged with common goals for sustainable agriculture and rural development - cooperating, sharing resources and co-producing new knowledge by creating conditions for communication” (Brunori et al., 2013)

However, since the national network is too large to review completely, we have chosen to select one of the regional networks in a geographically limited area (the province of Drenthe) to illustrate some of the developments that play out in the larger national network as well. The development of the LINSAs in Drenthe encompasses some of the most important national brokers and their working methods that they also employ in other regions. Where appropriate we will refer to the developments and discussions of LEIA at the national level.

2 METHODS

Data gathering involved a mix of participatory observation and in-depth interviews with some of the people involved in the low external input farming practice. The participatory observations included:

- Two seminars in which experts highlighted specific elements of the working method: soil fertility on the 28th of February 2012, and phosphate efficiency on the 6th of March 2012.
- Workshop ‘ Soil Quality in the Beemster area’ with the CONO milkfactory and farmer and soil researchers.
- Award ceremony in for the ‘most sustainable dairy farmer of Drenthe’ (18th of April 2012, Erica)
- Attendance of a study club of Hans Dirksen working on the nutrient management (22 October 2012, Bodegraven),
- The final manifestation of the Duurzaam Boer Blijven Drenthe project (28 September 2012, Assen)
- Meeting/ seminar of the Quadrupool Academy / Landjuweel (21st of December, Wageningen).
- 1st Round Table 15th of November on the Future of low external input farming, Assen
- 2nd Round Table on Kringlooplandbouw in Noord Nederland, 19th of March 2013.
- Seminar of DMS and Boeren Verstand on kringlooplandbouw (27th of April 2013)

For the interviews a number the actors involved in the network were identified that played a central role in the LINSAs: researchers, consultants and civil servants.

Researchers/ Scientists:

- Marthijn Sonneveld (WUR – Soil Geography and Landscape)
- Jaap van Bruchem (WUR – Animal Sciences (retired); currently Quadropool Academy)
- Frans Aarts (WUR – Plant Research International / Koeien en Kansen)
- Egbert Lantinga (WUR – Plant Sciences)

Consultants

- Hans Dirkse (DMS – Dirksen Management Support)
- Frank Verhoeven (BoerenVerstand)
- Henk Kieft (ETC – Consultancy)
- Everhard van Essen (Aequator / NFW)

Civil Servants

- Arnout Venekamp (project leader of the Duurzaam Drenthe project)

An open interviewing format was used for the interviews. Topics to be discussed in the interviews were derived from the different characteristics of a LINSAs: Degree of Integration, Level of Innovation, Governance, Level of learning, Links Between AKIS and LINSAs, Efficiency and Effectiveness of Support. Not all topics were discussed, but these topics which were deemed the most relevant for the person interviewed and their role within the LINSAs were chosen. A brief introduction of their personal involvement on the topic of kringlooplandbouw and how they viewed its development was included in all the interviews. Most of the interviews lasted over an hour. Interviews were recorded and transcribed. Respondents were given an opportunity to read the transcripts and make some changes if they deemed them necessary. Some small changes were made after their comments, mostly relating to some factual mistakes, or misunderstandings of the interviewer.

The topic of sustainable agriculture was investigated using Q-methodology. Several of the people that had been interviewed earlier, were revisited. In addition, four dairy farmers were asked to do a Q-sort. The results of this exercise will not be reported here, but in a separate document.

3 RESULTS

3.1 Network characteristics: development and integration

We will first discuss some of the general characteristic of the national level LINSA and subsequently focus on the LINSAs at the provincial level.

3.1.1 Development and integration at the national level

The national level of the low external input farming LINSAs is an example of a complex network. Different actors, like farmer unions, advisory services, government agencies and research institutes are all involved in a partly overlapping set of activities on low external input farming. The national network is built up of several regional networks who are connected by a small number of consultancy firms, such as BoerenVerstand, ETC, DMS Management Support, Aequator, Takens Kringlooplandbouw Advies, etc. However, what adds another layer of complexity to the national network is that it does not only encompass a number of regional networks at different geographical locations, but also contains different communities of practice that define low external input farming in different ways. These communities of practice are made up of dairy farmers from different parts of the country. Following Hees et al. (2009) we can distinguish between two different communities of practice. Both these groups share the same history of the experiments and development of the low external input farming practice in the Northern Frisian Woodlands. However, at a certain point a conflict developed on the statistical interpretation of the results of the grassland experiments (see Stuiver, 2008 and Hermans et al., 2013b). In the end, the two groups split and each developed their own approach of low external input farming.

The first group are the descendants of the pioneering group of Jaap van Bruchem and the PMOV association. Over the years this group has focussed more on researching the effects of carbon within the nutrient cycle. Some general characteristics of their practice are:

- Holistic perspective on farming and farmers knowledge (as opposed to the 'reductionist' method of official science)
- Improving manure quality by feeding and additives
- Focussing on soil functioning e.g. organic matter (carbon) and soil life
- Broadcast spreading of manure (against the strict government policy that requires the use of manure injectors)
- General tendency to value 'low-tech' solutions and extensification of production

This group of dairy farmers has organised themselves in the VBBM: Vereniging tot Behoud van Boer en Milieu (association for the conservation of farmers and the environment). A small sub-network of this group is actively working on 'quantum agriculture' that have taken up practices that qualify as 'fringe physics': re-vitalising water, neutralising negative electromagnetic radiation from the earth and sending out specific frequencies in stables to combat animal diseases. This small sub-network has organised itself in the Netwerk Vitale Landbouw and Voeding and 'Quadrupool Academy'.

The second group other group are the decedents of the animal scientist. They have picked up the nutrient management idea, but instead of carbon they have focussed on the nitrogen cycle and phosphate cycles, since these two are the most important from the perspective of existing European environmental legislation (the European nitrate directive). This group still has a research programme in place called Koeien en Kansen. Based on this project, a new project at the European level has been launched that also uses this approach (the project called Dairyman). The general characteristics of this group are:

- Mainly technology driven (relying on manure separators, manure fermentation and high tech stable concepts.
- Precision feeding and fertilization
- Focussing on Nitrogen to conform to the European environmental legislation
- "Sustainable intensification"

Most dairy farmers involved in low external input farming combine certain elements of these two approaches. Wolleswinkel et al. (2004) give an overview of innovating techniques of dairy farmers that could fit in both approaches. At the moment some boundary work is done within the project "kringloopwijzer" (developing a nutrient compass), to bring these two Communities of Practice back together. The nutrient compass is developed as a calculating method for nutrient flows on the farm. This calculating method has its roots in the practice that focusses more on the nitrogen and phosphorous management of the Koeien en Kansen projects, but some of the innovation brokers and consultants that have their roots in the PMOV inspired CoP are also part of this working group. Although not present yet, the idea is to incorporate the carbon flows in a future version of the method (see also section 'governance').

3.1.2 Development and network characteristics at the provincial Level

The regional network within the province of Drenthe derived its inspiration from the first group of farmers, connected to the PMOV. However, over the years their ideas have shifted from the PMOV group towards the ideas of the Koeien en Kansen groep. This shift was partly the result of the growing interest of some people in the PMOV network for topics like quantum agriculture and fringe physics that deterred conventional dairy farmers. However another reason for

the shift within the DBB LINSAs towards that Koeien en Kansen perspective, was a result of their own experiences and the analysis of the data provided by Hans Dirksen. These analyses showed that the most environmental gains were realised by the participating intensive dairy farmers. During the final conference of the Duurzaam Boer Blijven Drenthe projects, the term “sustainable intensification” was used by various speakers as the way forward.

3.1.2.1 Network size

Over the years the size of the network size within the province of Drenthe has changed considerably. Main factor influencing the amount of participating number of farmers was the amount of financing the provincial government was able and willing to invest itself, but also how many money it derived from other (national) sources and the conditions set on these secondary funds (for instance whether or not farmers could count the hours working on the program as their own contribution in time, to the project).

Table 1 provides an overview of the amount of dairy farmers involved in the different provincial projects. The participation of farmers was decided at the provincial level. Usually, more farmers were interested than there was room for, and this allowed the organisers of the network to select their own participants. In the first phase, farmers who already were familiar with a study club were invited to join. Later, this target group was broadened. Usually, groups were set-up around three or four committed dairy farmers in a study group, and the rest would be selected from their vicinity, to cut down on traveling time. Finally, the geographical spread of study clubs over the province of Drenthe was used to fill in the study clubs. It is estimated that over the 10 year existence of the various projects, circa 200 dairy farmers located in the province has participated in one or more project groups.

Table 1: size of the LINSAs over time

Phase / year	Participating farmers	Funds
BBD1-1 (2001)	40	Provincial Government Drenthe
BBD-2 (2002)	100	Provincial Government Drenthe
BBD-3 (2004)	58	Fund for functional agro-biodiversity
DBB-4 (2008-2012)	100	1.2 M from ILG (national fund); 200k from prov. Gov Drenthe; 500k participating farmers (in hours); total 2M

¹⁾The first projects were named: *Bedreven Bedrijven Drenthe (BBD)*, later this project name was changed to *Duurzaam Boer Blijven (DBB)* because this fitted better with other networks working under the same name in other provinces.

3.1.2.2 Network centralisation

The regional network is fairly centralised in a number of aspects. Firstly, the central decisions within the provincial network are taken by just a handful of actors of which the provincial government will have had the most influence on who was allowed to participate, what would be the topics discussed and the preferred way of teaching (study clubs). Of course, the consultants were formally the responsible actors, because they were the ones who always had to submit a project plan for the approval of the provincial authorities. However, these project plans were of course beforehand negotiated to such a point that all the involved actors would be happy with the final project plan.

Secondly, as a result of the choice for study clubs, the communication structure within the network was fairly centralised: farmers involved in the network will not have had a lot of contact outside their own study group and the group facilitators were the only bridge between different groups of farmers. To combat this effect somewhat the data gathering was outsourced to DMS management support. DMS collected all the necessary data from all participating dairy farms in the whole of the province, process it and calculate the averages for the whole group. This meant that the farmers would receive also the information from the other farmers as well (see also the section on 'learning').

3.1.2.3 Network composition

The network organisers displayed more variety however: that level consisted of civil servants and different types of innovation brokers. As the years progressed, the organising network became more and more diverse: more actors were invited to also engage with the low external input agriculture approach and bring in their own expertise for the benefit of the participating farmers. One of the first new groups to help facilitate study groups was an organisation for veterinarians. Later the dairy feeding industry was also involved in one of the project themes. The composition of the network therefore broadened somewhat over time and this in turn changed the topics selected for discussion.

At the level of participating dairy farmers, the provincial network Bedreven Bedrijven Drenthe was a relatively homogenous network in the sense that it only targeted one type of farmer. However there are some differences between the participating dairy farmers: more intensive or more extensive production types and different types of cows.

3.2 Governance

3.2.1 Project governance

For the regional network, the governance of the network was done with a small group consisting of the most important facilitators like ETC and BoerenVerstand

who decide on the most important issues together with the province of Drenthe. The province pays most of the projects, with additional funds provided the farmers themselves and some national funds procured by the province. The organisers shape the project and then request authorisation from the province to grant them the project. Rules and regulations are determined in the formal project contract. In this phase the actors also decide on how many and which farmers get to participate in the study clubs and the specific goals of the project. There is an advisory council that can make recommendations. In it are some of the regime players like the Friesland Campina Cooperative, but also the Water Board, the Ministry of Agriculture, Provincial Environmental Federation, and the LTO-Noord (farmer union). The advisory council is used to link the project to the rest of the dairy sector, share some of the experiences of the project with them but also to get them involved in the solving practical problems or dilemmas within the project.

After the ten year involvement of the provincial government it wants to take a step back. So far this has proven not so easy. The 'Round Table Meetings' that were organised to set-up a follow up for the DBB project is also aimed at scaling up the project to other provinces, and may be to link up as an operational group under the new European Innovation Partnerships. In this process the three northern provinces (Drenthe, Friesland and Groningen) still play an important role.

3.2.2 Certification as a new form of governance

At the national level a new approach has been supported by many of the regional networks. They have all introduced some form of certification to try to both formalise the working methods, and to calculate the different nutrient flows on the farm. Many of the involved people, including the province of Drenthe, see this as an promising method to anchor the environmental performances of the approach. The 'kringloopwijzer' has functioned as a boundary objects of sorts that has united different parts of the nutrient management approaches.

The unified goal of this working group is to get (scientific) agreement on many of the nutrient flows of a farm. If all actors agree on this calculating method, it could form the basis of a number of certification schemes. The shared interest in all actors in this approach is its promise to function as a replacement of the current environmental legislation governing the sector. Another advantage would be that, at least according to the farmers, the national environmental policy regarding the most important pollutants has changed over the years: first it was acid rain, then ammonia, the phosphorous, then nitrogen and phosphorous and the last years climate change and methane emission has gotten pronounced attention. By bringing all these pollutants in a single calculation method, The thinking If it would become possible to calculate the environmental pressure per farm, this would give an incentive for individual farmers to bring down their environmental loads. The sector wants to move away from the 'instrumental laws' that (for instance) prescribe the injection of manure, and go to this type of personalised schemes at the farm level. The idea is that the government only sets the overall aims and the farmer can decide

where to focus on. At the moment the different regional networks all have different certificates that focus in different indicators. None of these certificates has yet an formal status.

For the province of Drenthe, the certification approach is especially interesting for two reasons. First, the certificates would make it possible to also involve other actors in the LINSAs who could share some of the financial burden. For instance, some of the water boards of a specific region might be interested to use the certification scheme to combat nutrients flows to surface and ground waters. Another option would be a private actor who could become involved. The CONO milk factory has started a payment scheme based on the certificates. However at the moment, farmers just need to have certificate and no performance indicators have set yet. The second interesting advantage the approach offers is that it will take the approach a step further. It will also interest a new group of farmers who previously have not yet been interested. The certificates could be used on an individual level, and farmers who don't like to be involved in the study clubs could also participate.

3.3 Learning and Innovation Processes

Learning and innovation are central to the concept of a LINSAs. In the conceptual framework of the SOLINSAs project, it is shown how processes of innovation and learning are deeply linked together and that learning is central to any innovation process. In this section we will first take a look at the innovative ideas behind the low external input farming and subsequently will investigate some of the dominant learning processes within the low external input farming community. We will do this for the whole of the Netherlands, since it is impossible to separate the developments in Drenthe from the development on the national level. In the final section we will look at how the regional LINSAs within Drenthe has functioned within the Agricultural Knowledge and Innovation System as a whole.

3.3.1 Low external input farming as radical or incremental innovation?

Wiskerke and Van der Ploeg (2004) have described how the low external input farming approach has been linked to the emergence of the Dutch environmental cooperatives in the Northern Frisian Woodlands: VEL and Vanla. They describe the establishment and operation of the cooperatives in term of Strategic Niche Management. Low external input farming has been one of the main goals of the cooperatives and can be seen as the novelty that has been introduced into practice by the cooperatives. The environmental cooperatives themselves have been defined by Van der Ploeg et al. (2004) as niches in the sense that the exemption they enjoy from the national environmental legislation regarding surface spreading of manure, the cooperatives are in fact a 'protected space' for learning and experimentation.

With the two Communities of Practice both brandishing their own approach of

'kringlooplandbouw' it is difficult to categorise the term kringlooplandbouw as 'radical' or 'incremental' innovation. First of all, the basic idea of managing nutrient cycles and aiming for low external input farming is not unique for low external input farming, and in fact it can be found in many different approaches, including organic farming. Closing nutrient cycles can occur on many levels: plot, farm, regional, national and even internationally. Different farmers aim for different levels to be sustainable on and this results in different practices of the concept. However, the most contested element of the two approaches has to do with the question of how to deal with the manure. For the technologically inclined farmers of the Koeien en Kansen CoP, it is no problem to install manure gasification installation on their farm to treat manure separately. It is hard to distinguish this last approach from conventional dairy practices. The other end of the spectrum is formed by those farmers who reject direct manure injections into the soil. These farmers represent a more radical view of innovation (although strictly speaking, returning to broadcast spreading of manure can hardly be called an innovation). At the moment there is a new discussion on alternative methods to do surface broadcasting, by introducing a 'duospray', or the 'green duo' (www.thegreenduo.com). In this method a separate water tank is coupled to the manure tank that will spread a thin layer of water over the manure during surface broadcasting, thereby reducing ammonia emissions. This is a typical example of an innovation by introducing an end-of-pipe technique.

3.3.2 Learning processes

The project in the province of Drenthe has had a strong focus on learning all through its 10 year existence. It started with copying an existing approach that was pioneered in the neighbouring province of Friesland. The core of the working method is the study club approach in which farmers come together and discuss issues on a certain topic: in this case the different aspects of low external input farming. Sometimes external experts are brought into a meeting to give more depth to a certain issue, but most of the time the farmers and an external facilitator learn and discuss amongst themselves. The province of Drenthe has set-up the framework around the concept of low external input farming in a collaboration with two other partners: ETC and BoerenVerstand (consultancy firms). Later this network has broadened to also include also the NMI (another consultancy agency) and a veterinary service. These consultants provided the content of the study programme and the province arranged the finances for the programme. In the last phase of the project three topics were selected that each concentrated on three themes, each with their own set of facilitators.

1. Soil, water and climate (facilitated by NMI, Netherlands Measuring Institute)
2. Entrepreneurship (facilitated by BoerenVerstand)
3. Cow health and diets (facilitated by 2 veterinarian practices, and a pilot project that involved a company working in the cow feed industry)

Within the study club the farmers themselves have the freedom to discuss various topics. In the last four years the project was divided into two main groups: an experimental group of experienced farmers who were long-time participants in the network. These groups were tasked with trying to take the low external input farming to its limits: try to find the breaking points of the system. This was a form of learning-by-doing and using the farmers as a 'field laboratory'. The other groups were composed of 'new' farmers who were introduced into the low external input farming production style. In these last groups there may have been some more emphasis on transfer of some forms of codified knowledge.

We can identify learning at the individual, organisational and social level. However, the most important learning has been taking place on the individual and the organisational level. Some social learning processes were also organised, especially around the beginning and the end of each project cycle (there have been 4 different rounds of programme over the ten years): new and external actors were invited to comment on the chosen approach. However, these social learning opportunities were relatively minor impact, since the goal was not to come to a convergence of visions in these meetings. The idea of these meetings was to generate new ideas and improve upon the existing approach. Sometimes the approach programme was then adapted based on the comments received during these meetings.

This means that learning has occurred on different levels. At the individual level, farmers would receive feedback on their performance and farming practices during each study club in which they participated. The company of Hans Dirksen will calculate their own specific farming results (not only environmental, but also financially) and compare that to the average of a group of farmers with approximately the same farming style (type of soil, farms size, etc). This way the farmers get an idea of how they are performing compared to their peers. In the study club itself they can discuss potential strategies with other farmers when they experience a problem. This type of study club can be very efficient in transferring knowledge, however it does require a certain open attitude of a dairy farmer. He or she must be willing to discuss their day to day operations and financial results with their neighbours. As the provincial government has realised, this approach will not reach all farmers because some farmers will never want to share such sensitive information.

The provincial government has experienced some organisational learning. The results of the individual farmers were collected and aggregated into a single database, where the results were also analysed. Some external agencies (NMI & CLM) were also invited to evaluate the project and its results. The province itself monitored the results using their own groundwater and surface water quality monitoring systems. These indicators showed that the approach was proving to be successful for the farmers who were active in the different projects. Over time the perspective of the province (and the other main actors involved) shifted slowly away from a preference for extensive types of agriculture. The results of the environmental assessments challenged this (somewhat implicit and tacit) assumptions about extensive agriculture as the results showed that most environmental pressure reduction was realised by the intensive farmers who were participating. This was also reflected in the winners

of the yearly ‘most sustainable farmers award’: that was instigated in 2009. So far, the winners of this prize have all been intensive farmers. It seems that following the nutrient management approach reduces their environmental loads the most.

At the national level learning has focussed on the issue of ammonia emissions and surface broadcast spreading. The element of surface broadcast spreading of manure is by far the most contested element of the whole nutrient management cycle. A small group of farmers has gotten an exemption as part of several scientific experiments to investigate alternative ways of combating nitrogen emissions. This exemption has started as early as 1998 and has been extended ever since. Results of the scientific experiments have shown that surface spreading can be done in such a way that it reduces the emission of ammonia (Gerritsen et al., 2011). However the gap with the conventional manure injection can't be closed completely and at the same time it is also clear that the alternative track requires a very delicate management process that depends on the weather, time in the season and the quality of the manure. These factors are very sensitive and that makes the approach not very robust from an environmental point of view. Recently the debate on the emission factors of the conventional injection of manure has been revived again as a result of the measurements a student of Egbert Lantinga has done on the duospray. One of the conclusions of an international experts council has been is that existing measurement methods of ammonia are still adequate, but new experiments and testing is required to keep up with new scientific developments (Sutton, 2013).

3.4 Relationships with the formal AKS

The innovation systems perspective provides an analytical framework to study techno-logical change in agriculture as a process of actions and interactions among a diverse set of actors engaged in generating, exchanging, and using knowledge (Hall et al., 2003, Spielman et al., 2008). We will look here at the position of the DBB Linsa in relation to the formal Agricultural Knowledge System in the form of the traditional triptych of Research, Education and Extension.

The discussion on surface spreading of manure, and the proper way to measure ammonia emissions played out on the national level (and international) scientific level, but not the provincial level. The issue of surface broadcast spreading was never an issue within the DBB project because this method is still not allowed under environmental legislation and the provincial government does not have the authority to change it. At the provincial level, there have been some informal contacts with the Wageningen UR led research project: Koeien en Kansen project, but their involvement was never formalised. No scientists were involved in the Advisory Council of the project. The reason for the lack of scientific involvement at the provincial level, was given by one of the innovation brokers we interviewed. He described how the project initially was set up as a way to convince farmers to work together with the provincial government. As such, the scientific underpinnings of the approach initially were not the most important aspect for the provincial government, but the use of farmer knowledge was.

Later they found from their own measurements that the approach gave positive results in environmental terms and therefore the projects were always continued.

In the 1990s extension services in the Netherlands were privatised in an attempt to create an 'information market' and turn farmers into information consumers who would pay for their advice (Klerkx and Leeuwis, 2008). As a result classic extension services are now being done by a number of private advisory companies and consultants. As mentioned before, consultants play a very important role, both in the national network but also in the provincial network. Companies like ETC-NL, BoerenVerstand and NMI have organised and facilitated many of the study clubs. DMS of Hans Dirksen provided support through data analysis of the participating farmers. These firms are not only working in Drenthe but are also providing their services in other provinces, they are also acceptable partners for all the different perspectives on low external input farming. They work and have worked with the whole range of dairy farmers and scientists alike.

The link with agricultural education has been strengthened over time. One of the recommendations of the report by Hees et al (2009) was that current curricula in agricultural education are organised in separate modules and that an introduction into nutrient management practices is necessary to link these different modules together. The results of the project (combined with experiences in other provinces) has been reworked into a (multi-media / cd-rom) based course that will be made available for use in the curriculum of both the Middle and Higher Agrarian Educational Programmes.

3.5 Support

There is an important difference between the national level support for the concept of nutrient management and actual support the provincial government has given. At the political level, the support for the farmers who want to continue with their surface broadcasting of manure has been surprisingly widespread and consistent over the years. The necessary exemptions for the research projects have been extended from the early beginnings of the VEL/Vanla cooperatives to the broader network of the VBBM farmers. The last years these exemptions for the surface broadcasting have been extended by a unanimously accepted motion in parliament, that extended the exemption even without any scientific research and monitoring being done. As Van der Ploeg (Van der Ploeg et al., 2004) has argued, these exemptions have been very important in creating a protected space for experimentation and learning for the concept of nutrient management.

The hard support at the provincial level consisted of the financial support the provincial authorities gave the different projects. The total amount invested in the various DBB projects is unknown, however for the last project cycle (2006-2010) the total amount of funding was: 2 Million: 1.2 M from ILG (national fund); 200k from prov. Gov Drenthe; 500k participating farmers (calculated in their hours spend on the study clubs).

Based on this figure we can calculate funds for the whole 10 years cycle as a very (!) rough estimate:

2007 – 2010 (100 farmers): 2 Million

2003 – 2006 (58 farmers): 1 Million

2002 - 2003 (100 farmers): 500k

2001-2002 (40 farmers): 300k

Total: 3.8 Million euros over 10 years.

Important has been the soft support and the political backing of the projects. The first project (in 2001) was set-up as a means of the provincial government to earn the trust of the farmers and their organisations. Therefore they were primarily concerned with the doing a project involving farmer knowledge that would directly benefit farmers. Later the positive environmental effects of the projects provided an argument for the continuation of the projects. The DBB LINSAs thus had the political support from the start and throughout the different projects. Further support has been organised by instating an advisory council with 'regime' actors. This way the information of the LINSAs was disseminated beyond the project partners themselves and also the LINSAs were able to gather some fresh new insights and advice from outside the project partners.

3.5.1 Evaluation criteria used

Two evaluation criteria were used. The first consisted of measurements on the participating farms: during the first project cycle (DBB1), the provincial government took ground water samples on the participating farms. These samples were analysed for the amount of nitrate and these were compared to conventional dairy farms of the same size. The on-farm nitrate analyses have remained farms have been in place for also during the second and third project cycles.

The second criteria to evaluate the project was done using the opinions of the participating farmers. At the end of 2006 two students were given an assignment to evaluate the projects from the original start up to the year 2006. The evaluation consisted of several questions / criteria:

1. the functioning of the study groups;
2. reasons why participants quit the project
3. the use of the new knowledge
4. facilitation of the project

These points were further worked out in a survey that was set out among the participating farmers.

A survey was used to ask the opinions of the participating farmers on about the project they participated. One of the questions was what kind of changes they made as a result of the projects. The most mentioned methods all involved a reduction in artificial fertilizer used. This was confirmed by the on-farm measurements of nitrate in groundwater. The comparison with conventional dairy farms within the provincial borders showed that, on average, farmers participating in the DBB projects were able to remain within the 50 mg/l Nitrate directive over the years 2002-2006, while the conventional dairy farmers could not.

3.5.2 Effectiveness and impact of support

Without the direct support from the provincial government there still would be some farmers practicing low external input farming in Drenthe. Although, probably not as many as there are now. However, there are no figures available on the occurrence of more low external input farmers in Drenthe compared to other provinces that did not organise such an extended period of support therefore it is difficult to quantify this effect exactly.

The outputs and outcomes of the financial support did result in a number of outputs and outcomes. Outputs are there on the collective goods of the environment. Water quality around participating farms has increased measurably according to the provincial water quality monitor. For the participating farmers the benefit was better insight into their own operations and knowledge sharing with other farmers. For the facilitators it gave a good experience with the method, that they could also work with in other areas. The data collected by Hans Dirkse have also been made publicly available for further analysis by other interested researchers.

The outcomes are twofold. The increased level of trust farmers, government and environmental movement has, as a result of these projects has increased and it has led to a new collaborative manifest between the environmental and the farmer unions within the provincial borders that also mentions the positive contribution low external input farming can have on the environment and for farmers themselves. Finally the network involved in low external input farming has been notably expanded. Without the intensive support of the provincial government and the extended project periods, it is unlikely that the veterinarians and the farm feeding industry would be as involved as they are now.

There have not been any cost benefit calculations on the efficiency of the support given. However, the province of Drenthe has indicated that they consider the whole study club method that has been propagated in the LINSIA in the last few years a very good method to reach the pioneers, but that it is difficult to reach the 'main stream' of the dairy farmers. As such they consider the projects as relatively expensive. They estimate that they have reached

approximately 200 dairy farmers over a 10 year period. On a population of 1,125 dairy farms in 2012, according to (CBS-statline), this is a significant number, but there remains a large majority of dairy farmers who could still benefit from the approach. The province has indicated that they were willing to accept these high costs in the beginning, but now there is a tendency to look at other methods that will help spread the information and practice of low external input farming as more cost effective. This explains their interest in the certification schemes for quality of production and the 'kringloopwijzer', methods that would allow milk factories, or the water boards would pay participating farmers a higher milk price when they obtain such a certificate.

4 CONCLUSIONS

Under the umbrella of the term 'kringlooplandbouw', a wide variety of different practices is done by a variety of regional networks within the Netherlands. The consultants in the national network have been the driving force in connecting the different groups, not only the different regions but also the different practices together. The two main approaches have their roots in the environmental cooperatives of the Northern Frisian Woodlands and later developed in two separate directions. They still take the idea of nutrient management and the closing of nutrient cycles as leading for their operations, but they differ in the nutrients to focus on (carbon, vs. nitrogen and phosphorous). For a small subgroup of farmers the manure application method of broadcast surface spreading is an indispensable part of their holistic view of the nutrient cycle.

The consultants have been able to cater to all groups and have established themselves as reliable and expert partners on the different aspects of low external input farming. The driving force behind the regional networks differs from region to region, but in the case of DBB the provincial government played a vital role. The study club method facilitated by these expert consultants has proved to be a very good way to get farmers involved in the provincial LINSAs. This provincial LINSAs was fairly centralised in its governance and communication structure. This made it easy to manage information flows within the province and promote learning on the level of the whole provincial network, beyond the individual participants and create a certain amount of trust. However, the method proved also to be expensive for the relatively small share of dairy farmers reached. At this moment the province of Drenthe is therefore looking at most cost effective methods to promote the approach. Certification is looked at as a promising option for the future in this regard.

Through the boundary work done in the project Kringloopwijzer (developing a Nutrient Compass), the two approaches of kringlooplandbouw have been brought together. Researchers and consultants have worked on some common ground in the calculation of the nutrient flows on a farm. In this project the existing knowledge on low external input farming is formalised in calculation rules. With this formalisation of the method, certification of the approach might become a viable option. The hope is that these certificates will be used to base government policy on and this in turn is expected to provide individual farmers

with the incentive to reduce their environmental impact through low external input farming.

However with the introduction of the kringloopwijzer, the original low external input farming method that was pioneered in the Northern Frisian Woodlands has undergone a radical change of meaning. Where the original approach focussed on the extensification of production within the small scale plots that are so characteristic of the landscape in the Northern Frisian Woodlands, the new approach is promoted to new dairy farmers with the argument that the kringloopwijzer will make it possible to ‘intensify’ production in a sustainable way. In approximately 20 years, the meaning and practice of kringlooplandbouw has therefore turned from a focus on extensification into its opposite as a result of the up-scaling process from the regional to the national level. The developments of the regional level network of DBB in Drenthe is somewhat exemplary of this shift. It had its origin in the PMOV approach, but as a result of external and internal influences over the years moved towards the Koeien en Kansen perspective.

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APPENDIX 1: POSTER



Agricultural Knowledge Systems In Transition:
Towards a more effective and efficient support of Learning
and Innovation Networks for Sustainable Agriculture

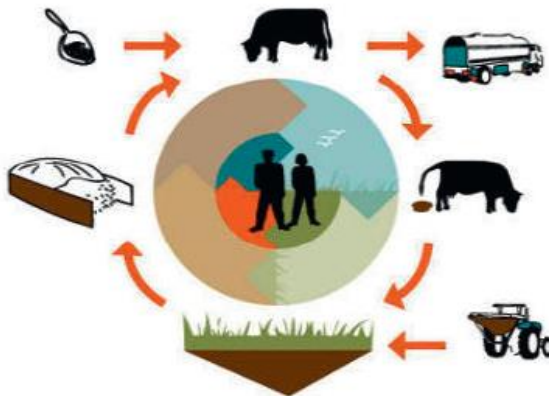
solinsa.net

DUURZAAM BOER BLIJVEN / SUSTAINABLE DAIRY FARMING DRENTHE (AND OTHER PROVINCES IN THE NETHERLANDS)

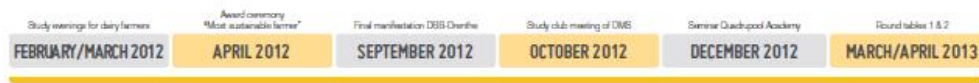


01. SHORT PRESENTATION OF THE LINSA

- A. Aim:** 1. optimisation of the nutrient cycle and
2. improving farmers craftsmanship and skills
B. Who is member: dairy farmers and facilitating consultants
C. How is it organised? Informal network of study clubs



02. INTERACTIONS WITH THE SOLINSA PROJECT TEAM DURING THREE YEARS



03. HOW TO SUPPORT A LINSA ?

- Provide legislative space for experimentation
- Study clubs are effective (but also expensive)
- Monitoring and evaluation of practices are important

