syscope

► Working on System Innovations ► Re-designing ► Farming with Future ► Network Energy Saving ► Strengthening Entrepreneurship ► Monitoring and Evaluation

Theme: Co-innovation

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Co-innovation

Realizing innovations is a cooperative process where every party has a role to play. Ideally, this means that entrepreneurs aim for a sustainable future for their business with vision and drive. Governmental authorities create space for innovations in their policies and actually support businesses in this endeavour. Knowledge institutions implement their passion for innovation in different ways to speed up the innovation process.

The range of methodological approaches which are used by researchers from Wageningen UR to promote these processes is very wide and varies from the development of future visions as source of inspiration, forging coalitions of stakeholders within networks dealing with innovation questions, to strengthening competencies in businesses involved in innovation.
The researcher functions as co-innovator and adds value by linking scientific knowledge with stakeholders' practical experience to achieve concrete innovations. Competencies and skills to manage these processes have been developed and improved by Wageningen UR.

In this English language version of Syscope, we have brought together a collection of several articles on methods that have been developed in the past few years to promote co-innovation processes which contribute to a more sustainable agriculture. Using practical examples, we show how this works in practice in the Netherlands and what the critical success factors are in these approaches.

Working methodologically on system innovations

Dutch agriculture is facing the challenge to develop into a sustainable sector. To achieve this goal, innovations are needed which force breaks with past trends and speed up the tempo of sustainable development. The System Innovation Programmes developed by Wageningen UR contribute with new, future-oriented business concepts and integral strategies for sustainable agriculture. This is realized using various systematic approaches, which can be implemented either individually or in conjunction with one another.

Agrarian entrepreneurs are faced with major choices relating to the future course of their businesses. Working from an idea of what the future might hold, they need to determine what they want, what they are able to do and how to translate this into concrete action. All these choices are made in an environment that is currently subject to dramatic changes. Think of rapid technological developments, globalising of our economy and society's demand for more sustainable production processes. The current economic crisis places business profitability heavily under pressure but that can also prove to be a strong incentive for sustainable innovations.

This is because innovations that lead to a reduction in use of natural resources or energy cut costs at the same time. Innovations that have a positive effect on the "p" of planet and/or people, but that are also profitable, are economically sustainable choices for businesses.

>> The transition assignment

The search for innovations that force a break in trends and speed up sustainable development is the focus of the transition assignment for entrepreneurs. The Dutch Ministry of Economic

Regional initiative the **Betuwse Bloem** *presents the results of innovations and network set-ups in an orchard in the River area of the province of Gelderland. Provincial representative, Harry Keereweer is speaking to participants in the network which is made up of civic leaders, businesses partners and representatives from knowledge institutions.*

Affairs, Agriculture and Innovation (EL&I) supports entrepreneurs in this endeavour. It backs measures which stimulate the economy and contribute to sustainable development in agriculture. The extra investment goes towards sustainable stalls, the development of bio based materials, and ingenious logistic solutions that reduce CO_2 emissions. These subsidies tie in with the Ministry's transition and innovation policy. Regional authorities and development organisations back the stimulation of sustainable innovations with increasing vigour. They see opportunities to further strengthen Dutch agribusinesses not only from an economic perspective, but also from the viewpoint of the intrinsic value of this sector and the possibility that agriculture could contribute to quality of life. Examples of Dutch regions that have placed the agrarian sector as spearhead in policy are the *Zuidelijke Westerkwartier* in the north of the Netherlands, *AgriBoard* in the north of the province of North Holland, *Betuwse Bloem* in Gelderland (see box Innovation Agendas), *Greenport Venlo* in Limburg (see box Innovation Agendas) and the *Zuidwestelijke Delta* in Zeeland. Sustainability and innovation are also high priorities for policy in the three regional agrarian branch organisations in the Netherlands (*LTO Noord, ZLTO* and *LLTB*). They have chosen to take an active role in forming the agenda for regional and national knowledge and innovation programmes, together with other stakeholders (*Platform Agrokennis*, see box Innovation Agendas).

>> Collective agenda forming

Since 2001, the Ministry of EL&I has implemented policies directed towards fostering the transition to sustainable agriculture. The System Innovation Programmes fall into this category and work on realizing new, future-oriented business concepts and integral strategies for sustainable agriculture (see box System Innovation). A vision on transition and innovation using two complementary transition pathways has been developed by the platform of programme leaders during the process of implementing this cluster of programmes (see box Transition Pathways, Wijnands and Vogelezang, 2009). In the path from future to practice, future visions are being developed and on the basis of these visions ground-breaking innovation experiments are being carried out to bring the future closer by. In the path from practice to future, pioneering entrepreneurs receive support for their ambitions to achieve more sustainable business practice. Both transition pathways are based on the forming of networks (see examples, p.18 & 22). For current practice, both developments are significant for the middle long term.

National and regional authorities choose increasingly for a facilitating role when stimulating sustainable innovations, by making funds available under certain conditions. They push the innovation process by taking the initiative in forming network organisations and to ensure that initiatives for activities are based on addressing business needs. Both organised business and private business take up their role in this process. Research and educational institutions are viewed by government and business as strategic partners and are invited to participate in a collective agenda forming process. In this way a new innovation structure has arisen with a strong collaboration between the three O's (*Ondernemers, Overheden en Onderzoek- en onderwijsinstelling*) [Entrepreneurs, Governmental authorities and Research and education institutions]. There are now various national and regional innovation programmes being implemented (see box Innovation Agendas).

>> Innovation Agenda

These developments in practice have lead to new insights for innovation and transition within the System Innovation Programmes, and have in turn resulted in elaborations to the transition pathways model. Two elements have been added. The stakeholders' innovation agenda has been given a central role in steering the activities in both transition pathways. The activities in both transition pathways have been linked to each other through the innovation agenda, which could lead to a further acceleration in realizing innovations.

System innovation

System innovations are changes that transcend individual businesses. They are needed for the change in agriculture to sustainable, socially acceptable production systems. System innovations can only be successful in the larger context of collaboration with all vested interests: agrarian entrepreneurs, parties involved in the supply and production chains, agricultural branch organisations, national and regional governments and social organisations. Wageningen UR works together with these partners in System Innovation Programmes to realize new, future-oriented business concepts and integral strategies for sustainable agriculture. There are System Innovation Programmes for different clusters of animal and plant production sectors.

The two transition pathways

The first transition pathway runs from the target visions of the future to current practice in the field. This pathway begins with an inventory of visualized future visions. They are not blueprints but a direction for development. They are also called target visions or design sketches. The most important transition points which block the route towards the future are traced by *backcasting*. An agenda of transition points emerges that fall under either *hardware* (new technology), *orgware* (new collaborations, regulations) or *software* (new routines). Next, innovation experiments are set up and implemented and actions are taken to tackle these transition points. Networks of interested stakeholders are built up around these transition points. Concepts that are developed (or certain parts of them) will find their way into the field via these networks.

The second transition pathway runs from practice to the future. This pathway puts all its energy into supporting innovations by pioneering entrepreneurs. They form the avant-garde in the field and are the first to meet up with all sorts of (system) limitations. Their experiences and problems constitute an important source of input for the innovation agenda. New knowledge is developed in co-creation with these entrepreneurs.

Connecting innovators and innovative experiments brings together all the available experience and expertise. A continuous reflection on progress ensures that the innovation agenda is based on progressive insights. In this way promoting system innovations that are necessary for the transition to sustainable agriculture can be worked on more rapidly and more accurately.
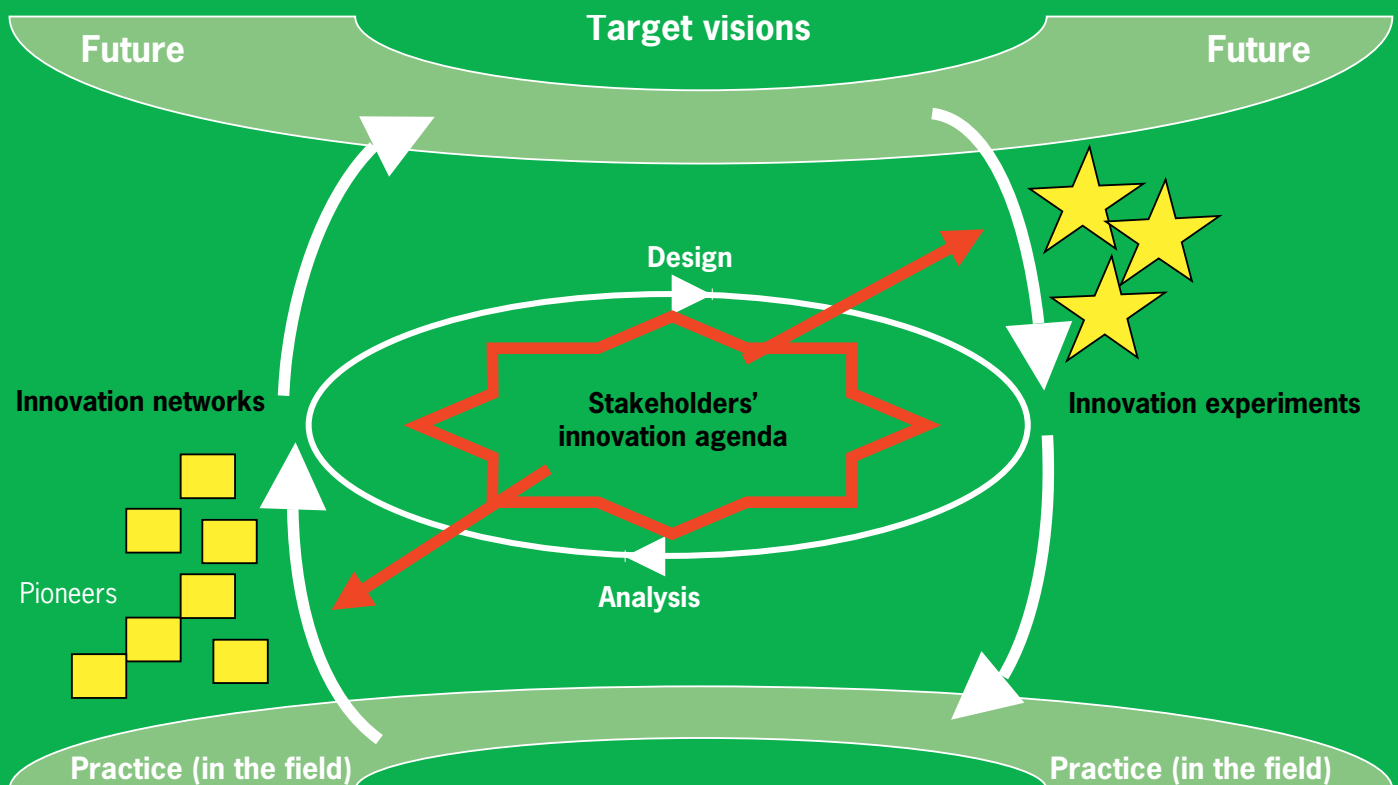
The network Farming with a future *(p.18) enters into a dialogue with both growers and other parties such as suppliers and business consultants. The cooperative effort is aimed at improving the quality of surface water. A demonstration of mechanical weed removal in the tree cultivation sector is seen here, which is an alternative for the use of chemical crop protection.*

Pioneering entrepreneurs in the pathway leading from practice to the future can be inspired by future visions and innovation experiments from the pathway leading from the future to practice. At the same time it is precisely these innovators who can indicate where new insights or breakthroughs are needed for the middle long-term from their own experience in the field. This interplay between inspiring future concepts and realisable steps in practice gives the innovation agenda direction for the short and the long term. We are convinced that it is precisely this coherent use of activities in both pathways that leads to a faster and sharper focus on promising development routes for the future.

>> Learning cycle

A second, new element in the transition pathways model is the continuous learning cycle of analysis and design. It has become apparent that it is important to reflect on the process and the results, and discuss this with participants, in order to get a better view of progress in the innovation process (*Systematic approaches and methods for monitoring and evaluation*, see p.31; *Networks in Animal Husbandry*, see p.34). Monitoring and evaluation can make a significant contribution to that learning process and ensures that the innovation agenda is based on progressive insights. Monitoring and evaluation can also contribute to changes in the organisation and methods used by the stakeholder network. Stakeholders are not only concerned with the content of the innovation agenda, but

they also focus on the transition assignment itself and what consequences that has for the way in which things are organised now. After the collapse of the Dutch OVO triptych (*Onderzoek, Voorlichting en Onderwijs*) [Research, Extension services and Education] in the 90s of the previous century, the parties involved have embarked on a search for a new, contemporary entrepreneur-driven innovation structure. The various innovation agendas that have grown out of national and regional networks seem to give form to that interpretation of the new collaboration between the three "O"s.

In the last few years, many projects have been carried out by System Innovation Programmes which contribute to the transition towards a more sustainable agriculture. In these projects, there is a large degree of collaboration with stakeholders in networks. Depending on the goals that are set for the project, there are different methodological approaches (see box *Methodological approaches*). A number of essential elements emerge from this wide variety of methodological approaches, which can make a large contribution to the success of these projects. These will be elaborated on below: the development of a common vision for the future; working in networks in which participants inspire one another; a continuous dialogue with stakeholders to create a support base; and regarding short term applications as a step towards realization of long term goals.

>> Vision for the future

It has become apparent that it is very important to develop and visualize future visions in a collaborative process with stakeholders. This creates a common perspective and ownership that transcends the individual vested interests of the parties. It determines the follow-up steps for routes leading to solutions. The effectiveness of visuals has been confirmed recently in the project *Cow Power* (see p.10) in the publicity around a visit by former Agriculture Minister, Mrs. Verburg to Wageningen UR to see how this project is working on the ambition to realise a sustainable animal husbandry sector by the year 2023. The project *Agromere*, which works to create a support base for the idea of developing agriculture within the city limits of Almere, has also used visualised future visions as an important source of inspiration to mobilize and bind stakeholders. The result was a well-supported concept for a city expansion with 60,000 new homes whereby agriculture plays a prominent role (Visser *et al.*, 2009).

Networks benefit from a shared vision for the future. Future visions appeared to be an essential step for developing a shared vision in the innovation network *Waardewerken* [Value Works], a network of agricultural businesses with a side line in things such as health support, conservation, mini camp ground, child-minding or farm shop. They were the starting point for setting up a break-through agenda which indicated which changes were necessary in order to allow multifunctional agriculture to become a fully fledged branch of business (see www.waardewerken.nl).

>> Learning networks

Time and again it turned out that working with heterogeneous networks of interested parties has been a key to triggering change. In the act of exchanging different visions and perceptions with each other, a learning process gets underway that can lead to a shift in perspectives (enlarging strategic space, reframing). In this way a larger space for solutions is created, with new, surprising solutions and a greater stakeholder commitment to actually contribute to the realization of solution pathways (Vogelezang *et al.*, 2009). Heterogeneous networks can come about by bringing parties together who have never previously collaborated, for example around a new concept like Agropark Flevoland, a cluster of diverse

Methodological approaches

The System Innovation Programmes use various methodologies which can be applied in projects either on their own or in conjunction with one another. They are grouped according to the function below:

Inspiring	- by identifying trends and opportunities
	- by creating future visions (design)
	- by following developments from other sectors, branches and internationally
Agendizing	- of prioritized, future oriented directions for development
	- of conditions for an optimal innovation climate
	- of transition points (necessary break-throughs, dilemmas)
Innovating	- by generating new insights (*proof of principle*)
	- by removing obstructions
	- by cleverly combining existing knowledge in new situations
Connecting	- by creating places to meet (innovation cafés, workshops)
	- by mediating and connecting (alliances, coalitions)
	- by forming networks around innovations
Stimulating	- through individual coaching
	- through supervision of networks
	- through developing competencies (inspiring learning environments)
Expanding	- through organising meetings
	- through presenting appealing examples (demonstrations)
	- through bundling of information in virtual (www) and physical knowledge centres.

businesses with agro-functions or related industries at a specific location (TU Delft, 2009; Wolf, 2011). Another example is "new agriculture" whereby the sector fulfils a new role in, for example, conservation, recreation and vitality in rural areas.

Networks of pioneering entrepreneurs also benefit by heterogeneity and regular renewal. Entrepreneurs say that they find these networks inspiring. The participants should come from different backgrounds that are diverse enough to learn from each other, but not as diverse as to cause them to no longer understand each other (Heymann and Wals, 2002; Wals and Heymann, 2004). Examples of these sorts of heterogeneous networks are *Waardewerken* [Value works], where multi-functional agrarian entrepreneurs work together

on professionalizing their sector, and *Innovation Network Energy Systems* (INES) in North Limburg for greenhouse growers with diverse crops (p.22).

>> Support base for renewal

System innovations mostly transcend individual businesses and they demand new relationships and strategic collaborations in the chain or region. A support base, commitment and dedication from a large group of diverse stakeholders is needed to achieve this. The projects *Farming with a future* (p.18) and *Agromere* both use stakeholder management to this end. The *Farming with a future* project enters into dialogue with suppliers and other intermediaries to motivate them to advise growers to use sustainable crop protec-

Innovation agendas

In the past few years, various national and regional network organisations in the Netherlands have been formed that together fulfil the role of motor behind knowledge and innovation. Below are a number of examples:

>> Bioconnect is a national network in organic farming where entrepreneurs determine themselves which knowledge projects need to be pursued. Knowledge projects can relate to research, advice and publicity and education. The network has a market-oriented structure. Farmers and growers are not the only members; there is always collaboration with processors, suppliers, distributors and social organisations. The practical expertise is bundled in *product and theme project groups*. This market-oriented structure has been developed together with the Ministry of EL&I. The methodology of Bioconnect is in this way an example of the ministry's policy "from caring for, to ensuring that" the market gets more responsibility and government merely facilitates.

>> Betuwse Bloem [Flourishing Betuwe] directs its effort towards strengthening the position of the five horticultural clusters in the river area of Gelderland (de Betuwe). The entrepreneurs form *pacts* within the horticultural clusters with all relevant parties in their region and implement their own innovation programme. An umbrella entrepreneurs' platform functions as sounding board for horticultural developments in the whole area and forms the driving force behind *Betuwe Bloem*. A key team which transcends the pacts, initiates and coordinates an umbrella programme with a number of strategic projects in strengthening business skills, sustainability and regional profiling.

>> Innovations in the region of North Limburg take place under the collective name, **Greenport Venlo**, with the aim of making it the most prominent fresh food region in Europe. Their ambition is to realise a growth in turnover from one to two billion added value within a period of 10 years. The development in Greenport Venlo is based on four pillars: *creation of value* (economy), *learning how to learn* (knowledge), *basics* (regional development) and *quality of life* (lifestyle). To promote focus, growth and connectedness, a new entrepreneur-driven innovation structure was presented in May 2009 with six *programme lines*. A new (to be built) InnovaTower will function as landmark and meeting place.

>> Platform Agro Kennis [Platform for Agro-knowledge] is a recent initiative from ZLTO and Wageningen UR to be strategic partners in realising a renewed knowledge infrastructure in the south of the Netherlands. HAS Den Bosch [a technical college] and EL&I have joined them. To set up this platform, the named parties want to form *knowledge networks*, comprised of contributing parties from the sector who have a shared vision. An important objective for the knowledge network is to achieve a knowledge agenda set by the businesses themselves, whereby research issues, educational issues and innovation assignments for the long term are specified.

There is a network of farmers, environmentalists, government authorities in the region Zuidelijke Westerkwartier *(in the north of the Netherlands) who are tackling regional issues relating to the development of agriculture, conservation and quality of life.*

tion strategies. By determining what all the vested interests are, and everyone's conditions and criteria to be able or willing to take part, win-win-situations can be created whereby the participants work to achieve the communal ambitions and still stay true to their own vested interests. The project is successful with this. Currently there are 230 stakeholders from various sectors active in this network. In the *Agromere* project, integrating suburban and agrarian functions, it was crucial to connect the right *movers* in the initial stages to get the process underway.

Entering into dialogue with stakeholders also indicates whenever new directions for solutions, initiated from the perspective of a future vision, are not feasible. Using current growing methods, it has been shown that nutrient losses in sandy, leaching-prone soils are not sufficiently manageable even with tested new innovative routes for solutions. As well as that, these routes for solutions enjoy very little support from future end-users. A transfer to more radical routes for solutions is needed, for example by taking horti-cultural crops out of the soil and cultivating them in troughs, pots or tubs instead (*Techniques from greenhouse cultivation*).

>> Connecting to future end-users

In most cases, it is not possible to implement a radical innovation in one hit. Results en route to the desired future are mostly achieved step-by-step. This means that when future visions are being designed, allowances have to be made in order to translate ideas into a design for individual business situations. In the presentation of the designs for sustainable dairy farming in the *Cow Power* project, this lead to the design of concepts for different business situations to increase entrepreneurs' identification with the plans (p.10). During implementation of system innovation projects, it became apparent that paying enough attention to short term successes to maintain support for the desired long term objectives was an important factor. This can be done by, for example, also concentrating on short term questions and to explicate the possible intermediate steps in the greater process of change. In this way, the knife cuts both ways: the implementation of spin-offs in the short term, increases the support base for the development of the longer term perspective and makes a concrete contribution to bringing the future closer by.

*For more information: José Vogelezang, **t** 0317 481245, **e** jose.vogelezang@wur.nl*
*Frank Wijnands, **t** +31 320 291621, **e** frank.wijnands@wur.nl*

Re-designing as starting point for more sustainable dairy farming

Measures that make economic sense for a dairy farm often turn out to be less beneficial for the welfare of the cows. On the other hand, an improvement in animal welfare can turn out to be bad for the environment. 'These intractable cause and effect connections occur frequently in modern cattle farming systems, but they could be disconnected from one another by a completely new approach', argues Bram Bos from Wageningen UR. This is what the project *Cow Power*, that ran from 2007-2009 was all about.

Bos talks enthusiastically about how the researchers set about achieving this. They followed a new approach to make dairy farms sustainable (Bos *et al.*, 2009a; Bos *et al.*, 2009b), based on their earlier experience in laying hen husbandry. Bos and his colleagues searched for solutions to these problems by redesigning the whole dairy farming system and not, as is usually the case, by looking for solutions to isolated problems. It is a question of zooming out and looking critically at the accepted structures within the system. This approach called *Reflexief Interactief Ontwerpen (RIO)* [Reflexive Interactive Design] has been developed by Bos and his colleagues

(Bos *et al.*, forthcoming; Groot Koerkamp and Bos, 2008; Bos and Grin, 2008) and has been applied in laying hen husbandry, pig husbandry, broiler production and dairy farming. This interactive and creative approach breaks through intractable cause and effect connections in modern dairy farming [see box].

>> More than just tinkering

Dairy farmers are familiar with sustainability. Fifteen years ago the first emission reduced stalls were put into place where the ammonia emissions were greatly reduced compared to the conven-

The Meent XL is one of the concepts that demonstrate how sustainable dairy husbandry can be realised if a completely new start is made. But making a new start is not absolutely necessary. There are surprisingly many possibilities to modify an existing farm by adopting a number of principles and solutions from these design concepts.

De Meent XL

If you want more
Three times 50 cows
Year-round space (360 m² per cow)
Three ranges ● plus pasture ●
Welfare: 95% of maximum (Cowel)
Keep faeces (solid manure) and urine separate
Ammonia emissions 75% lower
20 m² solar roof per cow
Economy: not more expensive

Stable herds of 50 cows

Protection from heat stress, strong winds and heavy rain

Space for physical exercise, free choice and social behaviour

Dry, soft, non-slip floors

Saving of labour by automation

The method Reflexive Interactive Design

tional stalls of the time. But sustainability achieved in this way is not what Bos means. In his eyes, sustainable dairy farming is more than just tinkering with one stall in the current system. Factors that play a part in sustainability in the Netherlands can lie, according to Bos, in the level of spatial utilization elsewhere in the world, in liberalisation and market forces. 'Dairy farming is more controversial than, say, twenty years ago. In those days the issues were manure and acid rain, which is mainly a problem locally. Now the issues are, for example, exhaustion of global phosphate supplies. This cannot be solved within the existing structures without causing problems elsewhere.'

>> Why cows?
Whoever wants to achieve sustainability in different aspects of dairy farming has to return to basics. This is an exercise that research-ers have tackled together with a group of stakeholders. It began with the question; why do we keep cows in the Netherlands? Bos: 'The most basic function of a cow in dairy husbandry is turning grass into milk. However, she uses 40 percent of her intake for her own metabolism. So you could ask if this conversion can take place without the cow. But many people see good reasons for wanting to keep dairy farming in the Netherlands. So the next question is: if dairy farming has a future here, how can we make it as sustainable as possible?'
Firstly, the *Cow Power* team analysed which aspects of the business were unsustainable. One example is the contribution to global warming through emissions of methane and nitrous oxide. Then the researchers categorized the causes of these unsustainable factors; like methane production in the gut and the production of cattle feed concentrates and artificial fertilizers which cost huge amounts of energy.

>> Disconnection
It is quite a simple matter to point out the causes of unsustainable practices, but removing the cause is complex, because these factors can also produce a very desirable effect as well. Removing the cause can also mean eliminating the desirable effect. Bos illustrates this using an example taken from greenhouse cultivation: consumers want to eat capsicums all year round but this can only be achieved if the horticulturalist uses a lot of fossil fuel in the winter. Burning fossil fuel is good for capsicums but bad for the environment. This intractable linkage is 'structural' and disconnec-tion cannot take place spontaneously. Cultivation without fossil fuel calls for a completely new frame of thinking, whereby it has to be determined how the desired effect and the undesirable effect are linked together. This analysis has lead to the development of the *Greenhouse as source of energy* project for greenhouse cultivation, a new concept in which the link between fossil fuels and the green-house has been severed.

>> Functional feed
Bos has the same aims in mind for different connections in dairy farming. To start with it is necessary to delve deeply into the different problems and related structures by questioning basic assumptions. In the case of cattle feed concentrates the question is: why do dairy farmers use concentrates? Answer: to maximize production. A dairy farmer makes more efficient use of his cows with concentrates. This works out to produce less greenhouse gases per kilogram of milk which in turn forms a reduced stress on the local environment. This is the positive effect of concen-trates. The negative effect is among other things that there is a lot of energy required to produce the concentrates in the first place and nitrous oxide emissions increase as a result of this. The ques-tion that arises at this stage is whether it is possible to achieve the positive effect in another way. The researchers returned to the basic question: what is the basic function of concentrates exactly? They discovered that it was not so much a matter of providing extra protein as such, but more a matter of providing nutrients that are quickly absorbed in the gut. That was the beginning of the solution. Bos: 'Then you can start thinking about fabricating special feed, made of ordinary grass, for example.'

Re-designing by breaking intractable connections

Intractable connections can be found every-where in daily life. Creating "desirable" effects often involves "undesirable" ones as well. Sometimes they are recognisable immediately, sometimes over a period of time.
The example that improvements to animal welfare go hand in hand with extra envir-onmental stress or the other way around is well known. Whenever cows and pigs graze outside, more ammonia is emitted. To combat this, increasing numbers of pig farmers install an air-cleaner in their sheds to reduce the emission of ammonia and smells. This is only effective if the shed is completely sealed, which is less advanta-geous for animal welfare. These intractable connections are also called transition points or system faults. The system is stuck at this point and a new solution is needed.

It is often thought that the one cannot exist without the other. But there are possible avenues for action that can be determined by a fundamental analysis of the system which lies at the root of the intractable link-age in order to 'disconnect' it. The main principle behind 'disconnection' is a sustain-able management of the world's resources: the utilization and exploitation of supplies must not lead to the exhaustion of those supplies. 'Supplies' is in this sense a broad definition. It refers not only to raw materials but also to biodiversity, the environment, employment and culture.

By linking sectors together, new win-win situations are created when waste can be used as input in another production line. One good example of this is the project *Zeeuwse Tong* [Zeeland's Sole]. A system is being developed where parcels of agri-cultural land are being transformed into salt water ponds to raise sole, shellfish (food for sole) and algae (food for shellfish), the cultivation of saltwater vegetables and development of new conservation areas. By thinking about recycling of waste without compromising quality at the design stage, the cradle-to-cradle approach becomes sustainable. In this way new functions are added to the production system and products.

By re-designing a system – for example an animal husbandry system – system faults can be solved which have crept into it in years of one-sided focus on, for example, production efficiency. Wageningen UR's researchers are designing this kind of new animal husbandry system according to Reflexive Interactive Design (RID). They have been commissioned by the Ministry of Economic Affairs & Agriculture and Innovation. RID defines 'the system' as the larger vision of what animal husbandry involves. This includes not only the stall or the business but also the supply and production chains in the area and on the other side of the world, as well as other parties such as conservation groups, government, citizens and consumers. Re-designing occurs interactively with the above-named parties. It is, therefore, not just re-designing but also co-designing. The researchers do preliminary work and challenge the parties to come up with new solution pathways. The more concrete the choices become, the more important it is to involve the parties with a vested interest.

The result is one or more sketches of the future for the animal farming sector. In order to put the re-design into practice, the parties are involved in a way that makes them see opportunities for themselves. The objective of co-designing is so that other parties say 'this is an objective worth pursuing, let's all ensure that we can make this vision reality', and then a number of those involved turn words into deeds. The researchers consider their work suc-cessful once parties or individuals indicate that they stand behind actually testing and realising the re-design or parts of it. The researchers help the parties to do this, by connecting the right people with each other; by creating a protected environment for the organisation of experiments; or by deliver-ing technical ideas which can lead in the short term to a step in the direction of realizing the re-design.

Cow Power is just one of the RIO routes for change. Previous re-design routes have been implemented for laying hens (*Houden van Hennen*) [Keeping/loving Chickens] and for pigs (*ComfortClass*). Last year the project (*Varkansen*) [Pig Opportunities] was started which aims to clarify opportunities for sustainability in pig farming and RIO routes will be starting shortly for industrial egg production and for poultry farming.

>> Manure and urine

Another example is artificial fertilizers. The desired effect is better crop growth. Undesirable effects are exhaustion of worldwide phosphate supplies, radiation which is released from rocks during mining, a part of which leaches unused back into the soil when applied and, finally, the creation of greenhouse gases and pollution through production, transport and nitrogen emissions. Solutions to these problems are ordinarily sought in improvements to the efficiency of the animal. Dairy farmers feed the animals with measured doses so that they produce as much as possible with a minimum of excess mineral excretions. This is difficult to manage because slight malnutrition leads to problems for the animal and slight overfeeding leads to mineral excretions. In this case the question is very similar: where do you place the cut to disconnect the two so that the desirable effect of artificial fertilizer – faster crop growth – can take place without the negative effects. Bos: 'You need to get to the bottom of the structure of the system that leads to the use of artificial fertilizer. In this case it is worthwhile to step back from efficiency-thinking. Manure and urine are essentially valuable products if the concentration of minerals can be controlled and checked. If you can make manure and urine into assets then it doesn't matter how much of either comes out of the cow. In this way many turnarounds in traditional thinking have been defined in the *Cow Power* project.

>> Drawing board

After finishing this first analytical stage the project defined pathways where solutions might be found. The next step is identifying the key functions which need to be fulfilled by the different aspects of dairy farming. This means that concrete questions have to be asked such as: how can you offer cows space to move about, in combination with separate harvests for manure and urine. After this, solutions to these key functions were sought, that were linked to integrated design concepts. Of course, there are technical components involved, such as designing a shed floor that separates manure and urine. 'But the solutions are certainly not just technological', Bos adds. The design phase also makes explicit what the consequences are at other levels, such as government, the concentrates industry or artificial fertilizer manufacturers. If manure and urine are assets, then this has implications for regulations but also, for example, for the competitive position of the farmer in relation to the artificial fertilizer manufacturer.

>> Considerable mental capacity

Peter Schmeitz, in 2008 assigned to the project by the Ministry of Economic Affairs and Innovation is impressed by the creative think-

Turnaround of four aspects

The design concepts are based on four radical turnarounds in thinking and acting:

1. Satisfy all the demands of the cows instead of giving them what happens to be left over

2. Consider minerals to be valuable resources instead of waste

3. Share capital and labour with others instead of dividing them over more cows

4. See the soil as a productive ecosystem instead of as a dead substrate

ing within the project. '*The crème de la crème* of researchers and stakeholders is working on this.' He is quite confident that good pathways to solutions will come from Cow Power. 'In any event, the process is promising, interactive and transcends the partitions in the different academic disciplines. But it is also very complex. It is encouraging to know that Wageningen UR has already explored a number of transition routes using future visions. At the same time it is apparent that the process usually stagnates once the design is ready. Farmers have to buy into the idea, stall builders have to run with it, added value has to be retrieved from the market, permits are not always given. In the *ComfortClass* project for pig farming, for example, you see the whole process slowing down.'

Bos is more reserved in his judgement over the process. The pathways to solutions are promising, but he does not dare say whether they can be realized 'painlessly' for farmers and for society as a whole. 'The basic assumption is that animal farming can be made sustainable without society itself having to give anything up, like eating less meat. This remains to be seen, of course.'

Greenport greenhouse as a source of inspiration

The Greenport greenhouse in Venlo is a benchmark in greenhouse cultivation. Tomato grower, Joep Raemakers, achieves 10 percent higher productivity and a savings of 35 percent in energy costs with this semi-closed greenhouse. The nearby Health Centre, and the Mytyl School can also rack up large energy savings by using the surplus heat from the Greenport greenhouse.

Raemakers is the driving force. Without him there would be no Greenport greenhouse. How did it all begin? He emphasizes that he is first and foremost a tomato grower. He is not a philanthropic institution but is interested in making a business profit just like every other entrepreneur. The initiative for the Greenport greenhouse was derived from his drive to be an expert in his field. 'For years the pro-ductivity increased about 5 to 8 percent per year, but the last few years the growth in productivity tapered off. We had reached the limit. Every year you have a number of days in which there is too little light, there is too much heat or there is either too little or too much damp.' What can you do about that? The tomato grower concluded: 'You have to be able to de-humidify, to cool and to dampen.'

Joep Raemakers briefs the consultation group in his semi-closed greenhouse.

In this way, Raemakers came up with the semi-closed greenhouse, which made de-humidifying and cooling possible, with an additional misting installation and assimilation lighting. This had one disadvantage: more heat in the greenhouse. But he figured out a solution for that too: heat storage in underground water at a depth of 90 metres and pumping it to the surface when needed. He was prepared to supply the surplus heat to his neighbours: a Health Centre and the Mytyl School.

In this way, Raemakers linked his own interest to that of others. His aim was to increase production by 20 percent and to halve his energy bill. He was prepared to share the energy savings with his neighbours at the same time. With this energy saving, he addressed a community goal: reduction of the greenhouse gas, CO_2.

>> Never seen before

Raemakers saw that his idea carried little risk. 'The techniques had been available for some time in the functional building sphere. The only thing was they had never been applied in horticulture before.' Not everyone shared Raemaker's confidence. For example, his neighbours with whom he wanted to share his energy surplus. To be dependent on a tomato grower for your energy requirements had no precedent. What would happen if the tomato grower went bankrupt? The neighbours were reluctant.

It was a good thing that Raemakers had chosen a crucial first partner for this process: the technical installation firm Thissen who was responsible for the energy supply for the whole Health Centre Group. Together with Thissen, Raemakers did the calculations for the entire project and they came to the conclusion that energy supplied from a horticultural business was quite a feasible option. With Thissen's encouragement, the Health Centre agreed. In the end, the grower won over all the institutions and partners involved (Vermeulen *et al.*, 2010). Obstacles are never insurmountable: 'You only need to take the time to achieve what you set out to do.'

>> Support for cultivation

As a result of his determination, Raemakers has succeeded in getting a whole network of organisations and enthusiastic people to stand behind him. He received a subsidy from SenterNovem to build the greenhouse and, as well as that, a subsidy from the then Ministry of Agriculture for three years of support by researchers from Wageningen UR. They assist him with cultivation issues, because cultivation in a semi-closed greenhouse requires a different method of growing than in traditional greenhouses. Data is continually collected and monitored from the greenhouse, like

plant temperature measurement. A permanent supervisor, Wouter Verkerke, comes by every week to discuss the data and to hear about possible problems. Verkerke knows his way around the research world and knows which researcher to consult for each cultivation problem they come across. The other activities whereby the supervisor assists are just as important. Raemakers: 'In projects like this, it's all about working well together with all parties, so that you form a team. Wouter and I spend a lot of time on motivating people so that everyone is heading for the same goal.'

>> Shining example

Up until now, this has been successful. All the parties who took part at the beginning are still involved (Verkerke and Vermeulen, 2008). This can be attributed to the approach taken by the project (Raaphorst *et al.*, 2010). Priority has been given to transfer of knowledge within the sector. To this end, the website www.greenportkas.nl offers detailed information about what is happening in the greenhouse. On a restricted page, the consultation group can continuously access the data. This group is comprised of pioneering greenhouse growers from the region, and from various crop sectors. They consider and discuss the results. There are regular visits by other growers in the whole country who take over ideas and parts of the greenhouse design. Two growers from the consultation group – a strawberry grower and a chamomile cultivator – both want to get going with a similar project. Every business that is in some way connected to this initiative is proud to be associated with the environmentally friendly aspects of this greenhouse. The Horticultural Trade Board does as well. In its New Year's speech, the greenhouse cultivation sector was praised for the socially responsible action of providing heating for the Health sector. In this way, the project is a shining example of how an innovative idea in the field can become a source of inspiration for the entire sector.

>> Developments continue

In the meantime, the innovative ideas continue to develop. Raemakers is not prepared to publicize all his ideas, but the concept of a new type of glass is already public. A test is about to be set up using double-glazing to reduce energy consumption without compromising the amount of light that passes through it. In this way, the project is the centre point of new developments which in the end are beneficial to the entire greenhouse horticultural sector.

Facilitating innovations

Many innovations involve changes which transcend the individual business or are only achievable when various businesses and/or interested parties take up the challenge together. In System Innovation Programmes, the necessary innovations are facilitated by means of workshops related to specific areas and by forming socio-technical networks.

>> Region-based workshops

Some businesses are not able to innovate on their own. The situation in an individual business, the physical environment, the power sphere of interested parties or restrictive laws and regulations do not always allow for this. Innovations often involve changes that transcend the individual business and are only achievable if various businesses and interested parties work together to achieve the necessary changes. The question is, how do you organise things to ensure that the parties find common ground in new ideas and projects?

The System Innovation Programmes have acquired the necessary experience in workshops related to regional issues in diverse regions and with diverse issues (Veerse Meer, Maashorst, marsh-meadow areas, Overijsselse Vecht). These workshops have proved to be an excellent instrument in order to bring together entrepreneurs and other interested parties in the region to come up with innovative ideas and projects. The way the workshop is set up is very important. Sometimes fruitful collaboration seems impossible because the short term interests of various regional parties are diametrically opposed. If the starting point is a region specific problem

The Regional Farm

In the Regional Farm concept, six themes for regional collaboration have been expanded upon where entrepreneurs can extract added-value. Agricultural businesses collaborate intensively or merge together.

The entrepreneurs manage machinery in collaboration so that they can be utilized more efficiently. They also divide the tasks, which leads to specialization and a more efficient business operation. The time that the entrepreneurs gain can be used to broaden their activities. Farmers combine their individual conservation plans into a single local conservation plan and manage it as a group. At regional level the wooded ridges, banks, old creek beds and natural ditches form a coherent whole.

Maashorst Energie is a cooperative venture formed around one or more biomass fermen-

tation installations. There is enough raw material in the Maashorst to generate a total capacity of 15 to 20 megawatt. The manure surplus, some 28,000 truckloads, together with corn, grass or crop remains are turned into electricity and heat by mixed-fermentation.

Regional supermarket branches are developing their own brand together with the Maashorst farmers. With new – regional – products, the producers and retailers earn more. The supermarkets also radiate the luxury and quality image of the region. The Maashorst also attracts new target groups with luxury accommodation. Think of double income earners who are happy to pay for authenticity, luxury, privacy, wellness and comfort. Agrarian buildings are converted into accommodation "Maashorst" style and package deals are developed.

Stakeholders debating the issue of nutrient leaching on sandy soils in the Netherlands. They stand in a landscape between profit (foreground), planet (background), technology (right) and regulations (left). The body language clearly shows that the stakeholders in grid 5 and 7 on the left have their doubts about the opinions of the farmer in grid 9 on the right. The opinions and the body language of the players can be used to form coalitions and/or to divide tasks around the subject of innovation. More information can be found in Buurma et al., 2006.

and/or a future vision, then this results in shared visions and interests. From that point, you can move towards innovative ideas which can be addressed in project form. It is essential to tap into the innovative power, positive interest and energy of the parties involved. A good example of this is the Regional Farm concept, an umbrella term for all sorts of different cooperative activities in the Maashorst, an area in the province of Brabant of about 4000 hectares (see box).

>> Socio-technical networks

It often appears that various parties (entrepreneurs, supply and production chains, public interest groups) already have ideas for innovations in a common domain, aspect of a chain or farm management . The problem is that they are not able to find each other – literally and figuratively – or that they meet up with obstacles that they can't surmount on their own.

A socio-technical network unites the diverse parties around this sort of common issue. The name refers back to the two main factors involved in this sort of network. It is not only a question of the technical aspects of innovation, but also changes in the way people collaborate and in the institutional environment.

>> Visions

Initiating the network begins with an extensive round of interviews with the various parties. These interviews are summarized in an innovation landscape: an overview of the concerns and mindsets of the different parties. This system reveals both the central problem or challenge and the search direction for the short term (operation-

al) or long term (strategic). In this way, it becomes clear where the common ground is and where their visions diverge from one another. These visions are discussed and where possible, coalitions are made around shared directions for solutions. This is the basis for forming projects. In this way completely new initiatives and close-knit networks grow around a common challenge. It is precisely because the parties are appealed to on the basis of what they themselves find important, that there is a good chance that this sort of network will work with a united front.

>> Surprising results

System Innovation Programmes have acquired a great deal of experience with socio-technical networks. This organisational form has lead to future-oriented sustainable initiatives and surprising results. Where research and policy have been inclined to look for solutions within their own field of expertise, socio-technical networks often search for avenues for a solution in a different way. One such surprising result is found in the project *Mobysant* (mobile cultivation system for chrysanthemums) for the chrysanthemum network. This was initiated to deal with the issue of pest control. The sustainable solution was found via an innovative mobile cultivation system that also deals with other operational dilemmas. The forming of a chain for the supermarket channel in the gerbera sector is a good example of a result when market and chain parties discover one another within a network.

Socio-technical networks are also used as a tool in innovation projects to ensure that a broad collaboration born of shared interest actually works on innovations and on surmounting obstacles.

Farming with future: making crop protection sustainable

The project *Farming with future* works with parties with a vested interest to promote sustainable crop protection in practice. Besides developing new knowledge, it spends a good deal of its energy in the embedding of sustainable practices within relevant organisations, businesses and agrarian entrepreneurs in order to make these practices permanent features of their activities.

Farming with future (2003-2010), a collaboration between Wageningen UR and DLV Advies, is active in the entire crop production sector in the Netherlands. The project works together with entrepreneurs and stakeholders in the field to test, develop and promote strategies and methods for sustainable crop protection. The stakeholders in crop protection are mainly the parties that have signed the crop protection covenant. These are the producers of crop protection products brought together under *Nefyto* and the dealers that form the organization *Agrodis*, the ministries of Economic Affairs & Innovation, and that of Infrastructure and the Environment, the Union of Water Boards (UvW), the united drinking water boards (VEWIN) and the agricultural organisations that form *LTO Nederland.*

Best practices

The knowledge column
Wageningen UR was commissioned by the Ministry of Economic Affairs, Agriculture and Innovation in 2004 to develop a classification system to make an inventory of the knowledge column in crop protection for the first research project via best practices to good practices. Best practices are integrated crop protection measures which are not yet used in the field by most parties but which have the potential to contribute to a reduction in environmental impact. They arise, in general, from current or finished research. By the term "good practices" we mean effective and feasible measures for widespread use in the field. A "best practice" only becomes a "good practice" if it is attainable for 70-80% of all growers. A sector specific list of best practices is drawn up and published every two years by Farming with future in consultation with *LTO* (2004, 2006, 2009). The project then tests and develops the best practices in the field. A number of them grow to become robust good practices; others are impeded by obstructions (work, risk, implementation, etc.) and have to be further worked on in research and/or in the field.

Examples from the 2009 best practice agenda for arable and vegetable crops
Arable farming:
• biomass sensors on the spraying machines to determine dosage when applying herbicides to defoliate potatoes,
• control strategies for fungal disease in grain and root crops,
• weed control in maize,
• guided control of thrips in onions,
• control of leaf fungi in sugar beet.
Open field vegetables:
• different aspects in strawberry cultivation: *phytophthora* control, testing *trianum* (new organic pesticide), organic soil disinfectant and cultivation on ridges,
• decision support systems for *stemphyllium* control in asparagus,
• guided control of thrips in leeks with the aid of perfumes.

Stakeholders have the ball in their court

Stakeholders have a direct (via business or personal contacts) or indirect (the atmosphere or climate which surrounds socially relevant theme and current issues) influence on the mind set and behaviour of entrepreneurs. In this way they can contribute towards the desired process of sustainability in crop protection. They can convince farmers of the usefulness and the need for sustainability and they can recommend good practices. Moreover, stakeholders determine directly or indirectly the pre-conditions for sustainability (laws, regulations, collaboration methods and how problems should be tackled, etc.) for today and for the future; together they form the "regime" in the crop protection system. Regime is a term taken from transition thinking and stands for the entire system of institutions, their networks, relationships and procedures. Together they "determine" the culture, how things are done, what the dominant procedures are; the written and unwritten rules. It is characteristic of the transition that agriculture is going through that traditional values and 'certainties' in the regime are disappearing. Under the influence of new issues and themes such as socially accountable entrepreneurship and sustainability, stakeholders in the regime are searching for a new interpretation of their changing roles and relationships. This is characteristic for system innovation. Farming with future wants to facilitate this quest by stakeholders and wants to promote any opportunities to stimulate the utilization of sustainable practices in the field.

The project *Farming with future* was designed to support the covenant targets in the area of "Promotion of innovation and improvement of management". We see the effort and commitment of the vested interests as being essential to the process of sustainability (see box Stakeholders have the ball in their court)

>> Developing relevant knowledge

Farming with future's knowledge agenda consists of so called best Practices: promising sustainable methods and measures that still need to be tested in the field to make them ripe (effective and attainable) for practice. (see box Best Practices). *Farming with*

Farming with future tries out new techniques, such as hoeing equipment for the mechanical removal of weeds, in the cultivation of trees for urban areas - a key sector in Dutch horticulture.

future works on a total of about 30 new best practices annually in all different sub-sectors of the crop production sector. Most practices are tested for some years together with selected entrepreneurs and interested parties who can and want to work together for a particular measure. The testing and demonstration of best practices takes place on commercial farms, in study club groups or at research farms belonging to Wageningen UR. Many best practices have become good practices (see box Best Practices) and are disseminated in the agricultural network. *Farming with future* has described 65 good practices in a series of flyers and these have been widely distributed.

>> Knowledge circulation

Farming with future communicates with all interested parties in the regions and sectors where it is active: in total more than two hundred stakeholders. The aim of the talks is to explore the possibilities for common distribution of knowledge on more sustainable crop protection. Which measures can rely on support from the stakeholders and under what conditions? Can we fulfil these conditions together in order to facilitate the involvement of the stakeholders? In past years hundreds of collaborative activities have been launched in this way, varying from contributions at member evenings, articles in professional journals, publication of flyers and brochures as well as practical demonstrations, show days and informative meetings. The collaboration between entrepreneurs, stakeholders and *Farming with future* has in this way been the motivating force behind the distribution of sustainable methods and techniques.

>> Perspectives on sustainability

Farming with future builds on this collaboration by intensifying the bilateral and multilateral talks with stakeholders to establish what sustainability means to them, what their ambitions are in this respect and how that is implemented in their business practice and how this can affect entrepreneurs in the field. In this way, it becomes clear what the vested interests are and what criteria (the conditions which need to be fulfilled) must be met to ensure active involvement.

Farming with future uses all sorts of methods to bring stakeholders together and involves them in a common course of action. The confrontation with each other and the differing perspectives on the sustainability problem and the possible solutions, promotes self-reflection about positions, vested interests and the way in which these can be served. This method of working often offers an unexpected wealth of starting points for the exploration of opportunities for individual and/or coordinated action. Stakeholders
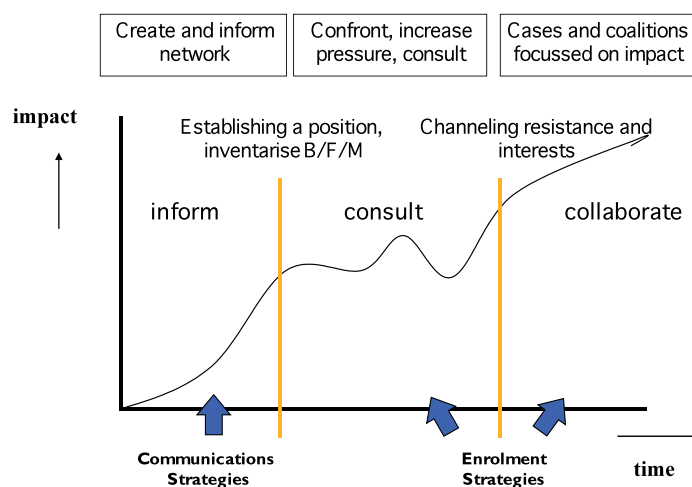
Figure: The stakeholder management process characterised in three phases. B/F/M stands for respectively Blockers, Floaters and Movers, see text.

ask questions of each other, call one another to account or make suggestions for concrete action.

Within each group of stakeholders we see individual businesses and organisations moving forward and creating new initiatives to give shape to sustainable behaviour. In many cases *Farming with future* is approached to work as a partner in their activities. Also more and more coordinated forms of action evolve from the established contacts offering stakeholders the perspective to contribute to the intended change in a coordinated manner in line with their own interests.

>> Stakeholdermanagement and enrolment

The methodological approach taken by *Farming with future* is called Stakeholder Management [see box] and is aimed at enrolment of the stakeholders: that they take (over) responsibility for sustainable crop protection and behave in more sustainable ways. The stakeholder manager fosters the integration of sustainability into the thinking and behaviour of businesses and organisations, allowing for their own identity.

Being a stakeholder manager is not an easy task. The stakeholder manager has to be committed to the change and have the personal drive to contribute to it. It requires new expertise and new process management skills. To this end, appropriate training courses were organised specifically for the stakeholder managers. Join our experience, stakeholder management is an excellent instrument to contribute to system innovations, because it allows for addressing the necessary organisational and institutional changes next to the technological ones.

Stakeholder management

Stakeholder management is a methodological approach designed to initiate and facilitate change processes by effectively influencing the stakeholders to act in their own interests in line with a well defined intended change target. A stakeholder is a person who has a felt interest in the outcome of the intended change (Donaldson and Preston, 1995), yet to be implemented. Stakeholder management is ultimately the outcome of the change process that counts for every stakeholder (Freeman, 1984). Stakeholder management originates in the private sector and is in *Farming with future* reworked for use in the public sector. The term management is here used in terms of organising, initiating, stimulating and facilitating. Stakeholder management is divided into three phases that are described below:

The inform phase:
- In this phase the stakeholder manager (STMA) communicates the need for change and the change objectives to all stakeholders. Stakeholders determine what is at stake for them, how it interacts with their interests and what their position in relation to this target/goal is or will be.
- The STMA informs himself on the attitude and behaviour of the stakeholders (individuals) towards the intended change and categorizes it by asking himself the following questions: Which stakeholders support the goals and are willing to make an active contribution (Mover), which ones have reservations or conditions (Floater) and which ones oppose the change because they have an opposite and therefore conflicting interest regarding the change targets (Blocker). He maps the position of the stakeholders and their interests in a network and stakeholder analysis and re-evaluates it regularly as basis for the design of his actions.
- The STMA starts working with the movers to initiate new actions which promote the desired change. The STMA is keen to bring movers together in a leading coalition for change.

The consult phase
- In this phase the STMA consults the stakeholders about the change and their contribution. He uses three basic principles to influence stakeholders, 1) by increasing the pressure to become active by using confrontation; 2) by giving insight into the problems and possible solutions; and 3) by tempting stakeholders to get involved by claiming the need for their unique contribution (see also Cialdini, 2001). The final aim is to stimulate stakeholders to re-evaluate their position and interests and ensure that they become involved.
- Scenarios, breakthrough solutions and modes of actions are explored by the STMA and movers in order to find new feasible ways to contribute to the intended change. New activities are started. The STMA is omnipresent; he is facilitator, broker, and accelerator all at the same time.
- The blockers are specifically addressed and confronted in this phase. Their objections have to be dealt with to strengthen the solutions of the movers. Their cooperation is needed in order to ensure a sustainable change. The STMA has to find out how to incorporate their criteria in the search directions so that the change serves their interests as well.

The collaborate phase
- The stakeholders take over the responsibility for the change, it becomes their change. The new, more sustainable way of working that fits the stakeholders' everyday reality, the elaborated scenarios and fruitful collaborations of the cnsult phase, are rolled out to realise the change.
- The STMA now retreats to a more supporting role to coach the enrolled stakeholders in their activities in order to embed the change in their organisations and roll it out in their network.
- The STMA remains active to embed the change in the institutional networks. He however, only undertakes activities in close consultation with his stakeholders.
- In this last phase floaters will follow what now has become the general trend.

The STMA guides the stakeholders through the three phases from "the freedom of choice to the responsibility of choice". The intended change is considered necessary and stakeholders have interests that are linked to the change. The change cannot be realised without their professional input and support. In the process towards the intended change it is no longer possible to be indifferent. The stakeholder must get involved or at least make a conscious decision on their role and position. Stakeholder enrolment is the name for the process in which the stakeholders increasingly take over ownership of the change process. An enrolled stakeholder has a positive attitude towards the change, sees a role for his organisation and works hard to find feasible ways to contribute to the change by his actions and he also influences others in his network to become involved as well.

'Because of this network we really are involved in energy saving'

Talking in crop specific terms about tomatoes and trusses, for example, has become passé. Now it's all about dry matter and stomatal apertures. This change was necessary because otherwise the growers in the greenhouse Innovation network *Nieuwe Energie Systemen (INES)* [New Energy Systems] in North Limburg could never have learned from each other. This is because the growers in this network are not organised into crop sectors anymore, but form a mixed group representing various crop sectors together. This is one of the conditions for fruitful sharing of experiences in cultivation using new energy systems. The approach works.

The initiative for forming the network originated with the farmers and growers branch organisation LLTB in Limburg (in the south of the Netherlands). Wageningen UR plays a facilitating role in this network. There are numerous new developments in the area of energy. The Limburg greenhouse growers are currently familiarizing themselves with this development. It is apparent that individual growers cannot access the learning experiences of other growers on their own, and nor do they find out about the failures within the new concepts. More regional coherency is needed. Annemie Hermans is involved in the network on behalf of LLTB.

'The greenhouse growers can use one another as sounding board. This stimulates a sort of collective knowledge boost. It speeds up the development and it helps entrepreneurs to support their choices with more certainties. In this way you create a super-study group that gets smarter as a team.'

>> Opportunities for energy savings

Jaap van den Beukel, greenhouse grower in Venlo and one of the participants is completely in agreement. 'We all say that something has to be done about energy savings. This is certainly understood by all growers and through this type of network you are actually working on it. Now that I'm in a network, I give my time to the issue of energy. If you don't focus on it, you don't really notice it. You think, oh, tomorrow is another day. Now I use colleagues as a sounding board and I see where the opportunities lie. Sometimes I get confirmation on things and other times I hear things that I haven't yet considered.' Van den Beukel cultivates *Matricaria* (chamomile), a crop which has a low energy bill in relation to the total cost of production. It is about 13 percent, while vegetable cultivation has an energy bill that is easily double that. This is the reason that he is not yet investing in a large energy saving system. He has, however, modified parts of the greenhouse according to the principle of the air conditioned greenhouse. This is a semi-closed greenhouse in which energy can be saved relatively cheaply by combining greenhouse cooling with air humidifying. This activity makes the grower one of the five leaders in the network, all of whom are now at the point of investing or having already invested in new energy systems. Together they form a network within the network. There is more openness and more mutual trust here than in the larger group, both of which are preconditions for delving more deeply into issues; for example, over the reasons why someone has made a particular decision or taken a particular step in the process.

>> Group dynamics

Speaking frankly with each other was something the growers had to learn. That was also true for Van den Beukel. 'It's not an information evening where you passively sit and listen. If you are there to gain or transfer knowledge, you have to share information. We really had to learn how to do that.' Hermans calls this developing *sparring competencies*; ensuring that discussion delivers results, that business firms begin to think about choices that they make and that a gathering isn't just for consumption. 'In this way a group dynamic evolves. Everyone gets to know what the other can deliver. They can literally visit each other's businesses and learn

something.' This insight has not just been discerned by the entrepreneurs but also by the researchers. Both groups now realise that if you match issues in practice to theoretical research, it creates a greater learning yield.

>> Backing for the network

The growers value the approach used in the network. Not only do they visit each other, but also growers outside of their network. They invite guest speakers and learn from growers who cultivate crops completely different to their own. The growers had not realised that they could learn so much from each other, according to Hermans.
This working method seems to have caught on. A survey among participants, followed by a discussion with them, showed that energy develops when things are tackled together, for example going on an excursion together. A common frame of reference develops for looking at innovations. Participants feel supported by the network to take up innovations themselves or with others. This leads to new initiatives.

>> Large steps

Hermans considers, therefore, that all the objectives have been realized. The growers take on new experiences and knowledge more easily and they are able to gather knowledge from elsewhere. This type of network makes it attractive for other parties to join. 'Of course, an explosion of new developments and investments doesn't happen straightaway, but doing things together enriches the discussion. Entrepreneurs take large steps, even though this is not always directly due to the network. They take these steps among other things because of the insights they have gained in this framework.' Grower Van den Beukel confirms this wholeheartedly. He has not planned any large investments yet, but he is enthusiastic about the excursion to a firm that processes vegetables and has built a bio-fermentation installation. 'The man told us what he needed and what he saw as the opportunities or the threats. To build something like that costs time but when I build up a new business in a few years, I will seriously look at whether I can bring all sorts of parties together to work on something like this.' In the meantime he would rather continue in INES; with supervision. 'Even when there's no supervision anymore, I want to continue, but I wonder if we will then still carry on. Someone has to be the motivating force, to organise good excursions and good speakers. We can try to do it ourselves but we don't have the connections.'

Strengthening entrepreneurship through coaching and developing competencies

Strengthening entrepreneurship is an important strategy for stimulating the transition to sustainable agriculture. But how is that done? One example is the Interactive Strategic Management method, which supports entrepreneurs in the creation and execution of future-focused strategies.

The environment surrounding agrarian entrepreneurs is changing fast. They have to deal with not only globalization and competition of the World market but also a national and local environment that puts demands on their production methods. In other words: the market determines if you can produce (price) and the environment determines if you are *allowed* to produce (license to produce). In this complex situation entrepreneurs must carefully calculate which long-term choices they want to make.

Diverse projects focused on increased sustainability in business management show that the most successful entrepreneurs are not those that adopt the advice of experts without further thought, but rather those that create their own strategies based on a broader perspective and integrate sustainable measures into that strategy. This finding has led to the development of the Interactive Strategic Management (ISM) method to support entrepreneurs in the formation of strategies and prepare them to work according to their own

integral strategy (Smit *et al.*, 2002; Smit 2004). ISM has three basic principles: emphasis on the entrepreneur, business in interaction with its environment, focus on actual progress or actions of the entrepreneur.

>> Emphasis on entrepreneur

Placing the entrepreneur at the center means they themselves are responsible for the content of their strategic plan rather than the advisor. The entrepreneur must therefore write the strategic plan themselves; the advisor is only there to guide and stimulate the process.

In an ISM-track the entrepreneurs are challenged to thoroughly examine their business, the environment and themselves; for example by analyzing current business performance. The entrepreneur can have a benchmark made in which he can chose which group of businesses he wants to be compared with. Based on the results of the benchmark the entrepreneur establishes – with the aid of an advisor – the strong and weak points of his business. Because the ISM-track almost always takes place in group situations, the entrepreneur can also make use of the expertise and feedback of his colleagues.

The intent is that the entrepreneur intensely experiences the entire process and simultaneously develops the competences necessary for the future of his business. You could say that the approach focuses on the *empowerment* of the entrepreneur. The literature also discusses the internal locus of control (Fishbein, 1975); the larger this internal locus of control, the more control an entrepreneur has over his own future. A small internal *locus of control* means that his future is largely in the hands of developments in his environment; things that happen to him. Research (Bergevoet, 2005) shows that working on strategic choices in groups leads to a larger internal locus of control and therefore more control over one's own future.

>> Business in interaction with environment

While the entrepreneur may be central in Interactive Strategic Management, he is by no means isolated. In present-day society, especially in the crowded Netherlands, agrarian businesses cannot be seen as an isolated link in the food chain. Depending on the proposed strategy of the entrepreneur, he must enter into a dialogue with his environment: with his neighbors concerning plans for expansion, for example, or with (new) chain partners, colleagues or nature and environmental organizations.

The role of the advisor or coach is to challenge the entrepreneur to include the developments in his direct environment or in broader

Figure 1. With the Strategic Management Tool the entrepreneur can judge his own situation by filling in scores for the three E's of Entrepreneur (competences), Enterprise (structure and performance) and Environment (market and society).

society into his strategy and to involve these in his plans. This prevents the tendency some entrepreneurs have to set themselves apart from the community ('the municipality wants nothing'). Because the entrepreneur is a part of the community he must gain more insight and learn how to deal with situations pro-actively. Strategic decision-making is about more than simply choosing the best technical-economic long-term direction for the business, after all. It's also about legitimizing the business (Schans, 2008).

>> Focus on actions of entrepreneur

Interactive Strategic Management is meant more to bring entrepreneurs in motion than to transfer (theoretical) knowledge. This also means that the supplied knowledge is often adapted to the context in which the entrepreneur must work. An example is the use of game simulations that allow an entrepreneur to calculate the necessary measures for his own business. In this way he is offered implicit knowledge which, by using his own business data, can be directly translated into his own context. The criteria for the use of knowledge is more "*what* works the best in these circumstances" rather than "*why* does this work the best and *when* would it work in another situation?". This approach attaches as much importance to knowledge of the entrepreneur and of his colleagues as to science-based knowledge. This applies not only for technical matters but also for knowledge about the process of making strategic choices. The core of the ISM-approach is therefore not so much to come to a total objective image of the entrepreneur, his business and environment but rather to generate so much energy and confidence that the entrepreneur can take (solid and well-founded) steps

Competences · Internal Business Factors · Business Performance

forward. It's about simultaneously thinking and doing. Apart from that it is necessary that the entrepreneur forms as realistic an image of his possibilities as he can in order to make good plans. The interactive approach of ISM is pre-eminently suited to bringing ideas into focus (Schans, 2008).

>> ISM-training in practice

A customized approach has been developed in a variety of projects based on the three ISM principles, depending on the goal and context of the project. Here we focus on the group-training "Enterprise with vision" to support entrepreneurs in making long-term strategic choices. In order to further support the process the entrepreneur must go through, a number of web-based tools have been designed. The entrepreneur can use the Strategic Management Tool (SMT) to judge his own situation by filling in scores for the three E's:

Entrepreneur (competences), *Enterprise* (structure and performance), and *Environment* (market and society). Based on these scores, the tool calculates a score for fifteen possible business strategies. For example; developing added value for products, bulk production, economically efficient enterprise, specialization, etc.. The entrepreneur can then compare the scores of the various strategies with the strategy/strategies that he has developed for his business. The analyses result in a profile for each E. It is important that the entrepreneur doesn't think too much in terms of strong or weak, chance or threat. Whether something is strong or weak depends mainly on the context and more often than not on the (still to be chosen) strategy. An example is the location of the business. If it is situated near a village or city, a strong growth strategy is unfavorable, but a strategy focusing on direct farm product marketing is very favorable. Once again, creativity is essential.

Wageningen UR AgroCenter

Wageningen UR AgroCenter for Sustainable Enterprise is a network of researchers from Wageningen UR with the motto "putting knowledge in motion." The network strives to be a leader in strengthening enterprise in the agricultural sector through developing scientifically based methods for practical application. In order to do so the network has made strategic links with partners such as the platform *Partners voor Ondernemerschap* (Partners for Enterprise) and the *Groene Kenniscoöperatie* (Green Knowledge Co-operative) through which 'green' education is united.

The network is active in many different sectors – dairy, arable farming, greenhouse cultivation, fishery, multifunctional agriculture – and works with a variety of themes – innovation, sustainability, chain, region. Recording practical knowledge in concepts and tools is an important aspect of the network's system. These are then transferred with a 'train-the-trainers' approach to advisors or teachers. The approach designed to support entrepreneurs in the making of long-term choices (Interactive Strategic Management) is highlighted in this article. Other examples of AgroCenter projects are *PlattelandsImpuls* (Rural Impulse), focused on the professionalizing of multifunctional agriculture and *Bedrijf als Schakelplaats* (The Business as a Link) in the green chain, where students can learn the ins and outs of the trade and the competences of enterprise at real businesses of entrepreneurs (Schoorlemmer, 2008). More information at: www.agrocenter.wur.nl

Figure 2. Results of the Strategic Management Tool with profiles for the three E's (Entrepreneur, Enterprise (2x), Environment) and the scores for the fifteen strategies.

In the Strategic Management Report – also a web-based tool – the entrepreneur records the process of strategy formation and the eventual choice of strategy in a personal document (see figure 2). The process is completed with a concrete action plan and a presentation for the group.

>> What does it provide?

The integral Strategic Management track provides the entrepreneur with a well-founded plan. These plans and the corresponding presentations are often used by entrepreneurs in negotiating with financers or making agreements with other stakeholders.

However, this plan is "just" a by-product. The strengthening of enterprise is the biggest gain. The approach is especially focused on the development of a position in which changes and developments in the market, society, governmental policies, the business and private situation are continually observed and translated into possible consequences for the strategy and business management. Because the entrepreneur continually works from within his own situation and with his own passion combined with surprising perspectives, he sometimes arrives at unexpected strategies. Sometimes the process can be confrontational, because a certain proposed direction of development turns out to be unsuitable or unattainable.

Pioneering can be learned

A *pioneer* has specific competencies that a *follower* does not have, or has to a much lesser degree. For example, the capability of gathering information but also processing this information for use in his own business, are skills that a pioneer has developed to a large degree. But people who are not pioneers can also learn these competencies.

Where do pioneers get their information and how do they learn from it? If you can find out you can possibly stimulate others to do the same. Whoever wants to start up something new or solve a problem, consciously or unconsciously follows a process of collecting information in order to implement the best solutions. This process can be reproduced in a circuit diagram that has been developed by Jan Buurma (see box). Pioneers apparently follow this process quickly and easily. In the same way, there are other obvious pioneering characteristics which can be linked to improving innovation potential and innovation climate.

>> Pioneers follow the whole process

The circuit diagram shows the most important differences between pioneers and followers. Pioneers are more observant of the things happening around them and they can switch to something new more quickly than other entrepreneurs. It all begins by following the whole process in the circuit diagram – sometimes more than once. Followers do only part of it. The pioneer follows one, two or more

strategic lines and seeks out structural solutions when making a choice. Sticking plaster solutions do not exist in his vocabulary. He can switch rapidly because he can find the right people and involve them in a short space of time. He can assess when he can do something himself and when he needs someone else (Lans, 2010). One entrepreneur in this research project admitted: 'If I go to the council office on my own, I just get worked up and angry. Now I take a communication advisor with me, and then they listen.'

>> Creative and persistent

It is striking to note that pioneers do not have a defensive attitude. Instead of stamping their feet when a certain regulation works out completely wrong, or complaining that government authorities want to ruin agriculture, they try to be creative and are persistent in thinking up solutions for their specific problem. When it later appears that other people have also been dealing with this problem, they are not really interested. It is mainly the steps that lead from collecting information up to, and including, translating the

Four crop farmers have merged their three businesses and work closely together. They have operated under the name De Sjalon since 14th March 2008.

Circuit diagram for innovative entrepreneurship

Collecting information about the market and society

a

| What is happening around me and to me? |

Translation into the consequences for one's own business

b

| What does this mean for my business? |

| **Strategic track** (structural modification) | **Tactical track** (protection of interests) |

c Translating the consequences into a strategic vision

| How will I carry on in the future? | How do I limit the damage? |

d Collecting information about the market and society

| What do I need to organise to deal with it? | Which actions are necessary? |

e

Balancing and implementing the found solutions

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vision into concrete activities, that run quite smoothly. One pioneer gets a buzz from reading news magazines for example, and is very interested in what is happening in the outside world and knows how to translate this for his own business.

>> From the football field

At each connecting point, the pioneer uses different sources. To gather information he calls on 'information providers', such as traders and clients, but also his own experience. In translating this into consequences for his own business the pioneer uses 'interpreters'. This could include his own insights, but also things he picks up on the sidelines of a football field, from overseas examples or from the Chamber of Commerce (Lans, 2009). To translate this into the strategic vision, the pioneer seeks advice by 'creativity promoters'. He can test his ideas on partners, business partners, network supervisors. But other branches, a creativity course or an overseas visit can foster the pioneer's creativity. The pioneer translates the vision into concrete activities after he has consulted with experts, such as process supervisors or lawyers or via professionals, such as trade journals, retired growers or a model business.

>> The outside world is necessary

Implementing the solutions he has found is the most difficult step. Not because he cannot do it, but because he really needs the outside world to do it. It is precisely because the pioneer is ahead of his time and he has unexpected or strange plans, that he meets resistance: the council does not see why it should approve the plan; there are competing interests or bureaucracy slows everything down. The trick is to get all these parties, clients or personnel behind the plan. Pioneers are often soloists. They do a lot of abstract thinking and are less concrete. That works against them. There are also pioneers who are very good in bringing people together and they derive their innovations from this. A good example is the chrysanthemum grower who brought together various parties to find an innovative solution for structural problems in their sector with increasing costs. In this last step, pioneers have the support of 'implementers and supporters'. This group comprises diverse people and institutions such as communication advisors, researchers, subsidy funds, personal circle of friends or provincial government authorities.

>> Learning competencies

The entrepreneur that follows the circuit diagram quickly and smoothly has a number of specific competencies. He is, for example, creative, can think strategically, is persistent, can gather and analyse information, can collaborate in networks and communicate professionally. The question is; can a future entrepreneur or an existing one, learn these competencies? Can others stimulate the learning process? Thomas Lans en Jos Verstegen, both working for Wageningen UR and researching competencies, both believe that it is possible.

>> Eighty percent can be developed

Competencies that closely relate to someone's character – consider, for example, creativity – are difficult to develop for someone who does not have them. Changing one's character is after all difficult. Some people will always have to try harder to become an entrepreneur than others and will possibly never achieve that 100 percent. But Lans and Verstegen's proposition is that everyone can learn 80 percent of the needed competencies to be a good businessman (Mulder, 2007). Along with this, both researchers differentiate between starters and existing entrepreneurs. Stimulating someone to start a business requires different stimulants than stimulating existing entrepreneurs to become more entrepreneurial. To begin with, the idea is to create an entrepreneurial climate already at school level. This is happening more and more, observes Verstegen. Students have to manage their own mini-business, whereby they even have

to register with the Chamber of Commerce. As well as that, the introduction of competence-directed education has created more opportunities for initiatives directed at entrepreneurship.

>> Learning to see opportunities

Existing entrepreneurs will, above all, have to learn to discern opportunities and realise them. Lans and Verstegen indicate that it is also useful if entrepreneurs have an instrument to compare themselves with others in entrepreneurship. The government can stimulate the development and use of this tool. Experience has taught that the commitment to implement innovative behaviour can be lost in the daily grind. Moreover, it would be good for the government to stimulate network forming by promoting regional clusters where private business, research institutions, consultancies and other institutions work together on innovative entrepreneurship. In policy, set down objectives fosters entrepreneurship better than setting down means. It is also beneficial to set criteria for businesses in financial/economic regulations and stimulation subsidies. Another way to stimulate entrepreneurship is via exemplary role models. A pioneer that is in the limelight can be an important source of inspiration for aspirant entrepreneurs and colleagues. Farmers and growers that initially seemed unwilling to change, might do that after a business analysis. What about farmers that really do not want to? You have to leave them alone, say Lans and Verstegen in stereo. 'Agriculture does not only need pioneers.'

Approaches and methods for monitoring and evaluation

The aim of many agricultural innovation networks is to realize a system innovation. With system innovation, whole production and consumption systems change, including social relationships, division of roles, formal rules and values, and the technical artefacts and infrastructure. This type of innovation takes place when stakeholders learn from each other in a process of thinking and acting together. In order to get to grips with these learning processes, it is increasingly common to use monitoring and evaluation methods. What are the methods that can be used, what are the most significant differences between them and to what degree are the methods from the different approaches of use in evaluating and managing innovation projects?

In the world of monitoring and evaluation (M&E) three approaches can be identified: result-oriented, constructivist and reflexive (see table p.32). Every approach includes principles, methods and tools that can be used for projects that have the ambition to contribute to (system) innovation. But they differ widely in their vision on reality, the on-going processes and their results and how to support, manage or adjust these processes. Deciding which method is the best depends heavily on the nature of the project, its context, and the monitoring and evaluation objectives. In practice, it may be desirable to use a selection of methods from the different approaches in order to combine their strong points.

>> Result-oriented approach

The emphasis on result-oriented monitoring and evaluation lies in "measuring": to what degree have the original project objectives and subsequent interventions been achieved? In other words: what

are the results? (The "what" question; Zall Kusek and Rist, 2004). Result-oriented approaches are often used to provide an accountability trail for the investment in the project, whenever financiers and their backers have to or want to see what has been done with their money. Planning methods which match this type of M&E are LogFrames or Logic Charts or the more flexible Theory of Change (Davies, 2002).

These methods are based on assumptions and expectations of causality and linearity: 'If we do this in the project, then this will happen and this or that change will take place; to put it another way, the project can plan for change and then measure it.' The strength of result-oriented methods lies in strategy and planning. They force project managers and participants to consider carefully what they want their contribution to be and how they think they should act to achieve this. In other words, they support the development or explication of the intervention strategy. By developing an intervention strategy the project managers and participants can assess what works and what doesn't work at specific times. If necessary, the strategy can be modified along the way. As well as that, the result-oriented methods can be useful in monitoring the progress of the projects, the so-called operational process.

Result-oriented methods are powerful instruments but they have their limitations in (system) innovation processes. An example of a well known intervention strategy in system innovation is the stimulation of unforeseen contacts in order to trigger surprising new insights and initiatives. During the implementation of a result-oriented M&E, project managers and the participants will want answers to a number of questions. In the short term, to what degree they are successful in stimulating unforeseen contacts (output). Further in the process, they will want to know to what degree these contacts have lead to surprising new initiatives (outcome). In the long term, they will want to gain an insight into the degree to which the initiatives have contributed to, for example, a more sustainable agricultural sector (impact). The strength of result-oriented methods lies in asking these pointed questions, but they can often only provide part of the answer. Collective learning and innovation processes do not evolve in a linear way but are unpredictable. As a consequence, cause and effect relations are not easily traceable. Result-oriented methods do not address the value of collective learning and the development of a shared understanding of the project and/or its context.

>> Constructivist approach

The constructivist M&E approach assumes that people are the motor behind the development of novelties and societal change processes. They achieve this through interaction and negotiation (Guba and Lincoln, 1989). Mutual understanding and exchange of experiences support collective learning, improvement and change. Constructivist methods focus heavily on monitoring and evaluation of the progress of the collective learning process. They do not so much define (the "what" question) but highlight more how successful collective learning processes are initiated and prolonged (the "how" question).

A central activity is sharing experiences from different perspectives by different people. An analysis of the most important issues is made on the basis of individual stories and together with the story-tellers, the group reflects on possible further steps. Related M&E methods are Learning Histories (Kleiner and Roth, 1997), see Networks Learning from Learning Histories, p.34, and Responsive Evaluation (Abma and Widdershoven, 2005). A method like Most Significant Change (Davies and Dart, 2005) also falls under this approach.

The strength of constructivist methods is that they stimulate the exchange of perspectives. They ensure a good insight into how processes evolve. These insights are of value for the learning process itself and the relationships within the project or network

	Result-oriented approach	Constructivist approach	Reflexive approach
Methods	LogFrames, Logic Charts, Theory of Change	Learning Histories, Responsive Evaluation, Most Significant Change	Reflexive Monitoring in Action/ Reflexive Process Monitoring / Interactive Learning Approach
Objective	Accountability and managing	Learning from each other and modifying processes Agenda setting	Learning, change of practices and their institutional setting
Paradigm	Reality exists and can be measured/defined objectively	Reality is constructed through interaction and negotiation.	Reality has to be reconstructed/ a new reality has to be developed
Focus	Results/predefined objectives or procedures	Meanings and values, based on negotiations	Calling existing practices and institutional settings into question

Table. Summary of the differences in objective, paradigm and goals between the three M&E approaches.

can be strengthened using the results of monitoring and evaluation. In particular, constructivist methods can help collective learning when the outcomes of an intervention are unpredictable, the process of change is intangible involving multiple pathways and inter-related factors, and the actors involved have different perspectives on the central problems and their causes, a common phenomenon in innovation projects. This type of learning can increase support for the project. One weakness of this method is that the insights are not easily transferable or exchangeable with the people who have not taken part in the M&E process. One trap can be that there is so much focus on the exchange of perspectives that the intention of a project to contribute to actual change is forgotten.

>> Reflexive approach

We call the most recent approach in M&E-country reflexive (Voss *et al.*, 2006). Reflexive methods focus on both a collective learning process (in groups of actors and in networks) as well as on the results in terms of learning and institutional change. The reflexive approach has a constructivist basis but goes further. Project or network participants not only exchange their personal viewpoints and motives but they also debate their presumptions and underlying values and norms and the institutional context in which they operate. In this way, they can arrive at diverse agreements about possi-

ble joint actions. Reflexive monitoring assumes that system innovation can only take place if the institutions (laws, regulations, culture, etc.) which have until now perpetuated the current (non-sustainable) practices change as well (Mierlo, 2010a). The leading question in reflexive monitoring is whether the activities in an innovation project stimulate precisely those learning processes that can lead to a change in current practices of interdependent parties.

The strength of this approach is that it is based on thinking in terms of systems; current practices are questioned and the aim is to change a complete system. For this reason, the approach is promising for projects where the ambition is to contribute to system innovation. Because reflexive monitoring has not yet been implemented in practice very often, there are few people with knowledge and experience of it. It requires sincere commitment and intensive effort; self-monitoring is not or hardly possible. Related methods are the Interactive Learning Approach (Regeer *et al.*, 2009), Reflexive Process Monitoring and Reflexive Monitoring in Action. Reflexive Monitoring in Action (RMA) has mainly been conducted in the context of agriculture in the Netherlands; a few examples of RMA experience in practice can be found in Mierlo *et al.*, 2010a and Mierlo *et al.*, 2010b.

Networks learn from
Learning Histories

The research programme *Networks in Animal Husbandry* began in 2004 without any concrete final objectives. The programme did have to contribute in all sorts of ways: by making "knowledge from the shelf" applicable, to making animal farming more robust, stimulating new knowledge arrangements and even to system innovations. It did all that – and more – in its facilitating role in the networks of animal farmers and other stakeholders in the sector. The programme began in effect as a big experiment.

From the start of *Networks in Animal Husbandry*, the Ministry of Economic Affairs, Agriculture and Innovation (EL&I) who commissioned it, wanted the main focus to be on concrete relevant output from the research programme. But because of the experimental character of *Networks in Animal Husbandry*, it became quickly apparent that the learning experience needed to be explicated and shared. Because of this, monitoring and evaluation in the network played a double role: it fostered both learning and accountability. The relevant questions played at two levels within the project as well. In the first, the facilitators wanted to reflect on and learn about the effectiveness of their intervention strategies (can we do things better?) and the project leadership was interested in both tracing the network's development and testing the network as an instrument in itself. As well as that, the project was accountable to the EL&I for the achieved results. This variety of goals made it difficult to monitor and evaluate the programme. The network had to decide where it should focus its attention. In the course of the project the answer became clearer (see figure 1).

>> The first round of networks

For the network facilitators in the first sixty networks, it was a search to find out which tasks they should and could do. Was it a question of clearly leading the networks or was it more a case of assuming a less directive role. What did the networks need most? Knowledge input, contribution to the process or working on the conditions for realising the network objectives? The ideas of the networks and network facilitators often differed dramatically. These differences were discussed at length in combined network facilitators meetings, which were supported by a methodical and conceptual contribution from the action research team. This team was set up in the project to support the network facilitators in the implementation and development of their role and their task was to provide the monitoring and evaluation (M&E).

The action research team began by designing a coordinated monitoring model. They did this by looking at what was happening in a few networks, but also by approaching the network facilitators with

Input	Throughput	Output	Outcome

Objectives EL&I and programme Networks in Animal Husbandry → Supervising the network → 1 Making more strategic space for agriculturalists / 2 Strengthening networks / 3 Renewing the knowledge arrangements →
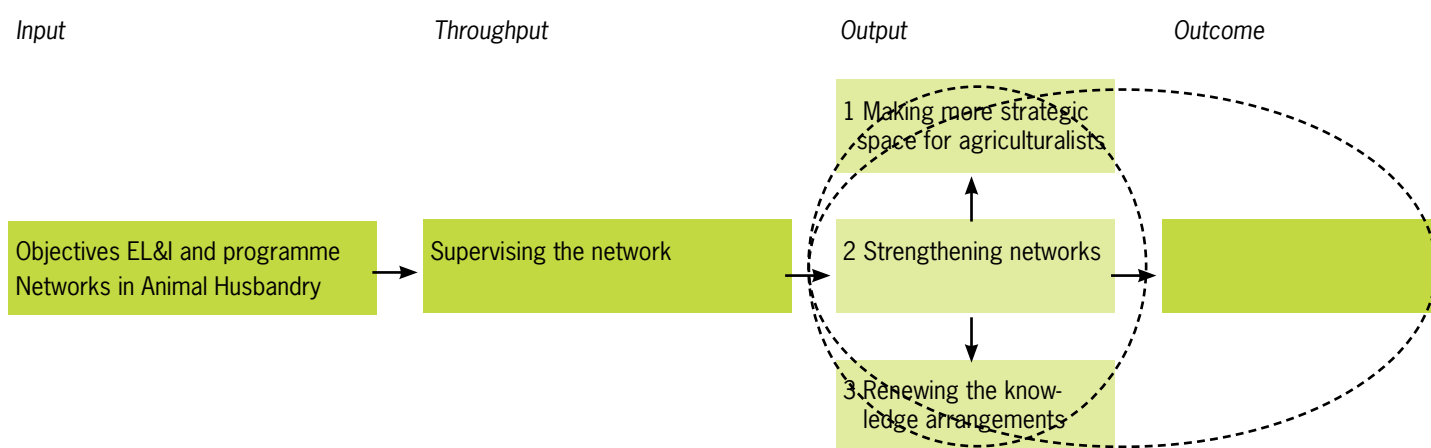
Figure 1. Flow chart of input through to outcome of Networks in animal husbandry. The dotted lines show the focus of the monitoring and evaluation.

lists of questions such as: what are you doing? What are the network's main activities? The idea was that this would deliver a significant amount of information on how the network functioned and how the network facilitators approached their role. In many cases, the network facilitators saw this method of working as a form of interference or sign of mistrust. They were themselves surely responsible for the functioning of the network? No-one else other than the network leadership had anything to do with this? In the end it was not so much the monitoring by the action research team but the combined meetings with network leaders that offered the most insights. Among other things about the way in which network facilitators guided the network; about the differences in perceptions about the project goals and the priorities within it; in the necessary criteria for participation in networks and in how the programme can better support the networks and their facilitators. The meetings revealed clearly that a number of network facilitators had difficulty dealing with the change from being a researcher to being a process manager.

>> The second round

 The network facilitators in the second round of networks in 2006 were also recruited as action researchers. This involved not only supervising the networks but at the same time also reflecting on the network's functioning and then looking for improvements to the working methods. In this way a foundation was laid for monitoring and evaluation "on the job". Every network facilitator began with at least two networks to acquire more, more rapid and broader experience. Facilitators from outside of Wageningen UR were brought in to provide different supervising skills and to anchor the working methods outside of Wageningen UR as well.

The network facilitators received focused support by the action research team with a number of new instruments to acquire more insight into network processes and to develop intervention strategies which could help the network progress. The instruments chosen were: network analysis, triangle of change, innovation spiral and coherency circle (see figure 2).

The network facilitators could also ask questions and share experiences during intervision meetings. This was the first form of interactive monitoring and evaluation whereby the relevant information from intervision meetings was shared at programme level. As well as that, the effect monitor was developed to explicate the effect of the networks on the evolution of new knowledge arrangements; on the entrepreneurs' strategic space; and on the contribution to sustainable agriculture. Strategic space refers to the opportunities and possibilities which the entrepreneur sees for developing his business (space to move in).

>> Learning history as M&E method

The search was on for an M&E method that could include all relevant levels (facilitator, network and programme) and would deliver usable results quickly. This was found in Learning History (see box and figure 1). This method offered the networks, in modified form, the opportunity to explicate what was learned and achieved up till now. Facilitators could describe and evaluate the intervention strategies with it. At programme level, the goals for working with networks as well as the results could be explained. The instruments that were developed for the network facilitators could be integrated into this M&E approach (see figure 2). The instruments enhanced the possibility for reflection on the network processes. Both the

Networks in Animal Husbandry

The research programme *Networks in Animal Husbandry*, financed by the Ministry of EL&I was set up in 2004 with the objective of developing a network approach which would give an impulse towards a more sustainable animal husbandry sector. Guiding principles in this programme were: issue-steered from within agrarian business practice; the desire to learn together; and forming connections. Collaborative entrepreneurial initiatives could apply to the Ministry for support via public tender. Selection was made on the basis of the importance to the sector and to society in general and the innovation and drive of the applicants. In the first tender, in 2004, 165 ideas were submitted and 60 of them received support. In the second tender, the criteria were more severe. There were fewer applicants for that reason, but they had a higher sustainability quotient. Finally, the third and last tender delivered once again 60 supported networks. In the four year duration of the programme, a total of 120 different networks were supported; some for one year and a number for several years. The support involved providing process supervision by a network facilitator, who could if necessary access knowledge from within Wageningen UR or other knowledge institutions. There was also a team for the external communication. An action research team provided the monitoring and evaluation methods and support for the network facilitators.

Network Analysis

Composition of the network

Who are involved? How do we connect those involved? Which positions have the actors taken? Are we missing important players? Is this a network to build on?

Spiral of Innovations

Development of the content

How far has the idea developed? What should the next step be? What sort of knowledge is needed for that? Which actors need to move?

Triangle of Change

Steering with energy

Where does the energy for change come from? What is the best sequence to use in approaching the actors? When can we take the following step in this sequence?

Circle of Coherence

Steering by connections

How healthy is the interaction? Which connections act as a limiting factor? Which intervention is effective at this moment to improve the interaction?

Figure 2 Network instruments

Figure 3 Translation

Time-line Method

Progress talks with the network

What were crucial moments? What can we learn from this for the future?

Learning History

Self evaluation

What does the "documentary film" of the network look like? What are the most important scenes? How can we understand what happened? What are the lessons to be learned?

Learning History

The Learning History method was originally developed for organisations in transition processes with the objective of involving workers more closely with these processes and to allow everyone to learn from them. In the setting of the *Networks in Animal Husbandry* programme, this method was modified and named "Network Story" (figure 1). The basis for this was the Time-line Method, an interactive session with network participants where they named the most striking moments and occasions along a time-line. The network story was written on the basis of this, supplemented with reflections by the network supervisor and the action researchers, viewed through different glasses such as the Network Analysis, the Triangle of Change, the Innovation Spiral and the Circle of Coherence (figure 2). The Effect Monitor was also added; the network results described in terms of increasing the entrepreneurs' strategic space and that of the networks and the resulting knowledge arrangements.

network facilitators and the network participants were very enthusiastic about simultaneously sharing ideas and learning about network processes and the parts of the story that were suitable for external communication.

In 2007, 29 learning histories from the second round of networks were analyzed. The network facilitator's own development from project director via network facilitator to the new role as free actor emerged from this analysis (Wielinga et al., 2008). From being a network manager that is the type of project leader who plans the network activities, minds the budget and reports on progress; working from and with the linear knowledge transfer model. Via the network facilitator who guides the process and is less involved in the content; someone who stimulates co-creation of knowledge in the network and consciously steers towards increasing the strategic space for the participants. To the free actor who mirrors and reflects and above all stimulates on the basis of energy and connection; someone who continuously fosters learning within the network. The network facilitators observed that research colleagues slowly began to see the value of their changing research role. In short, we not only perceived a change in approach in the entrepreneurs' business practice, but also in the entrepreneurial researcher who took up the role of free actor. The learning histories have also shown what the output was from the networks' activities (effect monitor). Entrepreneurs became more conscious of their environment and could more easily make their own connections with other parties. They also applied this approach with other challenges. And new coalitions were created between entrepreneurs, other parties in the chain and education.

>> What have we learned from Learning History?
The method, Learning History has proved itself in *Networks in Animal Husbandry* to be a suitable instrument for monitoring and

evaluation in learning environments, for both the network participants and facilitators. An inspirational organisational form creates insight into how the network dynamics evolve; how different organisational forms can be guided and steered; and which processes of change can be identified in the field. The network stories (learning histories) are a fascinating form in which to communicate both the content and the process of networks and their results to third parties. It can be an example to others to take a similar approach and to show what can be achieved. To conclude: the chosen organisational structure in Networks in animal husbandry created a close collaboration between the different programme components. Because of this, and the informal consultation structures based on the network philosophy, the programme set-up and supervision structure could be continually modified and optimized. The intervision structure turned out to be a valuable form in which to address the network facilitators as action researchers and to help them share experiences with each other and to learn together.

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