# 2 Methodology for prototyping Integrated and Organic Farming Systems

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# 2.1 Innovation and prototyping

Innovation in agriculture is a continuous process of creating or utilising opportunities, counteracting threats and solving problems. At present, a complex of problems is destabilising agriculture and threatening the sustainability. However, at the same time, there are opportunities available to revitalise agriculture by looking for connections with the urban population. This is accomplished by offering scarce products and functions as agro-tourism, recreational facilities and diversified landscape. Therefore, innovation in agriculture is now synonymous to finding integral and coherent solutions while integrating different objectives and functions.

Innovation is encouraged with:

- 1. the total complex of policy regulatory packages,
- 2. technological developments,
- 3. market developments,
- 4. more social action at the basic farming community level.

Policy packages offer an excellent opportunity to create incentives for change and to facilitate this change. Technological developments are necessary to make innovation possible. These technological solutions can be divided in three levels: 1) system innovations, 2) processintegrated solutions and 3) end of pipe solutions. It is obvious that end of pipe solutions are often improvised solutions that alleviate the negative effect of farming. Sustainable farming systems have to be based on system innovation and process-integrated solutions. Novel systems are based on strategic overall concepts that constitute and enhance system innovation. Novel systems are also based on integrated, technology-based agro-ecological principles; agronomy; and biological, physical and chemical methods. In essence, these novel systems are low input – high output systems that will have to be more sustainable in ecological, agronomical, economical and social terms.

Socially based solutions refer to farming communities with common objectives and plans that operate as a group when communicating with the "stakeholders" in the region. This community forming and communication process can be stimulated and facilitated by social scientists and extensionists (Butler Flora, 1998; Pretty, 1998).

Innovation is always a process made up of design, testing and improvement (see Figure 2.1) based on multiple objectives. Innovation is, however, not always a rational process resulting from or guided by institutions. The innovation process can be stimulated by all the abovementioned approaches. In many projects all over the world, this is attempted in a top-down approach. As initial step, this might be appropriate. However, when insufficient attention is given to interaction with the target group and their learning process, innovation is destined to fail. On the other hand, when successful, the initial linear innovation model (top-down) evolves into a circular, continuous innovation model, supported by the group itself. The prerequisite is, that from the start, the viewpoint of the farmer is taken into account, in addition to the viewpoints of other stakeholders. Prototyping is a method that structures the process of continuous innovation towards more sustainable farming systems from a technological perspective. Prototyping of farming systems allows theoretical design to be applied in practice in different systems. Therefore, the four steps as described in Figure 2.1, apply as well to innovation as to



Figure 2.1 Innovation as a dynamic continuous process of design, testing and improvement. Prototyping is a four-step process prototyping. These steps are elaborated in more detail in the following sections.

# 2.2 Analysis and diagnosis

The process of prototyping starts with an extensive regionally based analysis and diagnosis phase. In addition to examining the past and the current status, future trends have to be identified as well. By identifying trends and progressive views, a window of opportunities opens.

Figure 2.2 presents a possible framework of the analysis. The central point in the analysis is the farm. First, it is important to get a good view of the farming practice by studying sectoral statistics, farm structure and the agroecological problems. Also structural changes are identified. Social demands have to be examined, economically and politically as well as socially. Finally, the ecological and environmental impact of current farming systems needs to be studied. The three phases are described in more detail below.

#### **Farming practices**

1. Sectoral statistics:

A statistical analysis has to be made of all possible factors concerning the sector under study. The factors include: the total surface area, the crops, the area per crop, the trade value per crop, the involved trade channels, the import/export flows of products and commodities. With this analysis, a picture the sector's importance and the chosen crops can be established. When possible, this analysis has to be out for different regions or for the region where the project is located, in perspective to national data.

2. Farm structure:

The farms are analysed as production units in order to define a comprehensive typology of the chosen farms in terms of size, geographical location, scale and type of crops grown. 3. Agro-ecological, state-of-the-art:

An analysis of the following factors: current farming practices (methods and strategies); threats; problems and sustainability of production in terms of quality production and the underlying maintenance of soil fertility (especially biological and physical soil fertility); crop protection (long term control options of (soilborn) pests and diseases); and other agronomical aspects.

4. Trends in structural changes:

The developments during the past decade have to be analysed in terms of farm size, specialisation, mechanisation, demand and availability of labour, and market developments to put the present situation into perspective. For example, some general trends in the EU are a decreasing number of farms, decreasing employment in agriculture and increasing specialisation.

#### **Social demands**

- 5. Socio-economic situation:
- Economic conditions in farming and developments in markets are analysed. Factors examined included: farmers' incomes, production costs such as labour and land, product prices and competition in national and international markets. Also, options to enhance farmers' incomes are studied. An inventory is made of possibilities to increase efficiency (specialisation and scale enlargement), to add value to products with post-harvest processes (sorting, packing) or to focus on special products or niche markets.
- Current socio-political conditions: An analysis is carried out of all legislation, rules, policies and subsidies that influence the way farmers work on different levels (EU, national, regional and local level).
- 7. Multi-functionality:

The demands on and expectations of agriculture are gathered from stakeholders in the region, including the urban population. Opportunities are derived from these demands and expectations.



#### **Ecological and environmental effects**

8. Ecological/environmental impact: Effects of farming on the quality of ecology (biodiversity, nature, landscape) and environment (contamination of soil, air and water) have to be identified and documented in relation to farming practices.

Based on this analysis, a clear view can be described of a sector's structure and importance in the region, the typology of the farms and the relative importance of different crops and their marketing needs. In addition, the shortcomings in agronomy, farming, ecology and environment, and the degree of anticipation of socio-political changes can be identified. This includes the economic position of farms and their development in general. Future perspectives are made clear. The outcome of this process forms the basis for the second step in the prototyping: the design phase.

In Chapter 3, the results of the analysis and diagnosis carried out in VEGINECO study are summarised. The following items are described in detail: farm economic and structural aspects, farm types, policy, legislation on an EU and national or regional level, certification guidelines and environmental problems.

# 2.3 Design

In the design phase, the prototype is developed. Before this can be done, the objectives of the prototype must be clear and the parameters need to be developed to evaluate the prototype. Therefore, the design phase consists of several steps:

- Defining objectives from an innovation vision.
- Quantifying objectives with a set of parameters, covering the objectives totally and setting ambitious and relevant target values for these parameters.
- (Re)designing farming practices to be able to reach the target values.
- Implementing general strategies in a theoretical prototype, drawing up specific farming and cropping programmes, and designing the agro-ecological layout.

#### 2.3.1 Objectives and themes

To formulate objectives, it is important to have a clear innovation vision. This vision has to be based on the results of the analysis and diagnosis. The vision contains a search direction for the position of farming in the total field of multifunctional agriculture, the type of farms and cropping activities and the position in market, society and environment. Then, the current situation can be described in terms of shortfall to the vision. When the causes of the shortfall are known, priorities can be set for development of new systems and objectives can be defined. Based on this innovation vision, objectives can be established. In the prototyping methodology, there is a standardised well-defined set of main objectives and subobjectives (between brackets) (Vereijken, 1992):

- food supply (sustainability, stability, accessibility, quality and quantity),
- employment (farm, region, national),
- basic income/profit (farm, region, national),
- abiotic environment (water, soil, air),
- nature/landscape (flora, fauna and landscape),
- health/well-being (farm animals, rural or urban population).

Quality production	The objective is to produce a sufficient volume and quality. A secondary objective is the production of healthy and safe products.
Clean environment	The objective is to prevent and minimise the emission of environmental damaging inputs. Emission and damage of nutrients and pesticides are the most important aspects.
Nature and landscape	The main objective is to strengthen and protect the current ecological value of farms, integrated in an ecological infrastructure, embedded in the regional landscape to enhance the environment for humans, flora and fauna. Other functions can be implied as well, for example care for different groups of people on a farm and water storage.
Sustainable management of resources	The main objectives are maintenance and/or improvement of production means (soil and water) and minimisation of the use of production means with a lasting stock (energy, water and phosphates). Maintaining or improving the soil means maintaining or improving soil fertility (biologically, physically and chemically) without causing environmental damage and organic matter management.
Farm continuity	Safeguarding farm continuity by improving farm economics, use of labour and manage- ment, especially with respect to crop rotation, fertilisation, labour organisation and inte- gral quality chain care. The main objective is to manage a farm with profitable result.

Table 2.1 Description of the themes

These rather abstract objectives can be converted to directional themes that cover all aspects of farming. The themes used in the VEGINECO project are: quality production, clean environment, multifunctionality, sustainable use of resources and farm continuity (Table 2.1). Another possible theme is well being/health, which is mainly important in animal production systems. These themes are significant for all progressive systems. There can be a difference in the degree in which priority is given to different themes and sub-aspects and the targets.

When the innovation vision is clear and the objectives are set, a choice has to be made on the type of farms to be used in the project. Also, the type of system to be defined has to be chosen: integrated, organic or both type of systems, pure vegetable farms or a combination with arable crops. For example in the Netherlands, the trend is to include vegetable crops in arable rotations. Therefore, this type of farm was chosen to work on, with integrated as well as an organic systems.

#### 2.3.2 Quantification of themes: parameters and target values

Next in the design phase, the requirements of the system have to be identified. A target picture for the medium-long and long term has to be developed for the type of systems chosen. Within each theme, a set of parameters needs to be chosen which represents the state of a theme in a clear and understandable way. Parameters need to be chosen that are objective-oriented (in contrast to means-oriented) and easy to define. In addition, the parameter must be able to be influenced by one or more farming practices. Parameters are not only descriptive, but they must be controllable as well. To evaluate a prototype of a farming system, only a limited set of parameters can be used, for practical and strategic reasons. In the prototyping methodology, only parameters should be chosen whose status is taken seriously in the improvement process. "Empty shells" should be eliminated. From the objectives and the vision can arise that the development of new parameters is necessary.

Every parameter needs a target value to give ambition and focus to the development of the system. The difference between a parameter's actual value and the target value indicates the deficit in the parameter.

Target values can be elaborated from different sources:

- policies and legislation on regional national and global level,
- system specific values,
- scientific state-of-the-art technology.

If all of the parameters have target values, the target picture is quantified and the results of management are verifiable to the target picture. Sometimes, more research is

Table 2.2 Overview of the common set of main objective parameters			
Theme	Parameters	Abbreviation	
Quality production	<ol> <li>Quantity of produce</li> <li>Quality of produce</li> <li>Nitrate content of produce</li> </ol>	QNP QLP NCONT	
Clean environment nutrients	<ol> <li>Nitrogen (mineral) Available Reserves</li> <li>Phosphate Annual Balance</li> <li>Potash Annual Balance</li> </ol>	NAR PAB KAB	
Clean environment pesticides	Pesticides input active ingredients 7. Synthetic 8. Copper Environment Exposure to Pesticides 9. Air 10. Groundwater 11. Soil	PESTAS-Synth PESTAS-Cu EEP-air EEP-groundwater EEP-soil	
Nature and landscape	12. Ecological Infrastructure	El	
Sustainable use of resources	<ol> <li>Phosphate Available Reserves</li> <li>Potash Available Reserves</li> <li>Organic Matter Annual Balance</li> <li>Energy Input</li> </ol>	PAR KAR OMAB ENIN	
Farm continuity	<ul><li>16. Net Surplus</li><li>Hours hand weeding</li></ul>	NS HHW	

Table 2.2 Overview of the common set of multi-objective parameters

needed to establish a target value. Then, estimations can be used in first instance.

A target picture can be more or less ambitious. The farm type in its regional context determines this picture. The picture can often be deduced from the innovation vision and the overall objectives set. Overall, the target picture can be set on different levels:

- minimum requirements from policy and legislation or economic laws,
- technical feasibility,
- the ideal picture for the middle-long or long term.

It can be considered to define target values at all three levels. Then the distance of the actual realisation with the different target pictures can be made.

Target values can also be a result of negotiations between stakeholders in the development of these new systems. The nature and justification of a target value therefore might vary considerably between parameters. Target values are necessary as they play a crucial role in the process of testing and improving.

The parameters used in the VEGINECO project are listed in Table 2.2. The definition, justification for the choice of parameters and target values are discussed in Chapter 4. More comprehensive definitions of the parameters are given in Annex 2.

#### 2.3.3 Methods

In the next step, a suitable set of farming methods has to be designed that enables the targeted results to be reached as quantified in the parameters. The conventional, one-sided, production-oriented methods have to be evaluated, redesigned. New methods have to be developed to be able to meet all of the objectives. Methods are defined as coherent strategies for the major aspects of farming, consisting of packages of several techniques (Figure 2.4). All of the traditional areas of farming are involved starting with crop rotation, followed by nutrient management, crop protection and soil tillage. Farming is not possible when the principles of these methods are not applied.

As in every system, the system is a result of interacting processes (Figure 2.3). Processes have internal effects, influencing the system itself, and external effects. A set of coherent strategies has to be redesigned to create the right method, which optimises internal effects (interaction) and minimises external effects. In each strategy, the right techniques should be chosen from the toolbox with techniques to reach the target values of the parameters. For instance, the general crop protection strategy is stepwise from prevention, need of control to control. To operate this strategy, different techniques are available for each step. A suitable technique in prevention is cultivar choice, decision support systems can be used to establish the need of control and application techniques can help during control. The techniques should be chosen with the aim to reach target values.

It may be clear that this redesign cannot be done on an ad hoc basis or a case-by-case approach. It has to be done in the context of farming with the full awareness of the interaction with the other farming methods. Every single technique has to have the character of a process-integrated solution contributing to the system innovation. To elaborate on the methods in the context of new farming systems, the following steps have to be taken:

- 1. inventory of all available knowledge,
- analysis of negative external effects, specifically focused on the interactions within the system context and on the (re)interpretation of the validity of these conclusions as these are often biased by the onesided focus on physical yields,
- consultation with specialists to extract the available expert knowledge in the light of the systems objectives,
- adapting and integrating knowledge in the farming method strategies and the underlying toolbox of available techniques.

The elaboration of methods follows a natural sequence: it starts with the elaboration of a multi-functional crop rotation, followed by the design of methods for nutrient management, soil tillage, crop protection and nature conservation on the farm. Optimisation of the farm structure concludes this.

Below, an overview is given of the methods that are in operation; definitions that are more extensive are given in Annex 3. Most of these methods were defined previously in the EU concerted action (Vereijken, 1994; 1995; 1996; 1998). The specific manuals on the farming methods (see VEGINECO publication list) will go into a considerate amount of detail on each of these methods.

#### **Multifunctional Crop Rotation (MCR)**

MCR is the major method to preserve soil fertility in biological, physical and chemical terms and to sustain quality production with a minimum of inputs (pesticides, manual and machine labour, fertiliser and support energy). A well-balanced "team" of crops is lined up to reach these objectives.

# Integrated and Ecological Nutrient Management (I/ENM)

I/ENM gives directions to supply nutrients to crops in such amounts and forms and at such time to achieve optimal quality production, minimise nutrient losses to the environment and maintain agronomically desired and ecologically acceptable nutrient and organic matter reserves in the soil. Maximum use is made of the nutrients within the rotation and application techniques.

#### Integrated and Ecological Crop Protection (I/ECP)

I/ECP supports MCR and Ecological Infrastructure Management (EIM) in achieving optimal quality production by selectively controlling residual harmful species with



minimal exposure of the environment to pesticides. Need of control is reduced by giving maximum emphasis to prevention (resistant varieties, cultural measures such as adapted sowing date and row spacing), a correct interpretation of the need of control. Careful pesticide selection and application technique can lower risks of emission.

#### **Ecological infrastructure management (EIM)**

EIM supports MCR in achieving optimal quality production by providing airborne and semi soil-borne beneficials a place to survive unfavourable conditions, and recover and disperse in the cropping season. In addition, EIM should achieve nature/landscape objectives.

Operating EIM implies establishing an area of linear and non-linear elements to obtain spatial and temporal continuity in nature area, establishing buffer strips to protect these natural areas and finally establishing a plan for the long term considering the target species/communities and special ecological elements such as ponds and hay stacks.

#### **Minimum Soil Cultivation (MSC)**

MSC is a method additional to all other methods to sustain quality production by preparing seedbeds, controlling weeds, incorporating crop residues and restoring physical soil fertility reduced by compaction from machines, notably at harvest. However, Soil Cultivation should be minimal in order to achieve the objectives with respect to energy use; to maintain sufficient soil cover as basis for erosion-prevention; shelter for natural predators and landscape/nature values; and to maintain an appropriate organic matter annual balance too.

#### Farm Structure Optimisation (FSO)

FSO determines the minimum amounts of land, labour and capital goods needed to achieve the required net surplus (all revenues - total costs, including labour), which should be larger than zero. A region specific tested prototype that can meet the quantified objectives has to have also farm economic perspective. FSO elaborates insight in the needed farm structure to render an agronomically and ecologically optimised system economically optimal too. A method "new" style is a coherent multi-objective strategy that is safe, flexible and utilises a diversified set of techniques, dependent on the specific conditions on the farm and during the growing season. Each method will affect the status of several parameters in different themes. The influence of the method on a parameter can be different. In Figure 2.4, the relation between the methods and the themes (and underlying parameters) is visualised.

#### 2.3.4 Theoretical prototype and cropping programmes

As a last phase in the design process, methods have to be put together in a theoretical prototype. A design has to be made for the prototype in the actual place where it will be tested and cropping programs have to be set up.



Figure 2.4 Relationship between methods and themes (parameters) used in the VEGINECO project. Thick arrows indicate a strong relationship between the methods and the themes (the parameter value in a theme is mainly influenced by the method). Thin arrows indicate a weaker relationship between the method and the theme (the parameter value in a theme is partly influenced by the method, however other methods are important as well).

In a theoretical prototype, parameters and methods are linked to each other as basis for a correct evaluation. This final step is necessary to check the links between methods and parameters and functions as basic framework for interpretation of the results. Before the prototype is put into practice, a theoretical ex-ante evaluation of the prototype can be made. Values of the parameters can be calculated or estimated on the basis of expert knowledge and standard figures. These estimated values are compared with target values. If the values are far below the target values in some parameters, it may be necessary to redesign the system. Lack of knowledge can also be identified, which can be included more disciplinary research programs.

The basis for a successful test phase is the design of the farming system in time and space. This concerns not only the design of a multifunctional crop rotation and the other methods, but the agro-ecological identity of the farm as well.

"A farming system is an agro-ecological unity that consists of a set of continuous interactions, and rotating of crops and possibly livestock, together with their accompanying (beneficial or harmful) flora and fauna" (Vereijken, 1994).

An optimal, agro-ecological layout contributes to the biological soil fertility by controlling harmful species with crop rotation and encouraging beneficial species. Additional criteria can be formulated with regard to the layout such as: field adjacency, field size, field length and width, adjacency of subsequent crop rotation blocks and the ecological infrastructure. This ensures that crop rotation contributes optimally to the prevention of pests and diseases (Vereijken, 1994). In this framework, subsequent fertilisation, soil cultivation, crop protection and the management of the ecological infrastructure are also optimal. The agro-ecological layout is discussed in more detail in the design of the MCR (Chapter 6.3.4).

The last part of the theoretical exercise ends with a detailed operational plan, the cropping programmes. Before the first growing season, exact and detailed cropping programmes are set up in which the tasks are described that have to be done, at which time and the expected inputs to be used. Running the system is then a matter of operating these cropping programmes. Adjustments to the cropping programs in practice might be necessary depending on actual crop, weather and soil conditions.

# 2.4 Testing and improving

# 2.4.1 Pilot farms or experimental farms

When the design of the prototype is completed, it is ready to be put into practice. Prototypes can be tested and improved on experimental farms or with groups of pilot farms. The advantage of testing on experimental farms is the experimental freedom. The design of the system can be carried out without compromises. The level of detail can be very high which provides opportunities for a thorough analysis of the shortfall. Especially when the systems seem to be very experimental, a first development phase on experimental farms is necessary. On these farms, a full implementation, testing, and improvement of the prototype is possible. The advantages of pilot farms are the interaction with the farm management and the possibility to have "replicates" with respect to soil, farm, and management conditions.



When working with farmers, interaction and communication is essential. However, in order to guarantee sufficient innovation and implementation of the prototype, farmers will have to commit themselves to a contract that commits to a fundamental and well-planned "conversion" of their present system.

If testing and improving is done on an experimental farm, it has to be repeated again as dissemination on small scale with a group of farmers. A more detailed analysis of the problems and challenges encountered in this interactive method of working can be found in Wijnands, 1992 and Wijnands et al. 1998.

#### 2.4.2 Annual implementation and monitoring of the prototype

In order to develop the prototypes in practice, each year the complete prototype on the farms needs to be run according to the cropping programmes with specific weather, field and other conditions. This task is usually time-consuming and involves a great deal of fieldwork and input costs. A high level of strategic and agronomic expertise is needed from the research group and the farm manager with the team. It is recommended to appoint a researcher as the responsible co-ordinator for this task, who will work with the farm manager as a team on implementing the plans.

All agronomic data is recorded including: all inputs and outputs, all operations, machinery and equipment utilised, all data of operations and labour. This experimental agronomic database forms the basis for all relevant evaluations. Sets of all test parameters are assessed according to the standardised formats, aggregated where necessary and compared with the target results.

# **2.4.3 Testing and improving of the prototype**

Testing implies that the shortfall between the parameters' target values and actual results are analysed. The method that causes the shortfall has to be identified. Within this method, the responsible strategies and techniques need to be improved. The agronomic database and the qualitative observations during the growing season are indispensable for the analysis of the shortfall (Figure 2.5).

In this phase, detailed knowledge is generated about the different methods and underlying production techniques; their compatibility with other farming methods; their

effectiveness in relation to the objectives; and the (potential) conflicts with other methods and objectives. This information is directly used to improve the prototype. It increases the general knowledge of input-output relationships and enables to exchange production techniques in model studies when different balances of objectives are to be reached (Rossing et al 1995).

Testing on farm level also implies testing of the degree of usefulness and manageability of the newly developed methods. On pilot farms, attention also has to be paid to how well the farm manager accepts the new methods (Vereijken, 1995).

The prototype will be improved by enhancing the set of methods in a precise manner. This means looking at how to make the currently utilised farming methods more safe, efficient, acceptable and manageable and, at the same, reach the desired results. The prototypes will continue to be improved from year to year. Any adjustment in the cropping programmes must be considered carefully in order to avoid new conflicts between the objectives and needs.

The testing and improving continues until the objectives as initially defined for each of the relevant parameters are reached. Agro-ecological objectives are tested under field conditions. Economic objectives can be studied and optimised with model studies, involving different scales of farms. These studies can be done during and after the testing and improving of the agronomic parameters. In these studies, the needed farm structure can be made explicit to fulfil the agronomic and ecological objectives. This is a very important point of view for policymakers. The required time to reach the objectives is dependent on the objectives, the specific character of the parameters (variability and response-time), the specific situation of the prototype and the extent to which production methods are already developed.

#### **2.5 Dissemination**

The potential of new prototypes can only be evaluated in practice. Management is the key factor for the success and feasibility of these new approaches. When the prototype shows stable results, such as when parameter values are stable and have reached (almost) all target values, dissemination is the next step. Dissemination can be take place on a small scale or on a large scale. During small-scale dissemination, a small group of pilot farms is guided closely. During large-scale dissemination, larger groups of farmers are supported more extensively.

#### Dissemination on a small scale

A first test on a small number of pilot farms of the prototype(s) developed on experimental farms is an indispensable step before introducing new prototypes on a large scale in practice. The first phase of dissemination should involve a group of well-motivated practical farmers with various soil, farm and management conditions. For each farm, a specific variation of the general prototype has to be set up. The two major objectives of this phase are 1) to evaluate the effectiveness and feasibility (manageability and acceptability) of the prototype and 2) to gain the necessary knowledge to implement the prototype safely and successfully on a large scale under a wide range of circumstances.

Very close co-operation between the researchers, extensionists and farmers is a pre-requisite for the dissemination of the results in the next phase: the dissemination on a large scale.

#### Dissemination on a large scale

The aim of dissemination on a large scale is to introduce as efficiently and effectively as possible the prototype tested on a small scale. This can only be successful if the expertise is available to adapt the general prototype into farm-specific variations. It is important that the agricultural community's (extension, education and farming industries) motivation for and the familiarity with the new prototype should be sufficient. These conditions can only be fulfilled if during the preceding stage, sufficient attention was given to the transfer of this expertise. It is recommended to approach this phase as a coherent project with a clear infrastructure as this ensures clear objectives and good transfer of expertise.

#### **Obstacles in the dissemination process**

How the dissemination of new prototypes must be organised is highly dependent on the motivation for, the knowledge of and the experience with the new prototypes of the individual farmers and the farming community as a whole. Motivation has to be gained from an increasing awareness of the agronomic, environmental, ecological and economical problems that agriculture is currently facing. Different points of view on these topics are expressed in society and the public discussion in agricultural magazines is rather confusing. Awareness of the necessity for changes leads to a change in attitude. When alternatives with sufficient potential are available too, a change in behaviour is possible.

The alternatives in this case are the new prototypes. Increasing knowledge about the new systems and building up individual experience follows naturally when the positive motivation is apparent. Support from the sector is inevitable for a successful implementation of future-oriented systems because the "social carrying capacity" has to originate there. Moreover, sector (farmers or productoriented) organisations often play an important role in financing these types of projects. A complicating factor is that these types of systems often base their objectives on the same perspective that policy visions are based on. Thereby, they acquire a political and negative dimension in the view of the sector.